

# **Natural**

# **Statements**

Version 8.2.8

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Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

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# **Preface**

This document describes native Natural programming language (DML) statements and Natural SQL statements. It is organized under the following headings:

Statements Grouped by Function	Provides an overview of the Natural statements ordered by functional groups.
Syntax Symbols and Operand Definition Tables	Information on the symbols that are used within the diagrams that describe the syntax of Natural statements and on operand definition tables.
Using Natural SQL Statements	Describes rules specific to using Natural SQL statements.
Referenced Example Programs	Contains additional example programs that are referenced in the <i>Statements</i> and <i>System Variables</i> documentation.

#### **Related Topics:**

See also the *Programming Guide* for statement usage related topics such as: *User-Defined Variables* | *Dynamic and Large Variables* | *User-Defined Constants* | *Report Specification* | *Text Notation* | *User Comments* | *Rules for Arithmetic Assignment* | *Logical Condition Criteria* | *Function Call* 

#### **Statements in Alphabetical Order:**

A - C	D-F	G - O	P - R	S-Z
ACCEPT/REJECT	DECIDE FOR	GET	PARSE XML	SELECT (SQL)
ADD	DECIDE ON	GET SAME	PASSW	SEND METHOD
ASSIGN	DEFINE CLASS	GET	PERFORM	SEPARATE
AT BREAK	DEFINE DATA	TRANSACTION	PERFORM BREAK	SET CONTROL
AT END OF DATA	DEFINE FUNCTION	DATA	PROCESSING	SET GLOBALS
AT END OF PAGE	DEFINE PRINTER	HISTOGRAM	PRINT	SET KEY
AT START OF DATA	DEFINE PROTOTYPE	IF	PROCESS	SET TIME
AT TOP OF PAGE	DEFINE	IF SELECTION	PROCESS COMMAND	SET WINDOW
BACKOUT	SUBROUTINE	IGNORE	PROCESS PAGE	SKIP
TRANSACTION	DEFINE WINDOW	INCLUDE	PROCESS	SORT
BEFORE BREAK	DEFINE WORK FILE	INPUT	SQL (SQL)	STACK
PROCESSING	DELETE	INSERT (SQL)	PROPERTY	STOP
CALL	DELETE (SQL)	INTERFACE	READ	STORE
CALL FILE	DISPLAY	LIMIT	READ RESULT SET	SUBTRACT
CALL LOOP	DIVIDE	L00P	(SQL)	SUSPEND
CALLDBPROC (SQL)	DO/DOEND	MERGE (SQL)	READ WORK FILE	IDENTICAL
CALLNAT	DOWNLOAD PC FILE	METHOD	READLOB	SUPPRESS
CLOSE	EJECT	MOVE	REDEFINE	TERMINATE
CONVERSATION	END	MOVE INDEXED	REDUCE	UPDATE
CLOSE PC FILE	END TRANSACTION	MULTIPLY	REINPUT	UPDATE (SQL)
CLOSE PRINTER	ESCAPE	NEWPAGE	REJECT	UPDATELOB

A - C	D-F	G - O	P-R	S-Z
CLOSE WORK FILE	EXAMINE	OBTAIN	RELEASE	UPLOAD PC FILE
COMMIT (SQL)	EXPAND	ON ERROR	REPEAT	WRITE
COMPOSE	FETCH	OPEN	REQUEST DOCUMENT	WRITE TITLE
COMPRESS	FIND	CONVERSATION	RESET	WRITE TRAILER
COMPUTE	FOR	OPTIONS	RESIZE	WRITE WORK FILE
CREATE OBJECT	FORMAT		RETRY	
			ROLLBACK (SQL)	
			RUN	

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# 1 About this Documentation

Document Conventions	
Online Information and Support	
Data Protection	

#### **Document Conventions**

Convention	Description
Bold	Identifies elements on a screen.
Monospace font	Identifies service names and locations in the format folder.subfolder.service, APIs, Java classes, methods, properties.
Italic	Identifies:  Variables for which you must supply values specific to your own situation or environment.  New terms the first time they occur in the text.
	References to other documentation sources.
Monospace font	Identifies:  Text you must type in.  Messages displayed by the system.  Program code.
{}	Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols.
1	Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the   symbol.
[]	Indicates one or more options. Type only the information inside the square brackets. Do not type the [] symbols.
	Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis ().

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- Browse through our vast knowledge base.
- Ask questions and find answers in our discussion forums.
- Get the latest Software GmbH news and announcements.
- Explore our communities.
- Go to our public GitHub and Docker repositories at <a href="https://github.com/softwareag">https://github.com/softwareag</a> and <a href="https://containers.softwareag.com/products">https://containers.softwareag.com/products</a> and discover additional Software GmbH resources.

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- Download products, updates and fixes.
- Search the Knowledge Center for technical information and tips.
- Subscribe to early warnings and critical alerts.
- Open and update support incidents.
- Add product feature requests.

#### **Data Protection**

Software GmbH products provide functionality with respect to processing of personal data according to the EU General Data Protection Regulation (GDPR). Where applicable, appropriate steps are documented in the respective administration documentation.

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# 2 Statements Grouped by Function

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#### Notes:

- 1. Certain statements can be used both in structured mode and in reporting mode, while others can be used in reporting mode only. See *Natural Programming Modes* in the *Programming Guide*.
- 2. The statements DLOGOFF, DLOGON, SHOW, IMPORT and EXPORT are only available when Entire DB is installed. For a description, see the *Entire DB* documentation.

## **Database Access and Update**

The following types of statements are available:

- Natural DML Statements
- Natural SQL Statements

#### **Natural DML Statements**

The following Natural data manipulation language (DML) statements are used to access and manipulate information contained in a database.

READ	Reads a database file in physical or logical sequence of records.
READLOB	Reads a LOB field (Large OBject field) in fixed length segments using multiple database calls.
FIND	Selects records from a database file based on user-specified criteria.
HISTOGRAM	Reads the values of a database field.
GET	Reads a record with a given ISN (internal sequence number) or RNO (record number).
GET SAME	Re-reads the record currently being processed.
ACCEPT/REJECT	Accepts/reject records based on user-specified criteria.
PASSW	Provides password for access to a password-protected file.
LIMIT	Limits the number of executions of a READ, FIND or HISTOGRAM processing loop.
STORE	Adds a new record to the database.
UPDATE	Updates a record in the database.
UPDATELOB	Updates a data segment of a LOB field (Large OBject field) in a database record.
DELETE	Deletes a record from the database.
END TRANSACTION	Indicates the end of a logical transaction.
BACKOUT TRANSACTION	Backs out a partially completed logical transaction.
GET TRANSACTION DATA	Reads transaction data stored with a previous END $$ TRANSACTION statement.

RETRY	Attempts to re-read a record which is in hold status for another user.
AT START OF DATA	Specifies statements to be performed when the first of a set of records is processed in a processing loop.
AT END OF DATA	Specifies statements to be performed after the last of a set of records has been processed in a processing loop.
AT BREAK	Specifies statements to be performed when the value of a control field changes (break processing).
BEFORE BREAK PROCESSING	Specifies statements to be performed before performing break processing.
PERFORM BREAK PROCESSING	Immediately invokes break processing.

### **Natural SQL Statements**

In addition to the Natural DML statements, Natural also provides SQL statements for use in Natural programs that manipulate data on an SQL database.

The following Natural SQL statements are available:

CALLDBPROC	Invokes a stored procedure of the SQL database system to which Natural is connected.
COMMIT	Indicates the end of a logical transaction and releases all data locked during the transaction. All data modifications are committed and made permanent.
DELETE	Deletes either rows in a table without using a cursor ("searched" DELETE) or rows in a table to which a cursor is positioned ("positioned" DELETE).
INSERT	Adds one or more new rows to a table.
MERGE	Updates a table using the specified input data. Rows in the target table that match the input data are updated as specified, and rows that do not exist in the target table are inserted.
PROCESS SQL	Issues SQL statements to the underlying database.
READ RESULT SET	Reads a result set which was created by a stored procedure that was invoked by a previous CALLDBPROC statement.
ROLLBACK	Undoes all database modifications made since the beginning of the last recovery unit.
SELECT	Supports both the <b>cursor-oriented selection</b> that is used to retrieve an arbitrary number of rows and the <b>non-cursor selection</b> (singleton SELECT) that retrieves at most one single row.
UPDATE	Performs an update operation on either rows in a table without using a cursor ("searched" UPDATE) or columns in a row to which a cursor is positioned ("positioned" UPDATE).

# **Arithmetic and Data Movement Operations**

The following statements are used for arithmetic and data movement operations:

COMPUTE	Performs arithmetic operations or assigns values to fields.
ADD	Adds two or more operands.
SUBTRACT	Subtracts one or more operands from another operand.
MULTIPLY	Multiplies two or more operands.
DIVIDE	Divides one operand into another.
EXAMINE TRANSLATE	Translates the characters contained in a field into upper-case or lower-case, or into other characters.
MOVE	Moves the value of an operand to one or more fields.
MOVE ALL	Moves multiple occurrences of a value to another field.
COMPRESS	Concatenates the value of two or more fields into a single field.
SEPARATE	Separates the content of a field into two or more fields.
EXAMINE	Scans a field for a specific value and replaces it, and/or counts how often it occurs.
RESET	Sets the value of a field to zero (if numeric) or blank (if alphanumeric), or to its initial value.

## **Loop Execution**

The following statements are related to the execution of processing loops:

ESCAPE	Stops the execution of a processing loop.	
FOR	Initiates a processing loop and controls the number of times the loop is to be processed.	
REPEAT	Initiates a processing loop (and terminates it based on a specified condition).	
SORT	Sorts records.	

## **Creation of Output Reports**

The following statements are used for the creation of output reports:

To Statements

FORMAT	Specifies output parameter settings.
DISPLAY	Specifies fields to be output in column form.
WRITE / PRINT	Specifies fields to be output in non-column form.
WRITE TITLE	Specifies text to be output at the top of each page of a report.
WRITE TRAILER	Specifies text to be output at the bottom of each page of a report.
AT TOP OF PAGE	Specifies processing to be performed when a new output page is started.
AT END OF PAGE	Specifies processing to be performed when the end of an output page is reached.
SKIP	Generates one or more blank lines in a report.
EJECT	Causes a page advance without titles or headings.
NEWPAGE	Causes a page advance with titles and headings.
SUSPEND IDENTICAL SUPPRESS	Suspends identical suppression for a single record.
DEFINE PRINTER	Allocates a report to a logical output destination.
CLOSE PRINTER	Closes a printer.

# **Screen Generation for Interactive Processing**

The following statements are used to create data screens (maps) for the purpose of interactive processing of data:

INPUT	Creates a formatted screen (map) for data display/ entry.
REINPUT	Re-executes an INPUT statement (if invalid data were entered in response to the previous INPUT statement).
DEFINE WINDOW	Specifies the size, position and attributes of a window.
SET WINDOW	Activates and de-activates a window.
PROCESS PAGE	Creates a data mapping to a web rich GUI screen.
PROCESS PAGE USING	Performs rich GUI I/O processing using an adapter object generated from a page layout.
PROCESS PAGE UPDATE	Re-executes a PROCESS PAGE statement.
PROCESS PAGE MODAL	Initiates a processing block and controls the lifetime of a rich GUI window.

## **Processing of Logical Conditions**

The following statements are used to control the execution of statements based on conditions detected during the execution of a Natural program:

IF	Performs statements depending on a logical condition.
IF SELECTION	Verifies that in a sequence of alphanumeric fields one and only one contains a value.
DECIDE FOR	Performs statements depending on logical conditions.
DECIDE ON	Performs statements depending on the contents of a variable.

# **Invoking Programs and Routines**

The following statements are used in conjunction with the execution of programs and routines:

CALL	Invokes a non-Natural program from a Natural program.
CALLNAT	Invokes a Natural subprogram.
CALL FILE	Invokes a non-Natural program to read a record from a non-Adabas file.
CALL LOOP	Generates a processing loop containing a call to a non-Natural program.
DEFINE SUBROUTINE	Defines a Natural subroutine.
ESCAPE	Stops the execution of a routine.
FETCH	Invokes a Natural program.
PERFORM	Invokes a Natural subroutine.
PROCESS COMMAND	Invokes a command processor.
RUN	Compiles and executes a source program.

## **Functions**

The following Natural statements are used to create functions:

	Creates functions which can be called instead of operands in Natural statements. Functions are defined in Natural objects of type function.
DEFINE PROTOTYPE	Specifies the properties to be used for a function call.
Function Call	Used to call Natural objects of type function.

# **Program and Session Termination**

The following Natural statements are used to terminate the execution of an application or to terminate the Natural session.

STOP	Terminates the execution of an application.
TERMINATE	Terminates the Natural session.

#### **Control of Work Files / PC Files**

The following Natural statements are used to read/write data to a physical sequential (non-Adabas) work file:

WRITE WORK FILE	Writes data to a work file.
DOWNLOAD PC FILE	Enables transfer data from a mainframe, UNIX or OpenVMS platform to the PC.
READ WORK FILE	Reads data from a work file.
UPLOAD PC FILE	Enables transfer data from a PC to a mainframe, UNIX or OpenVMS platform.
CLOSE WORK FILE	Closes a work file.
CLOSE PC FILE	Closes a specific PC work file.
DEFINE WORK FILE	Assigns a file name to a work file.

## **Component Based Programming**

The following Natural statements are used in conjunction with component based programming:

DEFINE CLASS	Specifies a class from within a Natural class module.	
CREATE OBJECT	Creates an object (also known as an instance) of a given class.	
SEND METHOD	Invokes a method of an object.	
INTERFACE	Defines an interface (a collection of methods and properties) for a certain feature of a class.	
METHOD	Assigns a subprogram as the implementation of a method, outside an interface definition.	
PROPERTY	Assigns an object data variable as the implementation to a property, outside an interface definition.	

# **Memory Management Control for Dynamic Variables or X-Arrays**

EXPAND	Expands the allocated memory of dynamic variables to a given size.	
REDUCE	Reduces the size of a dynamic variable.	
RESIZE	Adjusts the size of a dynamic variable.	

#### **Natural Remote Procedure Call**

OPEN CONVERSATION	Allows the RPC Client to open a conversation and specify the remote subprograms to be included in the conversation.
CLOSE CONVERSATION	Allows the client to close conversations. You can close the current conversation, another open conversation, or all open conversations.
DEFINE DATA CONTEXT	Defines variables known as context variables, which are meant to be available to multiple remote subprograms within one conversation, without having to explicitly pass the variables as parameters with the corresponding CALLNAT statements.

See also the section *Natural Statements Involved* in the *Natural RPC (Remote Procedure Call)* documentation.

## **Internet and XML**

PARSE	Allows you to parse XML documents from a Natural program.
REQUEST DOCUMENT	Allows you to access an external system.

## **Miscellaneous**

DEFINE DATA	Defines the data elements which are to be used in a Natural program or routine.	
END	Indicates the end of the source code of a Natural program or routine.	
INCLUDE	Incorporates Natural copycode at compilation.	
ON ERROR	Intercepts runtime errors which would otherwise result in a Natural error message, followed by the termination of the Natural program.	
RELEASE	Deletes the contents of the Natural stack; releases sets of ISN sets retained via a FIND statement; releases Natural global variables.	
SET CONTROL	Performs a Natural terminal command from within a Natural program.	
SET KEY	Assigns functions to terminal keys.	
SET GLOBALS	Sets values for session parameters.	
SET TIME	Establishes a point-in-time reference for a *TIMD system variable.	
STACK	Places data and/or commands into the Natural stack.	

# **Reporting Mode Statements**

The following statements are for reporting mode only:

LOOP	Closes a processing loop.
DO/DOEND	Specify a group of statements to be executed based on a logical condition.
OBTAIN	Causes one or more fields to be read from a file.
REDEFINE	Redefines a field.

The following statements can be used both in structured mode and in reporting mode, however, the statement structure and, with some of them, the functionality is different:

AT START OF DATA	Specifies statements to be performed when the first of a set of records is processed in a processing loop.	
AT END OF DATA	Specifies statements to be performed after the last of a set of records has been processed in a processing loop.	
AT BREAK	Specifies statements to be performed when the value of a control field changes (break processing).	
AT TOP OF PAGE	Specifies processing to be performed when a new output page is started.	
AT END OF PAGE	Specifies processing to be performed when the end of an output page is reached.	
BEFORE BREAK PROCESSING	Specifies statements to be performed before performing break processing.	
CALL LOOP	Generates a processing loop containing a call to a non-Natural program.	
CALL FILE	Invokes a non-Natural program to read a record from a non-Adabas file.	
COMPUTE	Performs arithmetic operations or assigns values to fields.	
DEFINE SUBROUTINE	Defines a Natural subroutine.	
ESCAPE	Stops the execution of a processing loop.	
FIND	Selects records from a database file based on user-specified criteria.	
GET SAME	Re-reads the record currently being processed.	
HISTOGRAM	Reads the values of a database field.	
IF	Performs statements depending on a logical condition.	
IF SELECTION	Verifies that in a sequence of alphanumeric fields one and only one contains a value.	
ON ERROR	Intercepts runtime errors which would otherwise result in a Natural error message, followed by the termination of the Natural program.	
READ	Reads a database file in physical or logical sequence of records.	
READ WORK FILE	Reads data from a work file.	
REPEAT	Initiates a processing loop (and terminates it based on a specified condition).	
SORT	Sorts records.	
STORE	Adds a new record to the database.	
UPDATE	Updates a record in the database.	
UPLOAD PC FILE	Enables transfer data from a PC to a mainframe, UNIX or OpenVMS platform.	

## Statements Available with Predict Case and Entire DB

The following Natural statements can be used in conjunction with Predict Case and Entire DB Engine:

- DLOGOFF/DLOGON
- IMPORT
- EXPORT
- SHOW

For more information about these statements, see the Predict Case documentation.

# 3 Syntax Symbols and Operand Definition Tables

Syntax Symbols	. 2	2(
Operand Definition Table	. 2	21

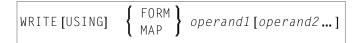
# **Syntax Symbols**

The following symbols are used within the diagrams that describe the syntax of Natural statements:

Syntax Symbol	Description	
ABCDEF	Upper-case non-italic letters indicate that the term is either a Natural keyword or a Natural reserved word that must be entered exactly as specified.	
ABCDEF	If an optional term in upper-case letters is completely underlined (not a hyperlink!), this indicates that the term is the default value. If you omit the term, the underlined value applies.	
<u>ABC</u> DEF	If a term in upper-case letters is partially underlined (not a hyperlink!), this indicates that the underlined portion is an acceptable abbreviation of the term.	
abcdef	Letters in italics are used to represent variable information. You must supply a valid value when specifying this term.	
	<b>Note:</b> In place of <i>statement</i> or <i>statements</i> , you must supply one or several suitable	
	statements, depending on the situation. If you do not want to supply a specific statement, you may insert the IGNORE statement.	
[ ]	Elements contained within square brackets are optional.	
	If the square brackets contain several lines stacked one above the other, each line is an optional alternative. You may choose at most one of the alternatives.	
{ }	If the braces contain several lines stacked one above the other, each line is an alternative. You must choose exactly one of the alternatives.	
	The vertical bar separates alternatives.	
	A term preceding an ellipsis may optionally be repeated. A number after the ellipsis indicates how many times the term may be repeated.	
	If the term preceding the ellipsis is an expression enclosed in square brackets or braces, the ellipsis applies to the entire bracketed expression.	
,	A term preceding a comma-ellipsis may optionally be repeated; if it is repeated, the repetitions must be separated by commas. A number after the comma-ellipsis indicates how many times the term may be repeated.	
	If the term preceding the comma-ellipsis is an expression enclosed in square brackets or braces, the comma-ellipsis applies to the entire bracketed expression.	
:	A term preceding a colon-ellipsis may optionally be repeated; if it is repeated, the repetitions must be separated by colons. A number after the colon-ellipsis indicates how many times the term may be repeated.	
	If the term preceding the colon-ellipsis is an expression enclosed in square brackets or braces, the colon-ellipsis applies to the entire bracketed expression.	

Syntax Symbol	Description
Other symbols	All other symbols except those defined in this table must be entered exactly as specified.
1:	<i>Exception</i> : The SQL scalar concatenation operator is represented by two vertical bars that must be entered literally as they appear in the syntax definition.

## **Example:**



- WRITE, USING, MAP and FORM are Natural keywords which you must enter as specified.
- *operand1* and *operand2* are user-supplied variables for which you specify the names of the objects you wish to deal with.
- The braces indicate that you must choose whether to specify either FORM or MAP; however, you must specify one of the two.
- The square brackets indicate that USING and *operand2* are optional elements which you can, but need not, specify.
- The ellipsis indicates that you may specify operand2 several times.

## **Operand Definition Table**

Whenever one or more operands appear in the syntax of a Natural statement, the following table is provided:

Operand	Possible Structure	Possible Formats	Referencing Dynamic Definition
			Permitted
operand1	C S A G N/M	AUNPIFBDTLCO	yes/no yes/no

This table provides the following information on each operand:

## **Possible Structure**

Indicates the structure which the operand may take:

С	Constant.		
S	Single occurrence (scalar; that is, a field/variable which is neither an array nor a group).		
Α	Array.		
G	Group.		
N/M	Natural system variable:		
	N	All system variables can be used.	
	М	Only <i>modifiable</i> system variables can be used. For information on whether the content of a system variable is modifiable or not, see the Natural <i>System Variables</i> documentation.	
E	Arithmetic expressions.	•	

## **Possible Formats**

Indicates the format which the operand may take:

Α	Alphanumeric (EBCDIC code page)
U	Alphanumeric (Unicode)
N	Numeric unpacked
P	Packed numeric
I	Integer
F	Floating point
В	Binary
D	Date
T	Time
L	Logical
С	Attribute control
0	HANDLE OF OBJECT

## **Referencing Permitted**

Indicates whether the operand may be referenced or not, using a statement label or the source code line number.

## **Dynamic Definition**

Indicates whether the field may be dynamically defined within the body of the program. This is possible in reporting mode only.

# II

## **Using Natural SQL Statements**

In addition to the native Natural DML statements, Natural provides Natural SQL statements for use in Natural programs that maintain data contained in an SQL or SQL-compliant database.

This chapter describes the special syntax rules and conventions that apply when using Natural SQL statements.

Common Set and Extended Set
Basic Syntactical Items
Natural View Concept
Scalar Expressions
Search Conditions
Select Expressions
Flexible SQL

## Overview of Natural SQL Statements:

CALLDBPROC | COMMIT | DELETE | INSERT | MERGE | PROCESS SQL | READ RESULT SET | ROLLBACK | SELECT | UPDATE

# 4

## Common Set and Extended Set

The SQL statements available within the Natural programming language comprise two different syntax sets:

### Common Set

The Common Set basically corresponds to the standard SQL syntax definitions and is provided for each SQL-compliant database system supported by Natural.

## **Extended Set**

The Extended Set, in addition, provides special enhancements to the Common Set to support specific features of the various supported database systems. The supported part of the Extended Set differs with each of these database systems.

The Natural SQL statements documentation mainly describes the Natural SQL Common Set. The statement syntax adheres as far as possible to the syntax described in the relevant literature on SQL; please, refer to this literature for further details. For details on the Natural SQL Extended Set, see the documentation of *Natural for DB2*.

# 5 Basic Syntactical Items

Constants	31
Names	
Parameters	
■ Include Columns Clause	
Period Clause	
Natural Formats and SQL Data Types	

This chapter describes basic syntactical items, which are referenced within the individual SQL statement descriptions.

## **Constants**

The constants used in the syntactical descriptions of the Natural SQL statements are:

constant	The item constant refers to either a Natural constant or an SQL datetime constant.
integer	The item integer always represents an integer constant.



**Note**: If the character for decimal point notation (session parameter DC) is set to a comma (,), any specified numeric constant must not be followed directly by a comma, but must be separated from it by a blank character; otherwise an error or wrong results occur.

Invalid Syntax:	Valid Syntax:		
VALUES (1,'A') leads to a syntax error.	VALUES (1 ,'A')		
VALUES (1,2,3) leads to wrong results.	VALUES (1 ,2 ,3)		

### **SQL Datetime Constants**

An SQL datetime constant is a character string constant of a particular format that specifies one of the following:

DATE string-constant	Specifies an SQL date constant, for example: DATE '2013-15-01'.
TIME string-constant	Specifies an SQL time constant, for example: TIME '10:30:15'.
TIMESTAMP string-constant Specifies an SQL time stamp constant, for example: TIMESTAMP '2014-15-01 10:20:15.123456'.	

For information on the valid string-constant formats, refer to IBM's DB2 SQL reference information.

## **Names**

The names used in the syntactical descriptions of the Natural SQL statements are:

- authorization-identifier
- ddm-name
- view-name
- column-name
- location-name

- table-name
- correlation-name

## authorization-identifier

The item <code>authorization-identifier</code>, which is also called creator name, is used to qualify database tables and views. See also <code>authorization-identifier</code> under <code>table-name</code> below.

### ddm-name

The item <code>ddm-name</code> always refers to the name of a Natural data definition module (DDM) as created with the Natural utility <code>SYSDDM</code>.

#### view-name

The item *view-name* always refers to the name of a Natural view as defined in the DEFINE DATA statement.

### column-name

The item column-name always refers to the name of a physical database column.

#### location-name

The item <code>location-name</code> always denotes the location of the table. Specification of location-name is optional and belongs to the SQL Extended Set.

#### table-name

The item table-name in this section is used to reference both SQL base tables and SQL viewed tables.

Syntax of item table-name:

[[location-name.]authorization-identifier.]ddm-name

Syntax Element Description:

Syntax Element	Description
ddm-name	A Natural data definition module (DDM) must have been created for a table to be used. The name of such a DDM must be the same as the corresponding database table name or view name.
location-name	This optional item specifies the location of the table to be accessed.
authorization-identifier	There are two ways of specifying the <code>authorization-identifier</code> of a database table or view.  One way corresponds to the standard SQL syntax, in which the <code>authorization-identifier</code> is separated from the table name by a period. Using this form, the name of the DDM must be the same as the name of the database table without the <code>authorization-identifier</code> .  Example:
	DEFINE DATA LOCAL 01 PERS VIEW OF PERSONNEL 02 NAME 02 AGE END-DEFINE SELECT * INTO VIEW PERS FROM SQL.PERSONNEL
	Alternatively, you can define the <i>authorization-identifier</i> as part of the DDM name. The DDM name then consists of the <i>authorization-identifier</i> and the database table name separated by a hyphen (-). The hyphen between the <i>authorization-identifier</i> and the table name is converted internally into a period.
	<b>Note:</b> This form of DDM name can also be used with a FIND or READ statement, because it conforms to the DDM naming conventions applicable to these statements.
	Example:
	DEFINE DATA LOCAL 01 PERS VIEW OF SQL-PERSONNEL 02 NAME 02 AGE END-DEFINE SELECT * INTO VIEW PERS FROM SQL-PERSONNEL
	If the authorization-identifier has been specified neither explicitly nor within the DDM name, it is determined by the SQL database system.

Syntax Element	Description
	In addition to being used in SELECT statements, table names can also be specified in DELETE, INSERT and UPDATE statements.
	Examples:
	DELETE FROM SQL.PERSONNEL WHERE AGE IS NULL
	INSERT INTO SQL.PERSONNEL (NAME, AGE) VALUES ('ADKINSON', 35)
	UPDATE SQL.PERSONNEL SET SALARY = SALARY * 1.1 WHERE AGE > 30

## correlation-name

The item *correlation-name* represents an alias name for a *table-name*. It can be used to qualify column names; it also serves to implicitly qualify fields in a Natural view when used with the INTO clause of the SELECT statement.

## Example:

```
DEFINE DATA LOCAL

01 PERS-NAME (A20)

01 EMPL-NAME (A20)

01 AGE (I2)

END-DEFINE

...

SELECT X.NAME , Y.NAME , X.AGE

INTO PERS-NAME , EMPL-NAME , AGE

FROM SQL-PERSONNEL X , SQL-EMPLOYEES Y

WHERE X.AGE = Y.AGE

END-SELECT

...
```

Although in most cases the use of *correlation-names* is not necessary, they may help to make the statement clearer.

## **Parameters**

Syntax of item parameter:

[[:sql-type]:] host-variable [INDICATOR [:] host-variable] [LINDICATOR [:] host-variable]

Syntax Element Description:

Syntax Element	Description			
sq1-type	An $sql$ - $type$ specifies the SQL data type of the $host$ - $variable$ when it is used for DB2 access. The specification of $sql$ - $type$ is optional as most SQL data types are implicitly assigned to Natural host-variables. However, for some Natural host-variables the SQL data type cannot be associated implicitly. $sql$ - $type$ belongs to the SQL Extended Set.  If a $sql$ - $type$ is specified, it has to be surrounded by colons (:). Valid $sql$ -types are:			
	sq1-type	Natural Format	DB2 SQL Data Type	
	BLOBFILE	group(I4,I4,I4,A255)	BLOB file reference(916/917)	
	CLOBFILE	group(I4,I4,I4,A255)	CLOB file reference(920/921)	
	DBCLOBFILE	group(I4,I4,I4,A255)	DBCLOB file reference(924/925)	
	BLOBLOC	(I4)	BLOB locator960/961)	
	CLOBLOC	(I4)	CLOB locator(964/965)	
	DBCLOBLOC	(I4)	DBCLOB locator(968/969)	
	See also Nature	al Formats and SQL	Data Types.	
host-variable	A host-variable is a Natural user-defined variable (no system variable) which is referenced in an SQL statement. It can be either an individual field or defined as part of a Natural view.  When defined as a receiving field (for example, in the INTO clause), a host-variable identifies a variable to which a value is assigned by the database system.  When defined as a sending field (for example, in the WHERE clause), a host-variable			
	_	te to be passed from tall Formats and SQL	the program to the database syste  Data Types.	m.
[:]	Colon:	~	· · ·	
	When used wit		ost-variable can also be prefixors of the control o	•
	Example:			

Syntax Element	Description
	SELECT NAME INTO :#NAME FROM PERSONNEL WHERE AGE = :VALUE
	The colon is always required if the variable name is identical to an SQL reserved word. In a context in which either a <code>host-variable</code> or a column can be referenced, the use of a name without a colon is interpreted as a reference to a column.
INDICATOR	INDICATOR Clause:
	The INDICATOR clause is an optional feature to distinguish between a "null" value (that is, no value at all) and the actual values 0 or "blank".
	When specified with a receiving <code>host-variable</code> (target field), the <code>INDICATOR</code> <code>host-variable</code> (null indicator field) serves to find out whether a column to be retrieved is "null".
	Example:
	DEFINE DATA LOCAL  1 NAME (A20)  1 NAMEIND (I2)  END-DEFINE  SELECT *  INTO NAME INDICATOR NAMEIND
	In this example, NAME represents the receiving <code>host-variable</code> and <code>NAMEIND</code> the null indicator field.
	If a null indicator field has been specified and the column to be retrieved is null, the value of the null indicator field is negative and the target field is set to 0 or "blank" depending on its data type. Otherwise, the value of the null indicator field is greater than or equal to 0.
	When specified with a sending <i>host-variable</i> (source field), the null indicator field is used to designate a null value for this field.
	Example:
	DEFINE DATA LOCAL  1 NAME (A20)  1 NAMEIND (I2)  UPDATE  SET NAME = :NAME INDICATOR :NAMEIND  WHERE
	In this example, : NAME represents the sending <code>host-variable</code> and : NAMEIND the null indicator field. By entering a negative value as input for the null indicator field, a null value is assigned to a database column.
	An INDICATOR host-variable is of format/length I2.

Syntax Element	Description
LINDICATOR	LINDICATOR Clause:
	The LINDICATOR clause is an optional feature which is used to support columns of varying lengths, for example, VARCHAR or LONG VARCHAR type.
	When specified with a receiving <code>host-variable</code> (target field), the <code>LINDICATOR</code> <code>host-variable</code> (length indicator field) contains the number of characters actually returned by the database into the target field. The target field is always padded with blanks.
	If the VARCHAR or LONG VARCHAR column contains more characters than fit in the target field, the length indicator field is set to the length actually returned (that is, the length of the target field) and the null indicator field (if specified) is set to the total length of this column.
	Example
	DEFINE DATA LOCAL  1 ADDRESSLIND (12)  1 ADDRESS (A50/1:6) END-DEFINE SELECT * INTO :ADDRESS(*) LINDICATOR :ADDRESSLIND
	In this example, :ADDRESS(*) represents the target field which receives the first 300 bytes (if available) of the addressed VARCHAR or LONG VARCHAR column, and :ADDRESSLIND represents the length indicator field which contains the number of characters actually returned.
	When specified with a sending $host-variable$ (source field), the length indicator field specifies the number of characters of the source field which are to be passed to the database.
	Example:
	DEFINE DATA LOCAL  1 NAMELIND (I2)  1 NAME (A20)  1 AGE (I2)  END-DEFINE  MOVE 4 TO NAMELIND  MOVE 'ABC%' TO NAME  SELECT AGE  INTO :AGE  WHERE NAME LIKE :NAME LINDICATOR :NAMELIND
	• • • • • • • • • • • • • • • • • • • •

Syntax Element	Description
	A LINDICATOR <i>host-variable</i> is of format/length I2 or I4. For performance reasons, it should be specified immediately before the corresponding target or source field; otherwise, the field is copied to the temporary storage at runtime.
	If the LINDICATOR field is defined as an I2 field, the SQL data type VARCHAR is used for sending or receiving the corresponding column. If the LINDICATOR <code>host-variable</code> is specified as I4, a large object data type (CLOB/BLOB) is used.
	If the field is defined as DYNAMIC, the column is read in an internal loop up to its real length. The LINDICATOR field and *LENGTH are set to this length. In case of a fixed length field, the column is read up to the defined length. In both cases, the field is written up to the value defined in the LINDICATOR field.
	Let a fixed length field be defined with a LINDICATOR field specified as I2. If the VARCHAR column contains more characters than fit into this fixed length field, the length indicator field is set to the length actually returned and the null indicator field (if specified) is set to the total length of this column (retrieval). This is not possible for fixed length fields greater than or equal to 32 KB (length does not fit into null indicator field).

## **Include Columns Clause**

include-columns

This clause belongs to the **SQL Extended Set**. It is available in the statements DELETE, INSERT, MERGE and UPDATE.

Syntax of include-columns clause:

INCLUDE (column-name data-type,...)

## Syntax Element Description:

Syntax Element	Description
INCLUDE	The keyword INCLUDE introduces a list of columns that is to be included in the result table of a DELETE, INSERT, MERGE or UPDATE statement. INCLUDE can only be specified when a DELETE, INSERT, MERGE or UPDATE statement is nested in the FROM clause of a SELECT statement.
	Specifies the name of a column of the result table of the MERGE statement that is not the same name as another include column or a column in the target table.
data-type	Specifies the data type of the include column. See below.

data-type

```
{ built-in-type }
distinct-type }
```

Syntax Element Description:

Syntax Element	Description
1	Specifies a built-in data type. See the IBM $DB2$ for $z/OS$ documentation for a description of built-in types.
distinct-type	Specifies a distinct type.

## **Period Clause**

period-clause

This clause belongs to the **SQL Extended Set**. It is available in the statements **searched** DELETE and **searched** UPDATE.

Syntax:

FOR PORTION OF BUSINESS\_TIME FROM expr1 TO expr2

Syntax Element Description:

Syntax Element	Description
FOR PORTION OF BUSINESS_TIME	Specifies that the DELETE or UPDATE only applies to row values for the portion of the BUSINESS_TIME period in the row that is specified by the period clause.
	BUSINESS_TIME must be a period that is defined for the table referenced in the DELETE and UPDATE statement.
FROM expr1 TO expr2	Specifies that the update applies to rows for the period that is specified by FROM expr1 TO expr2.
	If the period that is specified by the start value and the end value for the BUSINESS_TIME of a row is fully contained in the specified period (if the start value for the period in the row is less than $expr2$ and the end value for the period in the row is greater than $expr1$ ), that row is updated or deleted, and the start and end values for the BUSINESS_TIME period remain unchanged.
	If the period that is specified by the start value and the end value for the BUSINESS_TIME of a row is only partially contained in the specified period (if the start value for the period in the row is greater than <i>expr2</i> or the end value for the period

Syntax Element	Description
	in the row is less than $expr1$ ), that row is updated or deleted and then one or two additional rows are inserted. The inserted rows represent the original row values for the periods that were not updated or deleted by the update operation. For the inserted rows, the start value and end value for the BUSINESS_TIME are set in such a way that either the start value for the BUSINESS_TIME is the start value for the BUSINESS_TIME of the original row and the end value is $expr1$ , or the start value is $expr2$ and the end value is the end value for the BUSINESS_TIME of the original row.
expr1 and expr2	Specify expressions that return a value of a built-in data type. The result of each expression must be comparable to the data type of the columns of the specified period. Timestamp with TIME ZONE is not allowed as the result data type for $expr1$ or $expr2$ .

# **Natural Formats and SQL Data Types**

The Natural data format of a **host-variable** is converted to an SQL data type according to the following table:

Natural Format/Length	SQL Data Type
An, A DYNAMIC	CHAR (n), VARCHAR(n), CLOB(n)
B2 (COMPOPT DB2BIN=OFF)	SMALLINT
B4 (COMPOPT DB2BIN=OFF)	INT
F4	REAL
F8	DOUBLE PRECISION
Ī2	SMALLINT
I4	INT
Nnn.m	NUMERIC (nn+m,m)
Pnn.m	NUMERIC (nn+m,m)
T, A8	TIME
T (COMPOPT DB2TSTI=ON)	TIMESTAMP
D, A10	DATE
A26	TIMESTAMP
A19	TIMESTAMP(0)
A20+n	TIMESTAMP(n) (1<=n<=12)
A25	TIMESTAMP( $\theta$ ) WITH TIMEZONE
A26+n	TIMESTAMP(n) WITH TIMEZONE (1<=n<=12)
Gn; for view fields only	GRAPHIC (n)

Natural Format/Length	SQL Data Type
Un, U DYNAMIC	GRAPHIC (n) ,VARGRAPHIC(n), DBCLOB(n) CCSID 1200
Bn, B DYNAMIC (COMPOPT DB2BIN=ON)	BINARY(n), VARBINARY(n), BLOB(n)
Bn, B DYNAMIC (COMPOPT DB2BIN=OFF)	CHAR(n), VARCHAR(n), BLOB(n)
P19.0	BIGINT
F8	DECFLOAT(n)
A DYNAMIC, B DYNAMIC, U DYNAMIC	XML
Group structure(I4,I4,I4,A255) prefixed with :BLOBFILE:	BLOB-file-reference
Group structure(I4,I4,I4,A255) prefixed with :CLOBFILE:	CLOB-file-reference
Group structure(I4,I4,I4,A255) prefixed with :DBCLOBFILE:	DBCLOB-file-reference
I4 prefixed with :BLOBLOC:	BLOB-locator
I4 prefixed with :CLOBLOC:	CLOB-locator
I4 prefixed with :DBCLOBLOC:	DBCLOB-locator

Natural does not check whether the converted SQL data type is compatible to the database column. Except for fields of format N, no data conversion is done.

In addition, the following extensions to standard Natural formats are available with Natural SQL:

- A one-dimensional array of format A can be used to support alphanumeric columns longer than 253 bytes. This array must be defined beginning with index 1 and can only be referenced by using an asterisk (\*) as the index. The corresponding SQL data type is CHAR (n), where n is the total number of bytes in the array.
- A special *host-variable* indicated by the keyword LINDICATOR can be used to support variable-length columns. The corresponding SQL data type is VARCHAR (*n*); see also the LINDICATOR clause.
- The Natural formats date (D) and time (T) can be used with Natural for DB2. They are converted to DB2 DATE and TIME.

A sending field specified as one-dimensional array without a LINDICATOR field is converted into the SQL data type VARCHAR. The length is the total number of bytes in the array, not taking into account trailing blanks.

# 6

## **Natural View Concept**

Some Natural SQL statements also support the use of Natural views.

A Natural view can be specified instead of a parameter list, where each field of the view - except group fields, redefining fields and fields prefixed with L@ or N@- corresponds to one parameter (host variable).

Fields with names prefixed with L@ or N@ can only exist with corresponding master fields; that is, fields of the same name, where:

- L@ fields are converted into LINDICATOR fields,
- N@ fields are converted into INDICATOR fields.

L@ fields should have been specified at view definition, immediately before the master fields to which they apply.

```
DEFINE DATA LOCAL
01 PERS VIEW OF SQL-PERSONNEL
 02 PERSID (I4)
  02 NAME
               (A20)
 02 NAME (A2
02 N@NAME (I2)
                                         /* null indicator of NAME
                                         /* length indicator of ADDRESS
 02 L@ADDRESS (I2)
  02 ADDRESS (A50/1:6)
                                         /* null indicator of ADDRESS
 02 N@ADDRESS (I2)
01 #PERSID
            (I4)
END-DEFINE
  . . .
SELECT *
  INTO VIEW PERS
  FROM SQL-PERSONNEL
  WHERE PERSID = #PERSID
END-SELECT
```

The above example is equivalent to the following one:

```
SELECT *

INTO PERSID,

NAME INDICATOR N@NAME,

ADDRESS(*)INDICATOR N@ADDRESS LINDICATOR L@ADDRESS

FROM SQL-PERSONNEL

WHERE PERSID = #PERSID

...

END-SELECT
```

# 7 Scalar Expressions

Scalar Expression	44
Scalar Operator	44
Factor	45
Row Value Expression	. 55

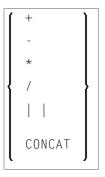
## **Scalar Expression**

A scalar-expression consists of a factor or other scalar expressions including scalar operators.

Concerning reference priority, scalar expressions behave as follows:

- When a non-qualified variable name is specified in a scalar expression, the first approach is to resolve the variable name as column name of the referenced table.
- If no column with the specified name is available in the referenced table, Natural tries to resolve this variable as a Natural user-defined variable (host variable).

## **Scalar Operator**



A scalar-operator can be any of the operators listed above. The minus (-) and slash (/) operators must be separated by at least one blank from preceding operators.

## **Factor**

Common Set Syntax:

```
atom
column-reference
aggregate-function
special-register
```

Extended Set Syntax:

```
atom
column-reference
aggregate-function
olap-specification
row-change-expression
special-register
scalar-function
(scalar-expression,...)
labeled-duration
case-expression
cast-expression
user-defined-function-reference
sequence-reference
time-zone-specific-expression
scalar-fullselect
```

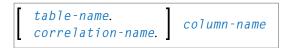
A factor can consist of one of the items listed in the above diagram and described in the text below.

## Atom

```
{ parameter }
 constant }
```

An atom can be either a parameter or a constant.

### Column Reference



A *column-reference* is a column name optionally qualified by either a *table-name* or a *correlation-name* (see also the section *Basic Syntactical Items*). Qualified names are often clearer than unqualified names and sometimes they are essential.



**Note:** A table name in this context must not be qualified explicitly with an authorization identifier. Use a correlation name instead if you need a qualified table name.

If a column is referenced by a table-name or correlation-name, it must be contained in the corresponding table. If neither a table-name nor a correlation-name is specified, the respective column must be in one of the tables specified in the FROM clause (see *Table Expression*).

## **Aggregate Function**

Common Set Syntax:

Extended Set Syntax:

```
scalar-expression
      COUNT
                                      DISTINCT }
    COUNT-BIG
       AVG
       MAX
       MIN
       SUM
                                             scalar-expression)
      STDDEV
   STDDEV SAMP
     VARIANCE
  VARIANCE_SAMP
   CORRELATION
                  (scalar-expression-1, scalar-expression-2)
    COVARIANCE
COVARIANCE_SAMP
```

SQL provides a number of special functions to enhance its basic retrieval power. The so-called SQL aggregate functions currently available and supported by Natural are:

AVG	gives the average of the values in a column
COUNT	gives the number of values in a column
MAX	gives the highest value in a column
MIN	gives the lowest value in a column
SUM	gives the sum of the values in a column

Apart from COUNT(\*), each of these functions operates on the collection of scalar values in an argument (that is, a single column or a scalar-expression) and produces a scalar value as its result.

## Example:

```
DEFINE DATA LOCAL

1 AVGAGE (I2)
END-DEFINE
...

SELECT AVG (AGE)
INTO AVGAGE
FROM SQL-PERSONNEL
...
```

### **DISTINCT**

In general, the argument can optionally be preceded by the keyword DISTINCT to eliminate redundant duplicate values before the function is applied.

If DISTINCT is specified, the argument must be the name of a single column; if DISTINCT is omitted, the argument can consist of a general *scalar-expression*.

DISTINCT is not allowed with the special function COUNT(\*), which is provided to count all rows without eliminating any duplicates.

## **ROW CHANGE Expression**

```
ROW CHANGE { TIMESTAMP TOKEN } FOR table-designator
```

A ROW CHANGE expression returns a token or a timestamp that represents the last change to a row.

TIMESTAMP	Specifies a timestamp is returned that represents the last time when a row was changed.
	Specifies a token of type BIGINT is returned that represents a relative point in the modification sequence of a row.
FOR table-designator	Identifies the table in which the expression is referenced. table-designator has to be a valid Natural SQL DDM.

## **OLAP Specification**

```
{ ordered-OLAP-specification 
  numbering-specification 
  aggregation-specification
```

ordered-OLAP-specification

```
{ RANK DENSE_RANK } ( ) OVER([window-partition-clause] window-order-clause)
```

## numbering-specification

```
ROW_NUMBER ( ) OVER ([window-partition-clause] [window-order-clause])
```

### aggregation-specification

```
aggregate-function OVER ([window-partition-clause])

RANGE BETWEEN UNBOUNDED PRECEDING AND UNBOUNDED FOLLOWING

RANGE BETWEEN UNBOUNDED

PRECEDING AND UNBOUNDED

FOLLOWING

window-aggregation-group-clause
```

### aggregate-function

```
AVG function

CORRELATION function

COUNT function

COUNT_BIG function

COVARIANCE function

MAX function

MIN function

STDDEV function

SUM function

VARIANCE function
```

#### window-aggregation-group-clause

```
\left\{ \begin{array}{l} {\sf ROWS} \\ {\sf RANGE} \end{array} \right\} \left\{ \begin{array}{l} {\it group-start} \\ {\it group-between} \\ {\it group-end} \end{array} \right\}
```

#### group-start

```
UNBOUNDED PRECEDING

unsigned-constant PRECEDING

CURRENT ROW
```

### group-between

```
BETWEEN group-bound-1 AND group-bound-2
```

### group-bound-1

```
UNBOUNDED PRECEDING
unsigned-constant PRECEDING
unsigned-constant FOLLOWING
CURRENT ROW
```

### group-bound-2

```
UNBOUNDED FOLLOWING
unsigned-constant PRECEDING
unsigned-constant FOLLOWING
CURRENT ROW
```

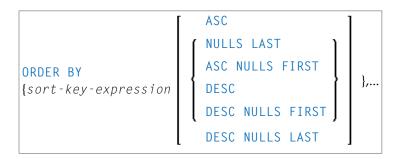
#### group-end

```
{ UNBOUNDED FOLLOWING unsigned-constant FOLLOWING }
```

## window-partition-clause

```
PARTITION BY partitioning-expression,...
```

#### window-order-clause



Online analytical processing (OLAP) specifications provide the ability to return ranking, row numbering and aggregation information as a scalar value in the result of a query. An OLAP specification can be included in an expression, in a select-list, or in the ORDER BY clause of a SELECT statement. The query result to which the OLAP specifications are applied is the result table of the innermost subselect that includes the OLAP specifications.

RANK	Specifies that the rank of a row is defined as 1 plus the number of rows that strictly precede the row.
DENSE_RANK	Specifies that the rank of a row is defined as 1 plus the number of preceding rows that are distinct with respect to the ordering.
ROW_NUMBER	Specifies that a sequential row number is computed for the row that is defined by the ordering, starting with 1 for the first row.
PARTITION BY	Defines the partition within which the OLAP operation is applied.
ORDER BY	Defines the ordering of rows within a partition that is used to determine the value of the OLAP specification.
ASC	Specifies that the values of sort-key-expression are used in ascending order.
DESC	Specifies that the values of sort-key-expression are used in descending order.
NULLS_FIRST	Specifies that the window ordering considers null values before all non-null values in the sort order.
NULLS LAST	Specifies that the window ordering considers null values after all non-null values in the sort order.

#### Example:

Display the ranking of employees that have a total salary of more than \$30,000, in order by last name.

```
SELECT EMPNO, LASTNAME, FIRSTNME, SALARY+BONUS AS TOTAL_SALARY,
RANK() OVER(ORDER BY SALARY+BONUS DESC) AS RANK_SALARY
FROM DSN8910-EMP WHERE SALARY+BONUS > 30000
ORDER BY LASTNAME;
```

#### **Time-Zone-Specific Expression**

time-zone-specific-expression

Specifies a timestamp with time zone value: AT LOCAL or AT TIME ZONE

AT LOCAL



#### AT TIME ZONE

```
function-invocation
                                      function-invocation
(expression)
                                       (expression)
constant
                                      constant
column-name
                                      column-name
                      {AT TIME ZONE}
variable
                                      variable
special-register
                                      special-register
scalar-fullselect
                                      scalar-fullselect
case-expression
                                      case-expression
cast-specification
                                      cast-specification
```

#### **Special Register**

special-register

A reference to a special register returns a scalar value.

For more information on the special registers that are supported by Natural, see <code>special-register</code> in the section <code>Syntactical Items Common to Natural SQL Statements</code> in the <code>Database Management System Interfaces</code> documentation.

#### **Scalar Function**

scalar-function

A scalar function is a built-in function that can be used in the construction of scalar computational expressions.

For information on the scalar functions that are supported by Natural, see <code>scalar-function</code> in the section <code>Syntactical Items Common to Natural SQL Statements</code> in the <code>Database Management System Interfaces</code> documentation.

#### **Labeled Duration**

labeled-duration

```
YEAR

YEARS

MONTH

MONTHS

DAY

DAYS

HOUR

HOURS

MINUTE

MINUTES

SECOND

SECONDS

MICROSECONDS

MICROSECONDS
```

A labeled-duration denotes a specific unit of time as expressed by a number which can be an expression followed by one of the duration keywords.

labeled-duration does not conform to standard SQL, and is therefore supported by the Natural SQL Extended Set only.

#### **Case Expression**

case-expression

A case-expression does not conform to standard SQL and is therefore supported by the Natural SQL Extended Set only.

#### **Searched WHEN Clause**

```
WHEN search-condition THEN \left\{ egin{array}{ll} {\sf NULL} \\ {\it scalar-expression} \end{array} \right\}
```

A Searched When Clause does not conform to standard SQL and is therefore supported by the Natural SQL Extended Set only.

See details on *search-condition*.

#### Simple WHEN Clause

```
scalar-expression \left\{ egin{array}{ll} {
m WHEN} & scalar-expression {
m THEN} & {
m NULL} \\ & scalar-expression {
m } \end{array} 
ight\} ...
```

A Simple WHEN Clause does not conform to standard SQL and is therefore supported by the Natural SQL Extended Set only.

#### **Cast Expression**

cast-expression

```
CAST (scalar-expression AS data-type)
```

A CAST expression does not conform to standard SQL and is therefore supported by the Natural **SQL Extended Set** only.

#### **User-Defined Function Reference**

The option *user-defined-function-reference* belongs to the Natural SQL Extended Set. This option enables you to invoke any user-defined function. Arguments have to be placed in brackets and separated by commas. The user-defined function must be declared in the target RDBMS.

#### Sequence Reference

The option sequence-reference belongs to the Natural SQL Extended Set.

```
\[ NEXT VALUE FOR sequence-name \] \[ PREVIOUS VALUE FOR sequence-name \]
```

This option enables you to reference the next value or the previous value of a sequence object. The sequence object has to be created in the target RDBMS before it could be referenced at runtime.

#### Scalar Fullselect

```
(fullselect)
```

The option *scalar-fullselect* belongs to the Natural **SQL** Extended Set.

A *scalar-fullselect* as supported in an expression is a *fullselect* - enclosed in parentheses - that returns a single row consisting of a single column value. If the *fullselect* does not return a row, the result of the expression is the null value. If more than one row is to be returned for a *scalar-fullselect*, an error occurs.

## **Row Value Expression**

(scalar-expression,...)

A row-value-expression returns a single row that consists of one or more column values. The values can be specified as a list of expressions. The number of columns that are returned by the row-value-expression is equal to the number of expressions. row-value-expression can be used as an operand of several predicates (quantified, DISTINCT, comparison, and IN).

## **Search Conditions**

Search Condition	. 58
Predicate	58

```
 \left\{ \begin{array}{c} [\texttt{NOT}] \left\{ \begin{array}{c} \textit{predicate} \\ \textit{(search-condition)} \end{array} \right\} \\ \textit{search-condition} \end{array} \right\} \\ \textit{search-condition} \\ \left\{ \begin{array}{c} \texttt{AND} \\ \texttt{OR} \end{array} \right\} \\ \textit{search-condition} \end{array} \right\}
```

## **Search Condition**

A search-condition can consist of a simple predicate or multiple search-conditions. Multiple search-conditions are combined with the Boolean operators AND, OR and NOT, and can contain parentheses if required to indicate a desired order of evaluation.

#### Example

```
DEFINE DATA LOCAL

01 NAME (A20)

01 AGE (I2)

END-DEFINE
...

SELECT *
  INTO NAME, AGE
  FROM SQL-PERSONNEL
  WHERE AGE = 32 AND NAME > 'K'

END-SELECT
...
```

### **Predicate**

```
scalar-expression [
                        scalar-expression
comparison
                        subquery
scalar-expression[NOT] BETWEEN scalar-expression AND scalar-expression
scalar-expression IS [NOT] DISTINCT FROM scalar-expression
column-reference
                        atom
                                                        [ESCAPE atom]
[NOT] LIKE
                        special-register
column-referenceIS [NOT] NULL
                        subquery
scalar-expression
[NOT] IN
                        ALL
scalar-expression
                        ANY
                                            subquery
comparison
                        SOME
EXISTS subquery
XMLEXISTS (xquery-expression-constant{BY REFIPASSING xquery-argument,...})
```

A predicate specifies a condition that can be "true", "false" or "unknown".

In a *search-condition*, a *predicate* can consist of a simple or complex comparison operation or other kinds of conditions.

#### Example:

```
SELECT NAME, AGE
INTO VIEW PERS
FROM SQL-PERSONNEL
WHERE AGE BETWEEN 20 AND 30
OR AGE IN ( 32, 34, 36 )
AND NAME LIKE '%er'
...
```

**Note:** The percent sign (%) may conflict with Natural terminal commands. If so, you must define a terminal command control character different from %; see *Changing the Terminal Command Control Character* in the *Terminal Commands* documentation.

The individual predicates are explained in the following topics (for further information on predicates, please refer to the relevant literature). According to the syntax above, they are called as follows:

- Comparison Predicate
- BETWEEN Predicate
- DISTINCT Predicate
- LIKE Predicate
- NULL Predicate

- IN Predicate
- Quantified Predicate
- EXISTS Predicate
- XMLEXISTS Predicate

#### **Comparison Predicate**

A comparison predicate compares two values or a set of values with another set of values.

In the syntax diagram above, comparison can be one of the following operators:

=	equal to
<	less than
>	greater than
<=	less than or equal to
>=	greater than or equal to
<>	not equal to

See information on *scalar-expression*.

#### Subquery

```
(select-expression)
```

A *subquery* is a *select-expression* that is nested inside another such expression.

#### Example:

```
DEFINE DATA LOCAL

1 #NAME (A20)

1 #PERSNR (I4)

END-DEFINE
...

SELECT NAME, PERSNR
INTO #NAME, #PERSNR
FROM SQL-PERSONNEL
WHERE PERSNR IN
( SELECT PERSNR
FROM SQL-AUTOMOBILES
WHERE COLOR = 'black')
```

```
END-SELECT
```

For further information, see *Select Expressions*.

#### **BETWEEN Predicate**

```
scalar-expression \ [{
m NOT}] \ {
m BETWEEN} \ scalar-expression \ {
m AND} \ scalar-expression
```

A BETWEEN predicate compares a value with a range of values.

See information on scalar-expression.

#### **DISTINCT Predicate**

A DISTINCT predicate compares a value with another value or a set of values with another set of values.

#### **LIKE Predicate**

A LIKE predicate searches for strings that have a certain pattern.

See information on column-reference, atom and special-register.

#### **NULL Predicate**

```
column-reference IS [NOT] NULL
```

A NULL predicate tests for null values.

If the compiler option DB2ARRY is set to ON, it is possible to specify an Natural array or an fixed index range of an array as atom. The Natural SQL compiler will then decompose the array or fixed index range into a list of scalar host variables.

See information on column-reference.

#### **IN Predicate**

```
 \left\{ \begin{array}{c} subquery \\ row-value-expression \ [\text{NOT] IN} \end{array} \right\}
```

An IN predicate compares a value or a set of values with a collection of values.

See information on scalar-expression, atom and special-register.

See information on *subquery*.

#### **Quantified Predicate**

```
 \left\{ \begin{array}{ll} scalar-expression & comparison \\ SOME \\ ANY \\ ALL \\ \end{array} \right\} subquery \\ cow-value-expression & = \\ cow-value-expression \\ cow-value-expression \\ cow-value-expression \\ cow-value-expression \\ cow-value-expression \\ cow-value-expression \\ comparison \\ compari
```

A quantified predicate compares a value or a set of values with a collection of values.

See information on *scalar-expression*, *comparison* and *subquery*.

#### **EXISTS Predicate**

```
EXISTS subquery
```

An EXISTS predicate tests for the existence of certain rows.

The EXISTS predicate evaluates to true only if the result of evaluating the *subquery* is not empty; that is, if there exists at least one record (row) in the FROM table of the *subquery* satisfying the search condition of the WHERE clause of this *subquery*.

Example of EXISTS:

```
DEFINE DATA LOCAL

1 #NAME (A20)

END-DEFINE
...

SELECT NAME
INTO #NAME
FROM SQL-PERSONNEL
WHERE EXISTS
( SELECT *
FROM SQL-EMPLOYEES
WHERE PERSNR > 1000
AND NAME < 'L' )
...

END-SELECT
...
```

See information on *subquery*.

#### **XMLEXISTS Predicate**

xquery-argument

```
{ xquery-context-item-expression  
  xquery-context-item-expression AS identifier }
```

The XMLEXISTS predicate belongs to the Natural SQL Extended Set.

The XMLEXISTS predicate tests whether an XPATH expression returns a sequence of one or more items. For further information, see the IBM *DB2 XML Guide*.

## 9 Select Expressions

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```
SELECT selection table-expression
```

A select-expression specifies a result table. It is used in the following Natural SQL statements: INSERT | SELECT | UPDATE

## **Selection**

```
 \left[ \begin{array}{c} \text{ALL} \\ \text{DISTINCT} \end{array} \right] \left\{ \left\{ \begin{array}{c} \textit{scalar-expression} \ [[AS] \ \textit{correlation-name}] \\ \star \end{array} \right\}, \dots \right\}
```

A selection specifies the columns of the result set tables to be selected.

Syntax Element Description:

Syntax Element	Description
ALL DISTINCT	Elimination of Duplicate Rows:
	Duplicate rows are not automatically eliminated from the result of a select-expression. To request this, specify the keyword DISTINCT.
	The alternative to DISTINCT is ALL. ALL is assumed if neither is specified.
scalar-expression	Scalar Expression:
	Instead of, or as well as, simple column names, a selection can also include general scalar expressions containing scalar operators and scalar functions which provide computed values (see also the section <i>Scalar Expressions</i> ).
	Example:
	SELECT NAME, 65 - AGE FROM SQL-PERSONNEL
	• • •
AS	The optional keyword AS introduces a <i>correlation-name</i> for a column.
correlation-name	Correlation Name:
	A correlation-name can be assigned to a scalar-expression as an alias name for a result column.
	The <i>correlation-name</i> need not be unique. If no <i>correlation-name</i> is specified for a result column, the corresponding <i>column-name</i> will be used (if the result column is derived from a column name; if not, the result table will have no name).

Syntax Element	Description
	The name of a result column may be used, for example, as column name in the ORDER BY clause of a SELECT statement.
*	Asterisk Notation:  All columns of the result table are selected.
	Example:
	SELECT * FROM SQL-PERSONNEL, SQL-AUTOMOBILES

## **Table Expression**

```
from-clause[where-clause]
```

The table-expression specifies from where and according to what criteria rows are to be selected.

The following topics are covered below:

- FROM Clause
- Table Reference
- WHERE Clause
- GROUP BY Clause
- HAVING Clause
- ORDER BY Clause
- INPUT SEQUENCE
- ORDER OF table-designator
- FETCH FIRST Clause
- Examples of Table Expressions

#### **FROM Clause**

FROM table-reference,...

This clause specifies from which tables the result set is built.

#### **Table Reference**

```
table-name[period-specification][correlation-clause]
[TABLE] subquery correlation-clause
  joined-table
TABLE (function-name(scalar-expression,...)) correlation-clause
  data-change-table-reference[correlation-clause]
  xmltable-function correlation-clause
```

The tables specified in the FROM clause must contain the column fields used in the selection list.

You can either specify a single table or produce an intermediate table resulting from a subquery or a "join" operation (see below).

Since various tables (that is, DDMs) can be addressed in one FROM clause and since a table-expression can contain several FROM clauses if subqueries are specified, the database ID (DBID) of the first DDM specified in the first FROM clause of the whole expression is used to identify the underlying database involved.

#### TABLE function-name Clause

The TABLE function-name clause belongs to the **SQL Extended Set** and requires a correlation-clause with a column-name list.

#### **Period Specification**

The period-specification clause belongs to the SQL Extended Set.

period-specification optionally specifies that a period specification applies to the temporal table table-name. The same period name (SYSTEM\_TIME or BUSINESS\_TIME) must not be specified more than one time for the same table.

Syntax Element	Description
FOR SYSTEM_TIME	Specifies that the SYSTEM_TIME period is used for the period-specification. SYSTEM_TIME must be a period that is defined in the table and the table must be a system-maintained temporal table that is defined with system data versioning.
FOR BUSINESS_TIME	Specifies that the BUSINESS_TIME period is used for the period-specification. BUSINESS_TIME must be a period that is defined in the table.

Syntax Element	Description
expr, expr1, expr2	Specify expressions that return a value of a built-in data type that is comparable to the data type of the columns of the specified period and must not contain a TIME ZONE.
AS OF expr	Specifies that the table includes each row for which the start value for the specified period is less than or equal to $expr$ and the end value for the period is greater than $expr$ .
FROM expr1 TO expr2	Specifies that the table includes rows that exist for the period specified from $expr1$ up to $expr2$ . A row is included in the table if the start value for the period in the row is less than $expr2$ and the end value for the period in the row is greater than $expr1$ .
BETWEEN expr1 AND expr2	Specifies that the table includes a row in which the specified period overlaps at any point in time between $expr1$ and $expr2$ . A row is included in the table if the start value for the period in the row is less than or equal to $expr2$ and the end value for the period in the row is greater than $expr1$ .

Optionally, a correlation-clause can be assigned to a table-name. For a subquery, a correlation-clause must be assigned.

#### **Correlation Clause**

```
[AS] correlation-name[(column-name,...)]
```

A correlation-clause consists of optional keyword AS and a correlation-name and is optionally followed by a plain column-name list. The column-name list belongs to the SQL Extended Set.

#### Joined Table

```
 \left\{ \begin{array}{l} \textit{table-reference} \\ \textit{table-reference} \\ \textit{RIGHT} \\ \textit{FULL} \\ \textit{[OUTER]} \\ \textit{(joined-table)} \end{array} \right\} \  \, \text{JOIN} \  \, \textit{table-reference} \, \text{ON} \, \textit{join-condition} \\ \text{(joined-table)}
```

A *joined-table* specifies an intermediate table resulting from a "join" operation.

The "join" can be an INNER, LEFT OUTER, RIGHT OUTER or FULL OUTER JOIN. If you do not specify anything, INNER applies.

Multiple "join" operations can be nested; that is, the tables which create the intermediate result table can themselves be intermediate result tables of a "join" operation or a <code>subquery</code>; and the latter, in turn, can also have a <code>joined-table</code> or another <code>subquery</code> in its <code>FROM</code> clause.

#### **Join Condition**

For INNER, LEFT OUTER, and RIGHT OUTER joins:

```
search-condition
```

For FULL OUTER joins:

```
full-join-expression = full-join-expression [AND ...]
```

#### **Full Join Expression**

Within a join-expression only column-names and the scalar-function VALUE (or its synonym COALESCE) are allowed.

See details on column-name.

#### **Data Change Table Reference**

The data-change-table-reference clause belongs to the SQL Extended Set.

A data-change-table-reference specifies an intermediate result table, which is based on the rows that are changed by the SQL change statement specified in the clause. A data-change-table-reference can only be specified as the only table reference in the FROM clause.

Syntax Element Description:

Syntax Element	Description
	Specifies that the rows of the intermediate result table represent the set of rows that are changed by the SQL data change statement as they appear at the completion of the SQL data change statement.
OLD TABLE	Specifies that the rows of the intermediate result table represent the set of rows that are changed by the SQL data change statement as they exist prior to the application of the SQL data change statement.

#### XMLTABLE Function

The xmltable-function clause belongs to the SQL Extended Set.

The item xmltable-function specifies an invocation of the built-in XMLTABLE function.

#### **WHERE Clause**

```
[WHERE search-condition]
```

The WHERE clause is used to specify the selection criteria (search-condition) for the rows to be selected.

### Example:

```
DEFINE DATA LOCAL
01 NAME (A20)
01 AGE (I2)
END-DEFINE
...
SELECT *
INTO NAME, AGE
FROM SQL-PERSONNEL
WHERE AGE = 32
END-SELECT
...
```

For further information, see *Search Conditions*.

#### **GROUP BY Clause**

```
[GROUP BY column-reference,...]
```

The GROUP BY clause rearranges the table represented by the FROM clause into groups in a way that all rows within each group have the same value for the GROUP BY columns.

Each column-reference in the selection list must be either a GROUP BY column or specified within an aggregate-function. Aggregate functions are applied to the individual groups (not to the entire table). The result table contains as many rows as groups.

For further information, see *Column Reference* and *Aggregate Function*.

#### Example:

```
DEFINE DATA LOCAL

1 #AGE (I2)

1 #NUMBER (I2)

END-DEFINE
...

SELECT AGE , COUNT(*)

INTO #AGE, #NUMBER

FROM SQL-PERSONNEL

GROUP BY AGE
...
```

If the GROUP BY clause is preceded by a WHERE clause, all rows that do not satisfy the WHERE clause are excluded before any grouping is done.

#### **HAVING Clause**

```
[HAVING search-condition]
```

If the HAVING clause is specified, the GROUP BY clause should also be specified.

Just as the WHERE clause is used to exclude rows from a result table, the HAVING clause is used to exclude groups and therefore also based on a <code>search-condition</code>. Scalar expressions in a <code>HAVING</code> clause must be single-valued per group.

For further information, see *Scalar Expressions* and *Search Conditions*.

#### Example:

```
DEFINE DATA LOCAL

1 #NAME (A20)

1 #AVGAGE (I2)

1 #NUMBER (I2)

END-DEFINE
...

SELECT NAME, AVG(AGE), COUNT(*)

INTO #NAME, #AVGAGE, #NUMBER

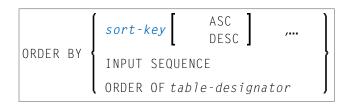
FROM SQL-PERSONNEL

GROUP BY NAME

HAVING COUNT(*) > 1

...
```

#### **ORDER BY Clause**



The *order-by* clause specifies row ordering of the result table.

sort-key

```
     column-name
     integer
     sort-key-expression
```

A sort-key-expression is an expression which is more than a column-name or an unsigned integer constant.

#### **INPUT SEQUENCE**

INPUT SEQUENCE belongs to the SQL Extended Set.

INPUT SEQUENCE indicates that the result table reflects the input order of the rows specified in the VALUES clause of an INSERT statement.

INPUT SEQUENCE can only be specified if an INSERT statement is specified in the from-clause.

#### **ORDER OF table-designator**

ORDER OF table-designator belongs to the SQL Extended Set.

ORDER OF specifies that the row ordering of the designated table by the table-designator is applied to the result table of the query.

table-designator uniquely identifies a base table, a view, or the nested table expression of a subselect.

#### **FETCH FIRST Clause**

The fetch-first clause belongs to the SQL Extended Set.

```
\left[\begin{array}{c} \text{FETCH FIRST } \left\{\begin{array}{c} 1 \\ integer \end{array}\right\} \left\{\begin{array}{c} \text{ROWS} \\ \text{ROW} \end{array}\right\} \text{ ONLY } \right]
```

The fetch-first clause limits the number of rows that can be fetched. It improves the performance of queries when only a limited number of rows are needed.

#### **Examples of Table Expressions**

#### Example 1:

```
DEFINE DATA LOCAL
01 #NAME (A20)
01 #FIRSTNAME (A15)
01 #AGE
         (I2)
. . .
END-DEFINE
SELECT NAME, FIRSTNAME, AGE
  INTO #NAME, #FIRSTNAME, #AGE
  FROM SQL-PERSONNEL
   WHERE NAME IS NOT NULL
     AND AGE > 20
 DISPLAY #NAME #FIRSTNAME #AGE
END-SELECT
. . .
END
```

#### Example 2:

```
DEFINE DATA LOCAL
01 #COUNT (I4)
...
END-DEFINE
...
SELECT SINGLE COUNT(*) INTO #COUNT FROM SQL-PERSONNEL
...
```

# 10 Flexible SQL

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The so-called "Flexible SQL", which is a further possibility of issuing SQL statements, enables you to use arbitrary SQL syntax.

## **Using Flexible SQL**

In addition to the SQL syntax described in the previous sections, flexible SQL enables you to use arbitrary SQL syntax.

#### Characters << and >>

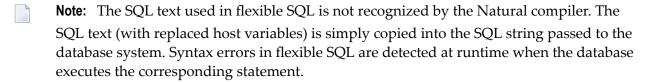
Flexible SQL is enclosed in << and >> characters. It can include arbitrary SQL text and host variables. Within flexible SQL, host variables *must* be prefixed by a colon (:).

The flexible SQL string can cover several statement lines. Comments are possible, too (see also the statement PROCESS SQL).

Flexible SQL can be used as a replacement for any of the following syntactical SQL items:

- atom
- column-reference
- scalar-expression
- predicate

Flexible SQL can also be used between the clauses of a select expression:



### Example 1

```
SELECT NAME
FROM SQL-EMPLOYEES
WHERE << MONTH (BIRTH) >> = << MONTH (CURRENT_DATE) >>
```

#### Example 2:

```
SELECT NAME
FROM SQL-EMPLOYEES
WHERE << MONTH (BIRTH) = MONTH (CURRENT_DATE) >>
```

#### Example 3:

```
SELECT NAME
FROM SQL-EMPLOYEES
WHERE SALARY > 50000
<< INTERSECT
    SELECT NAME
    FROM SQL-EMPLOYEES
    WHERE DEPT = 'DEPT10'
>>
```

## **Specifying Text Variables in Flexible SQL**

Within flexible SQL, you can also specify so-called "text variables".

```
<<:T:host-variable[LINDICATOR:host-variable]>>
```

The syntax items are described below:

:T:	A text variable is a <i>host-variable</i> prefixed by :T:. It must be in alphanumeric format.
	At runtime, a text variable within an SQL statement will be replaced by its contents that is, the text string contained in the text variable will be inserted into the SQL string.
	After the replacement, trailing blanks will be removed from the inserted text string.
	You have to make sure yourself that the content of a text variable results in a syntactically correct SQL string. In particular, the content of a text variable must not contain <code>host-variables</code> .
	A statement containing a text variable will always be executed in dynamic SQL mode.
LINDICATOR	LINDICATOR Option:

The text variable can be followed by the keyword LINDICATOR and a length indicator variable (that is, a *host-variable* prefixed by colon).

The length indicator variable has to be of format/length I2.

If no LINDICATOR variable is specified, the entire content of the text variable will be inserted into the SQL string.

If you specify a LINDICATOR variable, only the first n characters (n being the value of the LINDICATOR variable) of the text variable content will be inserted into the SQL string. If the number in the LINDICATOR variable is greater than the length of the text variable content, the entire text variable content will be inserted. If the number in the LINDICATOR variable is negative or 0, nothing will be inserted.

See general information on *host-variable*.

#### **Example Using Text Variable**

```
DEFINE DATA LOCAL

01 TEXTVAR (A200)

01 TABLES VIEW OF SYSIBM-SYSTABLES

02 NAME

02 CREATOR

END-DEFINE

*

MOVE 'WHERE NAME > ''SYS'' AND CREATOR = ''SYSIBM''' TO TEXTVAR

*

SELECT * INTO VIEW TABLES

FROM SYSIBM-SYSTABLES

<< :T:TEXTVAR >>

DISPLAY TABLES

END-SELECT

*

END
```

The generated SQL statement (as displayed with the LISTSQL system command) will look as follows:

```
SELECT NAME, CREATOR FROM SYSIBM.SYSTABLES:T: FOR FETCH ONLY
```

The executed SQL statement will look as follows:

```
SELECT TABNAME, CREATOR FROM SYSIBM.SYSTABLES
WHERE TABNAME > 'SYS' AND CREATOR = 'SYSIBM'
```

## III

## Referenced Example Programs

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This chapter contains additional example programs that are referenced in the Natural statements and system variables reference documentation. All these examples are contained in the library SYSEXSYN.



**Note:** Generally, the example programs shown in the statement descriptions are written in structured mode. For statements where the reporting-mode syntax differs considerably from the structured-mode syntax, references to equivalent reporting-mode examples are also provided. The example programs are available in source-code form in the Natural library SYSEXSYN. Further example programs of using Natural statements are documented in the section *Referenced Example Programs* in the *Programming Guide*. These example programs are provided in the Natural library SYSEXPG. Ask your Natural administrator about the availability of these libraries at your site. The example programs use data from the files EMPLOYEES and VEHICLES, which are supplied by Software AG for demonstration purposes.

#### **ASSIGN**

The following example is referenced in the ASSIGN/COMPUTE statement description:

#### ASGEX1R - ASSIGN (reporting mode)

```
** Example 'ASGEX1R': ASSIGN (reporting mode)
*************************
RESET #A (N3)
     #B (A6)
     #C (NO.3)
     #D (NO.5)
     #E (N1.3)
     #F (N5)
     #G (A25)
     #H (A3/1:3)
                                     WRITE NOTITLE '=' #A
\#A = 5
\#B = 'ABC'
                                     WRITE '=' #B
                                     WRITE '=' #C
\#C = .45
\#D = \#E = -0.12345
                                     WRITE '=' #D / '=' #E
ASSIGN ROUNDED \#F = 199.999
                                     WRITE '=' #F
                                     WRITE '=' #G
#G = 'HELLO'
\#H (1) = 'UVW'
\#H(3) = 'XYZ'
                                     WRITE '=' #H (1:3)
END
```

Output of Program AEDEX1R:

```
#A: 5

#B: ABC

#C: .450

#D: -.12345

#E: -0.123

#F: 200

#G: HELLO

#H: UVW XYZ
```

## **AT BREAK**

The following examples are referenced in the AT BREAK statement description:

### ATBEX1R - AT BREAK (reporting mode)

```
** Example 'ATBEX1R': AT BREAK (reporting mode)

*************************

LIMIT 10

READ EMPLOYEES BY CITY

AT BREAK OF CITY DO

SKIP 1

DOEND

/*

DISPLAY NOTITLE CITY (IS=ON) COUNTRY (IS=ON) NAME

LOOP
END
```

#### Output of Program ATBEX1R:

CITY	COUNTRY	NAME 
AIKEN	USA	SENKO
AIX EN OTHE	F	GODEFROY
AJACCIO		CANALE
ALBERTSLUND	DK	PLOUG
ALBUQUERQUE	USA	HAMMOND ROLLING FREEMAN LINCOLN
ALFRETON	UK	GOLDBERG

ALICANTE E GOMEZ

#### ATBEX5R - AT BREAK statement with multiple break levels (reporting mode)

```
** Example 'ATBEX5R': AT BREAK (multiple break levels) (reporting mode)
*********************
RESET LEAVE-DUE-L (N4)
LIMIT 5
FIND EMPLOYEES WITH CITY = 'PHILADELPHIA' OR = 'PITTSBURGH'
             SORTED BY CITY DEPT
 MOVE LEAVE-DUE TO LEAVE-DUE-L
 DISPLAY CITY (IS=ON) DEPT (IS=ON) NAME LEAVE-DUE-L
 AT BREAK OF DEPT
   WRITE NOTITLE /
         T*DEPT OLD(DEPT) T*LEAVE-DUE-L SUM(LEAVE-DUE-L) /
 AT BREAK OF CITY
   WRITE NOTITLE
         T*CITY OLD(CITY) T*LEAVE-DUE-L SUM(LEAVE-DUE-L) //
L00P
END
```

#### Output of Program ATBEX5R:

CITY	DEPARTMENT CODE	NAME	LEAVE-DUE-L
PHILADELPHIA	MGMT30	WOLF-TERROINI MACKARNESS	E 11 27
	MGMT30		38
	TECH10	BUSH NETTLEFOLDS	39 24
	TECH10		63
PHILADELPHIA			101
PITTSBURGH	MGMT10	FLETCHER	34
	MGMT10		34
PITTSBURGH			34

#### AT END OF DATA

The following example is referenced in the AT END OF DATA statement description:

#### AEDEX1R - AT END OF DATA (reporting mode)

```
** Example 'AEDEX1R': AT END OF DATA (reporting mode)
************************
EMP. FIND EMPLOYEES WITH CITY = 'STUTTGART'
 IF NO RECORDS FOUND
   ENTER
 DISPLAY PERSONNEL-ID NAME FIRST-NAME
         SALARY (1) CURR-CODE (1)
 /*
 AT END OF DATA DO
   IF *COUNTER (EMP.) = 0 DO
     WRITE 'NO RECORDS FOUND'
     ESCAPE BOTTOM
   DOEND
   WRITE NOTITLE / 'SALARY STATISTICS:'
                / 7X 'MAXIMUM:' MAX(SALARY(1)) CURR-CODE (1)
                / 7X 'MINIMUM: MIN(SALARY(1)) CURR-CODE (1)
                / 7X 'AVERAGE:' AVER(SALARY(1)) CURR-CODE (1)
 DOEND
L00P
END
```

#### Output of Program AEDEX1R:

PERSONNEL ID	NAN	МЕ	FIRST-NAME	ANNUAL SALARY	CURRENCY CODE
11100328	BERGHAUS		ROSE	70800	DM
11100329	BARTHEL		PETER	42000	DM
11300313	AECKERLE		SUSANNE	55200	DM
11300316	KANTE		GABRIELE	61200	DM
11500304	KLUGE		ELKE	49200	DM
SALARY STA	ATISTICS:				
MA>	KIMUM:	70800 DM			
MIM	NIMUM:	42000 DM			
AVE	ERAGE:	55680 DM			

#### AT END OF PAGE

The following example is referenced in the AT END OF PAGE statement description:

#### AEPEX1R - AT END OF PAGE (reporting mode)

#### Output of Program AEPEX1R:

NAME	CURRENT POSITION	SALARY	CURRENCY CODE
CREMER MARKUSH GEE KUNEY NEEDHAM JACKSON	ANALYST TRAINEE MANAGER DBA PROGRAMMER PROGRAMMER	34000 22000 39500 40200 32500 33000	USD USD USD USD
	AVERAGE SALARY:	33533	USD

## AT START OF DATA

The following example is referenced in the AT START OF DATA statement description:

#### ASDEX1R - AT START OF DATA (reporting mode)

```
** Example 'ASDEX1R': AT START OF DATA (reporting mode)
RESET #CITY (A20) #CNTL (A1)
REPEAT
 INPUT 'ENTER VALUE FOR CITY' #CITY
 IF \#CITY = ' 'OR = 'END'DO
    STOP
  DOEND
  FIND EMPLOYEES WITH CITY = #CITY
    IF NO RECORDS FOUND DO
     WRITE NOTITLE NOHDR 'NO RECORDS FOUND'
      ESCAPE
    DOEND
    /*
    AT START OF DATA DO
     INPUT (AD=0) 'RECORDS FOUND' *NUMBER //
                   'ENTER ''D'' TO DISPLAY RECORDS' #CNTL (AD=A)
     IF #CNTL NE 'D' DO
        ESCAPE BOTTOM
      DOEND
    DOEND
    /*
    DISPLAY NAME FIRST-NAME
  L00P
LOOP
END
```

Output of Program ASDEX1R:

ENTER VALUE FOR CITY PARIS

After entering and confirming city name:

```
RECORDS FOUND 26
ENTER 'D' TO DISPLAY RECORDS D
```

After entering and confirming D:

NAME	FIRST-NAME
MAIZIERE	ELISABETH
MARX	JEAN-MARIE
REIGNARD	JACQUELINE
RENAUD	MICHEL
REMOUE	GERMAINE
LAVENDA	SALOMON
BROUSSE	GUY
GIORDA	LOUIS
SIECA	FRANCOIS
CENSIER	BERNARD
DUC	JEAN-PAUL
CAHN	RAYMOND
MAZUY	ROBERT
FAURIE VALLY	HENRI ALAIN
BRETON	JEAN-MARIE
GIGLEUX	JACQUES
KORAB-BRZOZOWS	
XOLIN	CHRISTIAN
LEGRIS	ROGER
VVVV	

## AT TOP OF PAGE

The following example is referenced in the AT TOP OF PAGE statement description:

#### ATPEX1R - AT TOP OF PAGE (reporting mode)

```
** Example 'ATPEX1R': AT TOP OF PAGE (reporting mode)

**************************

*
FORMAT PS=15
LIMIT 15

*
READ EMPLOYEES BY NAME STARTING FROM 'L'
DISPLAY 2X NAME 4X FIRST-NAME CITY DEPT
WRITE TITLE UNDERLINED 'EMPLOYEE REPORT'
WRITE TRAILER '-' (78)
/*
AT TOP OF PAGE DO
WRITE 'BEGINNING NAME:' NAME

DOEND
/*
AT END OF PAGE DO
SKIP 1
WRITE 'ENDING NAME: ' NAME
```

```
DOEND
LOOP
END
```

## **DEFINE SUBROUTINE**

The following example is referenced in the DEFINE SUBROUTINE statement description:

#### DSREX1R - DEFINE SUBROUTINE (reporting mode)

```
** Example 'DSREX1R': DEFINE SUBROUTINE (reporting mode)
RESET #ARRAY-ALL (A300)
     #X (N2) #Y (N2)
REDEFINE #ARRAY-ALL (#ARRAY (A75/1:4))
         #ARRAY-ALL (#ALINE (A25/1:4,1:3))
FORMAT PS=20
LIMIT 5
MOVE 1 TO #X #Y
FIND EMPLOYEES WITH NAME = 'SMITH'
 OBTAIN ADDRESS-LINE (1:2)
 MOVE NAME
                       TO #ALINE (#X,#Y)
 MOVE ADDRESS-LINE(1) TO #ALINE (#X+1, #Y)
 MOVE ADDRESS-LINE(2) TO #ALINE (#X+2,#Y)
 MOVE PHONE
                     TO #ALINE (#X+3,#Y)
 IF \#Y = 3 D0
   MOVE 1 TO #Y
   PERFORM PRINT
 DOEND
 ELSE DO
   ADD 1 TO #Y
 DOEND
 AT END OF DATA DO
   PERFORM PRINT
 DOEND
L00P
DEFINE SUBROUTINE PRINT
 WRITE NOTITLE (AD=OI) #ARRAY(*)
 RESET #ARRAY(*)
 SKIP 1
RETURN
END
```

#### Output of Program AEDEX1R:

SMITH	SMITH	SMITH
ENGLANDSVEJ 222	3152 SHETLAND ROAD	14100 ESWORTHY RD.
	MILWAUKEE	MONTERREY
554349	877-4563	994-2260
SMITH	SMITH	
5 HAWTHORN	13002 NEW ARDEN COUR	
OAK BROOK	SILVER SPRING	
150-9351	639-8963	

### **FIND**

The following examples are referenced in the FIND statement description:

#### FNDFIR - FIND statement with FIRST option (reporting mode)

#### Output of Program FNDFIR:

```
TOTAL RECORDS SELECTED: 141

***FIRST PERSON SELECTED***

NAME: DEAKIN
DEPARTMENT: SALE01
JOB TITLE: SALES ACCOUNTANT
```

#### FNDNUM - FIND statement with NUMBER option (reporting mode)

#### Output of Program FNDNUM:

```
TOTAL RECORDS SELECTED: 41
TOTAL BORN BEFORE 1 JAN 1950: 16
```

#### FNDUNQ - FIND statement with UNIQUE option (reporting mode)

```
** Example 'FNDUNQ': FIND UNIQUE

*************************

RESET #NAME (A20)

*

*

INPUT 'ENTER EMPLOYEE NAME: ' #NAME

IF #NAME = ' '

STOP

*

FIND UNIQUE EMPLOYEES WITH NAME = #NAME

*

DISPLAY NOTITLE NAME FIRST-NAME JOB-TITLE

*

ON ERROR DO

WRITE 'NAME EITHER NOT UNIQUE OR DOES NOT EXIST'

FETCH 'FNDUNQ'

DOEND

*

END
```

#### Output of Program FNDUNQ:

```
ENTER EMPLOYEE NAME: HEURTEBISE
```

After entering and confirming name HEURTEBISE:

```
NAME FIRST-NAME CURRENT
POSITION
HEURTEBISE MICHEL CONTROLEUR DE GESTION
```

#### **FOR**

The following example is referenced in the FOR statement description:

#### FOREX1R - FOR (reporting mode)

#### Output of Program FOREX1R:

```
#INDEX: 1 #ROOT: 1.0000000

#INDEX: 2 #ROOT: 1.4142135

#INDEX: 3 #ROOT: 1.7320508

#INDEX: 4 #ROOT: 2.0000000

#INDEX: 5 #ROOT: 2.2360679

#INDEX: 1 #ROOT: 1.0000000

#INDEX: 3 #ROOT: 1.7320508

#INDEX: 5 #ROOT: 2.2360679
```

## **HISTOGRAM**

The following example is referenced in the <code>HISTOGRAM</code> statement description:

#### **HSTEX1R - HISTOGRAM (reporting mode)**

```
** Example 'HSTEX1R': HISTOGRAM (reporting mode)

*******************

*
LIMIT 8

HISTOGRAM EMPLOYEES CITY STARTING FROM 'M'

DISPLAY NOTITLE CITY

'NUMBER OF/PERSONS' *NUMBER *COUNTER

LOOP

*
END
```

#### Output of Program HSTEX1R:

CITY	NUMBER OF PERSONS	CNT	
			. =
MADISON	3		1
MADRID	41		2
MAILLY LE CAMP	1		3
MAMERS	1		4
MANSFIELD	4		5
MARSEILLE	2		6
MATLOCK	1		7
MELBOURNE	2		8

## IF

The following example is referenced in the IF statement description:

#### IFEX1R - IF (reporting mode)

```
** Example 'IFEX1R': IF (reporting mode)
              *******************
RESET #BIRTH (D)
MOVE EDITED '19450101' TO #BIRTH (EM=YYYYMMDD)
SUSPEND IDENTICAL SUPPRESS
LIMIT 20
FND. FIND EMPLOYEES WITH CITY = 'FRANKFURT'
                  SORTED BY NAME BIRTH
 IF SALARY (1) LT 40000
   WRITE NOTITLE '*****' NAME 30X 'SALARY LT 40000'
 ELSE DO
   IF BIRTH GT #BIRTH DO
     FIND VEHICLES WITH PERSONNEL-ID = PERSONNEL-ID (FND.)
       DISPLAY (IS=ON) NAME BIRTH (EM=YYYY-MM-DD)
                      SALARY (1) MAKE (AL=8)
     L00P
   DOEND
 DOEND
L00P
END
```

#### Output of Program IFEX1R:

NAME	DATE OF BIRTH	ANNUAL SALARY	MAKE	
BAECKER **** BECKER	1956-01-05	74400	BMW	SALARY LT 40000
BLOEMER FALTER	1979-11-07 1954-05-23	45200 70800	. =	
**** FALTER  **** GROTHE  **** HEILBROCK  **** HESCHMANN				SALARY LT 40000 SALARY LT 40000 SALARY LT 40000 SALARY LT 40000
HUCH **** KICKSTEIN **** KLEENE **** KRAMER	1952-09-12	67200	MERCEDES	SALARY LT 40000 SALARY LT 40000 SALARY LT 40000

#### PERFORM BREAK PROCESSING

The following example is referenced in the PERFORM BREAK PROCESSING statement description:

#### PBPEX1R - PERFORM BREAK PROCESSING (reporting mode)

#### Output of Program PBPEX1R:

```
______#LINE: 1
              _____ #LINE: 2
                _____#LINE: 3
              ______#LINE: 4
                _____#LINE: 5
             #LINE: 6
             _______#LINE: 7
              #LINE: 8
                _____#LINE: 9
PLEASE COMPLETE LINES 1-9 ABOVE
                  _____#LINE: 1
                _____#LINE: 2
               #LINE: 3
                ______#LINE: 4
         #LINE: 6
               ______ #LINE: 7
               ______#LINE: 8
              #LINE:
PLEASE COMPLETE LINES 1-9 ABOVE
```

#### **READ**

The following example is referenced in the READ statement description:

#### **REAEX1R - READ (reporting mode)**

```
** Example 'REAEX1R': READ (reporting mode)
**************************
LIMIT 3
WRITE 'READ IN PHYSICAL SEQUENCE'
READ EMPLOYEES IN PHYSICAL SEQUENCE
 DISPLAY NOTITLE PERSONNEL-ID NAME *ISN *COUNTER
L00P
WRITE / 'READ IN ISN SEQUENCE'
READ EMPLOYEES BY ISN STARTING FROM 1 ENDING AT 3
 DISPLAY PERSONNEL-ID NAME *ISN *COUNTER
L00P
WRITE / 'READ IN NAME SEQUENCE'
READ EMPLOYEES BY NAME
 DISPLAY PERSONNEL-ID NAME *ISN *COUNTER
L00P
WRITE / 'READ IN NAME SEQUENCE STARTING FROM ''M'''
READ EMPLOYEES BY NAME STARTING FROM 'M'
 DISPLAY PERSONNEL-ID NAME *ISN *COUNTER
L00P
END
```

#### Output of Program REAEX1R:

PERSONNEL ID	Λ	IAME	ISN	CNT	
					-
READ IN PH	HYSICAL SE	QUENCE			
50005800	ADAM		1		1
50005600	MORENO		2		2
50005500	BLOND		3		3
READ IN IS	SN SEQUENC	E			
50005800	ADAM		1		1
50005600	MORENO		2		2
50005500	BLOND		3		3
READ IN NA	AME SEQUEN	ICE			

60008339	ABELLAN	478	1	
30000231	ACHIESON	878	2	
50005800	ADAM	1	3	
READ IN N	AME SEQUENCE STARTING FF	ROM 'M'		
30008125	MACDONALD	923	1	
20028700	MACKARNESS	765	2	
40000045	MADSEN	508	_	

#### **REPEAT**

The following examples are referenced in the REPEAT statement description:

#### RPTEX1R - REPEAT (reporting mode)

Output of Program RPTEX1R:

ENTER A PERSONNEL NUMBER:

#### RPTEX2R - REPEAT with WHILE and UNTIL option (reporting mode)

```
** Example 'RPTEX2R': REPEAT (with WHILE and UNTIL option)

*******************

RESET #X (I1) #Y (I1)

*

*

REPEAT WHILE #X <= 5

ADD 1 TO #X

WRITE NOTITLE '=' #X

LOOP

*
```

```
SKIP 3

REPEAT

ADD 1 TO #Y

WRITE '=' #Y

UNTIL #Y = 6

LOOP

*
END
```

#### Output of Program RPTEX2R:

```
#X:
      1
♯X:
      2
#X:
      3
#X:
      4
#X:
     5
#X:
#Υ:
      1
#Υ:
      2
#Υ:
      3
♯Y:
      4
#Υ:
       5
#Υ:
```

## **SORT**

The following example is referenced in the SORT statement description:

#### SRTEX1R - SORT (reporting mode)

#### Output of Program SRTEX1R:

PERSONNEL ID	ANNUAL SALARY	ANNUAL SALARY	#TOTAL-SALARY	CURRENCY CODE	PERCENT OF AVER	
******	******	*****	***** AVG	CUMULATIVE	E SALARY:	44633
20000100	31000	29400	60400	USD	135.30	
20019200	18000	17100	35100	USD	78.60	
20020400	20000	18400	38400	USD	86.00	
*****	*****	*****	****** TOTA	L SALARIES	S PAID:	133900

## **STORE**

The following example is referenced in the STORE statement description:

#### STOEX1R - STORE (reporting mode)

```
#COUNTRY
                (A3)
     #CONF
                   (A1)
RFPFAT
 INPUT 'ENTER A PERSONNEL ID AND NAME (OR ''END'' TO END)' //
       'PERSONNEL-ID : ' #PERSONNEL-ID //
       'NAME : ' #NAME
       'FIRST-NAME : ' #FIRST-NAME
 /*
 /* VALIDATE ENTERED DATA
 IF #PERSONNEL-ID = 'END' OR #NAME = 'END'
  STOP
 IF #NAME = ' '
  REINPUT WITH TEXT 'ENTER A LAST-NAME' MARK 2 AND SOUND ALARM
 IF #FIRST-NAME = ' '
  REINPUT WITH TEXT 'ENTER A FIRST-NAME' MARK 3 AND SOUND ALARM
 /* ENSURE PERSON IS NOT ALREADY ON FILE
 /*
 FIND NUMBER EMPLOYEES WITH PERSONNEL-ID = #PERSONNEL-ID
 IF *NUMBER > 0
  REINPUT 'PERSON WITH SAME PERSONNEL-ID ALREADY EXISTS'
          MARK 1 AND SOUND ALARM
 MOVE 'N' TO #CONF
 /*
 /* GET FURTHER INFORMATION
 INPUT
   'ADDITIONAL PERSONNEL DATA'
                                                    ////
   'PERSONNEL-ID :' #PERSONNEL-ID (AD=IO) /
   'NAMF
                           :' #NAME (AD=IO) /
   'FIRST-NAME
                           :' #FIRST-NAME (AD=IO) ///
                            :' #MAR-STAT
   'MARITAL STATUS
                                                    /
   'DATE OF BIRTH (YYYYMMDD) : #BIRTH
                                                     /
   'CITY
                           :' #CITY
   'COUNTRY (3 CHARACTERS) : ' #COUNTRY
                                                     //
   'ADD THIS RECORD (Y/N) :' #CONF
                                             (AD=M)
 /*
 /*
    ENSURE REQUIRED FIELDS CONTAIN VALID DATA
 IF NOT (\#MAR-STAT = 'S' OR = 'M' OR = 'D' OR = 'W')
   REINPUT TEXT 'ENTER VALID MARITAL STATUS S=SINGLE ' -
                'M=MARRIED D=DIVORCED W=WIDOWED' MARK 1
 IF NOT (#BIRTH = MASK(YYYYMMDD) AND #BIRTH = MASK(1582-2699))
   REINPUT TEXT 'ENTER CORRECT DATE' MARK 2
 IF \#CITY = '
   REINPUT TEXT 'ENTER A CITY NAME' MARK 3
 IF #COUNTRY = ' '
  REINPUT TEXT 'ENTER A COUNTRY CODE' MARK 4
 IF NOT (\#CONF = 'N' OR = 'Y')
   REINPUT TEXT 'ENTER Y (YES) OR N (NO)' MARK 5
```

```
IF #CONF = 'N'
    ESCAPE TOP
 /* ADD THE RECORD
 MOVE EDITED #BIRTH TO #BIRTH-D (EM=YYYYMMDD)
  /*
 STORE RECORD IN EMPLOYEES
     WITH PERSONNEL-ID = #PERSONNEL-ID
          NAME
                      = #NAME
          FIRST-NAME = #FIRST-NAME
          MAR-STAT = #MAR-STAT
BIRTH = #BIRTH-D
          CITY
                      = #CITY
          CITY = #CITY
COUNTRY = #COUNTRY
 END OF TRANSACTION
 WRITE NOTITLE 'RECORD HAS BEEN ADDED'
 /*
L00P
END
```

#### **UPDATE**

The following example is referenced in the UPDATE statement description:

#### **UPDEX1R - UPDATE (reporting mode)**

```
** Example 'UPDEX1R': UPDATE (reporting mode)
**
** CAUTION: Executing this example will modify the database records!
************************
RESET #NAME (A20)
INPUT 'ENTER A NAME: ' #NAME (AD=M)
IF #NAME = ' '
 STOP
FIND EMPLOYEES WITH NAME = #NAME
 IF NO RECORDS FOUND
   REINPUT WITH 'NO RECORDS FOUND' MARK 1
 INPUT 'NAME: ' NAME (AD=0) /
       'FIRST NAME:' FIRST-NAME (AD=M) /
       'CITY: 'CITY (AD=M)
  /*
 UPDATE USING SAME RECORD
 /*
 END TRANSACTION
```

```
/*
LOOP
*
END
```

Output of Program UPDEX1R:

```
ENTER A NAME:
```

## **Example Programs for System Variables**

The following examples are referenced in the \*OCCURRENCE system variable description:

#### OCC1P - System Variable \*OCCURRENCE

```
** Example 'OCC1P': *OCCURRENCE

**************************

DEFINE DATA LOCAL

1 #N1 (N7/1:10)

1 #N2 (N7/1:10,1:10)

1 #N3 (N7/1:10,1:10,1:10)

END-DEFINE

*

CALLNAT 'OCC1N' #N1(*) #N2(1:2,1:4) #N3(1:6,1:7,1:8)

*

END
```

Subprogram OCC1N Called by Program OCC1P:

```
** Example 'OCC1N': *OCCURRENCE (called by OCC1P)
***********************
DEFINE DATA
PARAMETER
1 PARM1 (N7/1:V)
1 PARM2 (N7/1:V,1:V)
1 PARM3 (N7/1:V,1:V,1:V)
LOCAL
1 #0CC2 (I4/1:2)
1 #0CC3 (I4/1:3)
1 #0CC1 (I4)
END-DEFINE
MOVE *OCC(PARM1) TO #OCC1
MOVE *OCC(PARM2,*) TO #OCC2(*)
MOVE *OCC(PARM3,*) TO #OCC3(*)
DISPLAY #0CC1 #0CC2(*) #0CC3(*)
DISPLAY *OCC(PARM1,*) *OCC(PARM2,*) *OCC(PARM3,*)
```

```
*
NEWPAGE

*
WRITE NOHDR

'Occurrences of 1. parameter:' *OCC(PARM1)

/'Occurrences of 1. parameter:' *OCC(PARM1,1)

/'Occurrences of 1. parameter:' *OCC(PARM1,*)

/'Occurrences of 2. parameter:' *OCC(PARM2,1) *OCC(PARM2,2)

/'Occurrences of 2. parameter:' *OCC(PARM2,*)

/'Occurrences of 3. parameter:' *OCC(PARM3,1) *OCC(PARM3,2)

*OCC(PARM3,3)

/'Occurrences of 3. parameter:' *OCC(PARM3,*)

*
END
```

#### Output of Program OCC1P - Page 1:

```
Page 1 05-01-18 10:21:30

#0CC1 #0CC2 #0CC3

10 2 6
4 7
8
10 2 6
4 7
8
```

#### Output of Program OCC1P - Page 2:

```
Page
                                                            05-01-18 10:21:30
Occurrences of 1. parameter:
                                     10
Occurrences of 1. parameter:
                                     10
Occurrences of 1. parameter:
                                     10
Occurrences of 2. parameter:
                                      2
Occurrences of 2. parameter:
                                      2
                                                  4
Occurrences of 3. parameter:
                                      6
                                                  7
                                                              8
Occurrences of 3. parameter:
                                      6
```

#### OCC2P - System Variable \*OCCURRENCE

```
** Example 'OCC2P': *OCCURRENCE

*************************

DEFINE DATA LOCAL

1 #N (N7/1:10)

1 #I (I4)

END-DEFINE

*

FOR #I=1 TO 10

MOVE #I TO #N(#I)

END-FOR

*

WRITE 'Passing occurrences 1:5'

CALLNAT 'OCC2N' #N(1:5)

*

WRITE 'Passing occurrences 5:10'

CALLNAT 'OCC2N' #N(5:10)

*

END
```

#### Subprogram OCC2N Called by Program OCC2P:

#### Output of Program OCC2P:

```
Page 1 05-01-18 10:33:03

Passing occurrences 1:5

1 2 3 4 5

Passing occurrences 5:10

5 6
```

7	
8	
9	
10	

## IV

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# 12 ACCEPT/REJECT

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```
{ ACCEPT REJECT } [IF] logical-condition
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | HISTOGRAM | GET | GET SAME | GET TRANSACTION DATA | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

#### **Function**

The statements ACCEPT and REJECT are used for accepting/rejecting a record based on user-specified logical criterion. The ACCEPT/REJECT statement may be used in conjunction with statements which read data records in a processing loop (FIND, READ, HISTOGRAM, CALL FILE, SORT or READ WORK FILE). The criterion is evaluated *after* the record has been selected/read.

Whenever an ACCEPT/REJECT statement is encountered for processing, it will internally refer to the innermost currently active processing loop initiated with one of the above mentioned statements.

When ACCEPT/REJECT statements are placed in a subroutine, in case of a record reject, the subroutine(s) entered in the processing loop will automatically be terminated and processing will continue with the next record of the innermost currently active processing loop.

## **Syntax Description**

Syntax Element	Description
IF	IF Clause: An IF clause may be used with an ACCEPT or REJECT statement to specify logical condition criteria in addition to that specified when the record was selected/read with a FIND, READ, or HISTOGRAM statement. The logical condition criteria are evaluated after the record has been read and after record processing has started.
logical-condition	Logical Condition Criterion: The basic criterion is a relational expression. Multiple relational expressions may be combined with logical operators (AND, OR) to form complex criteria.  Arithmetic expressions may also be used to form a relational expression.

Syntax Element	Description
	The fields used to specify the logical criterion may be database fields or user-defined variables. For additional information on logical conditions, see <i>Logical Condition Criteria</i> in the <i>Programming Guide</i> .
	<b>Note:</b> When ACCEPT/REJECT is used with a HISTOGRAM statement, only the database field specified in the HISTOGRAM statement may be used as a logical criterion.

## **Processing of Multiple ACCEPT/REJECT Statements**

Normally, only one ACCEPT or REJECT statement is required in a single processing loop. If more than one ACCEPT/REJECT is specified *consecutively*, the following conditions apply:

- If consecutive ACCEPT and REJECT statements are contained in the same processing loop, they are processed in the specified order.
- If an ACCEPT condition is satisfied, the record will be accepted and consecutive ACCEPT/REJECT statements will be ignored.
- If a REJECT condition is satisfied, the record will be rejected and consecutive ACCEPT/REJECT statements will be ignored.
- If the processing continues to the last ACCEPT/REJECT statement, the last statement will determine whether the record is accepted or rejected.

If other statements are interleaved between multiple ACCEPT/REJECT statements, each ACCEPT/REJECT will be handled independently.

## **Limit Notation**

If a LIMIT statement or other limit notation has been specified for a processing loop containing an ACCEPT or REJECT statement, each record processed is counted against the limit regardless of whether or not the record is accepted or rejected.

#### **Hold Status**

ACCEPT/REJECT processing does not cause a held record to be released from hold status unless the profile parameter RI (Release ISNs) has been set to RI=ON.

## **Examples**

- Example 1 ACCEPT
- Example 2 ACCEPT / REJECT

#### **Example 1 - ACCEPT**

#### **Output of Program ACREX1:**

```
NAME: MORENO
                            S E X: M
                                         MARITAL STATUS: S
                            S E X: M
                                         MARITAL STATUS: S
NAME: VAUZELLE
NAME: BAILLET
                            S E X: M
                                         MARITAL STATUS: S
                           S E X: M
NAME: HEURTEBISE
                                         MARITAL STATUS: S
                           S E X: M
NAME: LION
                                         MARITAL STATUS: S
NAME: DEZELUS
                           S E X: M
                                         MARITAL STATUS: S
NAME: BOYER
                           S E X: M
                                         MARITAL STATUS: S
                           S E X: M
NAME: BROUSSE
                                         MARITAL STATUS: S
NAME: DROMARD
                           S E X: M
                                         MARITAL STATUS: S
NAME: DUC
                           S E X: M
                                         MARITAL STATUS: S
                           S E X: M
                                         MARITAL STATUS: S
NAME: BEGUERIE
NAME: FOREST
                           S E X: M
                                         MARITAL STATUS: S
                            S E X: M
                                         MARITAL STATUS: S
NAME: GEORGES
```

#### Example 2 - ACCEPT / REJECT

```
** Example 'ACREX2': ACCEPT/REJECT
********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 SALARY (1)
1 #PROC-COUNT (N8) INIT <0>
END-DEFINE
EMP. FIND EMPLOY-VIEW WITH NAME = 'JACKSON'
 WRITE NOTITLE *COUNTER NAME FIRST-NAME 'SALARY:' SALARY(1)
 ACCEPT IF SALARY (1) LT 50000
 WRITE *COUNTER 'ACCEPTED FOR FURTHER PROCESSING'
 /*
 REJECT IF SALARY (1) GT 30000
 WRITE *COUNTER 'NOT REJECTED'
 /*
 ADD 1 TO #PROC-COUNT
END-FIND
SKIP 2
WRITE NOTITLE 'TOTAL PERSONS FOUND ' *NUMBER (EMP.) /
             'TOTAL PERSONS SELECTED' #PROC-COUNT
END
```

#### **Output of Program ACREX2:**

```
1 JACKSON
                                                      SALARY:
                                 CLAUDE
                                                                   33000
         1 ACCEPTED FOR FURTHER PROCESSING
          2 JACKSON
                                 FORTUNA
                                                      SALARY:
                                                                   36000
          2 ACCEPTED FOR FURTHER PROCESSING
                                                      SALARY:
                                                                   23000
          3 JACKSON
                                 CHARLIE
         3 ACCEPTED FOR FURTHER PROCESSING
          3 NOT REJECTED
TOTAL PERSONS FOUND
                               3
TOTAL PERSONS SELECTED
```

# ADD

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Related Statements: COMPRESS | COMPUTE | DIVIDE | EXAMINE | MOVE | MOVE ALL | MULTIPLY | RESET | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

## **Function**

The ADD statement is used to add two or more operands.

This statements has two different syntax structures.



#### Notes:

- 1. At the time the ADD statement is executed, each operand used in the arithmetic operation must contain a valid value.
- 2. For additions involving arrays, see also the section *Arithmetic Operations with Arrays*.
- 3. As for the formats of the operands, see also the section *Performance Considerations for Mixed Formats*.

## Syntax 1 - ADD Statement without GIVING Clause

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Operand Definition Table (Syntax 1):

Operand	Possible Structure					P	os	sik	ble	For	nat	S	Referencing Permitted	Dynamic Definition
operand1	C	S	A	N		N	Р	Ι	F	D	T		yes	no
operand2		S	A	M		N	Р	Ι	F	D	T		yes	yes

Syntax Element Description:

Syntax Element	Description:
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 TO operand2	Operands:  operand1 and operand2 are summands. The result is stored in operand2 (result field). Hence, the statement is equivalent to:
	operand2 := operand2 + operand1 +
ROUNDED	ROUNDED Option:  If the keyword ROUNDED is used, the result will be rounded.
	For information on rounding, see <i>Rules for Arithmetic Assignment, Field Truncation and Field Rounding</i> in the <i>Programming Guide</i> .

#### Example:

#### The statement

```
ADD \#A(*) TO \#B(*) is equivalent to COMPUTE \#B(*) := \#A(*) + \#B(*) ADD \#S TO \#R is equivalent to COMPUTE \#R := \#S + \#R ADD \#S \#T TO \#R is equivalent to COMPUTE \#R := \#S + \#T + \#R ADD \#A(*) TO \#R is equivalent to COMPUTE \#R := \#A(*) + \#R
```

## Syntax 2 - ADD Statement with GIVING Clause

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Operand Definition Table (Syntax 2):

Operand	Possible Structure								Po	SS	ibl	le l	Forr	nat	S	Referencing Permitted	Dynamic Definition
operand1	C	S	Α		N				N	Р	Ι	F		D	Т	yes	no
operand2		S	A		M		A	U	N	Р	Ι	F	В*	D	Т	yes	yes

<sup>\*</sup> Format B of operand2 may be used only with a length of less than or equal to 4.

Syntax Element Description:

Syntax Element	Description:
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 GIVING operand2	operand1 is a summand. operand2 is only used to receive the result of the operation; it is not included in the addition. Hence, the statement is equivalent to:
	operand2 := operand1 +
ROUNDED	ROUNDED Option:  If the keyword ROUNDED is used, the result will be rounded.  For information on rounding, see <i>Rules for Arithmetic Assignment, Field Truncation and Field Rounding</i> in the <i>Programming Guide</i> .



**Note**: If Syntax 2 is used, the following applies: Only the (*operand1*) field(s) left of the keyword GIVING are the terms of the addition, the field right of the keyword GIVING (*operand2*) is just used to receive the result value. If just a single (*operand1*) field is supplied, the ADD operation turns into an assignment.

#### Example:

#### The statement

ADD #S	GIVING #R	is equivalent to COMPUTE #R := #S
ADD #S #T	GIVING #R	is equivalent to COMPUTE #R := #S + #T
ADD #A(*) 0	GIVING #R	is equivalent to COMPUTE $\#R := \#A(*) + 0$ which is a legal operation, due to the rules defined in Arithmetic Operations with Arrays
ADD #A(*)	GIVING #R	is equivalent to COMPUTE #R := #A(*) which is an illegal operation, due to the rules defined in Assignment Operations with Arrays

## **Example**

```
** Example 'ADDEX1': ADD
************************
DEFINE DATA LOCAL
1 #A
         (P2)
1 #B
         (P1.1)
1 #C
         (P1)
1 #DATE
         (D)
1 #ARRAY1 (P5/1:4,1:4) INIT (2,*) <5>
1 #ARRAY2 (P5/1:4,1:4) INIT (4,*) <10>
END-DEFINE
ADD +5 -2 -1 GIVING #A
WRITE NOTITLE 'ADD +5 -2 -1 GIVING #A' 15X '=' #A
ADD .231 3.6 GIVING #B
          / 'ADD .231 3.6 GIVING #B' 15X '=' #B
WRITE
ADD ROUNDED 2.9 3.8 GIVING #C
          / 'ADD ROUNDED 2.9 3.8 GIVING #C' 8X '=' #C
WRITE
MOVE *DATX TO #DATE
ADD 7 TO #DATE
           / 'CURRENT DATE:' *DATX (DF=L) 13X
WRITE
             'CURRENT DATE + 7:' #DATE (DF=L)
           / '#ARRAY1 AND #ARRAY2 BEFORE ADDITION'
WRITE
           / '=' #ARRAY1 (2,*) '=' #ARRAY2 (4,*)
ADD #ARRAY1 (2,*) TO #ARRAY2 (4,*)
WRITE
           / '#ARRAY1 AND #ARRAY2 AFTER ADDITION'
           / '=' #ARRAY1 (2,*) '=' #ARRAY2 (4,*)
END
```

#### **Output of Program ADDEX1:**

```
ADD +5 -2 -1 GIVING #A
                                    #A:
                                          2
ADD .231 3.6 GIVING #B
                                    #B: 3.8
ADD ROUNDED 2.9 3.8 GIVING #C
                                    #C: 7
CURRENT DATE: 2005-01-10
                                    CURRENT DATE + 7: 2005-01-17
#ARRAY1 AND #ARRAY2 BEFORE ADDITION
#ARRAY1:
             5
                    5
                           5
                                  5 #ARRAY2:
                                                 10
                                                        10
                                                               10
                                                                      10
```

#ARRAY1 AND #ARRAY2 AFTER ADDITION

#ARRAY1: 5 5 5 5 #ARRAY2: 15 15 15

# 14 ASSIGN

See the statement COMPUTE.

# 15 AT BREAK

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#### Structured Mode Syntax

```
[AT] BREAK [(r)] [OF] operand1 [/n/] statement ...
END-BREAK
```

#### **Reporting Mode Syntax**

```
[AT] BREAK [(r)] [OF] operand1 [/n/]  \left\{ \begin{array}{c} statement \\ DO \ statement \dots \ DOEND \end{array} \right\}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The AT BREAK statement is used to cause the execution of one or more statements whenever a change in value of a **control field** occurs. It is used in conjunction with automatic break processing and is available with the following statements: FIND, READ, HISTOGRAM, SORT, READ WORK FILE.

The automatic break processing works as follows: Immediately after a record was read by the processing loop, the control field is checked. If a value change is detected in comparison to the previous record, the statements included in the AT BREAK statement block are executed. This does not apply to the very first record in the processing loop. In addition, when the processing loop is terminated (as reading of records is complete or due to an ESCAPE BOTTOM statement), a final execution of the statements in the AT BREAK statement block is triggered.

For further information, see *Automatic Break Processing* in the *Programming Guide*.

An AT BREAK statement block is only executed if the object which contains the statement is active at the time when the break condition occurs.

It is possible to initiate a new processing loop within an AT BREAK condition. This loop must also be closed within the same AT BREAK condition.

This statement is non-procedural (that is, its execution depends on an event, not on where in a program it is located).

Natural system functions may be used in conjunction with an AT BREAK statement, see *Natural System Functions for Use in Processing Loops* in the *System Functions* documentation and *Example of System Functions with AT BREAK Statement* in the *Programming Guide*.

For further information, see also the section *AT BREAK Statement* in the *Programming Guide*. It covers topics such as:

- Control Break Based on a Database Field
- Control Break Based on a User-Defined Variable

# **Syntax Description**

#### Operand Definition Table:

Operand	Possible Structure		ure	Possible Formats					3		Referencing Permitted	Dynamic Definition						
operand1		S				A	U	N	Р	ΙI	В	D	Т	L		yes	no	

#### Syntax Element Description:

Syntax Element	Description
(r)	Reference Notation: By default, the final AT BREAK condition (for loop termination) is always related to the outermost active processing loop initiated with a FIND, READ, READ WORK FILE, HISTOGRAM or SORT statement.
	With the notation ( $r$ ) you can relate the final break condition of an AT BREAK statement to another specific currently open processing loop (that is, the loop in which the AT BREAK statement is located or any outer loop).
	Example:
	READ  FIND  FIND  AT BREAK  FIND  END-FIND  END-BREAK  END-FIND  END-FIND  END-FIND  END-FIND  END-FIND

Syntax Element	Description
	In this example, the final AT BREAK condition is related to the READ loop initiated in line 0120. It would be possible to have it related to one of the FIND loops initiated in line 0130 and 0140, but not to the one initiated in line 0160.
	If $(r)$ is specified for a break hierarchy, it must be specified with the first AT BREAK statement and applies also to all AT BREAK statements which follow.
operand1	Control Field: The field used as the break control field is usually a database field. If a user-defined variable is used, it must be initialized prior to the evaluation of automatic break processing (see BEFORE BREAK PROCESSING statement). A specific occurrence of an array can also be used as a control field.
/n/	Notation /n/: The notation / n/ may be used to indicate that only the first n positions (counting from left to right) of the control field are to be checked for a change in value. This notation can only be used with operands of <b>format</b> A, B, N or P.
	A control break occurs when the value of the control field changes, or when all records in the processing loop for which the AT BREAK statement applies have been processed.
statement	Statement(s) to be Executed at Break Condition:
	In structured mode, you must supply one or several suitable statements, depending on the situation. For an example of a statement, see <i>Examples</i> below.
END-BREAK	End of AT BREAK Statement:
statement DO statement DOEND	In structured mode, the Natural reserved word END-BREAK must be used to end the AT BREAK statement.
	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the AT BREAK statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.

# **Multiple Break Levels**

Multiple AT BREAK statements may be specified within a processing loop within the same program module. If multiple BREAK statements are specified for the same processing loop, they form a hierarchy of break levels independent of whether they are specified consecutively or interspersed within other statements. The first AT BREAK statement represents the lowest control break level, and each additional AT BREAK statement represents the next higher control break level.

Every processing loop in a loop hierarchy may have its own break hierarchy attached.

### **Example:**

Structured Mode:	Reporting Mode:
FIND	FIND
AT BREAK	AT BREAK
	D0
END-BREAK	• • • • • • • • • • • • • • • • • • • •
AT BREAK	DOEND
• • •	AT BREAK
END-BREAK	DO
AT BREAK	• • •
• • •	DOEND
END-BREAK	
END-FIND	

A change in the value of a control field in a break level causes break processing to be activated for that break level and all lower break levels, regardless of the values of the control fields for the lower break levels.

For easier program maintenance, it is recommended to specify multiple breaks consecutively.

See also *Example 3* below and the section *Multiple Control Break Levels* in the *Programming Guide*.

# **Examples**

This section covers the following topics:

- Example 1 AT BREAK
- Example 2 AT BREAK Using /n/ Notation
- Example 3 AT BREAK with Multiple Break Levels

For further examples of AT BREAK, see *Natural System Functions for Use in Processing Loops*, Examples ATBEX3 and ATBEX4.

## Example 1 - AT BREAK

```
** Example 'ATBEX1S': AT BREAK (structured mode)
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 CITY
 2 COUNTRY
 2 NAME
END-DEFINE
LIMIT 10
READ EMPLOY-VIEW BY CITY
AT BREAK OF CITY
   SKIP 1
 END-BREAK
 DISPLAY NOTITLE CITY (IS=ON) COUNTRY (IS=ON) NAME
END-READ
END
```

## **Output of Program ATBEX1S:**

CITY	COUNTRY	NAME
AIKEN	USA	SENKO
AIX EN OTHE	F	GODEFROY
AJACCIO		CANALE
ALBERTSLUND	DK	PLOUG
ALBUQUERQUE	USA	HAMMOND ROLLING FREEMAN LINCOLN
ALFRETON	UK	GOLDBERG
ALICANTE	Е	GOMEZ

Equivalent reporting-mode example: ATBEX1R.

## Example 2 - AT BREAK Using /n/ Notation

```
** Example 'ATBEX2': AT BREAK (with /n/ notation)

*************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 DEPT

2 NAME
END-DEFINE

*

LIMIT 10

READ EMPLOY-VIEW BY DEPT STARTING FROM 'A'

AT BREAK OF DEPT /4/

SKIP 1

END-BREAK

DISPLAY NOTITLE DEPT NAME

END-READ

*

END
```

#### **Output of Program ATBEX2:**

```
DEPARTMENT
                   NAME
  CODE
ADMA01
          JENSEN
ADMA01
          PETERSEN
ADMA01
          MORTENSEN
ADMA01
         MADSEN
ADMA01
          BUHL
ADMA02
         HERMANSEN
ADMA02
          PLOUG
ADMA02
          HANSEN
COMP01
          HEURTEBISE
COMP01
           TANCHOU
```

## **Example 3 - AT BREAK with Multiple Break Levels**

```
** Example 'ATBEX5S': AT BREAK (multiple break levels) (structured mode)

*************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 CITY

2 DEPT

2 NAME

2 LEAVE-DUE

1 #LEAVE-DUE-L (N4)

END-DEFINE
```

```
LIMIT 5
FIND EMPLOY-VIEW WITH CITY = 'PHILADELPHIA' OR = 'PITTSBURGH'
                 SORTED BY CITY DEPT
  MOVE LEAVE-DUE TO #LEAVE-DUE-L
 DISPLAY CITY (IS=ON) DEPT (IS=ON) NAME #LEAVE-DUE-L
 /*
 AT BREAK OF DEPT
    WRITE NOTITLE /
          T*DEPT OLD(DEPT) T*#LEAVE-DUE-L SUM(#LEAVE-DUE-L) /
  END-BREAK
  AT BREAK OF CITY
    WRITE NOTITLE
          T*CITY OLD(CITY) T*#LEAVE-DUE-L SUM(#LEAVE-DUE-L) //
  END-BREAK
END-FIND
END
```

# **Output of Program ATBEX5:**

CITY	DEPARTMENT CODE	NAME	#LEAVE-DUE-L
PHILADELPHIA	MGMT30	WOLF-TERROINE MACKARNESS	11 27
	MGMT30		38
	TECH10	BUSH NETTLEFOLDS	39 24
	TECH10		63
PHILADELPHIA			101
PITTSBURGH	MGMT10	FLETCHER	34
	MGMT10		34
PITTSBURGH			34

Equivalent reporting-mode example: ATBEX5R.

# 16 AT END OF DATA

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Restrictions	
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#### Structured Mode Syntax

```
[AT] END [OF] DATA [(r)]

statement ...

END-ENDDATA
```

#### **Reporting Mode Syntax**

```
[AT] END [OF] DATA [(r)]

{     statement
     DO statement ... DOEND }
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

# **Function**

The AT END OF DATA statement is used to specify processing to be performed when all records selected for a database processing loop have been processed.

This section covers the following topics:

- Processing
- Values of Database Fields
- Positioning
- System Functions

See also AT START/END OF DATA Statements in the Programming Guide.

## **Processing**

This statement is non-procedural, that is, its execution depends on an event, not on where in a program it is located.

#### Values of Database Fields

When the AT END OF DATA condition for the processing loop occurs, all database fields contain the data from the last record processed.

#### Positioning

This statement must be specified within the same program module which contains the loop creating statement.

#### **System Functions**

Natural system functions may be used in conjunction with an AT END OF DATA statement as described in *Using System Functions in Processing Loops* in the *System Functions* documentation.

## Restrictions

- This statement can only be used in a processing loop that has been initiated with one of the following statements: FIND, READ, READ, WORK\_FILE, HISTOGRAM or SORT.
- It may be used only once per processing loop.
- It is *not* evaluated if the processing loop referenced for END OF DATA processing is not entered.

# **Syntax Description**

Syntax Element	Description
( <i>r</i> )	<b>Reference to a Specific Processing Loop:</b> An AT END OF DATA statement may be related to a specific active processing loop by using the notation (r).
	If this notation is not used, the AT_END_OF_DATA statement will be related to the outermost active database processing loop.
statement	Statement(s) to be Executed at End of Data Condition:  In structured mode, you must supply one or several suitable statements, depending on the situation. For an example of a statement, see <i>Example</i> below.

Syntax Element	Description
END-ENDDATA	End of AT END OF DATA Statement:
DO statement DOEND	In structured mode, the Natural reserved word END-ENDDATA must be used to end the AT END OF DATA statement.  In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the AT END OF DATA statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.

# **Example**

```
** Example 'AEDEX1S': AT END OF DATA
*********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
 2 SALARY (1)
 2 CURR-CODE (1)
END-DEFINE
LIMIT 5
EMP. FIND EMPLOY-VIEW WITH CITY = 'STUTTGART'
 IF NO RECORDS FOUND
   ENTER
 END-NOREC
 DISPLAY PERSONNEL-ID NAME FIRST-NAME
         SALARY (1) CURR-CODE (1)
 /*
  AT END OF DATA
   IF *COUNTER (EMP.) = 0
     WRITE 'NO RECORDS FOUND'
     ESCAPE BOTTOM
   END-IF
   WRITE NOTITLE / 'SALARY STATISTICS:'
                 / 7X 'MAXIMUM:' MAX(SALARY(1)) CURR-CODE (1)
                 / 7X 'MINIMUM:' MIN(SALARY(1)) CURR-CODE (1)
                / 7X 'AVERAGE:' AVER(SALARY(1)) CURR-CODE (1)
   END-ENDDATA
 /*
END-FIND
END
```

See also *Natural System Functions for Use in Processing Loops* in the *System Functions* documentation.

## **Output of Program AEDEX1S:**

PERSONNEL ID	NAM	IE .	FIRST-NAME	ANNUAL SALARY	CURRENCY CODE
11100328	BERGHAUS		ROSE	70800	DM
11100329	BARTHEL		PETER	42000	DM
11300313	AECKERLE		SUSANNE	55200	DM
11300316	KANTE		GABRIELE	61200	DM
11500304	KLUGE		ELKE	49200	DM
SALARY STA	TISTICS:				
MAX	(IMUM:	70800 DM			
MIN	NIMUM:	42000 DM			
AVE	ERAGE:	55680 DM			

Equivalent reporting-mode example: **AEDEX1R**.

# 17 AT END OF PAGE

Function	140
Syntax Description	142
Example	143

#### Structured Mode Syntax

```
[AT] END [OF] PAGE [(rep)]

statement ...

END-ENDPAGE
```

### **Reporting Mode Syntax**

```
[AT] END [OF] PAGE [(rep)]

{
    statement
    DO statement ... DOEND
}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The AT END OF PAGE statement is used to specify processing that is to be performed when an end-of-page condition is detected (see session parameter PS in the *Parameter Reference*). An end-of-page condition may also occur as a result of a SKIP or NEWPAGE statement, but not as a result of an EJECT or INPUT statement.

See also the following sections in the *Programming Guide*:

- Report Format and Control
- Report Specification (rep) Notation
- Layout of an Output Page
- AT END OF PAGE Statement

#### **Processing**

An AT END OF PAGE statement block is only executed if the object which contains the statement block is active at the time when the end-of-page condition occurs.

An AT END OF PAGE statement must not be placed within an inline subroutine.

This statement is non-procedural, that is, its execution depends on an event, not on where in a program it is located.

### Logical Page Size

The end-of-page check is performed after the processing of a DISPLAY or WRITE statement is completed. Therefore, if a DISPLAY or WRITE statement produces multiple lines of output, overflow of the physical page may occur before an end-of-page condition is detected.

A logical page size (session parameter PS) which is less than the physical page size must be specified to ensure that information printed by an AT\_END\_OF\_PAGE statement appears on the same physical page as the title.

## **Last-Page Handling**

Within a main program, an end-of-page condition is activated when the execution of the main program terminates via ESCAPE, STOP or END.

Within a subroutine, an end-of-page condition is not activated when the execution of the subroutine terminates via ESCAPE-ROUTINE, RETURN or END-SUBROUTINE.

#### System Functions

Natural system functions may be used in conjunction with an AT END OF PAGE statement as described in the section *Using System Functions in Processing Loops* in the *System Functions* documentation.

If a system function is to be used within an AT END OF PAGE statement block, the GIVE SYSTEM FUNCTIONS clause must be specified in the corresponding DISPLAY statement.

#### INPUT Statement with AT END OF PAGE

If an INPUT statement is specified within an AT END OF PAGE statement block, no new page operation is performed. The page size (session parameter PS) must be reduced to a value that allows the lines created by the INPUT statement to appear on the same physical page.

#### See also:

- *Split Screen Feature* of INPUT Statement
- Example 2 AT END OF PAGE with INPUT Statement

# **Syntax Description**

Syntax Element	Description
(rep)	Report Specification:
	The notation ( rep) may be used to specify the identification of the report for which the AT_END_OF_PAGE statement is applicable. A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE_PRINTER statement may be specified.
	If ( rep) is not specified, the AT END OF PAGE statement will apply to the first report (Report 0).
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .
statement	Statement(s) to be Executed at End of Page Condition:
	In structured mode, you must supply one or several suitable statements, depending on the situation. For an example of a statement, see <i>Example</i> below.
END-ENDPAGE	End of AT END OF PAGE Statement:
statement DO statement DOEND	In structured mode, the Natural reserved word END-ENDPAGE must be used to end the AT END OF PAGE statement.
	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the AT END OF PAGE statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.

# **Example**

- Example 1 AT END OF PAGE
- Example 2 AT END OF PAGE with INPUT Statement

#### **Example 1 - AT END OF PAGE**

```
** Example 'AEPEX1S': AT END OF PAGE (structured mode)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
  2 NAME
 2 JOB-TITLE
 2 SALARY (1)
 2 CURR-CODE (1)
END-DEFINE
FORMAT PS=10
LIMIT 10
READ EMPLOY-VIEW BY PERSONNEL-ID FROM '20017000'
  DISPLAY NOTITLE GIVE SYSTEM FUNCTIONS
          NAME JOB-TITLE 'SALARY' SALARY(1) CURR-CODE (1)
  /*
AT END OF PAGE
    WRITE / 28T 'AVERAGE SALARY: ...' AVER(SALARY(1)) CURR-CODE (1)
  END-ENDPAGE
END-READ
END
```

See also Natural System Functions for Use in Processing Loops.

#### **Output of Program AEPEX1S:**

NAME	CURRENT POSITION	SALARY	CURRENCY CODE
CREMER MARKUSH GEE KUNEY NEEDHAM JACKSON	ANALYST TRAINEE MANAGER DBA PROGRAMMER PROGRAMMER	34000 22000 39500 40200 32500 33000	USD USD USD USD

```
AVERAGE SALARY: ... 33533 USD
```

Equivalent reporting-mode example: **AEPEX1R**.

#### Example 2 - AT END OF PAGE with INPUT Statement

```
** Example 'AEPEX2': AT END OF PAGE (with INPUT)
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 POST-CODE
 2 CITY
1 #START-NAME (A20)
END-DEFINE
FORMAT PS=21
REPEAT
 READ (15) EMPLOY-VIEW BY NAME = #START-NAME
   DISPLAY NOTITLE NAME FIRST-NAME POST-CODE CITY
 END-READ
 NEWPAGE
 /*
 AT END OF PAGE
   MOVE NAME TO #START-NAME
   INPUT / '-' (79)
         / 10T 'Reposition to name ==>'
               #START-NAME (AD=MI) '(''.'' to exit)'
   IF #START-NAME = '.'
     ST<sub>O</sub>P
   END-IF
 END-ENDPAGE
END-REPEAT
END
```

### **Output of Program AEPEX2S:**

NAME	FIRST-NAME	POSTAL ADDRESS	CITY
ABELLAN	KEPA	28014	MADRID
ACHIESON	ROBERT	DE3 4TR	DERBY
ADAM	SIMONE	89300	JOIGNY
ADKINSON	JEFF	11201	BROOKLYN
ADKINSON	PHYLLIS	90211	BEVERLEY HILLS

ADKINSON ADKINSON ADKINSON ADKINSON ADKINSON ADKINSON ADKINSON AECKERLE AFANASSIEV AFANASSIEV	HAZEL DAVID CHARLIE MARTHA TIMMIE BOB SUSANNE PHILIP ROSE	20760 27514 21730 17010 17300 66044 7000 39401 60201	GAITHERSBURG CHAPEL HILL LEXINGTON FRAMINGHAM BEDFORD LAWRENCE STUTTGART HATTIESBURG EVANSTON
AFANASSIEV AHL	ROSE FLEMMING	60201 2300	EVANSTON SUNDBY
Reposition	to name ==> AHL		('.' to exit)

# 18 AT START OF DATA

Function	14	8
Syntax Description		
Example	14	ç

#### Structured Mode Syntax

```
[AT] START [OF] DATA [(r)]

statement ...

END-START
```

#### **Reporting Mode Syntax**

```
[AT] START [OF] DATA [(r)]
{
     statement
     DO statement... DOEND
}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The statement AT START OF DATA is used to perform processing immediately after the first of a set of records is read for a processing loop that has been initiated by one of the following statements: READ, FIND, HISTOGRAM, SORT or READ WORK FILE.

See also AT START/END OF DATA Statements in the Programming Guide.

#### **Processing**

If the loop-initiating statement contains a WHERE clause, the at-start-of-data condition will be true when the first record is read which meets both the basic search and the WHERE criteria.

This statement is non-procedural, that is, its execution depends on an event, not on where in a program it is located.

#### Value of Database Fields

All database fields contain the values of the record which caused the at-start-of-data condition to be true (that is, the first record of the set of records to be processed).

### **Positioning**

This statement must be positioned *within* a processing loop, and it may be used only once per processing loop.

# **Syntax Description**

Syntax Element	Description	
(r)	Reference to a Specific Processing Loop:  An AT START OF DATA statement may be related to a specific outer active processing loop by using the notation (r). If this notation is not used, the statement is related to the outermost active processing loop.	
statement	Statement(s) to be Executed at Start of Data Condition:  In structured mode, you must supply one or several suitable statements, depending on the situation. For an example of a statement, see <i>Example</i> below.	
END-START	End of AT START OF DATA Statement:	
statement DO statement DOEND	In structured mode, the Natural reserved word END-START must be used to end the AT START OF DATA statement.	
	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the AT START OF DATA statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.	

# **Example**

```
** Example 'ASDEXIS': AT START OF DATA (structured mode)

*****************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME

2 FIRST-NAME

2 CITY

*

1 #CNTL (A1) INIT <' '>
```

```
1 #CITY (A20) INIT <' '>
END-DEFINE
REPEAT
  INPUT 'ENTER VALUE FOR CITY' #CITY
  IF \#CITY = ' 'OR = 'END'
   STOP
  END-IF
  FIND EMPLOY-VIEW WITH CITY = #CITY
   IF NO RECORDS FOUND
      WRITE NOTITLE NOHDR 'NO RECORDS FOUND'
      ESCAPE BOTTOM
   END-NOREC
   /*
  AT START OF DATA
      INPUT (AD=0) 'RECORDS FOUND' *NUMBER //
                   'ENTER ''D'' TO DISPLAY RECORDS' #CNTL (AD=A)
      IF #CNTL NE 'D'
        ESCAPE BOTTOM
      END-IF
    END-START
   DISPLAY NAME FIRST-NAME
  END-FIND
END-REPEAT
END
```

## **Output of Program ASDEX1S:**

ENTER VALUE FOR CITY PARIS

After entering and confirming name of city:

```
RECORDS FOUND 26
ENTER 'D' TO DISPLAY RECORDS D
```

#### Records displayed:

	NAME	FIRST-NAME
MAIZIERE	ELTO	SABETH
MARX		N-MARIE
REIGNARI		QUELINE
RENAUD	MICH	
REMOUE	GERM	1A I N E
LAVENDA	SALO	DMON
BROUSSE	GUY	
GIORDA	LOUI	S
SIECA	FRAN	VCOIS

CENSIER	BERNARD
DUC	JEAN-PAUL
CAHN	RAYMOND
MAZUY	ROBERT
FAURIE	HENRI
VALLY	ALAIN
BRETON	JEAN-MARIE
GIGLEUX	JACQUES
KORAB-BRZOZOWSKI	BOGDAN
XOLIN	CHRISTIAN
LEGRIS	ROGER
VVVV	

Equivalent reporting-mode example: ASDEX1R.

# 19 AT TOP OF PAGE

Function	154
Restriction	155
Syntax Description	155
Example	

### Structured Mode Syntax

```
[AT] TOP [OF] PAGE [(rep)]
statement...
END-TOPPAGE
```

### **Reporting Mode Syntax**

```
[AT] TOP [OF] PAGE [(rep)]  \left\{ \begin{array}{c} statement \\ DO \ statement \dots \ DOEND \end{array} \right\}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

# **Function**

The statement AT TOP OF PAGE is used to specify processing which is to be performed when a new page is started.

See also the following sections in the *Programming Guide*:

- Report Format and Control
- Report Specification (rep) Notation
- Layout of an Output Page
- AT TOP OF PAGE Statement

## **Processing**

A new page is started when the internal line counter exceeds the page size set with the session parameter PS (page size for Natural reports), or when a NEWPAGE statement is executed. Either of these events cause a top-of-page condition to be true. An EJECT statement causes a new page to be started but does not cause a top-of-page condition.

An AT TOP OF PAGE statement block is only executed when the object which contains the statement is active at the time when the top-of-page condition occurs.

Any output created as a result of AT TOP OF PAGE processing will appear following the title line with an intervening blank line.

This statement is non-procedural, that is, its execution depends on an event, not on where in a program it is located.

## Restriction

An AT TOP OF PAGE statement must not be placed within an inline subroutine.

# **Syntax Description**

Syntax Element	Description	
(rep)	Report Specification:	
	The notation ( rep) may be used to specify the identification of the report for which the AT TOP OF PAGE statement is applicable.	
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.	
	If ( rep) is not specified, the AT TOP OF PAGE statement applies to the first report (Report 0).	
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .	
statement	Statement(s) to be Executed at Start of Data Condition:	
	In structured mode, you must supply one or several suitable statements, depending on the situation. For an example of a statement, see <i>Example</i> below	
END-TOPPAGE	End of AT TOP OF PAGE Statement:	
statement DO statement DOEND	In structured mode, the Natural reserved word END-TOPPAGE must be used to end the AT TOP OF PAGE statement.	

Syntax Element	Description
	In reporting mode, use the DO DOEND statements to supply one or several
	suitable statements, depending on the situation, and to end the AT TOP OF
	PAGE statement. If you specify only a single statement, you can omit the DO
	DOEND statements. With respect to good coding practice, this is not recommended.

# **Example**

```
** Example 'ATPEX1S': AT TOP OF PAGE (structured mode)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 NAME
 2 FIRST-NAME
 2 CITY
 2 DEPT
END-DEFINE
FORMAT PS=15
LIMIT 15
READ EMPLOY-VIEW BY NAME STARTING FROM 'L'
  DISPLAY 2X NAME 4X FIRST-NAME CITY DEPT
  WRITE TITLE UNDERLINED 'EMPLOYEE REPORT'
 WRITE TRAILER '-' (78)
 /*
AT TOP OF PAGE
    WRITE 'BEGINNING NAME:' NAME
  END-TOPPAGE
  AT END OF PAGE
   SKIP 1
   WRITE 'ENDING NAME: ' NAME
  END-ENDPAGE
END-READ
END
```

#### **Output of Program ATPEX1S:**

EMPLOYEE REPORT				
BEGINNING NAME: LAFON NAME	FIRST-NAME	CITY	DEPARTMENT CODE	
LAFON LANDMANN LANE	CHRISTIANE HARRY JACQUELINE	PARIS ESCHBORN DERBY	VENT18 MARK29 MGMT02	

LANKATILLEKE	LALITH	FRANKFURT	PROD22
LANNON	BOB	LINCOLN	SALE20
LANNON	LESLIE	SEATTLE	SALE30
LARSEN	CARL	FARUM	SYSA01
LARSEN	MOGENS	VEMMELEV	SYSA02
ENDING NAME: LA	RSEN		

 $Equivalent\ reporting-mode\ example:\ {\color{blue}ATPEX1R}.$ 

## 20 BACKOUT TRANSACTION

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#### BACKOUT [TRANSACTION]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The BACKOUT TRANSACTION statement is used to back out all database updates performed during the current logical transaction. This statement also releases all records held during the transaction.

The statement is executed only if a database transaction under control of Natural has taken place. For which databases the statement is executed depends on the setting of the profile parameter ET (execution of END/BACKOUT TRANSACTION statements):

- If ET=0FF, the statement is executed only for the database affected by the transaction.
- If ET=0N, the statement is executed for all databases that have been referenced since the last execution of a BACKOUT TRANSACTION or END TRANSACTION statement.

#### **Backout Transaction Issued by Natural**

If the user interrupts the current Natural operation with a terminal command (command %% or CLEAR key), Natural issues a BACKOUT TRANSACTION statement.

See also the terminal command %% in the *Terminal Commands* documentation.

#### **Additional Information**

For additional information on the use of the transaction backout feature, see the sections *Database Update - Transaction Processing* and *Backing Out a Transaction* in the *Programming Guide*.

## Restriction

This statement is not available with Entire System Server.

## **Database-Specific Considerations**

DL/I Databases	Because PSB scheduling is terminated by a syncpoint request, Natural saves the PSB position
	before executing the BACKOUT TRANSACTION statement. Before the next command
	execution, Natural re-schedules the PSB and tries to set the PCB position as it was before
	the backout. The PCB position might be shifted forward if any pointed segment had been
	deleted in the time period between the backout and the following command.
SQL Databases	As most SQL databases close all cursors when a logical unit of work ends, a BACKOUT
	TRANSACTION statement must not be placed within a database modification loop; instead,
	it has to be placed after such a loop.

## **Example**

```
** Example 'BOTEX1': BACKOUT TRANSACTION
** CAUTION: Executing this example will modify the database records!
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 DEPT
 2 LEAVE-DUE
 2 LEAVE-TAKEN
1 #DEPT (A6)
1 #RESP (A3)
END-DEFINE
LIMIT 3
INPUT 'DEPARTMENT TO BE UPDATED: ' #DEPT
IF #DEPT = ' '
STOP
END-IF
FIND EMPLOY-VIEW WITH DEPT = #DEPT
  IF NO RECORDS FOUND
    REINPUT 'NO RECORDS FOUND'
  END-NOREC
```

```
INPUT 'NAME:
                    ' NAME (AD=0) /
        'LEAVE DUE: 'LEAVE-DUE (AD=M) /
        'LEAVE TAKEN: LEAVE-TAKEN (AD=M)
 UPDATE
END-FIND
INPUT 'UPDATE TO BE PERFORMED? YES/NO: #RESP
DECIDE ON FIRST #RESP
 VALUE 'YES'
    END TRANSACTION
 VALUE 'NO'
   BACKOUT TRANSACTION
 NONE
    REINPUT 'PLEASE ENTER YES OR NO'
END-DECIDE
END
```

## **Output of Program BOTEX1:**

```
DEPARTMENT TO BE UPDATED: MGMT30
```

### Result for department MGMT30:

```
NAME: POREE
LEAVE DUE: 45
LEAVE TAKEN: 31
```

### Confirmation query:

```
UPDATE TO BE PERFORMED YES/NO: NO
```

## 21 BEFORE BREAK PROCESSING

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#### Structured Mode Syntax

```
BEFORE [BREAK] [PROCESSING]

statement...
END-BEFORE
```

#### **Reporting Mode Syntax**

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The BEFORE BREAK PROCESSING statement may be used in conjunction with automatic break processing to perform processing:

- before the value of the break control field is checked;
- before the statements specified with an AT BREAK statement are executed;
- before Natural system functions are evaluated.

This statement is most often used to initialize or compute values of user-defined variables which are to be used in break processing (see AT BREAK statement).

This statement is non-procedural (that is, its execution depends on an event, not on where in a program it is located).

See also the following sections in the *Programming Guide*:

- Control Breaks
- BEFORE BREAK PROCESSING Statement
- Example of BEFORE BREAK PROCESSING Statement

## Restrictions

- The BEFORE BREAK PROCESSING statement may only be used with a processing loop that has been initiated with one of the following statements:
  - FIND
  - READ
  - HISTOGRAM
  - SORT
  - READ WORK FILE

It may be placed anywhere within the processing loop and is always related to the processing loop in which it is contained. Only one BEFORE BREAK PROCESSING statement may be specified per processing loop.

■ The BEFORE BREAK PROCESSING statement must not be used in conjunction with the statement PERFORM BREAK PROCESSING.

## **Syntax Description**

Syntax Element	Description					
statement	<b>Statement(s) for Break Processing:</b> In place of <i>statement</i> , you must supply one or several suitable statements, depending on the situation.					
	For an example of a statement, see <i>Example</i> below.					
	If no break processing is to be performed (that is, no AT BREAK statement is specified for the processing loop), any statements specified with a BEFORE BREAK PROCESSING statement will <i>not</i> be executed.					
END-BEFORE	End of BEFORE BREAK PROCESSING Statement:					
statement DO statement DOEND	In structured mode, the Natural reserved word END-BEFORE must be used to end the BEFORE BREAK PROCESSING statement.					
	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the BEFORE BREAK PROCESSING statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.					

## **Example**

```
** Example 'BBPEX1': BEFORE BREAK PROCESSING
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 CITY
 2 NAME
 2 SALARY (1)
 2 BONUS (1,1)
1 #INCOME (P11)
END-DEFINE
LIMIT 7
READ EMPLOY-VIEW BY CITY = 'L'
 /*
BEFORE BREAK PROCESSING
   COMPUTE \#INCOME = SALARY(1) + BONUS(1,1)
 END-BEFORE
 /*
 AT BREAK OF CITY
   WRITE NOTITLE 'AVERAGE INCOME FOR' OLD (CITY) 20X AVER(#INCOME) /
 END-BREAK
 /*
 DISPLAY CITY 'NAME' NAME 'SALARY' SALARY (1) 'BONUS' BONUS (1,1)
END-READ
END
```

### **Output of Program BBPEX1:**

CITY	NAME	SALARY	BONUS	
LA BASSEE	HULOT	165000	70000	
AVERAGE INCOME FOR	LA BASSEE			235000
LA CHAPELLE ST LUC	GUILLARD	124100	23000	
LA CHAPELLE ST LUC	BERGE	198500	50000	
LA CHAPELLE ST LUC	POLETTE	124090	23000	
LA CHAPELLE ST LUC	DELAUNEY	115000	23000	
LA CHAPELLE ST LUC	SCHECK	125600	23000	
LA CHAPELLE ST LUC	KREEBS	184550	50000	
AVERAGE INCOME FOR	LA CHAPELLE ST LUC			177306

## CALL

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```
CALL[INTERFACE4] operand1 [[USING] operand2...128]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL FILE | CALL LOOP | CALLNAT | DEFINE SUBROUTINE | ESCAPE | FETCH | PERFORM

Belongs to Function Group: Invoking Programs and Routines

## **Function**

The CALL statement is used to call an external program written in another standard programming language from a Natural program and then return to the next statement after the CALL statement.

The called program may be written in any programming language which supports a standard CALL interface. Multiple CALL statements to one or more external programs may be specified.

A CALL statement may be issued within a program to be executed under control of a TP monitor, provided that the TP monitor supports a CALL interface.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure				ure	Possible Formats									S	Referencing Permitted	Dynamic Definition		
operand1	С	S				A												yes	no
operand2	С	S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C	G	yes	yes

Syntax Element Description:

Syntax Element	Description
INTERFACE4	Interface Usage: The optional keyword INTERFACE4 specifies the type of the interface that is used for the call of the external program. See the section INTERFACE4 below.
operand1	Program Name:  The name of the program to be called (operand1) can be specified as a constant or - if different programs are to be called dependent on program logic - as an alphanumeric variable of length 1 to 8. A program name must be placed left-justified in the variable.

Syntax Element	Description
[USING]	Parameters to be Passed:
operand2	The CALL statement may contain up to 128 parameters ( <i>operand2</i> ), unless the INTERFACE4 option is used. In that case, the number of parameters is limited by the size of the cataloged object. Depending on all other statements in the Natural object, up to 16370 parameters may be used. Standard linkage register conventions are used. One address is passed in the parameter list for each parameter field specified.
	If a group name is used, the group is converted to individual fields; that is, if a user wishes to specify the beginning address of a group, the first field of the group must be specified.
	<b>Note:</b> The internal representation of positive signs of packed numbers is changed to
	the value specified by the PSIGNF parameter of the NTCMPO macro (Compilation Options) <i>before</i> control is passed to the external program.

## **Return Code**

The condition code of any called program (content of Register 15 upon return to Natural) may be obtained by using the Natural system function RET (Return Code Function).

## **Example:**

```
RESET #RETURN(B4)

CALL 'PROG1'

IF RET ('PROG1') > #RETURN

WRITE 'ERROR OCCURRED IN PROGRAM1'

END-IF
...
```

## **Register Usage**

Register	Contents
R1	Address pointer to the parameter address list.
1	Address pointer to the field (parameter) description list. The field description list contains information on the first 128 fields passed in the parameter list. Each description is a 4-byte entry containing the following information:
	■ the 1st byte contains the type of variable (A, B,);
	■ if a variable of type A exceeds a size of 32767 bytes, it is passed as type Y;

Register	Contents							
	■ if a variable of type B exceeds a size of 32767 bytes, it is passed as type X; the types X and Y have been introduced to support long alpha and binary variables with the standard CALL interface.							
	If field type is N or P:							
	■ the 2nd byte contains the total number of digits;							
	the 3rd byte contains the number of digits before the decimal point;							
	the 4th byte contains the number of digits after the decimal point.							
	If field type is X or Y:							
	the 2nd byte is unused;							
	■ the 3rd-4th byte contain zero;							
	■ the length of the field is passed via R4.							
	All other field types:							
	■ the 2nd byte is unused;							
	■ the 3rd-4th byte contain the length of field.							
R3	Address pointer to list of field lengths. Each length field is a 4-byte entry containing the length of each field passed in the parameter list. In the case of an array, the length is the sum of the individual occurrences' lengths.							
R4	Only for type X and Y:							
	a 4-byte long entry for each variable of type A or B that exceeds the size of 32767 bytes.							
R13	Address of 18-word save area.							
R14	Return address.							
R15	Entry address/return code.							

## **Storage Alignment**

See the section  $Storage\ Alignment$  in the  $Programming\ Guide.$ 

### Adabas Calls

A called program may contain a call to Adabas. The called program must not issue an Adabas open or close command. Adabas will open all database files referenced.

If Adabas exclusive (EXU) update mode is to be used, the Natural profile parameter OPRB (Database Open/Close Processing) must be used in order to open all referenced files. Before you attempt to use EXU update mode, you should consult your Natural administrator.

If a called program issues Adabas commands that begin or end a transaction, Natural will not be able to recognize the change of the transaction status.

Calls to Adabas must comply with the calling conventions for the Adabas application programming interface (API) for the respective TP monitor or operating system. This applies also if Natural is acting as a server, for example, under z/OS or SMARTS.

## **Direct/Dynamic Loading**

The called program may either be directly linked to the Natural nucleus (that is, the program is specified with the profile parameter CSTATIC (Programs Statically Linked to Natural) in the Natural parameter module (described in the *Operations* documentation), or it may be loaded dynamically the first time it is called.

If it is to be loaded dynamically, the load module library containing the called program must be concatenated to the Natural load library in the Natural execution JCL or in the appropriate TP-monitor program library. Ask your Natural administrator for additional information.

#### Example:

The example below shows a Natural program which calls the COBOL program TABSUB for the purpose of converting a country code into the corresponding country name. Two parameter fields are passed by the Natural program to TABSUB:

- the first parameter is the country code, as read from the database;
- the second parameter is used to return the corresponding country name.

Calling Natural Program:

```
** Example 'CALEX1': CALL PROGRAM 'TABSUB'
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 BIRTH
 2 COUNTRY
1 #COUNTRY
              (A3)
1 #COUNTRY-NAME (A15)
1 #FIND-FROM
              (D)
1 #FIND-TO
               (D)
END-DEFINE
MOVE EDITED '19550701' TO #FIND-FROM (EM=YYYYMMDD)
MOVE EDITED '19550731' TO #FIND-TO (EM=YYYYMMDD)
FIND EMPLOY-VIEW WITH BIRTH = #FIND-FROM THRU #FIND-TO
 MOVE COUNTRY TO #COUNTRY
 /*
 CALL 'TABSUB' #COUNTRY #COUNTRY-NAME
 DISPLAY NAME BIRTH (EM=YYYY-MM-DD) #COUNTRY-NAME
END-FIND
END
```

#### Called COBOL program TABSUB:

```
IDENTIFICATION DIVISION.
PROGRAM-ID. TABSUB.
REMARKS. THIS PROGRAM PROVIDES THE COUNTRY NAME
       FOR A GIVEN COUNTRY CODE.
ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
LINKAGE SECTION.
01 COUNTRY-CODE PIC X(3).
01 COUNTRY-NAME PIC X(15).
PROCEDURE DIVISION USING COUNTRY-CODE COUNTRY-NAME.
P-CONVERT.
  MOVE SPACES TO COUNTRY-NAME.
   IF COUNTRY-CODE = 'BLG' MOVE 'BELGIUM' TO COUNTRY-NAME.
   IF COUNTRY-CODE = 'DEN' MOVE 'DENMARK' TO COUNTRY-NAME.
   IF COUNTRY-CODE = 'FRA' MOVE 'FRANCE' TO COUNTRY-NAME.
  IF COUNTRY-CODE = 'GER' MOVE 'GERMANY' TO COUNTRY-NAME.
  IF COUNTRY-CODE = 'HOL' MOVE 'HOLLAND' TO COUNTRY-NAME.
   IF COUNTRY-CODE = 'ITA' MOVE 'ITALY' TO COUNTRY-NAME.
  IF COUNTRY-CODE = 'SPA' MOVE 'SPAIN' TO COUNTRY-NAME.
  IF COUNTRY-CODE = 'UK' MOVE 'UNITED KINGDOM' TO COUNTRY-NAME.
P-RETURN.
GOBACK.
```

## **Linkage Conventions**

Standard linkage register notation is used in batch mode. Each TP monitor has its own conventions. These conventions must be followed; otherwise, unpredictable results could occur.

The following sections describe conventions that apply for the supported TP monitors.

- CALL Using Com-plete
- CALL Using CICS

#### CALL Using Com-plete

The called program must reside in the Com-plete online load library. This allows Com-plete to load the program dynamically. The Com-plete utility ULIB may be used to catalog the program.

#### **CALL Using CICS**

The called non-Natural subprogram must reside in either a load module library concatenated to the CICS library or the DFHRPL library. The subprogram must have a PPT entry in the operating PPT so that CICS can locate the subprogram and load it.

The CALLRPL parameter of the NTCICSP macro controls where and how the parameter list addresses are passed to the external subroutine program.

If you wish the parameter values themselves, rather than the address of their address list, to be passed in a CICS COMMAREA (or Container), issue the Natural (call options) %P=C (or %P=CC) terminal command before the call. Alternatively, you can define the call options by using the PGP profile parameter.

When a Natural program calls a non-Natural subprogram under CICS, the call is accomplished by an EXEC CICS LINK request.

If you use standard linkage conventions (direct branch using a BASR instruction) for the call instead, issue the terminal command %P=S, or specify the STDL property with the PGP profile parameter. In this case, the called subprogram must adhere to standard linkage conventions with standard register usage.

Issue the %P=SQ terminal command, or specify the STDLQ property with the PGP profile parameter if both of the following conditions apply:

- The subprogram called using standard linkage conventions is quasi-reentrant only (but not threadsafe and fully reentrant), that is, it is defined with the CICS CONCURRENCY(QUASIRENT) attribute.
- Natural is defined with the CICS CONCURRENCY (REQUIRED) attribute.

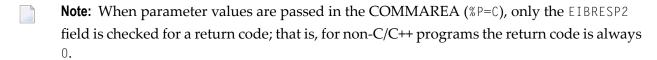
As a result, the called subprogram is executed under the CICS QR TCB.

If a program linked with AMODE=24 is called in a 31-bit-mode environment and the threads are allocated above the 16 MB memory line, a "call by value" will be performed automatically; that is, the specified parameters which are to be passed to the called program will be copied below the 16 MB memory line.

#### **Return Codes under CICS**

CICS itself does not support return codes for a call with CICS conventions (EXEC CICS LINK), with the exception of calling C/C++ programs where values passed by the exit() function or the return() statement are saved in the EIBRESP2 field. However, the Natural CICS Interface supports return codes for the CALL statement: When control is returned from the called program, Natural first checks the EIBRESP2 field for a non-zero return code.

Then Natural checks whether the first fullword of the COMMAREA has changed (only if COMMAREA was used for parameter address lists). If it has, its new content will be taken as the return code. If it has not changed, the first fullword of the TWA will be checked (only if TWA was used for parameter address lists) and its new content taken as the return code. If neither of the two fullwords has changed, the return code will be 0.



## **Program Properties**

To define properties permanently for external programs to be called, use the profile parameter PGP. To define temporary properties for external programs to be called, use the terminal command %P=.

## Calling a PL/I Program

A called program written in PL/I requires the following additional procedure:

■ Since the parameter list is a standard list and is not an argument list being passed from another PL/I program, the addresses passed do not point at a LOCATOR DESCRIPTOR. This problem may be resolved by defining the parameter fields as arithmetic variables. This causes PL/I to treat the parameter list as addresses of data instead of addresses of LOCATOR DESCRIPTOR control blocks.

The technique suggested for defining the parameter fields is illustrated in the following example:

Each parameter in the input list should be treated as a unique element. The number of input parameters should exactly match the number being passed from the Natural program. The input parameters and their attributes must match the Natural definitions or unpredictable results may occur. For additional information on passing parameters in PL/I, see the relevant IBM PL/I documentation.

The following topics are covered below:

- Example of Calling a PL/I Program
- Example of Calling a PL/I Program which is Operating under CICS

#### **Example of Calling a PL/I Program**

```
** Example 'CALEX2': CALL PROGRAM 'NATPLI'
**************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 AREA-CODE
 2 REDEFINE AREA-CODE
   3 #AC
                 (N1)
1 #INPUT-NUMBER (N2)
1 #OUTPUT-COMMENT (A15)
END-DEFINE
READ EMPLOY-VIEW IN LOGICAL SEQUENCE BY NAME
                STARTING FROM 'WAGNER'
 MOVE ' ' TO #OUTPUT-COMMENT
 MOVE #AC TO #INPUT-NUMBER
 CALL 'NATPLI' #INPUT-NUMBER #OUTPUT-COMMENT
END-READ
END
```

#### Called PL/I program NATPLI:

```
NATPLI: PROC(PARM_COUNT, PARM_COMMENT) OPTIONS(MAIN);
    /*
                                                   */
    /* THIS PROGRAM ACCEPTS AN INPUT NUMBER
                                                   */
   /* AND TRANSLATES IT TO AN OUTPUT CHARACTER
                                                   */
                                                  */
    /* STRING FOR PLACEMENT ON THE FINAL
    /* NATURAL REPORT
                                                   */
   /*
                                                   */
   /*
                                                   */
   DECLARE (PARM_COUNT, PARM_COMMENT) FIXED;
   DECLARE ADDR BUILTIN;
   COUNT_PTR = ADDR(PARM_COUNT);
   COMMENT_PTR = ADDR(PARM_COMMENT);
   DECLARE INPUT_NUMBER PIC '99' BASED (COUNT_PTR);
   DECLARE OUTPUT_COMMENT CHAR(15) BASED (COMMENT_PTR);
   DECLARE COMMENT_TABLE(9) CHAR(15) STATIC INITIAL
      ('COMMENT1
       'COMMENT2
       'COMMENT3
       'COMMENT4
       'COMMENT5
       'COMMENT6
       'COMMENT7
       'COMMENT8
       'COMMENT9
                 ');
    OUTPUT_COMMENT = COMMENT_TABLE(INPUT_NUMBER);
    RETURN;
END NATPLI:
```

## Example of Calling a PL/I Program which is Operating under CICS

```
** Example 'CALEX3': CALL PROGRAM 'CICSP'

************************

DEFINE DATA LOCAL

1 #MESSAGE (A10) INIT <' '>
END-DEFINE

*

CALL 'CICSP' #MESSAGE

DISPLAY #MESSAGE

*
END
```

#### Called PL/I program CICSP:

```
CICSP: PROCEDURE OPTIONS (MAIN REENTRANT);

DCL TWA_ADDRESS BASED(TWA_POINTER);

DCL LIST_ADDRESS POINTER;

DCL PTR_TO_LIST POINTER BASED(LIST_ADDRESS);

DCL PARM_01 POINTER;

DCL MESSAGE CHAR(10) BASED(PARM_01);

EXEC CICS ADDRESS TWA(TWA_POINTER);

MESSAGE='SUCCESS'; EXEC CICS RETURN; END CICSP;
```

## Calling a C Program

Before using a C program, you need to compile and link it.

- Use for instance IBM's C compiler to build the executable module. Since IBM's C compiler produces LE code, the sample is only executable in an LE environment. To execute LE programs, the Natural front-end needs to be installed LE enabled.
- If you intend to use any other C compiler, such as Dignus or SASC, you need to build a module which is callable from a non-C environment. Refer to the appropriate compiler documentation for further information.
- The include file NATUSER needs to be included in the C program.

C programs written for INTERFACE4 can be used on mainframe systems as well as on UNIX, OpenVMS or Windows systems, whereas C programs, written for the standard Call Interface, are platform-dependent.

If it is intended to call the C Program via CALL INTERFACE4 or if a Natural subprogram is called from the C Program, NATXCAL4 needs to be linked to the executable module. Use one of the INTERFACE4 Call Back Functions to retrieve the parameter description and parameter values. The Call Back Functions are described below.

Use function <code>ncxr\_if4\_callnat</code>, to execute a Natural subprogram from the C program.

#### Prototype:

```
int ncxr_if4_callnat ( char *natpgm, int parmnum, struct parameter_description \leftarrow *descr );
```

Parameter description:

natpgm	Name of the Natural subprogram to be invoked.					
parmnum	Number of parameter fields to be passed to the subprogram.					
descr	Address of a struct parameter_description.					
	See Operand Structure for INTERFA	ACE4 for a detailed description of this structure.				
return	Return Value:	Information:				
	0	OK				
		If an Natural error occurs while the subprogram is executed, information about this error will be returned in the variable <code>natpgm</code> in the form <code>*NATnnnn</code> , where <code>nnnn</code> is the corresponding Natural error number.				
	-1	Illegal parameter number.				
	- 2	Internal error.				

The following topics are covered below:

- Example of Calling a C Program via Standard CALL
- Example of Calling a C Program via CALL INTERFACE4

### **Example of Calling a C Program via Standard CALL**

```
** Example 'CALEX4': CALL PROGRAM 'ADD'

********************

DEFINE DATA LOCAL

1 #0P1 (I4)

1 #0P2 (I4)

1 #SUM (I4)

END-DEFINE

*

CALL 'ADD' #0P1 #0P2 #SUM

DISPLAY #SUM

*

END
```

#### Called C program ADD:

```
/*
** Example C Program ADD.c
*/
NATFCT ADD (int *op1, int *op2, int *sum)
{
*sum = *op1 + *op2;  /* add operands */
return 0;  /* return successfully */
} /* ADD */
```

## Example of Calling a C Program via CALL INTERFACE4

```
** Example 'CALEX5': CALL PROGRAM 'ADD4'

********************************

DEFINE DATA LOCAL

1 #0P1 (I4)

1 #0P2 (I4)

1 #SUM (I4)

END-DEFINE

*

CALL INTERFACE4 'ADD4' #0P1 #0P2 #SUM

DISPLAY #SUM

*

END
```

#### Called C program ADD4:

```
NATFCT ADD4 NATARGDEF(numparm, parmhandle, parmdec)
NATTYP_I4 op1, op2, sum;
                                       /* local integers */
                                       /* loop counter */
struct parameter_description desc;
int rc;
                                       /* return code access functions */
/*
** test number of arguments
if (numparm != 3) return 1;
** test types of arguments
*/
for (i = 0; i < (int) numparm; i++)
       rc = ncxr_get_parm_info( i, parmhandle, &desc );
      if ( rc ) return rc;
     if ( desc.format != 'I' || desc.length != sizeof(NATTYP_I4) || desc.dimensions ↔
! = 0)
      {
                                /* invalid parameter */
              return 2;
** get arguments
*/
rc = ncxr_get_parm( 0, parmhandle, sizeof op1, (void *)&op1 );
if ( rc ) return rc;
rc = ncxr_get_parm( 1, parmhandle, sizeof op2, (void *)&op2 );
```

```
if ( rc ) return rc;

/*

** perform the addition

*/

sum = op1 + op2;

/*

** move the result back to operand 3

*/

rc = ncxr_put_parm( 2, parmhandle, sizeof sum, (void *)&sum );

if ( rc ) return rc;

/*

** all ok, return success to the caller

*/

return 0;
} /* ADD4 */
```

### **INTERFACE4**

The keyword INTERFACE4 specifies the type of the interface that is used for the call of the external program. This keyword is optional. If this keyword is specified, the interface, which is defined as INTERFACE4, is used for the call of the external program.

The following table lists the differences between the CALL statement used with INTERFACE4 and the one used without INTERFACE4:

	-	CALL statement with keyword INTERFACE4
Number of parameters possible	128	16370 or less
Maximum data size of one parameter	no restriction	1 GB
Retrieve array information	no	yes
Support of large and dynamic operands	full read access, write without changing size of operand	yes
Parameter access via API	direct	via API

The maximum number of parameters is limited by the maximum size of the generated program (GP) and by the maximum size of a statement. 16370 parameters are possible if the program contains only the CALL statement. The maximum number is lower if other statements are used.

The following topics are covered below:

- INTERFACE4 External 3GL Program Interface
- Operand Structure for INTERFACE4

- INTERFACE4 Parameter Access
- Exported Functions

## INTERFACE4 - External 3GL Program Interface

The interface of the external 3GL program is defined as follows, when INTERFACE4 is specified with the Natural CALL statement:

NATFCT functionname (numparm, parmhandle, traditional)

USR_WORD	'	16 bit unsigned short value, containing the total number of transferred operands (operand2).
void	*parmhandle;	Pointer to the parameter passing structure.
void		Check for interface type (if it is not a NULL pointer it is the traditional CALL interface).

## **Operand Structure for INTERFACE4**

The operand structure of INTERFACE4 is named parameter\_description and is defined as follows. The structure is delivered with the header file *natuser.h.* 

struct	parameter_description		
void *	address	Address of the parameter data free() are not allowed.	ta, not aligned, realloc() and
int	format	Field data format: NCXR_TYP	E_ALPHA, etc. (natuser.h).
int	length	Length (before decimal point	, if applicable).
int	precision	Length after decimal point (if	fapplicable).
int	byte_length	Length of field in bytes int dir to IF4_MAX_DIM).	mension number of dimensions (0
int	dimensions	Number of dimensions (0 to IF4_MAX_DIM).	
int	length_all	Total data length of array in bytes.	
int	int flags Several flag bits combined by bitwise OR operat		bitwise OR operation, meaning:
		IF4_FLG_PROTECTED:	The parameter is write protected.
		IF4_FLG_DYNAMIC:	The parameter is a dynamic variable.
		IF4_FLG_NOT_CONTIGUOUS:	The array elements are not contiguous (have spaces between them).
		IF4_FLG_AIV:	The parameter is an application-independent variable.
		IF4_FLG_DYNVAR:	The parameter is a dynamic variable.

		IF4_FLG_XARRAY:	The parameter is an X-array.
		IF4_FLG_LBVAR_0:	The lower bound of dimension 0 is variable.
		IF4_FLG_UBVAR_0:	The upper bound of dimension 0 is variable.
		IF4_FLG_LBVAR_1:	The lower bound of dimension 1 is variable.
		IF4_FLG_UBVAR_1:	The upper bound of dimension 1 is variable.
		IF4_FLG_LBVAR_2:	The lower bound of dimension 2 is variable.
		IF4_FLG_UBVAR_2:	The upper bound of dimension 2 is variable.
int	occurrences[IF4_MAX_DIM]	Array occurrences in each di	mension.
int	<pre>indexfactors[IF4_MAX_DIM]</pre>	Array index factors for each dimension.	
void *	dynp	Reserved for internal use.	
void *	pops	Reserved for internal use.	

The address element is null for arrays of dynamic variables and for X-arrays. In these cases, the array data cannot be accessed as a whole, but must be accessed through the parameter access functions described below.

For arrays with fixed bounds of variables with fixed length, the array contents can be accessed directly using the address element. In these cases the address of an array element (i,j,k) is computed as follows (especially if the array elements are not contiguous):

```
elementaddress = address + i * indexfactors[0] + j * indexfactors[1] + k * ↔ indexfactors[2]
```

If the array has less than 3 dimensions, leave out the last terms.

### **INTERFACE4 - Parameter Access**

A set of functions is available to be used for the access of the parameters. The process flow is as follows:

- The 3GL program is called via the CALL statement with the INTERFACE4 option, and the parameters are passed to the 3GL program as described above.
- The 3GL program can now use the exported functions of Natural, to retrieve either the parameter data itself, or information about the parameter, such as format, length, array information, etc.
- The exported functions can also be used to pass back parameter data.

There are also functions to create and initialize a new parameter set in order to call arbitrary subprograms from a 3GL program. With this technique a parameter access is guaranteed to avoid

memory overwrites done by the 3GL program. (Natural's data is safe: memory overwrites within the 3GL program's data are still possible).

### **Exported Functions**

The following topics are covered below:

- Get Parameter Information
- Get Parameter Data
- Write Back Operand Data
- Create, Initialize and Delete a Parameter Set
- Create Parameter Set
- Delete Parameter Set
- Initialize a Scalar of a Static Data Type
- Initialize an Array of a Static Data Type
- Initialize a Scalar of a Dynamic Data Type
- Initialize an Array of a Dynamic Data Type
- Resize an X-array Parameter

#### **Get Parameter Information**

This function is used by the 3GL program to receive all necessary information from any parameter. This information is returned in the struct parameter\_description, which is documented above.

### Prototype:

```
int ncxr_get_parm_info ( int parmnum, void *parmhandle, struct parameter_description \leftrightarrow *descr );
```

#### Parameter Description:

parmnum	Ordinal number of the parameter. This identifies the parameter of the passed parameter list. Range: 0 numparm-1.	
parmhandle	Pointer to the internal parameter structure	
descr	Address of a struct parameter_description	
return	Return Value: Information:	
	0	OK
	-1	Illegal parameter number.
	- 2	Internal error.
	-7	Interface version conflict.

#### **Get Parameter Data**

This function is used by the 3GL program to get the data from any parameter.

Natural identifies the parameter by the given parameter number and writes the parameter data to the given buffer address with the given buffer size.

If the parameter data is longer than the given buffer size, Natural will truncate the data to the given length. The external 3GL program can make use of the function <code>ncxr\_get\_parm\_info</code>, to request the length of the parameter data.

There are two functions to get parameter data: ncxr\_get\_parm gets the whole parameter (even if the parameter is an array), whereas ncxr\_get\_parm\_array gets the specified array element.

If no memory of the indicated size is allocated for "buffer" by the 3GL program (dynamically or statically), results of the operation are unpredictable. Natural will only check for a null pointer.

If data gets truncated for variables of the type I2/I4/F4/F8 (buffer length not equal to the total parameter length), the results depend on the machine type (little endian/big endian). In some applications, the user exit must be programmed to use no static data to make recursion possible.

#### Prototypes:

```
int ncxr_get_parm( int parmnum, void *parmhandle, int buffer_length, void *buffer )
int ncxr_get_parm_array( int parmnum, void *parmhandle, int buffer_length, void ↔
*buffer, int *indexes )
```

This function is identical to ncxr\_get\_parm, except that the indexes for each dimension can be specified. The indexes for unused dimensions should be specified as 0.

#### Parameter Description:

parmnum	Ordinal number of the parameter. This identifies the parameter of the passed parameter list. Range: 0 numparm-1.	
parmhandle	Pointer to the internal parameter structure	
buffer_length	Length of the buffer, where the red	quested data has to be written to
buffer	Address of buffer, where the requested data has to be written to. This buffer should be aligned to allow easy access to I2/I4/F4/F8 variables.	
indexes	Array with index information	
return	Return Value: Information:	
	< 0	Error during retrieval of the information:
	-1	Illegal parameter number.
	- 2	Internal error.
	-3	Data has been truncated.

- 4	Data is not an array.
-7	Interface version conflict.
-100	Index for dimension 0 is out of range.
-101	Index for dimension 1 is out of range.
-102	Index for dimension 2 is out of range.
0	Successful operation.
> 0	Successful operation, but the data was only this number of bytes long (buffer was longer than the data).

#### Write Back Operand Data

These functions are used by the 3GL program to write back the data to any parameter. Natural identifies the parameter by the given parameter number and writes the parameter data from the given buffer address with the given buffer size to the parameter data. If the parameter data is shorter than the given buffer size, the data will be truncated to the parameters data length, that is, the rest of the buffer will be ignored. If the parameter data is longer than the given buffer size, the data will be copied only to the given buffer length, the rest of the parameter stays untouched. This applies to arrays in the same way. For dynamic variables as parameters, the parameter is resized to the given buffer length.

If data gets truncated for variables of the type I2/I4/F4/F8 (buffer length not equal to the total parameter length), the results depend on the machine type (little endian/big endian). In some applications, the user exit must be programmed to use no static data to make recursion possible.

#### Prototypes:

#### Parameter Description:

parmnum	Ordinal number of the parameter. This identifies the parameter of the passed parameter list. Range: 0 numparm-1.	
parmhandle	Pointer to the internal parameter structure.	
buffer_length	Length of the data to be copied back to the address of buffer, where the data comes from.	
indexes	Index information	
return	Return Value:	Information:
	< 0	Error during copying of the information:
	-1	Illegal parameter number.

- 2	Internal error.
- 3	Too much data has been given. The copy back was done with parameter length.
- 4	Parameter is not an array.
- 5	Parameter is protected (constant or AD=0).
- 6	Dynamic variable could not be resized due to an "out of memory" condition.
- 7	Interface version conflict.
-13	The given buffer includes an incomplete Unicode character.
-100	Index for dimension 0 is out of range.
-101	Index for dimension 1 is out of range.
-102	Index for dimension 2 is out of range.
0	Successful operation.
> 0	Successful operation., but the parameter was this number of bytes long (length of parameter greater than given length).

#### Create, Initialize and Delete a Parameter Set

If a 3GL program wants to call a Natural subprogram, it needs to build a parameter set that corresponds to the parameters the subprogram expects. The function ncxr\_create\_parm is used to create a set of parameters to be passed with a call to ncxr\_if\_callnat. The set of parameters created is represented by an opaque parameter handle, like the parameter set that is passed to the 3GL program with the CALL INTERFACE4 statement. Thus, the newly created parameter set can be manipulated with functions ncxr\_put\_parm\* and ncxr\_get\_parm\* as described above.

The newly created parameter set is not yet initialized after having called the function <code>ncxr\_create\_parm</code>. An individual parameter is initialized to a specific data type by a set of <code>ncxr\_parm\_init\*</code> functions described below. The functions <code>ncxr\_put\_parm\*</code> and <code>ncxr\_get\_parm\*</code> are then used to access the contents of each individual parameter. After the caller has finished with the parameter set, they must delete the parameter handle. Thus, a typical sequence in creating and using a set of parameters for a subprogram to be called through <code>ncxr\_if4\_callnat</code> will be:

```
ncxr_create_parm
ncxr_init_ parm*
ncxr_init_ parm*
...
ncxr_put_ parm*
ncxr_put_ parm*
...
ncxr_get_parm_info*
ncxr_get_parm_info*
ncxr_get_parm_info*
...
ncxr_get_parm_info*
```

```
...
ncxr_get_parm_info*
ncxr_get_parm_info*
...
ncxr_get_ parm*
ncxr_get_ parm*
...
ncxr_delete_parm
```

#### **Create Parameter Set**

The function ncxr\_create\_parm is used to create a set of parameters to be passed with a call to ncxr\_if\_callnat.

#### Prototype:

```
int ncxr_create_parm( int parmnum, void** pparmhandle )
```

#### Parameter Description:

parmnum	Number of parameters to be created.	
pparmhandle	Pointer to the created parameter handle.	
return	Return Value: Information:	
	< 0 Error:	
	-1 Illegal parameter count.	
	- 2 Internal error.	
	- 6	Out of memory condition.
	0 Successful operation.	

#### **Delete Parameter Set**

The function ncxr\_delete\_parm is used to delete a set of parameters that was created with ncxr\_create\_parm.

#### Prototype:

```
int ncxr_delete_parm( void* parmhandle )
```

#### Parameter Description:

parmhandle	Pointer to the parameter handle to be deleted.	
return	Return Value:	Information:
	< 0	Error:
	- 2	Internal error.
	0	Successful operation.

## Initialize a Scalar of a Static Data Type

## Prototype:

```
int ncxr_init_parm_s( int parmnum, void *parmhandle,
      char format, int length, int precision, int flags );
```

## Parameter Description:

parmnum	Ordinal number of the parameter. This identifies the parameter in the passed parameter list. Range: 0 numparm-1.	
parmhandle	Pointer to the parameter handle.	
format	Format of the parameter.	
length	Length of the parameter.	
precision	Precision of the parameter.	
flags	IF4_FLG_PROTECTED	
return	Return Value:	Information:
	< 0	Error:
	-1	Invalid parameter number.
	- 2	Internal error.
	- 6	Out of memory condition.
	-8	Invalid format.
	- 9	Invalid length or precision.
	0	Successful operation.

## Initialize an Array of a Static Data Type

## Prototype:

## Parameter Description:

parmnum	Ordinal number of the parameter. This is Range: 0 numparm-1.	dentifies the parameter in the passed parameter list.
parmhandle	Pointer to the parameter handle.	
format	Format of the parameter.	
length	Length of the parameter.	
precision	Precision of the parameter.	
dim	Dimension of the array.	
осс	Number of occurrences per dimension.	
flags	A combination of the flags  IF4_FLG_PROTECTED IF4_FLG_LBVAR_0 IF4_FLG_UBVAR_0	
	IF4_FLG_LBVAR_1 IF4_FLG_UBVAR_1 IF4_FLG_LBVAR_2 IF4_FLG_UBVAR_2	
return	Return Value:	Information:
	< 0	Error:
	-1	Invalid parameter number.
	- 2	Internal error.
	- 6	Out of memory condition.
	-8	Invalid format.
	- 9	Invalid length or precision.
	-10	Invalid dimension count.
	-11	Invalid combination of variable bounds.
	0	Successful operation.

## Initialize a Scalar of a Dynamic Data Type

## Prototype:

## Parameter Description:

parmnum	Ordinal number of the parameter. This identifies the parameter in the passed parameter list. Range: 0 numparm-1.			
parmhandle	e Pointer to the parameter handle.			
format	Format of the parameter.			
flags	IF4_FLG_PROTECTED			
return	Return Value:	Information:		
	< 0	Error:		
	-1	Invalid parameter number.		
	- 2	Internal error.		
	-6	Out of memory condition.		
	-8	Invalid format.		
	0	Successful operation.		

## Initialize an Array of a Dynamic Data Type

## Prototype:

## Parameter Description:

parmnum	Ordinal number of the parameter. This is Range: 0 numparm-1.	lentifies the parameter in the passed parameter list.
parmhandle	Pointer to the parameter handle.	
format	Format of the parameter.	
dim	Dimension of the array.	
осс	Number of occurrences per dimension.	
flags	A combination of the flags  IF4_FLG_PROTECTED  IF4_FLG_LBVAR_0 IF4_FLG_UBVAR_1 IF4_FLG_UBVAR_1 IF4_FLG_UBVAR_2 IF4_FLG_UBVAR_2 IF4_FLG_UBVAR_2	
return	Return Value:	Information:
	< 0	Error:
	-1	Invalid parameter number.
	- 2	Internal error.
	- 6	Out of memory condition.

-8	Invalid format.
-10	Invalid dimension count.
-11	Invalid combination of variable bounds.
0	Successful operation.

## Resize an X-array Parameter

## Prototype:

```
int ncxr_resize_parm_array( int parmnum, void *parmhandle, int *occ );
```

## Parameter Description:

parmnum	Ordinal number of the parameter. This identifies the parameter in the passed parameter list. Range: 0 numparm-1.	
parmhandle	Pointer to the parameter handle.	
осс	New number of occurrences per dimension.	
return	Return Value:	Information:
	< 0	Error:
	-1	Invalid parameter number.
	- 2	Internal error.
	-6	Out of memory condition.
	-12	Operand is not resizable (in one of the specified dimensions).
	0	Successful operation.

All function prototypes are declared in the file natuser.h.

# 23 CALL FILE

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### **Structured Mode Syntax**

```
CALL FILE'program-name' operand1 operand2
statement...
END-FILE
```

#### **Reporting Mode Syntax**

```
CALL FILE'program-name' operand1 operand2
statement...
LOOP
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL | CALL | LOOP | CALLNAT | DEFINE SUBROUTINE | ESCAPE | FETCH | PERFORM

Belongs to Function Group: Invoking Programs and Routines

## **Function**

The CALL FILE statement is used to call a non-Natural program which reads a record from a non-Adabas file and returns the record to the Natural program for processing.

## Restriction

The statements AT BREAK, AT START OF DATA and AT END OF DATA must not be used within a CALL FILE processing loop.

## **Syntax Description**

Operand Definition Table:

Operand	Pos	ssib	le St	ructure	Possible Formats	Referencing Permitted	Dynamic Definition
operand1		S	A		AUNPIFBDTLC	yes	yes
operand2		S	A	G	AUNPIFBDTLC	yes	yes

#### Syntax Element Description:

Syntax Element	Description
'program-name'	Program to be Called: The name of the non-Natural program to be called.
operand1	Control Field: operand1 is used to provide control information.
operand2	<b>Record Area:</b> <i>operand2</i> defines the record area.  The format of the record to be read can be described using field definitions (or FILLER $nX$ ) entries following the name of the first field in the record. The fields used to define the record format must not have been previously defined in the Natural program. This ensures that fields are allocated in the contiguous storage by Natural.
statement	Processing Loop: The CALL FILE statement initiates a processing loop which must be terminated with an ESCAPE or STOP statement. More than one ESCAPE statement may be specified to escape from a CALL FILE loop based on different conditions.
END-FILE	End of CALL FILE Statement:
LOOP	In structured mode, the Natural reserved keyword END-FILE must be used to end the CALL FILE statement.
	In reporting mode, the Natural statement LOOP is used to end the CALL FILE statement.

## **Example**

#### **Calling Program:**

```
** Example 'CFIEX1': CALL FILE

********************

DEFINE DATA LOCAL

1 #CONTROL (A3)

1 #RECORD

2 #A (A10)

2 #B (N3.2)

2 #FILL1 (A3)

2 #C (P3.1)

END-DEFINE

*
```

The byte layout of the record passed by the called program to the Natural program in the above example is as follows:

```
CONTROL #A #B FILLER #C
(A3) (A10) (N3.2) 3X (P3.1)

XXX XXXXXXXXXX XXXX XXX
```

#### **Called COBOL Program:**

```
ID DIVISION.
PROGRAM-ID. USER1.
ENVIRONMENT DIVISION.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
     SELECT USRFILE ASSIGN UT-S-FILEUSR.
DATA DIVISION.
FILE SECTION.
    USRFILE RECORDING F LABEL RECORD OMITTED
     DATA RECORD DATA-IN.
01
    DATA-IN
                    PIC X(80).
LINKAGE SECTION.
    CONTROL-FIELD PIC XXX.
    RECORD-IN PIC X(21).
PROCEDURE DIVISION USING CONTROL-FIELD RECORD-IN.
BEGIN.
     GO TO FILE-OPEN.
FILE-OPEN.
     OPEN INPUT USRFILE
     MOVE SPACES TO CONTROL-FIELD.
     ALTER BEGIN TO PROCEED TO FILE-READ.
FILE-READ.
     READ USRFILE INTO RECORD-IN
          AT END
          MOVE 'END' TO CONTROL-FIELD
          CLOSE USRFILE
          ALTER BEGIN TO PROCEED TO FILE-OPEN.
     GOBACK.
```

# 24 CALL LOOP

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#### **Structured Mode Syntax**

```
CALL LOOP operand1 [operand2]...40
statement...
END-LOOP
```

#### **Reporting Mode Syntax**

```
CALL LOOP operand1 [operand2] ...40
statement ...
LOOP
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL | CALL | FILE | CALLNAT | DEFINE SUBROUTINE | ESCAPE | FETCH | PERFORM

Belongs to Function Group: Invoking Programs and Routines

#### **Function**

The CALL LOOP statement is used to generate a processing loop that contains a call to a non-Natural program.

Unlike the CALL statement, the CALL LOOP statement results in a processing loop which is used to repeatedly call the non-Natural program. See the CALL statement for a detailed description of the CALL processing.

#### Restriction

The statements AT BREAK, AT START OF DATA and AT END OF DATA must not be used within a CALL LOOP processing loop.

## **Syntax Description**

### Operand Definition Table:

Operand	Possible Structure							P	os	sil	ble	Fo	orm	ats	3		Referencing Permitted	Dynamic Definition	
operand1	C	S				A												yes	no
operand2	С	S	A	G		Α	U	N	Р	Ι	F	В	D	T	L	C		yes	yes

### Syntax Element Description:

Syntax Element	Description
operand1	Program to be Called:  The name of the non-Natural program to be called can be specified as a constant or - if different programs are to be called dependent on program logic - as an alphanumeric variable of length 1 to 8. A program name must be placed left-justified in the variable.
operand2	Parameters: The CALL LOOP statement can have a maximum of 40 parameters. The parameter list is constructed as described for the CALL statement. Fields used in the parameter list may be initially defined in the CALL LOOP statement itself or may have been previously defined.
statement	Processing Loop: The CALL LOOP statement initiates a processing loop which must be terminated with an ESCAPE statement.
END-LOOP	End of CALL LOOP Statement:
LOOP	In structured mode, the Natural reserved word END-LOOP must be used to end the CALL LOOP statement.
	In reporting mode, the Natural statement LOOP is used to end the CALL LOOP statement.

## **Example**

```
DEFINE DATA LOCAL

1 PARAMETER1 (A10)

END-DEFINE

CALL LOOP 'ABC' PARAMETER1

IF PARAMETER1 = 'END'

ESCAPE BOTTOM

END-IF

END-LOOP

END
```

# 25 CALLDBPROC (SQL)

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Example	

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

See also *CALLDBPROC* - *SQL* in the *Natural for DB2* part of the *Database Management System Inter- faces* documentation.

#### **Function**

The CALLDBPROC statement is used to invoke a stored procedure of the SQL database system to which Natural is connected.

The stored procedure can be either a Natural subprogram (only available when executed from DB2 for z/OS) or a program written in another programming language.

In addition to the passing of parameters between the invoking object and the stored procedure, CALLDBPROC supports "result sets"; these make it possible to return a larger amount of data from the stored procedure to the invoking object than would be possible via parameters.

The result sets are "temporary result tables" which are created by the stored procedure and which can be read and processed by the invoking object via a READ RESULT SET statement.



**Note:** In general, the invoking of a stored procedure could be compared with the invoking of a Natural subprogram: when the CALLDBPROC statement is executed, control is passed to the stored procedure; after processing of the stored procedure, control is returned to the invoking object and processing continues with the statement following the CALLDBPROC statement.

## Restriction

This statement is available only with Natural for DB2.

# **Syntax Description**

Syntax Element	Description												
dbproc	Stored Procedure to be Invoked:												
	As <i>dbproc</i> you specify the name of the stored procedure to be invoked. The name can be specified either as an alphanumeric variable or as a constant (enclosed in apostrophes).												
	The name must adhere to the rules for stored procedure names of the target database system												
	If the stored procedure is a Natural sub longer than 8 characters.	program, the actual procedure name must not be											
ddm-name	Name of a Natural Data Definition Mo	Name of a Natural Data Definition Module:											
	The name of a DDM must be specified to the stored procedure. For further inform	provide the "address" of the database which executes mation, see <a href="ddm-name">ddm-name</a> .											
[USING]	Parameter(s) to be Passed:												
parameter	As parameter, you can specify parameters which are passed from the invoking object to the stored procedure. A parameter can be												
	a host-variable (optionally with INDICATOR and LINDICATOR clauses),												
	a constant, or												
	■ the keyword NULL.												
	See further details on <i>host-variable</i> .												
AD=	Attribute Definition:												
	If parameter is a host-variable, you	ı can mark it as follows:											
	AD=0	Non-modifiable, see session parameter AD=0.											
		(Corresponding procedure notation in DB2 for z/OS: I N.)											
	AD=M	Modifiable, see session parameter AD=M.											
		(Corresponding procedure notation in DB2 for z/OS: INOUT.)											
	AD=A	For input only, see session parameter AD=A.											

Syntax Element	Description									
		(Corresponding procedure notation in DB2 for z/OS: 0UT.)								
	If <i>parameter</i> is a constant, AD cannot be applies.	ter is a constant, AD cannot be explicitly specified. For constants, AD=0 always								
RESULT	Field for Result-Set Locator Variable:	r Result-Set Locator Variable:								
SETS result-set	s result-set you specify a field in which a result-set locator is to be returned.									
	A result set has to be a variable of forma	t/length I4.								
	The value of a result set variable is merely can be referenced in a subsequent READ	y a number which identifies the result set and which RESULT SET statement.								
	The sequence of the result-set values of the stored procedure.	correspond to the sequence of the result sets returned								
	The contents of the result sets can be proce	essed by a subsequent READ RESULT SET statement.								
	If no result set is returned, the correspon	ding result-set variable will contain 0.								
	Multiple result sets can be specified only for DB2.	ultiple result sets can be specified only when the stored procedure is invoked via Natura. DB2.								
	See also <i>Result Sets</i> (in the <i>Natural for DB</i> documentation).	2 part of the Database Management System Interfaces								
GIVING	GIVING sqlcode Option:									
sqlcode	This option may be used to obtain the SO stored procedure.	QLCODE of the SQL CALL statement invoking the								
		DE of the stored procedure is not 0, no Natural error ction to be taken in reaction to the SQLCODE value object.								
	The sqlcode field has to be a variable of	f format/length I4.								
	If the GIVING sqlcode option is omitted, a Natural error message will be issued if the SQLCODE of the stored procedure is not 0.									
CALLMODE=	= CALLMODE Parameter:									
	Possible settings are:									
	CALLMODE=NATURAL									

Syntax Element	Description	
		This setting also has an impact on internal parameters that are passed to/from the stored procedure. For details, see <i>CALLMODE=NATURAL</i> in the section <i>CALLDBPROC</i> of the <i>Natural for DB2</i> documentation.
	CALLMODE=NONE	This is the default.

## **Example**

The following example shows a Natural program that calls the stored procedure DEMO\_PROC to retrieve all names of table PERSON that belong to a given range.

Three parameter fields are passed to DEMO\_PROC: the first and second parameters pass starting and ending values of the range of names to the stored procedure, and the third parameter receives a name that meets the criterion.

In this example, the names are returned in a result set that is processed using the READ RESULT SET statement.

```
DEFINE DATA LOCAL
1 PERSON VIEW OF DEMO-PERSON
  2 PERSON_ID
 2 LAST_NAME
1 #BEGIN (A2) INIT <'AB'>
1 #END (A2) INIT <'DE'>
1 #RESPONSE (I4)
1 #RESULT (I4)
1 #NAME (A20)
END-DEFINE
CALLDBPROC 'DEMO_PROC' DEMO-PERSON #BEGIN (AD=0) #END (AD=0) #NAME (AD=A)
    RESULT SETS #RESULT
    GIVING #RESPONSE
READ RESULT SET #RESULT INTO #NAME FROM DEMO-PERSON
    GIVING #RESPONSE
  DISPLAY #NAME
END-RESULT
END
```

For further examples, see *Example of CALLDBPROC/READ RESULT SET* in the section *CALLDB-PROC* of the *Natural for DB2* documentation.

# 26 CALLNAT

Function	208
Syntax Description	
Parameter Transfer with Dynamic Variables	
Examples	212

CALLNAT operand1 
$$\left[ \begin{array}{c} Operand2 \\ NX \end{array} \right] \left[ \begin{array}{c} M \\ O \\ A \end{array} \right] \right] \right] \dots \right]$$

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL | CALL | FILE | CALL | LOOP | DEFINE SUBROUTINE | ESCAPE | FETCH | PERFORM

Belongs to Function Group: Invoking Programs and Routines

#### **Function**

The CALLNAT statement is used to invoke a Natural subprogram for execution. (A Natural subprogram can only be invoked via a CALLNAT statement; it cannot be executed by itself.)

When the CALLNAT statement is executed, the execution of the invoking object (that is, the object containing the CALLNAT statement) will be suspended and the invoked subprogram will be executed. The execution of the subprogram continues until either its END statement is reached or processing of the subprogram is stopped by an ESCAPE ROUTINE statement being executed. In either case, processing of the invoking object will then continue with the statement following the CALLNAT statement.



#### Notes:

- 1. A subprogram can in turn invoke other subprograms.
- 2. A subprogram has no access to the global data area used by the invoking object. If a subprogram in turn invokes a subroutine or helproutine, it can establish its own global data area to be shared with the subroutine/helproutine.

# **Syntax Description**

### Operand Definition Table:

Operand	Possible Structure								Po	SS	dia	le I	For	ma	ts		Referencing Permitted	Dynamic Definition		
operand1	С	S				A													yes	no
operand2	С	S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C	G	O	yes	yes

## Syntax Element Description:

Syntax Element	Description											
operand1	Subprogram to be Invoked:											
	As <code>operand1</code> , you specify the name of the subprogram to be invoked. The name may be specified either as a constant of 1 to 8 characters, or - if different subprograms are to be called dependent on program logic - as an alphanumeric variable of length 1 to 8. The case of the specified name is not translated.											
	The subprogram name may contain an ampersand (&); at execution time, this character will be replaced by the one-character code corresponding to the current value of the system variable *LANGUAGE. This makes it possible, for example, to invoke different subprograms for the processing of input, depending on the language in which input is provided.											
operand2	Parameters:											
	If parameters are passed to the subprogram, the structure of the parameter list must be defined in a DEFINE DATA PARAMETER statement. The parameters specified with the CALLNAT statement are the only data available to the subprogram from the invoking object.											
	By default, the parameters are passed <i>by reference</i> , that is, the data are transferred via address parameters, the parameter values themselves are not moved. However, it is also possible to pass parameters <i>by value</i> , that is, pass the actual parameter values. To do so, you define these fields in the DEFINE DATA PARAMETER statement of the subprogram with the option BY VALUE or BY VALUE RESULT (see <i>parameter-data-definition</i> in the description of the DEFINE DATA statement).											
	■ If parameters are passed <i>by reference</i> , the following applies: The sequence, format and length of the parameters in the invoking object must match exactly the sequence, format and length of the DEFINE DATA PARAMETER structure in the invoked subprogram. The names of the variables in the invoking object and the invoked subprogram may be different.											
	■ If parameters are passed <i>by value</i> , the following applies: The sequence of the parameters in the invoking object must match exactly the sequence in the DEFINE DATA PARAMETER structure of the invoked subprogram. Formats and lengths of the variables in the invoking object and the subprogram may be different; however, they have to be data transfer compatible;											

Syntax	Description				
Element					
	the <i>Programming Guide</i> . The names of the values that he passed back to the invoking object, you have	Rules for Arithmetic Assignments, Data Transfer in riables in the invoking object and the subprogram have been modified in the subprogram are to be we to define these fields with BY VALUE RESULT. LT, it is not possible to pass modified parameter less of the AD specification; see also below).			
	<b>Note:</b> With BY VALUE, an internal copy of th	e parameter values is created. The subprogram			
		will not affect the original parameter values in , an internal copy is likewise created, however, inal parameter values are overwritten by the			
	For both ways of passing parameters, the following	owing applies:			
		idual fields contained in that group are passed to ds a corresponding field must be defined in the			
	In the parameter data area of the invoked subp within a REDEFINE block.	program, a redefinition of groups is only permitted			
	If an array is passed, its number of dimensions and occurrences in the subprogram's parameter data area must be the same as in the CALLNAT parameter list.				
	<b>Note:</b> If multiple occurrences of an array that is defined as part of an indexed group are pass				
	with the CALLNAT statement, the corresponding fields in the subprogram's parameter data are must not be redefined, as this would lead to the wrong addresses being passed.				
	When the option PCHECK of the COMPOPT command is set to ON, the compiler will check the number, format, length and array index bounds of the parameters that are specified in a CALLNA statement. Also, the OPTIONAL feature of the DEFINE DATA PARAMETER statement is considere in the parameter check.				
AD=	Attribute Definition:				
	If operand2 is a variable, you can mark it in o	one of the following ways:			
	AD=0	Non-modifiable, see session parameter AD=0.			
	<b>Note:</b> Internally, AD=0 is processed in the sat				
	way as BY VALUE (see				
	parameter-data-definition in the description of the DEFINE DATA statement				
	AD=M Modifiable, see session parameter AD=M.				
	This is the default setting.				
	AD=A Input only, see session parameter AD=A.				
	If operand2 is a constant, AD cannot be explicitly specified. For constants AD=0 always applies.				

Syntax Element	Description
nX	Parameters to be Skipped:
	With the notation $nX$ you can specify that the next $n$ parameters are to be skipped (for example, $1X$ to skip the next parameter, or $3X$ to skip the next three parameters); this means that for the next $n$ parameters no values are passed to the subprogram. The possible range of values for $n$ is $1 - 4096$ .
	A parameter that is to be skipped must be defined with the keyword OPTIONAL in the subprogram's DEFINE DATA PARAMETER statement. OPTIONAL means that a value can - but need not - be passed from the invoking object to such a parameter.

## **Parameter Transfer with Dynamic Variables**

Dynamic variables may be passed as parameters to a called program object (CALLNAT, PERFORM). A call by reference is possible because the value space of a dynamic variable is contiguous. A call by value causes an assignment with the variable definition of the caller as the source operand and the parameter definition as the destination operand. In addition, a call by value result causes the movement to change to the opposite direction. When using a call-by-reference, both definitions must be <code>DYNAMIC</code>. If only one of them is <code>DYNAMIC</code>, a runtime error is raised. In case of a call by value (result) all combinations are possible.

The following table illustrates the valid combinations of statically and dynamically defined variables of the caller, and statically and dynamically defined parameters concerning the parameter transfer.

#### Call By Reference

operand2 of caller	Parameter definition	
	Static	Dynamic
Static	yes	no
Dynamic	no	yes

The formats of the dynamic variables A or B must match.

#### Call by Value (Result)

operand2 of caller	Parameter definition	
	Static	Dynamic
Static	yes	yes
Dynamic	yes	yes



**Note:** When using static/dynamic or dynamic/static definitions, a value truncation may occur according to the data transfer rules of the appropriate assignments.

## **Examples**

- Example 1
- Example 2

#### Example 1

#### Calling Program:

```
** Example 'CNTEX1': CALLNAT

****************************

DEFINE DATA LOCAL

1  #FIELD1 (N6)

1  #FIELD2 (A20)

1  #FIELD3 (A10)

END-DEFINE

*

CALLNAT 'CNTEX1N' #FIELD1 (AD=M) #FIELD2 (AD=0) #FIELD3 'P4 TEXT'

*

WRITE '=' #FIELD1 '=' #FIELD2 '=' #FIELD3

*

END
```

#### Called Subprogram CNTEX1N:

```
** Example 'CNTEX1N': CALLNAT (called by CNTEX1)

***********************

DEFINE DATA PARAMETER

1 #FIELDA (N6)

1 #FIELDB (A20)

1 #FIELDC (A10)

1 #FIELDD (A7)

END-DEFINE

*
```

```
#FIELDA := 4711
*
#FIELDB := 'HALLO'
*
#FIELDC := 'ABC'
*
WRITE '=' #FIELDA '=' #FIELDB '=' #FIELDC '=' #FIELDD
*
END
```

#### Example 2

#### **Calling Program:**

```
** Example 'CNTEX2': CALLNAT

*******************************

DEFINE DATA LOCAL

1 #ARRAY1 (N4/1:10,1:10)

1 #NUM (N2)

END-DEFINE

*

*

*

**

**

CALLNAT 'CNTEX2N' #ARRAY1 (2:5,*)

*

FOR #NUM 1 TO 10

WRITE #NUM #ARRAY1(#NUM,1:10)

END-FOR

*

END
```

#### **Called Subprogram CNTEX2N:**

```
** Example 'CNTEX2N': CALLNAT (called by CNTEX2)
                                       *******
DEFINE DATA
PARAMETER
1 #ARRAY (N4/1:4,1:10)
LOCAL
1 I
      (I2)
END-DEFINE
FOR I 1 10
 \#ARRAY(1,I) := I
 \#ARRAY(2,I) := 100 + I
 \#ARRAY(3,I) := 200 + I
 \#ARRAY(4.I) := 300 + I
END-FOR
END
```

# 27 CLOSE CONVERSATION

Function	21	6
Syntax Description		
Further Information and Examples	21	7

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DEFINE DATA CONTEXT | OPEN CONVERSATION

Belongs to Function Group: Natural Remote Procedure Call

### **Function**

The statement CLOSE CONVERSATION is used in conjunction with the Natural RPC (Remote Procedure Call). It allows the client to close conversations. You can close the current conversation, another open conversation, or all open conversations.



**Note:** A logon to another library does not automatically close conversations.

## **Syntax Description**

Operand Definition Table:

Operand	Pos	ssib	le St	ructure	Possible Forn	nats	Referencing Permitted	Dynamic Definition
operand1		S	A		I		yes	no

Syntax Element Description:

Syntax Element	Description	
operand1	Identifier of Conversation to be Closed:	
	To close a specific open conversation, specify its ID as operand1.	
	operand1 must be a variable of format/length I4.	
*CONVID	Closing the Current Conversation:	
	To close the current conversation, specify *CONVID.	
	The ID of the current conversation is determined by the value of the system variable *CONVID.	
ALL	Closing All Open Conversations:	
	To close all open conversations, specify ALL.	

## **Further Information and Examples**

See the following sections in the *Natural RPC (Remote Procedure Call)* documentation:

- Natural RPC Operation in Conversational Mode
- *Using a Conversational RPC*

# V

28 CLOSE PC FILE	221
■ 29 CLOSE PRINTER	
■ 30 CLOSE WORK FILE	229
■ 31 COMMIT (SQL)	233
■ 32 COMPOSE	235
■ 33 COMPRESS	
■ 34 COMPUTE	273
■ 35 CREATE OBJECT	281
36 DECIDE FOR	285
■ 37 DECIDE ON	291
■ 38 DEFINE CLASS	297

# 28 CLOSE PC FILE

Function	. 222
Syntax Description	
Example	. 222

```
CLOSE { PC WORK } [FILE] work-file-number
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DOWNLOAD PC FILE | UPLOAD PC FILE

Belongs to Function Group: Control of Work Files / PC Files

### **Function**

The statement CLOSE PC FILE is used to close a specific PC work file. It allows you to explicitly specify in a program that a PC work file is to be closed.

A work file is also closed automatically when command mode is reached.

The settings in the NTWORK macro apply.

See also the Natural Connection and Entire Connection documentation.

## **Syntax Description**

Syntax Element	Description
work-file-number	The work-file-number is the number of the PC work file to be closed.
	This number must correspond to one of the work file numbers for the PC as defined to Natural.

### **Example**

The following program demonstrates the use of the CLOSE PC FILE statement.

```
** Example 'PCCLEX1': CLOSE PC FILE

**

** NOTE: Example requires that Natural Connection is installed.

************************

DEFINE DATA LOCAL

O1 W-DAT (A40)

O1 REC-NUM (N3)

O1 I (P3)

END-DEFINE
```

```
REPEAT
UPLOAD PC FILE 7 ONCE W-DAT
                                         /* Data upload
  AT END OF FILE
    ESCAPE BOTTOM
  END-ENDFILE
  INPUT 'Processing file' W-DAT (AD=0)
    / 'Enter record number to display' REC-NUM
  IF REC-NUM = 0
    STOP
  END-IF
  FOR I = 1 TO REC-NUM
    UPLOAD PC FILE 7 ONCE W-DAT
    AT END OF FILE
      WRITE 'Max. record number reached, last record is'
      ESCAPE BOTTOM
    END-ENDFILE
  END-FOR
  I := I - 1
  WRITE 'Record' I ':' W-DAT
CLOSE PC FILE 7
                                          /* Close PC file 7
END-REPEAT
END
```

#### **Output of Program PCCLEX1:**

When you run the program, a window appears in which you specify the name of the PC file from which the data is to be uploaded. The data is then uploaded from the PC. At the end of each loop, the PC file is closed.

# 29 CLOSE PRINTER

Function	226
Syntax Description	
Example	

```
CLOSE PRINTER \left\{ \begin{array}{l} (logical-printer-name) \\ (printer-number) \end{array} \right\}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The CLOSE PRINTER statement is used to close a specific printer. With this statement, you explicitly specify in a program that a printer is to be closed.

A printer is also closed automatically in one of the following cases:

- when a DEFINE PRINTER statement in which the same printer is defined again is executed;
- when command mode is reached.

When a printer is closed, the profile associated with the printer (see PROFILE clause of the DEFINE PRINTER statement) is deleted, that is, any further writes to the printer are affected.

## **Syntax Description**

Syntax Element	Description
logical-printer-name	Logical Printer Name:
	With the <code>logical-printer-name</code> you specify which printer is to be closed. The name is the same as in the corresponding <code>DEFINE PRINTER</code> statement in which you defined the printer.
	Naming conventions for the <code>logical-printer-name</code> are the same as for user-defined variables, see <code>Naming Conventions</code> for <code>User-Defined Variables</code> in <code>Using Natural</code> .
printer-number	Printer Number:
	Alternatively to the <code>logical-printer-name</code> , you may define the <code>printer-number</code> to specify which printer is to be closed.
	The <i>printer-number</i> may be a number in the range from 0 - 31. This is the number also to be used in a DISPLAY / WRITE or DEFINE PRINTER statement.

Syntax Element	Description
	Printer number 0 indicates the hardcopy printer.

## **Example**

```
** Example 'CLPEX1': CLOSE PRINTER
************************
DEFINE DATA LOCAL
1 EMP-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
 2 BIRTH
1 #I-NAME (A20)
END-DEFINE
DEFINE PRINTER (PRT01=1)
REPEAT
 INPUT 'SELECT PERSON' #I-NAME
 IF #I-NAME = ' '
  STOP
 FND-IF
 FIND EMP-VIEW WITH NAME = \#I-NAME
   WRITE (PRT01) 'NAME :' NAME ',' FIRST-NAME
               'PERSONNEL-ID : PERSONNEL-ID
                'BIRTH : BIRTH (EM=YYYY-MM-DD)
 END-FIND
 /*
 CLOSE PRINTER (PRT01)
END-REPEAT
END
```

# 30 CLOSE WORK FILE

Function	230
Syntax Description	
Example	

CLOSE WORK[FILE] work-file-number

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DEFINE WORK FILE | READ WORK FILE | WRITE WORK FILE

Belongs to Function Group: Control of Work Files / PC Files

## **Function**

The statement CLOSE WORK FILE is used to close a specific work file. It allows you to explicitly specify in a program that a work file is to be closed.

A work file is closed automatically:

- When command mode is reached.
- When an end-of-file condition occurs during the execution of a READ WORK FILE statement.
- Before a DEFINE WORK FILE statement is executed which assigns another data set to the work file number concerned.
- According to sub-parameter CLOSE of profile parameter WORK.

CLOSE WORK FILE is ignored for work files for which CLOSE=FIN is specified in profile parameter WORK.

## **Syntax Description**

Syntax Element	Description
work-file-number	The number of the work file (as defined to Natural) to be closed.

# **Example**

```
** Example 'CWFEX1': CLOSE WORK FILE
************************
DEFINE DATA LOCAL
1 W-DAT (A20)
1 REC-NUM (N3)
1 I (P3)
END-DEFINE
REPEAT
 READ WORK FILE 1 ONCE W-DAT /* READ MASTER RECORD
 AT END OF FILE
   ESCAPE BOTTOM
 END-ENDFILE
 INPUT 'PROCESSING FILE' W-DAT (AD=0)
     / 'ENTER RECORDNUMBER TO DISPLAY' REC-NUM
 IF REC-NUM = 0
   STOP
 END-IF
   FOR I = 1 TO REC-NUM
   READ WORK FILE 1 ONCE W-DAT
   AT END OF FILE
     WRITE 'RECORD-NUMBER TOO HIGH, LAST RECORD IS'
     ESCAPE BOTTOM
   END-ENDFILE
 END-FOR
 I := I - 1
 WRITE 'RECORD' I ':' W-DAT
 /*
 CLOSE WORK FILE 1
 /*
END-REPEAT
END
```

# commit (sql)

Function	234
Consideration for Non-Natural-Programs	
Example	

```
COMMIT
```

Belongs to Function Group: Database Access and Update

See also *COMMIT - SQL* in the *Natural for DB2* part of the *Database Management System Interfaces* documentation:

# **Function**

The SQL COMMIT statement corresponds to the END TRANSACTION statement. It indicates the end of a logical transaction and releases all data locked during the transaction. All data modifications are committed and made permanent.



**Important:** As all cursors are closed when a logical unit of work ends, a COMMIT statement must not be placed within a database modification loop; instead, it has to be placed outside such a loop or after the outermost loop of nested loops.

# **Consideration for Non-Natural-Programs**

If an external program written in another standard programming language is called from a Natural program, this external program should not contain its own COMMIT statement if the Natural program issues database calls, too. The calling Natural program should issue the COMMIT statement on behalf of the external program.

# **Example**

```
...
DELETE FROM SQL-PERSONNEL WHERE NAME = 'SMITH'
COMMIT
...
```

# 32 COMPOSE

Function	236
Syntax Description	
Formatting Process	
Dialog Mode Processing	
Input/Output Processing by Non-Natural Programs	
Examples	254

This statement can only be used if the office system Con-nect and the text formatter Con-form are installed.

# COMPOSE [RESETTING-clause] [MOVING-clause] [ASSIGNING-clause] [FORMATTING-clause]

If you specify more than one clause, these clauses and their subclauses will be processed in the order shown above.

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

# **Function**

The COMPOSE statement may be used to initiate text formatting by Con-form directly from a Natural program. Con-form is a text formatter which is automatically installed with Con-nect.

The text to be formatted can either be supplied using variables or it may be retrieved from a Connect text block (a document containing Con-form formatting instructions).

The contents of Natural variables can be passed to Con-form as variables for dynamic inclusion in the formatted text.

The values contained in a Con-form variable can also be returned to the Natural program from the text formatter.

When the Con-form instructions are completed (resulting in a formatted document), the output is passed to one of the following places:

- a Natural report,
- a document in the Con-nect system file,
- variables in the Natural program that executes the COMPOSE statement,
- a non-Natural program.

# **Syntax Description**

- RESETTING-clause
- MOVING-clause
- ASSIGNING-clause
- FORMATTING-clause
- EXTRACTING-clause

#### **RESETTING-clause**

This clause may be used to delete information from the text format area of the Con-form buffer and to release memory from the Con-form buffer allocated by the CSIZE profile parameter in the Natural parameter module.



Syntax Element Description:

Syntax Element	Description
DATAAREA	Deletes all active text variables.
TEXTAREA	Deletes all text input data.
	<b>Note:</b> For compatibility reasons, the keyword TEXTAREA refers to DATAAREA as used in the
	MOVING clause.
MACROAREA	Deletes all text macros.
ALL	Deletes all of the above.

See also *Example 1* and *Example 2*.

#### **MOVING-clause**

You can use this clause to move text lines to the text format area of the Con-form buffer, or directly to the formatter, and to retrieve formatted text output from the Con-form buffer.

It may be used to move one or more text values to the text format area (see *Syntax 1*). This area may be used as a source of input for formatting operations.

If the text formatter is currently waiting for input (see *Dialog Mode Processing*), the text will be passed directly to it without being stored in Con-form's buffer (see *Syntax 1* and *Syntax 2*). The source input is terminated with the LAST option.

If the formatted text is currently waiting for output (see *Dialog Mode Processing*), *Syntax 3* of the MOVING clause is used to pass control back from the Natural program to the formatter.

For description of the status variables, see *FORMATTING-clause*.

Depending on the status of the dialog mode processing, one of the following forms of the MOVING clause may be used:

#### Syntax 1 - Dialog Mode for Input

Syntax 1 of the MOVING clause is applicable when formatting has not begun or the formatter is in dialog mode for input and is waiting for input (TERM in the status variable "State").

```
MOVING[operand1]...37 [TO DATAAREA][LAST]
[STATUS[TO] operand2 [operand3[operand4 [operand5]]]]
```

#### Syntax 2 - Dialog Mode for Both Input and Output

Syntax 2 of the MOVING clause is applicable when the formatter is in dialog mode for both input and output, and is waiting for further input (status TERM in the status variable "State"). The formatter will not accept more than one line of input in this mode.

The execution context may change between succession of executed COMPOSE statements. Therefore, it is necessary to re-specify the output variables even when the formatter is waiting for input.

```
MOVING [ operand1 [TO DATAAREA] } ] [OUTPUT] TO VARIABLES operand6 ... 20 [STATUS [TO] operand2 [operand3 [operand4 [operand5]]]]
```

#### Syntax 3 - Dialog Mode for Output

Syntax 3 of the MOVING clause is applicable when the formatter is in dialog mode for output (and possibly for input at the same time), and is passing output to the Natural program (status STRG in the status variable "State").

```
MOVING OUTPUT [TO VARIABLES] operand6 ... 20 [STATUS [TO] operand2 [operand3 [operand4 [operand5]]]]
```

#### Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure		Po	SS	ib	le l	For	m	ats	\$	Referencing Permitted	Dynamic Definition
operand1	C	S	A			A	N	Р							yes	no
operand2		S				A									yes	yes
operand3		S								I	3				yes	yes
operand4		S								I	3				yes	yes
operand5		S								I	3				yes	yes
operand6		S	A			A									yes	no

# Syntax Element Description:

Syntax Element	Description
operand1	Contains the input (unformatted) text lines.
	Format/length: (A $n$ ), where $n$ is a maximum value of 253, (N $n$ ) or (P $n$ ), where $n$ is a maximum value of 29.
operand2	Contains the status variable "State".
	Format/length: (A4)
operand3	Contains the status variable "Position" (page number).
	Format/length: (B4)
operand4	Contains the status variable "Position" (line number).
	Format/length: (B4)
operand5	Contains the status variable "Amount of output data" (number of lines).
	Format/length: (B4)
operand6	Contains the output (formatted) text lines.
	Format/length: (A $n$ ), where $n$ is a maximum value of 253.

### **ASSIGNING-clause**

You can use this clause to assign the values of Natural variables to Con-form text variables. These text variables may subsequently be referred to in formatting operations.

ASSIGNING [TEXTVARIABLE] { operand1=operand2}, ... 19

Operand Definition Table:

Operand	Possible Structure				Possible Formats									Referencing Permitted	Dynamic Definition	
operand1	С	S				A									yes	no
operand2	С	S				A	N	Р							yes	yes

Syntax Element Description:

Syntax Elemen	t Description
operand1	operand1 is the name of the Con-form text variable. The text variable must be specified in upper case.
	Format/length: (A $n$ ), where $n$ is a maximum value of 253.
operand2	operand2 is the name of a given Natural variable.
	Format/length: (A $n$ ), where $n$ is a maximum value of 253, (N $n$ ) or (P $n$ ), where $n$ is a maximum value of 29.

See also *Example 3* and *Example 4*.

#### **FORMATTING-clause**

This clause causes Con-form to produce formatted output. You can use it to create text in final form, that is, with correct line and page breaks, using input which can be a combination of text and Con-form instructions.

The formatting options are specified in one or more subclauses. If subclauses are omitted, Conform will apply default formatting options.

The status variable is used in dialog mode.

FORMATTING	OUTPUT-subclause INPUT-subclause STATUS-subclause PROFILE-subclause MESSAGES-subclause ERRORS-subclause ENDING-subclause STARTING-subclause	
------------	---	--

Syntax Element Description:

Syntax Element	Description										
OUTPUT-subclause	one or more Natural variables (or a program.										
	See <i>Output-subclause</i> in the following section.										
INPUT-subclause	Con-form buffer (see DATAAREA in Natural program(s) executing the	The input medium. This can be a Con-nect document, the text format area of the Con-form buffer (see DATAAREA in the MOVING clause), the environment of the Natural program(s) executing the COMPOSE statement(s) (see the MOVING clause), a non-Natural program, or a mixture of these four possibilities.									
STATUS-subclause	multiple executions of a COMPOSE example, the input is fed into the toutput is passed from the text for program (that is, one or more Natu the Natural program of the format The following variables are passed	tion. The formatting operation may involve statement (in dialog mode processing). For ext format area by a Natural program, and the mat area into the environment of a Natural ral variables). Therefore it is necessary to inform thing status.  It to the Natural program during the formatting									
	process: State	TEDM when the dialog mode is ready for input									
	State	TERM when the dialog mode is ready for input. STRG when the dialog mode is ready for output.									
		END if the formatting process was completed successfully.									
		ENDX if the formatting process was completed unsuccessfully.									
	Position	Page and line number of the document that is being formatted. The page and line numbers are kept separately in two variables (page position and line position).									
	Amount of Output Data	The number of lines of formatted output which are being passed to the Natural program. The formatter uses this number as the pointer to the next output variable to be filled. The value is incremented by 1 before the output line is issued. If the current value is out of range, the value is set to 1.									
PROFILE-subclause	Text block to be processed before i	nput is processed.									
	See <i>PROFILE-subclause</i> in the following section.										
MESSAGES-subclause	Controls the output of warning messages and statistical information and error processing.										
ERRORS-subclause											
	See MESSAGES-subclause and EF	RRORS-subclause in the following section.									
ENDING-subclause	Defines the page where output of	formatted text is to stop.									
	See <i>ENDING-subclause</i> in the foll	owing section.									

STARTING-subclause	Defines the page where output of formatted text is to start.
	See <i>STARTING-subclause</i> in the following section.

#### **OUTPUT-subclause**

This subclause enables you to direct Con-form's formatted text output to a specific destination.

If this subclause is omitted, Natural's main printer will be used as the default output device.

# Operand Definition Table:

Operand	Possible Structure					P	059	sib	le	Fo	orn	nat	S	Referencing Permitted	Dynamic Definition
operand1	C	S				A								yes	no
operand2	С	S				A								yes	no
operand3	С	S				A								yes	no
operand4		S	A			A								yes	no

# Syntax Element Description:

Syntax Element	Description
(rep)	If the output is directed to a printer (that is, the report number is not 0 and a Con-nect printer profile has been loaded (by the Con-nect API subprogram Z-DRIVER), the settings of that profile will be used to control the text highlighting options of the formatted output text.
	If a printer profile is active and the logical form feed controls were not specified, page ejects will be inserted by use of the appropriate internal Natural nucleus functions.
	Any other highlighting text option which is not reflected in the currently active Con-nect printer profile will be ignored.
	<b>Note:</b> Executions of the COMPOSE RESETTING ALL or COMPOSE FORMATTING statement with non-report output destination will unload a printer profile from the text format area.

	If output is directed to Report 0 or if a printer profile is not active, Con-nect will pass
	the responsibility of the output handling to the Natural nucleus routines. In this case,
	only the highlighting text options boldface, underline and italics will be recognized.
	<b>Note:</b> A report which is referred to in a DEFINE PRINTER (n) OUTPUT 'CONNECT'
	statement must not be specified as output destination in a COMPOSE FORMATTING
	statement.
SUPPRESSED	This option causes the output to be suppressed.
CALLING operand1	operand1 is the name of the called program.
	Format/length: (A $n$ ), where $n$ is a maximum value of 8.
	See the section Input/Output Processing by Non-Natural Programs.
TO VARIABLES	Generally, the formatted text will be passed in final format to an array of Natural
	variables. Each line fills one variable (if necessary, the line may be truncated to fit
operand3]	into the variables). Text highlighting options will be ignored, with the exception of
operand4	the CONTROL variables specified, which will be used to emphasize sections of the text (that is, boldface or underscore).
	If the CONTROL variables I and N are specified, the formatted text will be produced in an intermediate format (that is, with interspersed logical control sequences).
	operand2 is the starting character. Format/length: (A1).
	operand3 is the ending character. Format/length: (A1).
	Example using angle brackets as starting and ending characters:
	<abcxyz></abcxyz>
	operand4 is the output field. Format/length: (A $n$ ), where $n$ is a maximum value of 253.
	For further information, see the section <i>Dialog Mode Processing</i> , and in particular the subsection <i>Dialog Mode for Output</i> .
DOCUMENT-option	See DOCUMENT-option below.

# **DOCUMENT-option**

The DOCUMENT option of the OUTPUT subclause enables you to direct Con-form's formatted text to a Con-nect cabinet in final (Txt) or intermediate (Int) format. The document text of Int format cannot be modified.

```
 \begin{bmatrix} \text{DOCUMENT} & \text{IN}\underline{\text{TO}} & \begin{bmatrix} \text{FINAL} \\ \text{INTERMEDIATE} \end{bmatrix} \end{bmatrix} \text{ [CABINET] operand1 [PASSW=operand2]} \\ & [\text{GIVING]} & \begin{array}{c} operand3 & [operand4] \\ operand4 & [operand3] \end{array} \}
```

# Operand Definition Table:

Operand	Possible Structure						Pos	SS	ibl	le F	orr	na	ts	Referencing Permitted	Dynamic Definition
operand1	C	S				A								yes	no
operand2		S				A								yes	no
operand3		S								В				yes	yes
operand4		S								В				yes	yes

# Syntax Element Description:

Syntax Element	Description
IN <u>TO</u> FINAL   INTERMEDIATE CABINET	If the keyword FINAL is specified, the document will be created in final form text. In this case, specific text highlighting options such as boldface or italics will be ignored.
	If the keyword INTERMEDIATE is specified, the document will be added to the folder COMPOSE without a document name. The subject line will be filled with the name of the program executing the COMPOSE FORMATTING statement along with the date and time of execution.
CABINET operand1	operand1 may be used to identify a specific cabinet.
	Format/length: (A $n$ ), where $n$ is a maximum value of 8.
	If <code>operand1</code> is not specified, the document will be added to the current user's cabinet (that is, to the cabinet whose ID is identical to the currently active Natural user ID).
	Con-form enforces adherence to Con-nect access restrictions and only accepts cabinet IDs which have been defined to Con-nect.
	<b>Note:</b> Cabinet IDs must be specified in upper case.
PASSW=operand2	A password must be specified if storing the document in a cabinet to which the currently assumed user ID has no access.
	Format/length: (A $n$ ), where $n$ is a maximum value of 8.
operand3	operand3 is used by the formatter to pass a unique key from the document back to the Natural program. It is supported for compatibility reasons only.
	Format/length: (B10)

operand4	operand4 is used by the formatter to pass an ISN, which points to the formatted
	output document, back to the Natural program. This ISN can be useful when
	referencing the document in successive calls to Con-nect APIs.
	Format/length: (B4)

#### **INPUT-subclause**

This subclause may be used to specify the sources which will supply input for the text formatter.



**Note**: If this subclause is omitted, the DATAAREA (text format area of the Con-form buffer) will be processed by default.



#### Operand Definition Table:

Operand	Possible Structure						0:	ssi	bl	e F	or	m	ats	S	Referencing Permitted	Dynamic Definition
operand1	C	S				A									yes	no
operand2	С	S				A									yes	no
operand3		S				A									yes	no

# Syntax Element Description:

Syntax Element	Description
DATAAREA	The input may be taken from Con-form's data area (or a mixture of text from the text format area and from the <b>dialog mode</b> is also possible) which must be filled by one or more MOVING operations; see the MOVING clause.
operand1	Alternatively, the input may be taken from a text block. The name of the text block is specified by <code>operand1</code> .  Note: Text block IDs must be specified in upper case.
	Format/length: (An), where n is a maximum value of 253.  The text block may be contained in a Con-nect cabinet, or it may be supplied by a non-Natural program. It will be invoked using the same conventions which apply to the CALL statement. A hierarchy of Con-nect cabinets or non-Natural programs may be specified, each of which will be scanned in turn for the text block specified in operand1.

CABINET operand2	The input (a text block specified by operand1) might be taken from a specific Con-nect cabinet.
	operand2 is the name of the Con-nect cabinet.
	<b>Note:</b> Cabinet IDs must be specified in upper case.
	Format/length: (A $n$ ), where $n$ is a maximum value of 8.
EXIT operand2	operand2 is the name of the exit.
	Format/length: (A $n$ ), where $n$ is a maximum value of 8.
PASSW=operand3	A password must be specified if the document is stored in a cabinet to which the currently assumed user ID has no access.
	Format/length: (A $n$ ), where $n$ is a maximum value of 8.
	Con-form enforces adherence to Con-nect access restrictions and only accepts cabinet IDs which have been defined to Con-nect.

See also *Example 4*.

#### STATUS-subclause

The STATUS subclause used in the FORMATTING clause corresponds to the STATUS subclause of the MOVING clause. It should be used to make sure that the formatting process is always in the appropriate status for a given processing step.

STATUS operand1 [operand2 [operand3 [operand4]]]

# Operand Definition Table:

Operand	Possib		Pos	SSi	ble	Fo	orn	nat	S	Referencing Permitted	Dynamic Definition		
operand1	S			A								yes	no
operand2	S						I	3				yes	no
operand3	S						I	3				yes	no
operand4	S						I	3				yes	no

Syntax Element Description:

Syntax Element	Description
operand1	Contains the status variable "State" (status of formatting process).
	Format/length: (A4)
operand2	Contains the status variable "Position" (page number).
	Format/length: (B4)
operand3	Contains the status variable "Position" (line number).
	Format/length: (B4)
operand4	Contains the status variable "Amount of Output Data" (number of lines).
	Format/length: (B4)

#### **PROFILE-subclause**

This subclause causes the content of the specified text block to be processed prior to any input which has been specified with the INPUT **subclause** (by default, a text block will not be processed as a profile).

PROFILE *operand1* 

#### Operand Definition Table:

Operand	Po	Possible Formats								Referencing Permitted	Dynamic Definition				
operand1	C	S				A								yes	no

#### Syntax Element Description:

Syntax Element	Description
operand1	<i>operand1</i> is the name of the text block (for example, FPROFILE - formatting profile).
	Format/length: (A $n$ ), where $n$ is a maximum value of 32.

#### **MESSAGES-subclause**

When this subclause is specified, warning messages and statistical information are to be displayed upon completion of formatting or the error may be simply suppressed (ignored).

#### Syntax Element Description:

Syntax Element	Description
(rep)	The notation ( rep) specifies the report for which the subclause is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified. For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .
SUPPRESSED	When specified, this keyword indicates that no messages are to be displayed and errors are to be ignored.

#### **ERRORS-subclause**

You can use the ERRORS subclause to specify the actions to be performed when a formatting error occurs. The error may be processed by Natural's standard error-processing routine, or it may be listed on a specified Natural report.

#### Syntax Element Description:

Syntax Element	Description
(rep)	The notation $(rep)$ specifies the report for which the subclause is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified. For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .
INTERCEPTED	When specified, this keyword indicates that the error is to be processed by Natural's standard error-processing routine.



**Note:** Errors and messages are mutually exclusive. Some errors may cause the standard Natural error-process routine to be invoked, even if a different option was specified. Errors or messages must not be directed to a report which is directed to the Con-nect system by a DEFINE PRINTER (n) OUTPUT 'CONNECT' statement.

#### **ENDING-subclause**

This subclause causes output of formatted text to be suppressed after a specific page number. Alternatively, it limits the amount of formatted output to a specified number of pages.



#### Operand Definition Table:

Opera	nd	Possible Structure					Po	ssib	le l	For	ma	ts	Referencing Permitted	Dynamic Definition		
opera	and1	C	S				N	P					yes	no		

#### Syntax Element Description:

Syntax Element	Description
[AT] [PAGE] operand1	Causes output of formatted text to be suppressed following a page with a number specified in $operand1$ .  Format/length: (N $n$ ) or (P $n$ ), where $n$ is a maximum value of 5.
AFTER operand1 [PAGES]	Limits the amount of formatted output to a number of pages as specified with operand1.

#### STARTING-subclause

This subclause causes output of formatted text to be suppressed until the page with the specified number (operand1) is reached.

STARTING [FROM] [PAGE] operand1

#### Operand Definition Table:

Operand	Possible Structure				Po	ssik	ole	Fo	rma	its		Referencing Permitted	Dynamic Definition		
operand1	C	S				N	Р					T	yes	no	

Syntax Element Description:

Syntax Element	Description
1 '	The output of formatted text to be suppressed until the page with the number specified in <code>operand1</code> is reached.
	Format/length: $(Nn)$ or $(Pn)$ , where $n$ is a maximum value of 5.

#### **EXTRACTING-clause**

You can use this clause to assign the values of Con-form text variables to Natural variables. The current text variable settings may be the result of previous formatting operations.

EXTRACTING [TEXTVARIABLE] { operand1=operand2},... 19

#### Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure		Possible Formats				ma	ıts	Referencing Permitted	Dynamic Definition		
operand1		S				A	ANP						yes yes			
operand2	С	S				A								yes	no	

#### Syntax Element Description:

Syntax Element	Description
operand1	operand1 is the name of a given Natural variable.
	Format/length: (A $n$ ), where $n$ is a maximum value of 253, (N) or (P $n$ ), where $n$ is a maximum value of 29.
operand2	operand2 is the name of a Con-form text variable. It must be specified in upper case.
	Format/length: (A $n$ ), where $n$ is a maximum value of 253.

See also *Example 6*.

# **Formatting Process**

The formatting process begins when the FORMATTING clause of the COMPOSE statement is executed (even if text input via a MOVING clause is intended, but no such input has been provided yet). While the formatting process is active, the text input resulting from the execution of the COMPOSE MOVING statement is fed directly for formatting (and cannot be re-used in a later formatting process). If the formatting process is inactive, the text input is stored intermediately in the text format area of the Con-form buffer. Thus the input can be re-used for multiple formatting processes.

Since the Con-form buffer is not cleared at the end of the Natural program, the respective COMPOSE statements need not be executed within one Natural program; they can be issued in several successively invoked programs.

The execution of a RESETTING or FORMATTING clause, or a serious formatting error, causes the termination of an ongoing formatting pass.

End-of-input is specified by the LAST subclause of the MOVING clause.

When a Con-nect document is specified as the source of input, end-of-input is assumed when the end of that document is reached.



**Note**: It is recommended to use the STATUS subclause of the FORMATTING or MOVING clause to make sure that the formatting process is always in the appropriate status for a given processing step.

# **Dialog Mode Processing**

Dialog mode processing is the set of interactions which are performed between a user program and the formatter while formatting input and producing output.

Dialog mode allows a user program to supply raw text as input to the formatter at any level of the input hierarchy. It also accepts formatted output directly in the current program environment.

The dialog is achieved by subdividing the formatting process into a series of steps, each of which is separately invoked by a COMPOSE statement.

- Dialog Mode for Input
- Dialog Mode for Output
- Dialog Mode for Input and Output
- Execution of COMPOSE Statements in Dialog Mode

#### Dialog Mode for Input

Dialog mode for input is activated if the source of the input text is DATAAREA (text format area), or if the Con-form instruction . TE ON for terminal input is encountered, and the text format area does not contain any more text to be processed. Dialog mode for input is signaled by the value TERM in the status variable "State".

The user program should respond by supplying the required input by invoking the MOVING function in a subsequently-processed COMPOSE statement. The user program can terminate terminal input by specifying the LAST option of the MOVING clause (or .TE OFF if terminal input was invoked by .TE ON) as text through the MOVING function. The formatter will signal the end of the formatting process with END, or ENDX in the case of an error, in the status variable "State".

See also *Example 7*.

#### **Dialog Mode for Output**

Dialog mode for output is activated if the destination of the output is TO VARIABLES. The formatter passes control back to the Natural program environment as soon as the supplied Natural variables are filled or a page break is reached (whichever occurs first). Dialog mode for output is signaled with STRG in the status variable "State".

The user program should respond by taking the formatted output just placed into the Natural variables and designate another set of Natural variables as the output destination in a subsequently processed COMPOSE MOVING statement. The end of the formatting process is indicated with END (or ENDX in the case of an error) in the status variable "State".



**Note:** When dialog mode is used (see the INPUT and OUTPUT subclauses), the formatting operation is usually spread across several executions of a COMPOSE statement.

#### **Dialog Mode for Input and Output**

Dialog mode can be activated for combined input and output processing. Therefore, when the formatter requests for further input (indicated in the status variable "State" by TERM) or when the formatter provides output (indicated by STRG), the Natural program must take the appropriate action.

When dialog mode is entered for combined input and output processing, only one line of input is accepted by the formatter at a time. In the case of input mode only, multiple lines are accepted at one time.

#### **Execution of COMPOSE Statements in Dialog Mode**

While it has been pointed out that dialog mode is entered via a COMPOSE FORMATTING statement which encompasses a series of COMPOSE MOVING executions, please note the following:

- COMPOSE ASSIGNING and COMPOSE EXTRACTING statements are valid while dialog mode is active.
- COMPOSE RESETTING and COMPOSE FORMATTING will force the immediate termination of all formatting.

# **Input/Output Processing by Non-Natural Programs**

Depending on the parameters specified with the FORMATTING clause, input and output may be processed by non-Natural programs. Such programs are invoked by the same mechanism that is used within the Natural CALL statement.

The COMPOSE statement exchanges parameters with these programs using the standard linkage conventions (dynamic loading is not possible in a CICS environment).



**Note:** Input/output processing by non-Natural programs is only possible on mainframe computers; on other platforms, the appropriate parts of the COMPOSE statement are ignored.

Depending on the status of the formatting process, two or three parameters are passed between the formatter and the non-Natural programs:

Parameter 1		rmatter to non-Natural programs. Possible values:								
(format/length A1)	I	Initiate (input, output).								
A1)	0	Open document (input).								
	R	Read one line of document (input).								
	W	Write one line of output (output).								
	С	Close document (input).								
	Т	Terminate (input, output).								
Parameter 2	Response code is passed from non-l	Natural programs to the formatter.								
(format/length B1)	Possible values:									
	X'00'	Function successfully completed.								
	X'01'	In response to function 0: document could not be found								
		In response to function R: end of document was reached.								
	X'FF'	Function not completed.								
Parameter 3 (format A1/256)		these parameters are passed from the formatter to ne parameters from the function $R$ are passed from ther.								
	Bytes 1 - 2	Signify the length <i>n</i> of this parameter.								
	Bytes 3 - 4	Empty.								
	Bytes 5 - n	Function 0: Document name.								
		Function R: Line read by the non-Natural program.								
		Function W: Line of output from the formatter.								
	Output is preceded by N if a form fe	ed is required, otherwise by 1.								
	Specific options for highlighting text such as boldface and italics are ignored if the output is passed to a non-Natural program.									

# **Examples**

- Example 1
- Example 2
- Example 3
- Example 4
- Example 5
- Example 6
- Example 7

#### Example 1

The following COMPOSE statement results in a formatted output of the text block TEXT within the Con-nect cabinet TLIB which is produced on Report 1. Errors and statistical messages are displayed on Report 0 (the default printer).

```
COMPOSE RESETTING ALL
FORMATTING INPUT 'TEXT' FROM CABINET 'TLIB'
OUTPUT (1)
MESSAGES LISTED ON (0)
```

# Example 2

The following COMPOSE statements result in a formatted output of text on Report 0 (default printer).

#### Example 3

The following COMPOSE statement results in the assignment of values to Con-form text variables &VAR1 and &VAR2 in a Con-nect procedure.

```
COMPOSE ASSIGNING 'VAR1' = 'Text1', 'VAR2' = 540
```

#### Example 4

Text block XYZ in cabinet XYLIB:

```
.FI ON
Dear Mr &name.,
.IL
I am pleased to invite you to a presentation of our new product &prod..
```

#### Natural program:

```
INPUT #NAME (A32) #PROD (A32)

COMPOSE ASSIGNING 'NAME' = #NAME, 'PROD' = #PROD

FORMATTING INPUT 'XYZ' FROM CABINET 'XYLIB'

OUTPUT (1) MESSAGES SUPPRESSED

...
```

Input map produced by program:

```
#NAME Davenport
#PROD NaturalONE
```

#### Resulting output:

```
Dear Mr Davenport,

I am pleased to invite you to a presentation of our new product NaturalONE.
```

#### Example 5

This is an example of formatting in dialog mode with combined input/output handling. The example program initiates the line-oriented formatting mode of Con-form, passes some instructions/variables to Con-form, and performs a subroutine which displays status information and formatted output lines on the screen.

```
DEFINE DATA LOCAL
01 #LINES_PER_PERFORM(P5) /* counts_repeat_loops_per_PERFORM_CNF_OUT
01 #TRACE(A1) IINT<'N'> /* if 'Y' displays additional trace info
01 #OUT_FORM(A1) INIT<'F'> /* output format
01 #START_PAGE (P3) INIT<1> /* beginning of display
                           /* Loop counter
01 #CNTR (P5)
                            /* Status information
01 #STATI
02 #STATUS (A4)
02 #PAGE (B4)
02 #LINE (B4)
                          /* can be STRG TERM END or ENDX
/* current page number
                            /* current line number on page (not .tt/.bt)
                            /* number of lines returned
 02 #NO_LINES (B4)
 02 REDEFINE #NO_LINES
 03 #NO_LINES_I (I4)
```

```
01 #OUTPUT(A30/4)
                           /* output of formatted line
01 #INDEX (P3)
                           /* index as pointer to output line
END-DEFINE
SET KEY ALL
SET CONTROL 'M9'
INPUT
   008/008 'Demonstration of formatted output to variable'(I)
      08X 'Enter page to start display : ' #START_PAGE(AD=MIL)
      O8X 'Display additional trace data ?:' #TRACE(AD=MIT)
      O8X 'Please select the output format: ' #OUT_FORM(AD=MIT)
          '(F=Final without BP/US-marks'
      44X 'M=Final with BP/US marks "<>"'
      44X 'I=Intermediate)'
     50X 'PF3=Exit'(I)
IF *PF-KEY EQ 'PF3'
  SET CONTROL 'MB'
   STOP
END-IF
IF NOT (#OUT_FORM EQ 'F' OR EQ 'M' OR EQ 'I')
   REINPUT ' Please enter valid code!' MARK *#OUT_FORM ALARM
END-IF
WRITE TITLE LEFT
    'Stat * Page * Line * No.Lines >> Formatted Output'(I)
   / '-'(79)(I)
SET CONTROL 'MB'
COMPOSE RESETTING ALL /* clear all text format area of Con-form buffer
RESET #NO_LINES
* start line-oriented formatting-mode here
* starting from 0
DECIDE ON FIRST VALUE OF #OUT_FORM
   VALUE 'F'
      COMPOSE FORMATTING
          OUTPUT TO VARIABLES #OUTPUT (1:4) /* to Output
          STATUS #STATUS #PAGE #LINE #NO_LINES /* get Status
   VALUE 'M'
      COMPOSE FORMATTING
          OUTPUT TO VARIABLES CONTROL '<' '>'
                              #OUTPUT (1:4) /* to output
          STATUS #STATUS #PAGE #LINE #NO_LINES /* get Status
   VALUE 'I'
     COMPOSE FORMATTING
          OUTPUT TO VARIABLES CONTROL 'I' 'N'
                              #OUTPUT (1:4) /* to output
          STATUS #STATUS #PAGE #LINE #NO_LINES /* get Status
   NONE
     STOP
```

```
END-DECIDE
RESET #NO_LINES
* Put some commands to Con-form to see something
COMPOSE MOVING
     '.pl 16;.hs 2;.tt 1Formatting in Variable//;.tt 2//' /* Cmd
     OUTPUT TO VARIABLES #OUTPUT (1:4) /* to Output
                                                /* get Status
     STATUS #STATUS #PAGE #LINE #NO LINES
COMPOSE MOVING
     '.fs 1;.bt Page End \#//;.fi on;.tb *=15' /* Commands
     OUTPUT TO VARIABLES #OUTPUT (1:4) /* to Output STATUS #STATUS #PAGE #LINE #NO_LINES /* get Status
* loop 40-times, send commands to con-form and display output
COMPOSE ASSIGNING 'Value' = '1-20' /* Assign value to variable &Value
FOR #CNTR 1 40
                                    /* Loop some time
   IF #STATUS NE 'TERM' /* no wait-for-input => error!!!!
      IF #STATUS EO 'STRG'
         IGNORE
      ELSE
         WRITE 'Unexpected Status-code' #STATUS(AD=OI) 'found!'
           / 'Execution has stopped....'
         STOP
      END-IF
   END-IF
   IF #CNTR EQ 21
      COMPOSE ASSIGNING 'Value' = '21-40' /* Assign a variable-value
   END-IF
   COMPOSE ASSIGNING 'CNTR' = #CNTR /* Again assignment
   COMPOSE MOVING
        '.BP;&Value *Pass &CNTR;.BR' /* Commands
        OUTPUT TO VARIABLES #OUTPUT (1:4) /* to output
        STATUS #STATUS #PAGE #LINE #NO_LINES /* get status
   PERFORM CNF-OUT
                                               /* show result
END-FOR
COMPOSE MOVING
     LAST /* End of processing OUTPUT TO VARIABLES \#OUTPUT (1:4) /* to output
     STATUS #STATUS #PAGE #LINE #NO_LINES /* get status
IF #TRACE EO 'Y'
   WRITE 'End of processing...'(I)
END-IF
* Subroutines
```

```
PERFORM CNF-OUT
* Subroutine to display any waiting output from Con-form
DEFINE SUBROUTINE CNF-OUT
  RESET #LINES_PER_PERFORM
  REPEAT UNTIL #STATUS EQ 'TERM' /* TERM = input waiting
     PERFORM BREAK
                                /* do some break processing
     AT BREAK OF #PAGE
        IF #PAGE GT #START_PAGE
           WRITE '-'(79)(I)
        END-IF
        IF #TRACE EQ 'Y'
           WRITE 'End of this page...'(I)
         END-IF
        NEWPAGE
     END-BREAK
     IF #PAGE GE #START_PAGE /* show line of output
         IF #NO_LINES_I GT 0
           FOR #INDEX 1 #NO_LINES_I
              ADD 1 TO #LINES_PER_PERFORM /* count loops
              WRITE NOTIT NOHDR #STATUS '*' #PAGE '*' #LINE
                                         '*' #NO_LINES
                                         '>>' #OUTPUT (#INDEX)
           END-FOR
        END-IF
     END-IF
     IF #STATUS NE 'STRG' /* if no wait on output
        ESCAPE BOTTOM
     END-IF
     RESET #NO_LINES
     COMPOSE MOVING
          OUTPUT TO VARIABLES #OUTPUT (1:4) /* get output
          STATUS #STATUS #PAGE #LINE #NO_LINES /* Status
  END-REPEAT
  IF #TRACE EQ 'Y'
  WRITE 'Count of lines per PERFORM was'(I) #LINES_PER_PERFORM(AD=0I)
  END-IF
END-SUBROUTINE
SET CONTROL 'MB'
END
```

#### Example 6

Text block 'ABC' in cabinet 'ZLIB':

#### Natural Program:

```
DEFINE DATA LOCAL
. . .
01 NA
           (P14.1) INIT <-12345678.1>
O1 NB
           (N15.1) INIT <1234567890.1>
01 ND
          (P15.1) INIT <1122334455.1>
01 NC
           (N03.6)
01 NCOMP
           (N03.6)
END-DEFINE
COMPOSE RESETTING ALL
COMPOSE ASSIGNING 'A'=NA, 'B'=NB, 'D'=ND
COMPOSE FORMATTING INPUT 'ABC' FROM CABINET 'ZLIB'
COMPOSE EXTRACTING NC='C'
COMPUTE ROUNDED NCOMP=(NA+NB+ND) * NA /12345678901234567.89
WRITE (0) 'CONFORM C =' NC / 'NATURAL C =' NCOMP
END
```

#### **Resulting Output:**

```
CONFORM C = -2.344557
NATURAL C = -2.344557
```

#### Example 7

The following is an example of using the Con-form instruction .TE ON/OFF in dialog mode for input. A Natural program calls the Con-form document LETTER containing this instruction from cabinet XYLIB.

Natural program:



**Note:** This simplified Natural program is intended for demonstration purposes only; for example, the required fields SALUTATION, LASTNAME, STREET, CITY are not verified.

```
DEFINE DATA LOCAL
01 #ENTER (A15) INIT <'Special offer:'>
01 SLINE (A15) INIT <'.SL 1'>
01 #TEXT (A60/1:4)
01 SALUTATION (A30)
01 LASTNAME (A30)
01 STREET
            (A30)
01 CITY
             (A30)
01 #STATUS (A4)
01 #PAGE (B4)
01 #LINE
         (B4)
01 #NUMBER (B4)
END-DEFINE
COMPOSE RESETTING ALL
INPUT 25X 'Advertising letter'
       / '-' (75)
       / 'Salutation: ' SALUTATION (AD='_')
          'Lastname : 'LASTNAME (AD='_')
          'Street : 'STREET (AD='_')
                     : ' CITY (AD=' ')
          'City
          '-' (75)
       /
       // '-' #ENTER (AD=0I)
       / '-' #TEXT(1) (AD='_')
       / '-' #TEXT(2) (AD='_')
          '-' #TEXT(3) (AD='_')
        / '-' #TEXT(4) (AD='_')
COMPOSE ASSIGNING
                    'SALUT' = SALUTATION.
                    'NAME' = LASTNAME,
                    'STREET'= STREET,
                    'TOWN' = CITY
COMPOSE FORMATTING INPUT 'LETTER' FROM CABINET 'XYLIB'
DECIDE FOR FIRST CONDITION
  WHEN #TEXT(4) NE ''
       COMPOSE MOVING SLINE #TEXT(1) #TEXT(2) #TEXT(3) #TEXT(4)
               '.TE OFF' STATUS #STATUS #PAGE #LINE #NUMBER
  WHEN #TEXT(3) NE ''
       COMPOSE MOVING SLINE #TEXT(1) #TEXT(2) #TEXT(3)
               '.TE OFF' STATUS #STATUS #PAGE #LINE #NUMBER
  WHEN #TEXT(2) NE ' '
       COMPOSE MOVING SLINE #TEXT(1) #TEXT(2)
               '.TE OFF' STATUS #STATUS #PAGE #LINE #NUMBER
  WHEN #TEXT(1) NE ''
       COMPOSE MOVING SLINE #TEXT(1)
               '.TE OFF' STATUS #STATUS #PAGE #LINE #NUMBER
  WHEN NONE
      COMPOSE MOVING
               '.TE OFF' STATUS #STATUS #PAGE #LINE #NUMBER
END-DECIDE
END
```

#### Con-form document LETTER:

```
.PL 22;.LM 0;.RM 60;.HS 0;.HM 0;.FM 0;.FS 0
&salut &name
&street
&town
.SL 2
Dear &salut &name.,
.SL
.LM 0;.JU OFF;.FI ON
Your subscription with MAGNIFICENT WILDLIFE magazine will soon expire.
If you act now and renew your subscription for one full year, you will
receive a 40% discount - a savings of $25.00 off the newsstand price!$
.TE ON
.SL 2
Sincerely,$
J. Baker$
Vice President of Sales
```

#### Screen prior to input:

		 Adver	tising 1		 	 	
Salutation Lastname Street City	on: : :						
Special o	offer:						

#### Screen after input:

		Advertising letter
Lastname Street	: : :	Mister Poe 203 North Amity Street Baltimore, Maryland
	of	er:  If a trip to one of the world's premier wildlife- tinations through our travel partner

Resulting letter after formatting is complete:

MISTER POE 203 NORTH AMITY STREET BALTIMORE, MARYLAND

Dear MISTER POE,

Your subscription with MAGNIFICENT WILDLIFE magazine will soon expire. If you act now and renew your subscription for one full year, you will receive a 40% discount - a savings of \$25.00 off the newsstand price!

TAKE \$500 OFF A TRIP TO ONE OF THE WORLD'S PREMIER WILDLIFE-VIEWING DESTINATIONS THROUGH OUR TRAVEL PARTNER.

Sincerely, J. Baker Vice President of Sales

# 33 COMPRESS

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For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ASSIGN | COMPUTE | EXAMINE | MOVE | MOVE ALL | SEPARATE

Belongs to Function Group: Arithmetic and Data Movement Operations

# **Function**

The COMPRESS statement is used to transfer (combine) the contents of one or more operands into a single field.

# **Syntax Description**

Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure		Possible Formats									Referencing Permitted	Dynamic Definition		
operand1	С	S	A	G	N	A	U	N	Р	Ι	F	В	D	T		G	О	yes	no
operand2		S				A	U					В						yes	yes
operand3	С	S						N	Р	Ι		$B^*$						yes	no
operand4	С	S						N	Р	Ι		$B^*$						yes	no
operand5	С	S						N	Р	Ι		$B^*$						yes	no
operand6	С	S						N	Р	Ι		B <sup>*</sup>						yes	no
operand7	С	S				A	U					В						yes	no

<sup>\*</sup> Format B of operand3, operand4, operand5 and operand6 may be used only with a length of less than or equal to 4.

# Syntax Element Description:

Syntax Element	Description
NUMERIC	Handling of Sign Characters:
	This option determines how sign characters and decimal characters are to be handled:
	Without NUMERIC, decimal points and signs in numeric source values are suppressed before the values are transferred. For example:
	COMPRESS -123 1.23 INTO #TARGET WITH DELIMITER '*' Content of #TARGET is: 123*123
	With NUMERIC, decimal points and signs in numeric source values are also transferred to the target field.
	For floating point source values, decimal points and signs are transferred, regardless of whether NUMERIC has been specified or not.
	Example 1:
	COMPRESS NUMERIC -123 1.23 INTO #TARGET WITH DELIMITER '*' Content of #TARGET is: -123*1.23
	Example 2:
	COMPRESS NUMERIC 'ABC' -0056.00 -0056.10 -0056.01 INTO #TARGET WITH DELIMITER '*' Content of #TARGET is: ABC*-56*-56.1*-56.01
	Example 3:
	COMPRESS NUMERIC FULL 'ABC' -0056.00 -0056.10 -0056.01 INTO #TARGET WITH DELIMITER '*' Content of #TARGET is: ABC*-0056.00*-0056.10*-0056.01
FULL	Handling of Source Field Values:
	Without FULL, the following are removed from the source fields before the values are transferred:
	leading zeros before the decimal point for fields of format N, P or I
	■ trailing zeros after the decimal point for fields of format N or P
	■ trailing blanks for fields of format A
	and leading binary zeros for fields of format B
	For a numeric source field containing all zeros, one zero will be transferred. For example:

Syntax Element	Description
	COMPRESS 'ABC ' 001 INTO #TARGET WITH DELIMITER '*' Content of #TARGET is: ABC*1
	With FULL, the values of the source fields in their actual lengths will be transferred to the target field. In other words:
	leading zeros before the decimal point for fields of format N, P or I
	■ trailing zeros after the decimal point for fields of format N or P
	and trailing blanks for fields of format A
	leading binary zeros for fields of format B
	are displayed as entered. For example:
	COMPRESS FULL 'ABC ' 001 INTO #TARGET WITH DELIMITER '*' Content of #TARGET is: ABC *001
operand1	Source Fields:
	As operand1, you specify the fields whose contents are to be transferred.
	<b>Note:</b> If <i>operand1</i> is not of format A or B, its content is converted into alphanumeric
	representation before it is transferred. If necessary, the alphanumeric representation is truncated.
	If <i>operand1</i> is a time variable (format T), only the time component of the variable content is transferred, but not the date component.
operand2	Target Field:
	As operand2, you specify the field which is to receive the values of the source fields.
	If the target field is of format U (Unicode) and if a source field of format B is involved, the length of the sending binary field must be even.
LEAVING SPACE	Values in Target Field Separated by a Blank: If you use the COMPRESS statement without any further options, or if you specify LEAVING SPACE (which also applies by default), the values in the target field will be separated from one another by a blank.
LEAVING NO	Values in Target Field Not Separated:
SPACE	If you specify LEAVING NO SPACE, the values in the target field will not be separated from one another by a blank or any other character.
parameter	Print Mode/Date Format Parameters:
	As parameter, you can specify the session parameter PM or the session parameter DF:
	PM=I In order to support languages whose writing direction is from right to left, you can specify PM=I so as to transfer the value of <code>operand1</code> in inverse (right-to-left) direction to <code>operand2</code> . For

Syntax Element	Description							
		cample, as a result of the following statements, the content of #B would be ZYXABC:						
	CC	OVE 'XYZ' TO #A OMPRESS #A (PM=I) 'ABC' NTO #B LEAVING NO SPACE						
	(e: re	ny trailing blanks in <i>operand1</i> will be removed xcept if FULL is specified), then the value is versed character by character and transferred <i>operand2</i> .						
	th	operand1 is a date variable, you can specify se session parameter DF as parameter for this ariable.						
SUBSTRING (operand1, operand3, operand4)	SUBSTRING Option: If operand1 is of alphanumeric (A), Unicode (SUBSTRING option to transfer only a certain parameter) you specify first the starting position of the field portion to be transferred.	art of a source field. After the field name						
INTO	INTO Clause:							
SUBSTRING (operand2, operand5,	Also, you can use the SUBSTRING option in the certain part of the target field.	e INTO clause to transfer source values into a						
operand6)	In both cases, the use of the SUBSTRING option in a MOVE statement. See the MOVE statement for	-						
WITH DELIMITERS	Input Delimiter Character:							
DELIMITERS	If you wish the values in the target field to be character, you use the DELIMITERS option.	separated from one another by a specific						
	If you specify WITH DELIMITERS without open input delimiter character as defined with the s	1						
WITH DELIMITERS operand7	Specific Delimiter Character:  ITERS If you specify WITH DELIMITERS operand7, the values will be separated by the character							
	If the target field is of format A or B, the format/length of the delimiter has to be (A1), (B or (U1).							
	If the target field is of format U (Unicode), the (B2) or (U1).	format/length of the delimiter has to be (A1),						
WITH ALL	Handling of Delimiters:							
	Without ALL, a delimiter is placed in the target For example:	field only between values actually transferred.						

Syntax Element	Description
	COMPRESS 'A' ' 'C' ' 'INTO #TARGET WITH DELIMITERS '*' Content of #TARGET is: A*C
	With ALL, a delimiter is also placed in the target field for each blank value that is not actually transferred. This means that the number of delimiters in the target field corresponds to the number of source fields minus 1. This may be useful, for example, if the content of the target field is to be separated again with a subsequent SEPARATE statement. For example:
	COMPRESS 'A' ' 'C' ' ' INTO #TARGET WITH ALL DELIMITERS '*' Content of #TARGET is: A**C*

## **Processing**

A destination field of format B is handled like a destination field of format A.

The COMPRESS operation terminates when either all operands have been processed or the target field (*operand2*) is filled.

If the target field contains more positions than all operands combined, all remaining positions of <code>operand2</code> will be filled with blanks. If the target field is shorter, the value will be truncated.

If operand2 is a dynamic variable, the COMPRESS operation terminates when all source operands have been processed. No truncation will be performed. The length of operand2 after the COMPRESS operation will correspond to the combined length of the source operands. The current length of a dynamic variable can be ascertained by using the system variable \*LENGTH.

## **Examples**

This section covers the following topics:

- Example 1 Compress
- Example 2 Compress Leaving No Space

#### ■ Example 3 - Compress with Delimiter

#### **Example 1 - Compress**

```
** Example 'CMPEX1': COMPRESS
**********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 MIDDLE-I
1 #COMPRESSED-NAME (A20)
END-DEFINE
LIMIT 4
READ EMPLOY-VIEW BY NAME
 COMPRESS FIRST-NAME MIDDLE-I NAME INTO #COMPRESSED-NAME
 DISPLAY NOTITLE
        FIRST-NAME MIDDLE-I NAME 5X #COMPRESSED-NAME
END-READ
END
```

#### **Output of Program CMPEX1:**

FIRST-NAME	MIDDLE-I	NAME	#COMPRESSED-NAME
KEPA		ABELLAN	KEPA ABELLAN
ROBERT	W	ACHIESON	ROBERT W ACHIESON
SIMONE		ADAM	SIMONE ADAM
JEFF	Н	ADKINSON	JEFF H ADKINSON

#### **Example 2 - Compress Leaving No Space**

```
** Example 'CMPEX2': COMPRESS (with LEAVING NO SPACE)

**************************

DEFINE DATA LOCAL

1 EMPL-VIEW VIEW OF EMPLOYEES

2 NAME

2 CURR-CODE (1)

2 SALARY (1)

*

1 #CCSALARY (A20)
END-DEFINE

*

LIMIT 4

READ EMPL-VIEW BY NAME
```

```
COMPRESS CURR-CODE (1) SALARY (1) INTO #CCSALARY

LEAVING NO SPACE

DISPLAY NOTITLE

NAME CURR-CODE (1) SALARY (1) 5X #CCSALARY

END-READ

*
END
```

#### **Output of Program CMPEX2:**

NAME	CURRENCY CODE	ANNUAL SALARY	#CCSALARY	
ABELLAN	PTA	1450000	PTA1450000	
ACHIESON	UKL	11300	UKL11300	
ADAM	FRA	159980	FRA159980	
ADKINSON	USD	34500	USD34500	

#### **Example 3 - Compress with Delimiter**

```
** Example 'CMPEX3': COMPRESS (with delimiter)
**************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 CURR-CODE (1)
 2 SALARY
          (1)
1 #CCSALARY (A20)
END-DEFINE
LIMIT 4
READ EMPL-VIEW BY NAME
 COMPRESS CURR-CODE (1) SALARY (1) INTO #CCSALARY
         WITH DELIMITER '*'
 DISPLAY NOTITLE NAME CURR-CODE (1) SALARY (1) 5X #CCSALARY
END-READ
END
```

## Output of Program CMPEX3:

NAME	CURRENCY CODE	ANNUAL SALARY	#CCSALARY
ABELLAN	PTA	1450000	PTA*1450000
ACHIESON	UKL	11300	UKL*11300
ADAM	FRA	159980	FRA*159980
ADKINSON	USD	34500	USD*34500

# **COMPUTE**

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#### **Structured Mode Syntax**

```
 \left\{ \begin{bmatrix} \mathsf{COMPUTE} \\ \mathsf{ASSIGN} \end{bmatrix} \begin{bmatrix} \mathsf{[ROUNDED]} \\ \{operand1 \\ \mathsf{[:]=} \} \dots \end{bmatrix} \begin{cases} arithmetic-expression \\ operand2 \\ \mathsf{SUBSTR} \mathsf{ING} \\ (operand2, operand3, operand4) \end{cases} \right\}   \left\{ \begin{aligned} & operand1 \\ \mathsf{SUBSTR} \mathsf{ING} \\ & operand2 \\ & \mathsf{SUBSTR} \mathsf{ING} \\ & operand2, operand3, operand4) \end{aligned} \right\}
```

#### **Reporting Mode Syntax**

```
 \left[ \begin{array}{c} \left\{ \begin{array}{c} \text{COMPUTE} \\ \text{ASSIGN} \end{array} \right\} \quad \text{[ROUNDED]} \end{array} \right] \left\{ \begin{array}{c} \text{operand1} \text{[:]=} \} \dots \end{array} \left\{ \begin{array}{c} \text{arithmetic-expression} \\ \text{operand2} \\ \frac{\text{SUBSTR} \text{ING}}{\text{(operand2,operand3,operand4)}} \right\} \right\}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ADD | COMPRESS | DIVIDE | EXAMINE | MOVE | MOVE ALL | MULTIPLY | RESET | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

## **Function**

The COMPUTE statement is used to perform an arithmetic or assignment operation.

A COMPUTE statement with multiple target operands (operand1) is identical to the corresponding individual COMPUTE statements if the source operand (operand2) is not an arithmetic expression.

```
#TARGET1 := #TARGET2 := #SOURCE
is identical to
```

```
#TARGET1 := #SOURCE
#TARGET2 := #SOURCE
```

Example:

```
DEFINE DATA LOCAL
1 #ARRAY(I4/1:3) INIT <3,0,9>
1 #INDEX(I4)
1 #RESULT(I4)
END-DEFINE
#INDEX := 1
#INDEX :=
               /* #INDEX is 3
#RESULT :=
                /* #RESULT is 9
#ARRAY(#INDEX)
#INDEX := 2
#INDEX :=
                /* #INDEX is 0
#ARRAY(3) :=
                /* returns runtime error NAT1316
#ARRAY(#INDEX)
END
```

If the source operand is an arithmetic expression, the expression is evaluated and its result is stored in a temporary variable. Then the temporary variable is assigned to the target operands.

```
#TARGET1 := #TARGET2 := #SOURCE1 + 1
is identical to
#TEMP := #SOURCE1 + 1
#TARGET1 := #TEMP
#TARGET2 := #TEMP
```

#### Example:

For further information, see *Rules for Arithmetic Assignment* in the *Programming Guide* and particularly the following sections:

- *Arithmetic Operations with Arrays*
- *Data Transfer* (for information on data transfer compatibility and the rules for data transfer)

## **Syntax Description**

## Operand Definition Table:

Operand	Po	SSi	ble				Po	OS	sib	le F	orı	ma	ts				Referencing Permitted	Dynamic Definition		
operand1		S	A	M		A	U	N	Р	Ι	F	В	D	T	L	C	G	Ο	yes	yes
operand2	С	S	A	N	Е	A	U	N	Р	Ι	F	В	D	T	L	C	G	O	yes	no
operand3	С	S						N	Р	Ι		В*							yes	no
operand4	С	S						N	Р	Ι		B*							yes	no

<sup>\*</sup> If operand3 or operand4 is a binary variable, it may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description
COMPUTE   ASSIGN [:]=	Usage of Keywords:
	This statement may be issued in short form by omitting the statement keyword COMPUTE (or ASSIGN).
	In structured mode, when the statement keyword COMPUTE (or ASSIGN) is omitted, the equal sign (=) must be preceded by a colon (:).
	However, when the ROUNDED option is used, the statement keyword COMPUTE (or ASSIGN) must be specified.
ROUNDED	ROUNDED Option:
	If you specify the keyword ROUNDED, the value will be rounded before it is assigned to <code>operand1</code> .
	For information on rounding, see <i>Rules for Arithmetic Assignments, Field Truncation and Field Rounding</i> in the <i>Programming Guide</i> .
operand1	Result Field:
	operand1 will contain the result of the arithmetic/assignment operation.
	For the precision of the result, see <i>Precision of Results of Arithmetic Operations</i> in the <i>Programming Guide</i> .
	If operand1 is a database field, the field in the database is not updated.

Syntax Element	Description									
	If <i>operand1</i> is a dynamic variable, it is filled with exactly the data and length of <i>operand2</i> or the length of the result of the arithmetic-operation, including trailing blanks. The current length of a dynamic variable can be obtained by using the system variable *LENGTH.									
	For general information on dynamic variables, see <i>Using Dynamic and Large Variables</i> .									
arithmetic-expression	Arithmetic Expression:									
	An arithmetic expression consfields, and user-defined variab	ists of one or more constants, database les.								
	Natural mathematical function documentation) may also be u	ns (described in the <i>System Functions</i> sed as arithmetic operands.								
	Operands used in an arithmetic N, P, I, F, D, or T.	c expression must be defined with format								
	As for the formats of the operands, see also <i>Performance Considerations</i> for <i>Mixed Formats</i> in the <i>Programming Guide</i> .									
	The following connecting operators may be used:									
	Operator:	Symbol:								
	Parentheses	( )								
	Exponentiation	**								
	Multiplication	*								
	Division	/								
	Addition	+								
	Subtraction	-								
		ded and followed by at least one blank a variable name that contains any of the								
	The processing order of arithm	netic operations is:								
	1. Parentheses									
	2. Exponentiation									
	3. Multiplication/division (left to right as detected)									
	4. Addition/subtraction (left to right as detected)									
operand2	Source Field:									
	operand2 is the source field. If also be specified as an attribute	operand1 is of format C, operand2 may e constant.								
	See User-Defined Constants in the	he Programming Guide.								

Syntax Element	Description								
SUBSTRING	SUBSTRING Option:								
(operand2,operand3,operand4)	Without the substring option, the whole content of operand2 is moved.								
	If operand1 and operand2 are of alphanumeric, Unicode or binary format, you may use the SUBSTRING option to assign a certain part of operand2 to operand1.								
	After the field name (operand2) in the SUBSTRING clause, you specify the starting position (operand3) and then the length (operand4) of the field portion to be moved.								
	For example, to assign the 3rd to 6th position of field $\#B$ to field $\#A$ , you would specify:								
	#A := SUBSTRING(#B,3,4)								
	If you omit <i>operand3</i> , the starting position is assumed to be 1. If you omit <i>operand4</i> , the length is assumed to range from the starting position to the end of the field.								
	<b>Note:</b> ASSIGN with the SUBSTRING option is a byte-by-byte assignment								
	(that is, the rules described under <i>Rules for Arithmetic Assignment</i> in the <i>Programming Guide</i> do <i>not</i> apply).								
	See also MOVE SUBSTRING.								

## **Result Precision of a Division**

The precision (number of decimal positions) of the result of a division in a COMPUTE statement is determined by the precision of either the first operand (dividend) or the first result field, whichever is greater.

For a division of integer operands, however, the following applies: For a division of two integer constants, the precision of the result is determined by the precision of the first result field; however, if at least one of the two integer operands is a variable, the result is also of integer format (that is, without decimal positions, regardless of the precision of the result field).

## **Examples**

- Example 1 ASSIGN Statement
- Example 2 COMPUTE Statement

#### **Example 1 - ASSIGN Statement**

```
** Example 'ASGEX1S': ASSIGN (structured mode)
DEFINE DATA LOCAL
1 #A (N3)
1 #B (A6)
1 #C (NO.3)
1 #D (NO.5)
1 #E (N1.3)
1 #F (N5)
1 #G (A25)
1 #H (A3/1:3)
END-DEFINE
ASSIGN \#A = 5
                                         WRITE NOTITLE '=' #A
ASSIGN #B = 'ABC'
                                         WRITE '=' #B
ASSIGN \#C = .45
                                         WRITE '=' #C
ASSIGN \#D = \#E = -0.12345
                                         WRITE '=' #D / '=' #E
ASSIGN ROUNDED \#F = 199.999
                                         WRITE '=' #F
#G := 'HELLO'
                                         WRITE '=' #G
#H (1) := 'UVW'
#H (3) := 'XYZ'
                                         WRITE '=' #H (1:3)
END
```

#### **Output of Program ASGEX1S:**

```
#A: 5

#B: ABC

#C: .450

#D: -.12345

#E: -0.123

#F: 200

#G: HELLO

#H: UVW XYZ
```

Equivalent reporting-mode example: **ASGEX1R**.

#### **Example 2 - COMPUTE Statement**

```
** Example 'CPTEX1': COMPUTE
**********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 SALARY (1:2)
1 #A
             (P4)
1 #B
             (N3.4)
1 #C
             (N3.4)
1 #CUM-SALARY (P10)
1 #I
            (P2)
END-DEFINE
COMPUTE \#A = 3 * 2 + 4 / 2 - 1
WRITE NOTITLE 'COMPUTE \#A = 3 * 2 + 4 / 2 - 1' 10X '=' \#A
COMPUTE ROUNDED \#B = 3 - 4 / 2 * .89
WRITE 'COMPUTE ROUNDED \#B = 3 - 4 / 2 * .89' 5X '=' \#B
COMPUTE \#C = SQRT (\#B)
WRITE 'COMPUTE #C = SQRT (#B)' 18X '=' #C
LIMIT 1
READ EMPLOY-VIEW BY PERSONNEL-ID STARTING FROM '20017000'
  WRITE / 'CURRENT SALARY: ' 4X SALARY (1)
       / 'PREVIOUS SALARY:' 4X SALARY (2)
  FOR \#I = 1 TO 2
   COMPUTE \#CUM-SALARY = \#CUM-SALARY + SALARY (\#I)
 WRITE 'CUMULATIVE SALARY: ' #CUM-SALARY
END-READ
END
```

#### **Output of Program CPTEX1:**

```
COMPUTE #A = 3 * 2 + 4 / 2 - 1  #A: 7

COMPUTE ROUNDED #B = 3 -4 / 2 * .89  #B: 1.2200

COMPUTE #C = SQRT (#B)  #C: 1.1045

CURRENT SALARY: 34000

PREVIOUS SALARY: 32300

CUMULATIVE SALARY: 66300
```

# 35 CREATE OBJECT

Function	2	3	12
Syntax Description	2	3	12

CREATE OBJECT operand1 OF [CLASS] operand2
[GIVING operand3]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DEFINE CLASS | INTERFACE | METHOD | PROPERTY | SEND METHOD

Belongs to Function Group: Component Based Programming

## **Function**

The CREATE OBJECT statement is used to create an instance of a class.

## **Syntax Description**

Operand Definition Table:

Operand	ssib	le St	ruct	ure	Possible Formats										Referencing Permitted	Dynamic Definition	
operand1		S													О	no	no
operand2	С	S				A										yes	no
operand3		S			N				Ι							yes	no

Syntax Element Description:

Syntax Element	Description
operand1	Object Handle:
	operand1 must be defined as an object handle (HANDLE OF OBJECT). The object handle is filled when the object is successfully created. When not successfully returned, operand1 contains the value NULL-HANDLE.
OF CLASS	Class-Name:
operand2	operand2 is the name of the class of which the object is to be created. For classes that are not registered as DCOM classes, it must contain the class name defined in the DEFINE CLASS statement. For classes that are registered as DCOM classes, it must contain either the ProgID of the class or the class GUID. For Natural classes that are registered as DCOM classes, the ProgID corresponds to the class name specified in the DEFINE CLASS statement.

Syntax Element	Description
	CREATE OBJECT #01 OF CLASS "Employee" or CREATE OBJECT #01 OF CLASS "653BCFE0-84DA-11D0-BEB3-10005A66D231"
GIVING operand3	GIVING Clause:  If this clause is specified, <code>operand3</code> contains either the Natural message number if an error occurred, or zero on success.  If this clause is not specified, Natural run time error processing is triggered if an error occurs.

# 36 DECIDE FOR

Function	286
Syntax Description	
Examples	

```
DECIDE FOR { FIRST EVERY } CONDITION { WHEN logical-condition statement...} ... [WHEN ANY statement...] [WHEN ALL statement...] WHEN NONE statement... END-DECIDE
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DECIDE ON | IF | IF SELECTION | ON ERROR

Belongs to Function Group: Processing of Logical Conditions

## **Function**

The DECIDE FOR statement is used to decide for one or more actions depending on multiple conditions (cases).



**Note:** If *no* action is to be performed under a certain condition, you must specify the statement IGNORE in the corresponding clause of the DECIDE FOR statement.

## **Syntax Description**

Syntax Element	Description
FIRST CONDITION	Processing of First Condition Only:
	Only the first true condition is to be processed.
	See also <i>Example 1</i> .
EVERY CONDITION	Processing of Every Condition:
	Every true condition is to be processed.
	See also <i>Example 2</i> .
WHEN logical-condition	Logical Condition(s) to be Processed:
statement	With this clause, you specify the logical condition(s) to be processed.
	See the section Logical Condition Criteria in the Programming Guide.
WHEN ANY statement	WHEN ANY Clause:

Syntax Element	Description
	With WHEN ANY, you can specify the <b>statement(s)</b> to be executed when any of the logical conditions are true.
WHEN ALL statement	WHEN ALL Clause:
	With WHEN ALL, you can specify the <b>statement (s)</b> to be executed when all logical conditions are true.
	This clause is applicable only if EVERY has been specified.
WHEN NONE statement	WHEN NONE Clause:
	With WHEN NONE, you specify the statement(s) to be executed when none of the logical conditions are true.
END-DECIDE	End of DECIDE FOR Statement:
	The Natural reserved word END-DECIDE must be used to end the DECIDE FOR statement.

## **Examples**

- Example 1 DECIDE FOR with FIRST Option
- Example 2 DECIDE FOR with EVERY Option

#### **Example 1 - DECIDE FOR with FIRST Option**

```
** Example 'DECEX1': DECIDE FOR (with FIRST option)
*************************
DEFINE DATA LOCAL
1 #FUNCTION (A1)
1 #PARM
         (A1)
END-DEFINE
INPUT #FUNCTION #PARM
DECIDE FOR FIRST CONDITION
 WHEN #FUNCTION = 'A' AND #PARM = 'X'
   WRITE 'Function A with parameter X selected.'
 WHEN #FUNCTION = 'B' AND #PARM = 'X'
   WRITE 'Function B with parameter X selected.'
 WHEN #FUNCTION = 'C' THRU 'D'
   WRITE 'Function C or D selected.'
 WHEN NONE
   REINPUT 'Please enter a valid function.'
           MARK *#FUNCTION
END-DECIDE
```

\* END

#### **Output of Program DECEX1:**

```
#FUNCTION #PARM
```

#### After entering A and Y and pressing ENTER:

```
#FUNCTION A #PARM Y
Please enter a valid function.
```

#### **Example 2 - DECIDE FOR with EVERY Option**

```
** Example 'DECEX2': DECIDE FOR (with EVERY option)
***********************
DEFINE DATA LOCAL
1 #FIELD1 (N5.4)
END-DEFINE
INPUT #FIELD1
DECIDE FOR EVERY CONDITION
 WHEN #FIELD1 >= 0
   WRITE '#FIELD1 is positive or zero.'
 WHEN #FIELD1 <= 0
   WRITE '#FIELD1 is negative or zero.'
 WHEN FRAC(\#FIELD1) = 0
   WRITE '#FIELD1 has no decimal digits.'
 WHEN ANY
   WRITE 'Any of the above conditions is true.'
 WHEN ALL
   WRITE '#FIELD1 is zero.'
 WHEN NONE
   IGNORE
END-DECIDE
END
```

## **Output of Program DECEX2:**

#FIELD1 42

## After pressing ENTER:

```
#FIELD1 is positive or zero.
#FIELD1 has no decimal digits.
Any of the above conditions is true.
```

# 37 DECIDE ON

Function	292
Syntax Description	
Examples	

```
DECIDE ON  \left\{ \begin{array}{l} \text{FIRST} \\ \text{EVERY} \end{array} \right\} \begin{bmatrix} \text{VALUE} \\ \text{OF} \end{bmatrix} \qquad \left\{ \begin{array}{l} op1 \\ \text{SUBSTR} \\ (op3,op5,op6) \end{array} \right\}   \left\{ \begin{array}{l} \text{VALUE} \left\{ \begin{array}{l} op2 \\ \text{SUBSTR} \\ (op4,op7,op8) \end{array} \right\} \right\} \begin{bmatrix} \vdots \\ \text{SUBSTR} \\ (op4,op7,op8) \end{array} \right\} \left[ \vdots \\ \text{END-DECIDE} \right]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DECIDE FOR | IF | IF SELECTION | ON ERROR

Belongs to Function Group: Processing of Logical Conditions

## **Function**

The DECIDE ON statement is used to specify multiple actions to be performed depending on the value (or values) contained in a variable.



**Note:** If *no* action is to be performed under a certain condition, you must specify the statement IGNORE in the corresponding clause of the DECIDE ON statement.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure					Possible Formats												Referencing Permitted	Dynamic Definition	
op1		S	A		N	A	U	N	Р	Ι	F	В	D	T	L		G	O	yes	no
op2	С	S	A			A	U	N	Р	Ι	F	В	D	T	L		G	О	yes	no
ор3		S	A			A	U					В							yes	no
op4	С	S	A			A	U					В							yes	no
op5	С	S						N	Р	I		В*							yes	no
op6	С	S						N	Р	Ι		В*							yes	no
op7	С	S						N	Р	I		В*							yes	no

Operand	Possible Structure				Possible Formats									Referencing Permitted	Dynamic Definition		
op8	C	S					N	Р	I	В *						yes	no

<sup>\*</sup> Format B of op5, op6, op7 and op8 may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description
FIRST/EVERY	Processing of Values:
	With one of these keywords, you indicate whether only the first or every value that is found is to be processed.
op1	Selection Field:
	As op1 or op2 you specify the name of the field whose content is to be checked.
<u>VALUE</u> S <i>op2</i> [[, <i>op2</i> ]	VALUES Clause:
[:op2]statement	With this clause, you specify the value $(op2)$ of the selection field, as well as the $statement(s)$ which are to be executed if the field contains that value.
	You can specify one value, multiple values, or a range of values optionally preceded by one or more values.
	Multiple values must be separated from one another either by the input delimiter character (as specified with the session parameter ID) or by a comma. A comma must not be used for this purpose, however, if the comma is defined as decimal character (with the session parameter DC).
	For a range of values, you specify the starting value and ending value of the range, separated from each other by a colon.
SUBSTRING	SUBSTRING Option:
	Without the SUBSTRING option, the whole content of a field is checked. The SUBSTRING option allows you to check only a certain part of an alphanumeric, Unicode or binary field.
	After the field name ( $op3$ ), you specify first the starting position ( $op5$ ) and then the length ( $op6$ ) of the field portion to be checked.
SUBSTRING	SUBSTRING Option:
(op4,op7,op8)	After the field name ( $op4$ ), you specify first the starting position ( $op7$ ) and then the length ( $op8$ ) of the field portion to be checked.
ANY statement	ANY Clause:
	With ANY, you specify the <i>statement(s)</i> which are to be executed if any of the values in the VALUES clause are found. These statements are to be executed in addition to the statement specified in the VALUES clause.

Syntax Element	Description
ALL statement	ALL Clause:
	With ALL, you specify the <i>statement(s)</i> which are to be executed if all of the values in the VALUES clause are found. These statements are to be executed in addition to the statement specified in the VALUES clause.
	The ALL clause applies only if the keyword EVERY is specified.
NONE statement	NONE Clause:
	With NONE, you specify the <i>statement(s)</i> which are to be executed if none of the specified values are found.
END-DECIDE	End of DECIDE ON Statement:
	The Natural reserved word END-DECIDE must be used to end the DECIDE ON statement.

## **Examples**

- Example 1 DECIDE ON with FIRST Option
- Example 2 DECIDE ON with EVERY Option

## **Example 1 - DECIDE ON with FIRST Option**

#### **Output of Program DECEX3:**

```
Enter any PF key and check result
```

#### **Output after pressing PF1:**

```
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PF1 key entered.

PF1 or PF2 key entered.
```

#### **Example 2 - DECIDE ON with EVERY Option**

```
** Example 'DECEX4': DECIDE ON (with EVERY option)
*************************
DEFINE DATA LOCAL
1 #FIELD (N1)
END-DEFINE
INPUT 'Enter any value between 1 and 9: #FIELD (SG=OFF)
DECIDE ON EVERY VALUE OF #FIELD
 VALUE 1 : 4
   WRITE 'Content of #FIELD is 1-4'
 VALUE 2 : 5
   WRITE 'Content of #FIELD is 2-5'
 ANY VALUE
   WRITE 'Content of #FIELD is 1-5'
 ALL VALUE
   WRITE 'Content of #FIELD is 2-4'
 NONE VALUE
   WRITE 'Content of #FIELD is not 1-5'
   END-DECIDE
END
```

#### **Output of Program DECEX4:**

```
ENTER ANY VALUE BETWEEN 1 AND 9: 4
```

## After entering and confirming 4:

```
Page 1 05-01-11 15:11:45

Content of #FIELD is 1-4
Content of #FIELD is 2-5
Content of #FIELD is 1-5
Content of #FIELD is 2-4
```

# 38 DEFINE CLASS

Function	2	98
Syntax Description	2	98

```
DEFINE CLASS class-name

\[
\begin{align*}
\text{USING} & \left| \left|
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CREATE OBJECT | INTERFACE | METHOD | PROPERTY | SEND METHOD

Belongs to Function Group: Component Based Programming

## **Function**

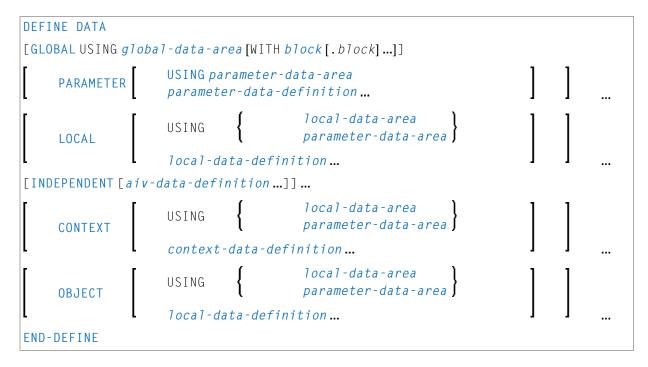
The DEFINE CLASS statement is used to specify a class from within a Natural class module. A Natural class module consists of one DEFINE CLASS statement followed by an END statement.

## **Syntax Description**

Syntax Element	Description
class-name	Class Name:
	This is the name that is used by clients to create objects of this class. The name can be up to a maximum of 32 characters long. The name may contain periods: this can be used to construct class names such as
	company-name.application-name.class-name
	Each part between the periods () must conform to the <i>Naming Conventions for User-Defined Variables</i> .

Syntax Element	Description
	If the class is planned to be used by clients written in different programming languages, the class name should be chosen in a way that it does not conflict with the naming conventions that apply in these languages.
OBJECT	OBJECT Clause:
	This clause is used to define the object data. The syntax of the <code>OBJECT</code> clause is the same as for the <code>LOCAL</code> clause of the <code>DEFINE DATA</code> statement.
	For further information, see the description of the LOCAL clause of the DEFINE DATA statement.
LOCAL	LOCAL Clause:
	This clause is only used to include globally unique IDs (GUIDs) in the class definition. GUIDs need only be defined if a class is to be registered with DCOM. GUIDs are mostly defined in a local data area.
	The syntax of the LOCAL clause is the same as for the LOCAL clause of the DEFINE DATA statement.
	For further information, see the description of the LOCAL clause of the DEFINE DATA statement.
INTERFACE USING	INTERFACE USING Clause:
	This clause is used to include copycode that contains INTERFACE statements.
copycode	Copycode:
	The copycode used by the INTERFACE USING clause may contain one or more INTERFACE statements.
interface-statement	INTERFACE Statement:
	The INTERFACE statement is used to define methods and properties for a class.
property-statement	PROPERTY Statement:
	The PROPERTY statement is used to assign an object data variable operand as the implementation to a property, outside an interface definition.
method-statement	METHOD Statement:
	The METHOD statement is used to assign a subprogram as the implementation to a method, outside an interface definition.
END-CLASS	End of DEFINE CLASS Statement:
	The Natural reserved word END-CLASS must be used to end the DEFINE CLASS statement.

## VI DEFINE DATA



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related topics in the *Programming Guide*: Use and Structure of DEFINE DATA Statement | Data Areas | Storage Alignment

The DEFINE DATA documentation is organized under the following headings:

**■** Function and Basic Syntax Rules

Data Definitions:

- Defining Global Data
- Defining Parameter Data
- Defining Local Data

- **■** Defining Application-Independent Variables
- Defining Context Variables for Natural RPC
- **■** Defining NaturalX Objects

## Clauses and Options:

- **■** Variable Definition
- **■** View Definition
- **■** Redefinition
- **■** Array Dimension Definition
- **■** Initial-Value Definition
- Initial/Constant Values for an Array
- EM, HD, PD Parameters for Field/Variable

## Examples:

**Examples of DEFINE DATA Statement Usage** 

## Function and Basic Syntax Rules

Function	304
General Syntax Rules	304
Programming Modes	304

### **Function**

The DEFINE DATA statement offers a number of clauses to declare data definitions for use within a Natural program, either by referencing predefined data definitions contained in a local data area (LDA), global data area (GDA) or parameter data area (PDA), or by writing in-line definitions.

### **General Syntax Rules**

- When a DEFINE DATA statement is used, it must be the first statement of the program/routine.
- An "empty" DEFINE DATA statement is not allowed; at least one clause (GLOBAL, PARAMETER, LOCAL, INDEPENDENT, CONTEXT or OBJECT) must be specified.
- You can specify more than one clause. However, if the GLOBAL and the PARAMETER clauses are used, GLOBAL must be the first clause of the statement and PARAMETER must follow GLOBAL (without GLOBAL, PARAMETER comes first if used). All other clauses can be specified in any order.
- The Natural reserved word END-DEFINE must be used to end the DEFINE DATA statement.

### **Programming Modes**

The DEFINE DATA statement is available in structured mode and in reporting mode. Differences are marked accordingly in the DEFINE DATA statement description.

Generally, the following applies:

- Structured Mode
- Reporting Mode

#### **Structured Mode**

All variables to be used, except **application-independent variables** (AIVs), must be defined in the DEFINE DATA statement; they must not be defined elsewhere in the program. If a DEFINE DATA INDEPENDENT statement is used, AIVs must not be defined elsewhere in the program.

### **Reporting Mode**

The DEFINE DATA statement is not mandatory since variables may be defined in the body of the program. However, if a DEFINE DATA LOCAL statement is used in reporting mode, variables, except application-independent variables (AIVs), must not be defined elsewhere in the program; and if a DEFINE DATA INDEPENDENT statement is used, application-independent variables (AIVs) must not be defined elsewhere in the program.

### 40 Defining Global Data

Function	30	3(
Syntax Description	30	)8

General syntax of DEFINE DATA GLOBAL:

```
DEFINE DATA

GLOBAL USING global-data-area [WITH block[.block...]]

END-DEFINE
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Function**

The DEFINE DATA GLOBAL statement is used to define data elements using a GDA (see Global Data Area).

### **Syntax Description**

Syntax Element	Description
USING	GDA Name:
global-data-area	Specify the name of a global data area (GDA) to be referenced.
	A GDA is created with the <i>Data Area Editor</i> . It contains predefined data elements which can be included in the DEFINE DATA GLOBAL statement.
	In contrast to an LDA, the data elements defined in a GDA can be referenced by more than one Natural object.
	For further information, see Global Data Area in the <i>Programming Guide</i> .
WITH block	Data Blocks:
	To save data storage space, you can create a global data area with data blocks. Data blocks can overlay one another during program execution, thereby saving storage space.
	The maximum number of block levels is 8 (including the master block).
	For further information, see <i>Data Blocks</i> in the <i>Programming Guide</i> .
.block	Block(s) to be Used:
	A single or multiple . block notations specify the block(s) which are used in the program.
END-DEFINE	End of DEFINE DATA Statement:

Syntax Element	Description
	The Natural reserved word END-DEFINE must be used to end the DEFINE DATA
	statement.

# 41 Defining Parameter Data

Function	. 31	12
Restrictions		
Syntax Description		

General syntax of DEFINE DATA PARAMETER:

```
DEFINE DATA

PARAMETER USING parameter-data-area parameter-data-definition...

END-DEFINE
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Function**

The DEFINE DATA PARAMETER statement is used to define the data elements that are to be used as incoming parameters in a Natural subprogram, external subroutine or helproutine. These parameters can be defined within the statement itself (see *Parameter Data Definition*); or they can be defined outside the program in a *parameter data area* (PDA), with the statement referencing that data area.

### Restrictions

- Parameter data elements must not be assigned initial or constant values, and they must not have edit mask (EM), header (HD) or print mode (PM) definitions; see also EM, HD, PM Parameters for Field/Variable.
- The parameter data area and the objects which reference it must be contained in the same library (or in a steplib).

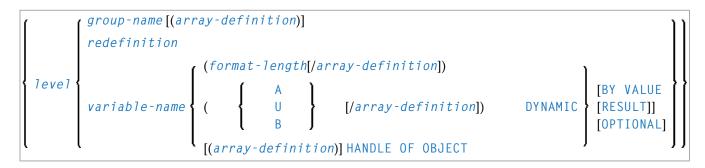
### **Syntax Description**

Syntax Element	Description
USING parameter-data-area	Parameter Data Area (PDA) Name:
	The name of the <i>parameter-data-area</i> (PDA) that contains data elements which are used as parameters in a subprogram, external subroutine or dialog.
parameter-data-definition	Parameter Data Definition:
	Instead of using a PDA, you can define parameter data directly.
	See Parameter Data Definition.

Syntax Element	Description
END-DEFINE	End of DEFINE DATA Statement:
	The Natural reserved word END-DEFINE must be used to end the DEFINE DATA statement.

### **Parameter Data Definition**

For parameter data definition, the following syntax applies:



Syntax Element Description:

Syntax Element	Description
1eve1	Level Number:
	Level number is a 1- or 2-digit number in the range from 01 to 99 (the leading zero is optional) used in conjunction with field grouping. Fields assigned a level number of 02 or greater are considered to be a part of the immediately preceding group which has been assigned a lower level number.
	The definition of a group enables reference to a series of fields (may also be only 1 field) by using the group name. With certain statements (CALL, CALLNAT, RESET, WRITE, etc.), you may specify the group name as a shortcut to reference the fields contained in the group.
	A group may consist of other groups. When assigning the level numbers for a group, no level numbers may be skipped.
group-name	Group Name:
	The name of a group. The name must adhere to the rules for defining a Natural variable name.
	See also the following sections:
	■ Naming Conventions for User-Defined Variables in Using Natural.
	Qualifying Data Structures in the Programming Guide.
array-definitio	Array Dimension Definition:

Syntax Element	Description
	With an array-definition, you define the lower and upper bounds of dimensions in an array-definition.
	For further information, see <i>Array Dimension Definition</i> and <i>Variable Arrays in a Parameter Data Area</i> .
redefinition	Redefinition:
	A redefinition may be used to redefine a group or a single field/variable (that is a scalar or an array). See <i>Redefinition</i> .
	<b>Note:</b> In a parameter-data-definition, a redefinition of groups is only permitted within a REDEFINE block.
variable-name	Variable Name:
	The name to be assigned to the variable. Rules for Natural variable names apply. For information on naming conventions for user-defined variables.
	For further information, see <i>Naming Conventions for User-Defined Variables</i> in <i>Using Natural</i> .
format-length	Format/Length Definition:
	The format and length of the field.
	For information on format/length definition of user-defined variables, see <i>Format and Length of User-Defined Variables</i> in the <i>Programming Guide</i> .
HANDLE OF OBJECT	Handle of Object:
	Used in conjunction with NaturalX. A handle identifies a dialog element in code and is stored in handle variables.
	For further information, see <i>NaturalX</i> in the <i>Programming Guide</i> .
A, U or B	Data Type:
	Alphanumeric (A), Unicode (U) or binary (B) for dynamic variable.
DYNAMIC	DYNAMIC Option:
	A parameter may be defined as DYNAMIC. For further information on processing dynamic variables, see <i>Introduction to Dynamic Variables and Fields</i> in the <i>Programming Guide</i> .
	Call Mode:
	Depending on whether call-by-reference, call-by-value or call-by-value-result is used, the appropriate transfer mechanism is applicable. For further information, see the CALLNAT statement.
(without BY VALUE)	Call-by-Reference:
	Call-by-reference is active by default when you omit the BY VALUE keywords. In this case, a parameter is passed to a subprogram/subroutine/function by reference (that

Syntax Element	Description	
	is, via its address); therefore a field specified as parameter in a CALLNAT/PERFORM statement must have the same format/length as the corresponding field in the invoked subprogram/subroutine/function.	
BY VALUE Call-by-Value:		
	When you specify BY VALUE, a parameter is passed to a subprogram/subroutine/function by value; that is, the actual parameter value (instead of its address) is passed. Consequently, the field in the subprogram/subroutine/function need not have the same format/length as the parameter passed in the CALLNAT/PERFORM statement or in the function call. The formats/lengths must only be data transfer compatible. For data transfer compatibility, the <i>Rules for Arithmetic Assignment</i> and <i>Data Transfer</i> apply (see <i>Programming Guide</i> ).	
	BY VALUE allows you, for example, to increase the length of a field in a subprogram/subroutine/function (if this should become necessary due to an enhancement of the subprogram/subroutine) without having to adjust any of the objects that invoke the subprogram/subroutine/function.	
	Example of BY VALUE:	
	* Program DEFINE DATA LOCAL 1 #FIELDA (P5) END-DEFINE	* Subroutine SUBR01 DEFINE DATA PARAMETER 1 #FIELDB (P9) BY VALUE END-DEFINE
	 CALLNAT 'SUBRO1' #FIELDA	
BY VALUE RESULT	Call-by-Value-Result:	
	While BY VALUE applies to a parameter passed to a subprogram/subrouting BY VALUE RESULT causes the parameter to be passed by value in both of that is, the actual parameter value is passed from the invoking object to subprogram/subroutine/function and, on return to the invoking object, the parameter value is passed from the subprogram/subroutine/function basinvoking object.	
	With BY VALUE RESULT, the formats/lengths of the fields concerned must be data transfer compatible in both directions.	
OPTIONAL	Optional Parameters:	
	For a parameter defined without OPTIONAL (default), a value <i>must</i> be passed from the invoking object.	
	For a parameter defined with OPTIONAL, the invoking object to this parameter.	a value can, but need not be passed from
	In the invoking object, the notation $nX$ is used to indicate parameters which are skipped, that is, for which no values are passed.	

Syntax Element	Description
	With the SPECIFIED option you can find out at run time whether an optional parameter has been defined or not.



**Note:** See also *Matching Format Specification of Array Dimensions* in the *Programming Guide*.

# 42 Defining Local Data

Function	. 3	18	2
Restriction			
Syntax Description	. 3	18	2

General syntax of DEFINE DATA LOCAL:

```
DEFINE DATA

LOCAL

USING {

    parameter-data-area }

    local-data-definition...}

END-DEFINE
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Function**

The DEFINE DATA LOCAL statement is used to define the data elements that are to be used exclusively by a single Natural module in an application. These elements or fields can be defined in different ways:

- either within the DEFINE DATA LOCAL statement itself, using the local-data-definition syntax (see Local Data Definition)
- or outside the program in a separate LDA (*Local Data Area*) or PDA (*Parameter Data Area*), with the DEFINE DATA LOCAL USING statement referencing that data area.

### Restriction

The LDA and the objects which reference it must be contained in the same library (or in a steplib).

### **Syntax Description**

Syntax Element	Description
local-data-area	LDA Name:
	Specify the name of the local data area (LDA) to be referenced.
	An LDA is created with the <i>Data Area Editor</i> . It contains predefined data elements which can be included in the DEFINE DATA LOCAL statement.
	You may reference more than one data area; in that case you have to repeat the reserved words LOCAL and USING, for example:

Syntax Element	Description
	DEFINE DATA LOCAL LOCAL USING DATX_L LOCAL USING DATX_P
	END-DEFINE ;
	For further information, see also <i>Defining Fields in a Separate Data Area</i> and <i>Local Data Area</i> , <i>Example 2</i> in the <i>Programming Guide</i> .
parameter-data-area	PDA Name:
	Specify the name of a parameter data area (PDA).
	<b>Note:</b> A data area referenced with DEFINE DATA LOCAL may also be a
	parameter data area (PDA). By using a PDA as an LDA you can avoid the extra effort of creating an LDA that has the same structure as the PDA.
	A PDA is created with the <i>Data Area Editor</i> .
	For further information, see Parameter Data Area in the Programming Guide.
local-data-definition	Local Data Definition:
	For information on how to define elements or fields within the statement itself, that is, without using an LDA or PDA, see the section <i>Local Data Definition</i> below.
END-DEFINE	End of DEFINE DATA Statement:
	The Natural reserved word END-DEFINE must be used to end the DEFINE DATA statement.

#### **Local Data Definition**

Local data can be defined directly. For local data definition, the following syntax applies:

```
\left\{\begin{array}{l} \textit{group-name}\left[(\textit{array-definition})\right] \\ \textit{variable-definition} \\ \textit{view-definition} \\ \textit{redefinition} \end{array}\right\}
```

For further information, see

- Example 1 DEFINE DATA LOCAL (Local Data Definition)
- Defining Fields within a DEFINE DATA Statement in the Programming Guide
- Local Data Area, Example 1 in the Programming Guide

Syntax Element Description for Local Data Definition:

Syntax Element	Description
level	Level Number:
	Level number is a 1- or 2-digit number in the range from 01 to 99 (the leading zero is optional) used in conjunction with field grouping. Fields assigned a level number of 02 or greater are considered to be a part of the immediately preceding group which has been assigned a lower level number.
	The definition of a group enables reference to a series of fields (may also be only 1 field) by using the group name. With certain statements (CALL, CALLNAT, RESET, WRITE, etc.), you may specify the group name as a shortcut to reference the fields contained in the group.
	A group may consist of other groups. When assigning the level numbers for a group, no level numbers may be skipped.
	A view-definition must always be defined at Level 1.
group-name	Group Name:
	The name of a group. The name must adhere to the rules for defining a Natural variable name.
	See also the following sections:
	■ Naming Conventions for User-Defined Variables in Using Natural.
	Qualifying Data Structures in the Programming Guide.
array-definition	Array Dimension Definition:
	With an array-definition, you define the lower and upper bounds of dimensions in an array-definition.
	See Array Dimension Definition.
variable-definition	Variable Definition:
	A <i>variable-definition</i> is used to define a single field/variable that may be single-valued (scalar) or multi-valued (array).
	See Variable Definition.
view-definition	View Definition:
	A <i>view-definition</i> is used to define a view as derived from a data definition module (DDM).
	See View Definition.
redefinition	Redefinition:

Syntax Element	Description
	A redefinition may be used to redefine a group, a view, a DDM field or a single field/variable (that is a scalar or an array).
	See Redefinition.

### 43 Defining Application-Independent Variables

Function	32	24
Syntax Description	33	24

General syntax of DEFINE DATA INDEPENDENT:

```
DEFINE DATA

INDEPENDENT [aiv-data-definition ...]

END-DEFINE
```

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

#### **Function**

The DEFINE DATA INDEPENDENT statement is used to define application-independent variables (AIVs).

An application-independent variable is referenced by its name, and its content is shared by all Natural objects executed within one application that refer to that name. The variable is allocated by the first executed Natural object that references this variable and is deallocated by the LOGON command or a RELEASE VARIABLES statement.

The optional INIT clause is evaluated in each executed Natural object that contains this clause (not only in the Natural object that allocates the variable).

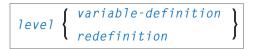


**Note:** In an RPC server, application-independent variables (AIVs) are not deallocated implicitly, but stay active across RPC requests, because different clients may have access to the same variables on the RPC server. This means they must be deallocated explicitly using the RELEASE VARIABLES statement. See *Application-Independent Variables* in the *Natural RPC* (*Remote Procedure Call*) documentation.

### **Syntax Description**

Syntax Element	Description
aiv-data-definition	AIV Data Definition:
	The DEFINE DATA INDEPENDENT statement can be used to define a single or multiple application-independent variables (AIVs). For each AIV, the syntax shown in <i>AIV Data Definition</i> applies.
END-DEFINE	End of DEFINE DATA Statement:
	The Natural reserved word END-DEFINE must be used to end the DEFINE DATA statement.

#### **AIV Data Definition**



### Syntax Element Description:

Syntax Element	Description
level	Level Number:
	An application-independent variable must be defined at Level 01. Other levels are only used in a redefinition.
variable-definition	Variable Definition
	A <i>variable definition</i> is used to define a single field/variable that may be single-valued (scalar) or multi-valued (array).
	For further information, see <i>Variable Definition</i> .
	<b>Note:</b> The name of an application-independent variable must start with a plus
	(+) character.
redefinition	Redefinition:
	With a <i>redefinition</i> , you can partition an application-independent variable into one or more subfields.
	For further information, see <i>Redefinition</i> .
	The subfields resulting from the redefinition must not be application-independent variables; that is, their name must not start with a plus sign (+). These fields are treated as local variables.

**Note:** The first character of the name must be a plus (+). Rules for Natural variable names apply, see *Naming Conventions for User-Defined Variables* in *Using Natural*.

### 

### **Defining Context Variables for Natural RPC**

Function	. 328
Restrictions	
Syntax Description	. 329

General syntax of DEFINE DATA CONTEXT:

```
DEFINE DATA

USING { local-data-area parameter-data-area}

context-data-definition...}
```

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

Belongs to Function Group: Natural Remote Procedure Call

### **Function**

The DEFINE DATA CONTEXT statement is used in conjunction with the Natural RPC (Remote Procedure Call). It is used to define variables known as context variables, which are meant to be available to multiple remote subprograms within one conversation, without having to explicitly pass the variables as parameters with the corresponding CALLNAT statements.

A context variable is referenced by its name, and its content is shared by all Natural objects executed in one conversation that refer to that name. The variable is allocated by the first executed Natural object that contains the definition of the variable and is deallocated when the conversation ends.

A context variable is not shared with subprograms that are called within the conversation. If such a subprogram or one of its callees references a context variable, a separate storage area is allocated for this variable.

Context variables can also be used in a non-conversational CALLNAT. In this case, the context variables only exist during a single invocation of this CALLNAT. The variable is allocated when the remote subprogram is started and deallocated when it ends. The content is shared by all Natural objects except subprograms executed by this non-conversational CALLNAT.

The optional INIT clause is evaluated in each executed Natural object that contains this clause (not only in the Natural object that allocates the variable). This is different to the way the INIT works for global variables.

For further information, see *Defining a Conversation Context* in the *Natural RPC (Remote Procedure Call)* documentation.

### **Restrictions**

A context variable must be defined at Level 01. Other levels are only used in a redefinition.

### **Syntax Description**

Syntax Element	Description
USING <i>local-data-area</i>	LDA Name:
	A local data area (LDA) contains data elements which are to be used in a single Natural module. You may reference more than one data area; in that case you have to repeat the reserved words CONTEXT and USING, for example:
	DEFINE DATA  CONTEXT USING DATX_L  CONTEXT USING DATX_P
	END-DEFINE;
	For further information, see <i>Defining Fields in a Separate Data Area</i> in the <i>Programming Guide</i> .
USING	PDA Name:
parameter-data-area	A parameter data area contains data elements which are used as parameters in a subprogram, external subroutine or dialog.
context-data-definition	Context Data Definition:
	Context data can be defined directly within a program or routine. For context data definition, the syntax shown <b>below</b> applies.
END-DEFINE	End of DEFINE DATA Statement:
	The Natural reserved word END-DEFINE must be used to end the DEFINE DATA statement.

#### **Context Data Definition**

Context data can be defined directly within a program or routine. For context data definition, the following syntax applies:

```
level \left\{ egin{array}{ll} variable-definition \\ redefinition \end{array} 
ight\}
```

For further information, see *Defining Fields within a DEFINE DATA Statement* in the *Programming Guide*.

Syntax Element	Description
level	Level Number:
	An application-independent variable must be defined at Level 01. Other levels are only used in a redefinition.
variable-definition	Variable Definition:
	A <i>variable-definition</i> is used to define a single field/variable that may be single-valued (scalar) or multi-valued (array).
	For further information, see <i>Variable Definition</i> .
	<b>Note:</b> The CONSTANT clause must not be used in this context
redefinition	Redefinition:
	A redefinition may be used to redefine a group, a view, a DDM field or a single field/variable (that is a scalar or an array).
	For further information, see <i>Redefinition</i> .



**Note**: The fields resulting from the redefinition are not considered a context variable. These fields are treated as local variables.

## 45 Defining NaturalX Objects

Function	33	2
Syntax Description	33	1

General syntax of DEFINE DATA OBJECT:

```
DEFINE DATA

OBJECT

USING { local-data-area parameter-data-area } ]

END-DEFINE
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Function**

The DEFINE DATA OBJECT statement is used in a subprogram or class in conjunction with NaturalX.

For further information, refer to the section *NaturalX* in the *Programming Guide*.

### **Syntax Description**

Syntax Element	Description
USING <i>local-data-area</i>	LDA Name:
	A local data area (LDA) contains data elements which are to be used in a single Natural module. You may reference more than one data area; in that case you have to repeat the reserved words <code>OBJECT</code> and <code>USING</code> , for example:
	DEFINE DATA OBJECT USING DATX_L OBJECT USING DATX_P
	END-DEFINE ;
	For further information, see also <i>Defining Fields in a Separate Data Area</i> in the <i>Programming Guide</i> .
USING	PDA Name:
parameter-data-area	A data area defined with DEFINE DATA OBJECT may be a parameter data area (PDA). By using a PDA as an object data area you can avoid the extra effort of creating an object data area that has the same structure as the PDA.
local-data-definition	Local Data Definition:

Syntax Element	Description
	Data can also be defined directly using the syntax shown in <i>Local Data Definition</i> in the section <i>Defining Local Data</i> .
END-DEFINE	End of DEFINE DATA Statement:  The Natural reserved word END-DEFINE must be used to end the DEFINE DATA statement.

## 46 Variable Definition

Syntax Description	3:	26
Symax Description	 Uι	ハ

```
{ scalar-definition }
  array-definition }
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The variable-definition option is used to define a single field/variable that may be single-valued (scalar-definition) or multi-valued (array-definition).

scalar-definition

```
variable\text{-}name \left\{ \begin{pmatrix} format\text{-}length \\ A \\ U \\ B \end{pmatrix} \right. \text{DYNAMIC} \left. \left\{ \begin{pmatrix} \frac{\text{CONST}}{\text{INIT}} \end{pmatrix} init\text{-}definition \right] [emhdpm] \right. \\ \left. \left\{ \begin{pmatrix} \frac{\text{CONST}}{\text{INIT}} \end{pmatrix} \right\} \left[ \left\{ \frac{\text{CONST}}{\text{INIT}} \right\} \right] \left[ \frac{\text{CONST}}{\text{INIT}} \right] \left[ \frac{\text{
```

array-definition

$$variable-name \left\{ \begin{array}{c} (format-length/array-definition) \\ ( & \left\{ \begin{array}{c} A \\ U \\ B \end{array} \right\} & \textit{/array-definition)} \text{ DYNAMIC} \end{array} \right\} \left[ \left\{ \begin{array}{c} CONSTANT \\ INIT \end{array} \right\} array-init-definition \right] \\ (array-definition) \text{ HANDLE OF OBJECT} \end{array} \right]$$

### **Syntax Description**

Syntax Element	Description	
variable-name	Variable Name:	
	The name to be assigned to the variable. Rules for Natural variable names apply. With DEFINE DATA INDEPENDENT, the variable name must begin with a plus character (+).	
	For information on naming conventions for user-defined variables, see <i>Naming Conventions for User-Defined Variables</i> in <i>Using Natural</i> .	
format-length	Format/Length Definition:	
	For information on format/length definition of user-defined variables, see <i>Format and Length of User-Defined Variables</i> in the <i>Programming Guide</i> .	
HANDLE OF OBJECT	Handle of Object:	
	Used in conjunction with NaturalX. A handle identifies a dialog element in code and is stored in handle variables.	

Syntax Element	Description
	For further information, see <i>NaturalX</i> in the <i>Programming Guide</i> .
A, U or B	Data Type:
	Alphanumeric (A), Unicode (U) or binary (B) for dynamic variables.
array-definition	Array Dimension Definition:
	With an array-definition you define the lower and upper bounds of dimensions in an array-definition.
	For further information, see <i>Array Dimension Definition</i> .
DYNAMIC	DYNAMIC Option:
	A field may be defined as DYNAMIC.
	For more information on processing dynamic variables, see <i>Introduction to Dynamic Variables and Fields</i> .
CONSTANT	CONSTANT Option:
	The variable/array is to be treated as a named constant. The constant value(s) assigned will be used each time the variable/array is referenced. The value(s) assigned cannot be modified during program execution.
	See also Field Definitions, User-Defined Constants, Defining Named Constants in the Programming Guide.
	Note:
	1. For reasons of internal handling, it is not allowed to mix variable definitions and constant definitions within one group definition; that is, a group may contain either variables only or constants only.
	2. The CONSTANT clause must not be used with DEFINE DATA INDEPENDENT and DEFINE DATA CONTEXT. The CONSTANT option cannot be used with X-arrays.
	3. The CONSTANT option must not be used with DEFINE DATA INDEPENDENT and DEFINE DATA CONTEXT.
INIT	INIT Option:
	The variable/array is to be assigned an initial value. This value will also be used when this variable/array is referenced in a RESET_INITIAL statement.
	If no INIT specification is supplied, a field will be initialized with a default initial value depending on its format (see table <i>Default Initial Values</i> below).
	For further information, see <i>Field Definitions, Initial Values</i> in the <i>Programming Guide</i> .

Syntax Element	Description	
	With DEFINE DATA INDEPENDENT and DEFINE DATA CONTEXT, the INIT	
	clause is evaluated in each executed Natural object that contains this clause	
	(not only in the Natural object that allocates the variable). This is different	
	the way the INI⊤ works for global variables.	
	The INIT option cannot be used with X-arrays.	
init-definition	Initial-Value Definition:	
	With the <i>init-definition</i> option, you define the initial/constant values for	
	a variable. See <i>Initial-Value Definition</i> .	
array-init-definition Initial/Constant Values for an Array:		
	The array is to be assigned an initial value. This value will also be used when	
	this array is referenced in a RESET INITIAL statement.	
	With an array-init-definition, you define the initial/constant values for	
	an array.	
	For further information, see <i>Initial/Constant Values for an Array</i> .	
emhdpm	EM, HD, PM Parameters for Field/Variable:	
	With this option, additional parameters to be in effect for a field/variable may	
	be defined.	
	For further information, see <i>EM</i> , <i>HD</i> , <i>PM Parameters for Field/Variable</i> .	

### **Default Initial Values**

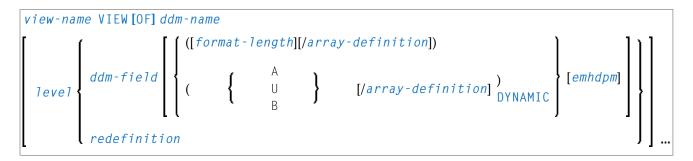
The following table shows the default initial values that are provided with the various formats:

Format	Default Initial Value
B, F, I, N, P	0
A, U	(blank)
L	FALSE
D	D' '
Т	T'00:00:00'
С	(AD=D)
Object Handle	NULL-HANDLE

Fields declared as DYNAMIC do not have any initial value because their field length is zero by default.

# 47 View Definition

	O 1 D 1 II	0.47
	Syntay Description	3/11
_	Office Description	 . UT



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The *view-definition* option is used to define a data view as derived from a data definition module (DDM).



**Note:** In a parameter data area, *view-definition* is not permitted.

For further information, see *Accessing Data in an Adabas Database* in the *Programming Guide* and particularly the following topics:

- Data Definition Modules DDMs
- *Database Arrays*
- Defining a Database View

## **Syntax Description**

Syntax Element	Description
view-name	View Name:
	The name to be assigned to the view.
	Rules for Natural variable names apply; see <i>Naming Conventions for User-Defined Variables</i> in <i>Using Natural</i> .
VIEW [OF]	DDM Name:
ddm-name	The name of the data definition module (DDM) from which the view is to be taken.
1eve1	Level Number:
	Level number is a 1- or 2-digit number in the range from 01 to 99 (the leading zero is optional) used in conjunction with field grouping. Fields assigned a level number of 02 or greater are considered to be a part of the immediately preceding group which has been assigned a lower level number.
	The definition of a group enables reference to a series of fields (may also be only one field) by using the group name. With certain statements (CALL, CALLNAT, RESET,

Syntax Element	Description
	WRITE, etc.), you may specify the group name as a shortcut to reference the fields contained in the group.
	A group may consist of other groups. When assigning the level numbers for a group, no level numbers may be skipped.
ddm-field	DDM Field Name:
	The name of a field to be taken from the DDM.
	When you define a view for a HISTOGRAM statement, the view must contain only the descriptor for which HISTOGRAM is to be executed.
redefinition	Redefinition:
	A redefinition may be used to redefine a group, a view, a DDM field or a single field/variable (that is a scalar or an array).
	For further information, see <i>Redefinition</i> .
format-length	Format/Length Definition:
	Format and length of the field. If omitted, these are taken from the DDM.
	In structured mode, the definition of format and length (if supplied) must be the same as those in the DDM.
	In reporting mode, the definition of format and length (if supplied) must be type-compatible with those in the DDM.
A, U or B	Data Type:
	Alphanumeric (A), Unicode (U) or binary (B) for dynamic variables.
	Note:
	1. For Adabas on mainframe computers, format U is available for LA fields (length <= 16381 bytes), but not for LB fields (length: <= 1 GB).
	2. Format B is not available with Adabas.
array-definition	Array Definition:
	Depending on the programming mode used, arrays (periodic-group fields, multiple-value fields) may have to contain information about their occurrences.
	For further information, see <i>Array Definition in a View</i> below.
emhdpm	EM, HD, PM Parameters for Field/Variable:
	With this option, additional parameters to be in effect for a field/variable may be defined. See <i>EM</i> , <i>HD</i> , <i>PM Parameters for Field/Variable</i> .
DYNAMIC	DYNAMIC Option:

Syntax Element	Description
	Defines a view field as DYNAMIC.
	For further information on processing dynamic variables, see <i>Introduction to Dynamic Variables and Fields</i> in the <i>Programming Guide</i> .

#### Array Definition in a View

Depending on the programming mode used, arrays (periodic-group fields, multiple-value fields) may have to contain information about their occurrences.

#### **Structured Mode**

If a field is used in a view that represents an array, the following applies:

- An index value must be specified for MU/PE fields
- When no format/length specification is supplied, the values are taken from the DDM.
- When a format/length specification is supplied, it must be the same as in the DDM.

#### **Database-Specific Considerations in Structured Mode:**

Adabas:	If MU/PE fields (defined in a DDM) are to be used inside a view, these fields must include an
	array index specification. For an MU field or ordinary PE field, you specify a one-dimensional
	index range, e.g. (1:10). For an MU field inside a PE group, you specify a two-dimensional
	index range, e.g. (1:10,1:5).

#### **Examples of Structured Mode:**

```
DEFINE DATA LOCAL
1 EMP1 VIEW OF EMPLOYEES
  2 NAME(A20)
  2 ADDRESS-LINE(A20 / 1:2)
1 EMP2 VIEW OF EMPLOYEES
  2 NAME
  2 ADDRESS-LINE(1:2)
1 EMP3 VIEW OF EMPLOYEES
  2 NAME
  2 ADDRESS-LINE(2)
1 #K (I4)
1 EMP4 VIEW OF EMPLOYEES
  2 NAME
  2 ADDRESS-LINE(#K:#K+1)
END-DEFINE
END
```

#### **Reporting Mode**

In this mode, the same rules are valid as for structured mode, however, there are two exceptions:

- An index value needs not be supplied. In this case, the index range for the missing dimensions is set to (1:1).
- The format/length specification may differ from the specification in the DDM. Then the definition of format and length must be type-compatible with those in the DDM.

#### **Examples:**

```
DEFINE DATA LOCAL
1 EMP1 VIEW OF EMPLOYEES
 2 NAME(A30)
 2 ADDRESS-LINE(A35 / 5:10)
1 EMP2 VIEW OF EMPLOYEES
 2 NAME
 2 ADDRESS-LINE(A40)
                           /* ADDRESS LINE (1:1) IS ASSUMED
1 EMP3 VIEW OF EMPLOYEES
 2 NAME
 2 ADDRESS-LINE
                            /* ADDRESS LINE (1:1) IS ASSUMED
1 #K (I4)
1 EMP4 VIEW OF EMPLOYEES
 2 NAME
 2 ADDRESS-LINE(#K:#K+1)
END-DEFINE
END
```

## 48 Redefinition

Restrictions	. 34	46
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```
 \left\{ \begin{array}{l} \textit{REDEFINE field-name} \; \left\{ \begin{array}{l} \textit{level} \; \left\{ \begin{array}{l} \textit{rgroup} \, [(\textit{array-definition})] \\ \textit{rfield} \, (\textit{format-length} \, [/\textit{array-definition}]) \end{array} \right\} \right\} \\ \textit{FILLER nX} \end{array} \right. ...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The redefinition option is used to redefine a group, a view, a DDM field or a single field/variable (that is a scalar or an array).

See also Redefining Fields in the Programming Guide.

### Restrictions

- A redefinition of a view or a DDM field is not applicable to a parameter-data-definition.
- Handles, X-arrays and dynamic variables cannot be redefined and cannot be contained in a redefinition clause.
- A group that contains a handle, X-array or a dynamic variable can only be redefined up to but not including or beyond the element in question.

## **Syntax Description**

Syntax Element	Description					
field-name	Name of Field to be Redefined:					
	The name of the group, view, DDM field or single field that is being redefined.					
level	Level Number of Field being Redefined:					
	Level number is a 1- or 2-digit number in the range from 01 to 99 (the leading zero is optional) used in conjunction with field grouping. Fields assigned a level number of 02 or greater are considered to be a part of the immediately preceding group, which has been assigned a lower level number.					
rgroup	Name of Resulting Group:					
	The name of the group resulting from the redefinition.					
	Note: In a redefinition within a view-definition, the name of rgroup					
	be different from any field name in the underlying DDM.					
rfield	Name of Resulting Field:					
	The name of the field resulting from the redefinition.					

Syntax Element	Description					
	<b>Note:</b> In a redefinition within a view-definition, the name of rfield must					
	be different from any field name in the underlying DDM.					
format-length	Format/Length of Resulting Field:					
	The format and length of the resulting field (rfield).					
array-definition	Array Dimension Definition:					
	With an array-definition, you define the lower and upper bounds of dimensions in an array-definition.					
	For further information, see <i>Array Dimension Definition</i> .					
FILLER nX	Filler Byte Definition:					
	With this notation, you define $n$ filler bytes - that is, segments which are not to be used - in the field that is being redefined.					
	The definition of trailing filler bytes is optional.					

### **Examples of REDEFINE Usage**

#### Example 1:

```
DEFINE DATA LOCAL

01 #VAR1 (A15)

01 #VAR2

02 #VAR2A (N4.1) INIT <0>
02 #VAR2B (P6.2) INIT <0>
01 REDEFINE #VAR2

02 #VAR2RD (A10)

END-DEFINE

...
```

### Example 2:

```
DEFINE DATA LOCAL

01 MYVIEW VIEW OF STAFF

02 NAME

02 BIRTH

02 REDEFINE BIRTH

03 BIRTH-YEAR (N4)

03 BIRTH-MONTH (N2)

03 BIRTH-DAY (N2)

END-DEFINE

...
```

### Example 3:

```
DEFINE DATA LOCAL

1 #FIELD (A12)

1 REDEFINE #FIELD

2 #RFIELD1 (A2)

2 FILLER 2X

2 #RFIELD2 (A2)

2 FILLER 4X

2 #RFIELD3 (A2)

END-DEFINE
```

# 49 Array Dimension Definition

Cuntay Description	שכו
Syntax Description	 วอเ

```
{[bound:] bound},... 3
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The array-dimension-definition option is used to define the lower and upper bound of a dimension in an array definition.

You can define up to 3 dimensions for an array.

## **Syntax Description**

Syntax Elem	nent Description
bound	Lower/Upper Bound:
	A bound can be one of the following:
	a numeric integer constant;
	a previously defined named constant;
	■ (for database arrays) a previously defined user-defined variable; or
	an asterisk (*) defines an extensible bound, otherwise known as an X-array (eXtensible array).
	If only one bound is specified, the value represents the upper bound and the lower bound is assumed to be 1.

#### X-Arrays

If at least one bound in at least one dimension of an array is specified as extensible, that array is then called an X-array (eXtensible array). Only one bound (either upper or lower) may be extensible in any one dimension, but not both. Multi-dimensional arrays may have a mixture of constant and extensible bounds, for example: #a(1:100, 1:\*).

#### Example:

```
DEFINE DATA LOCAL

1 #ARRAY1(I4/1:10)

1 #ARRAY2(I4/10)

1 #X-ARRAY3(I4/1:*)

1 #X-ARRAY4(I4/*,1:5)

1 #X-ARRAY5(I4/*:10)

1 #X-ARRAY6(I4/1:10,100:*,*:1000)

END-DEFINE
```

In the following table you can see the bounds of the arrays in the above program more clearly.

	Dimension 1		Dimension 2		Dimension 3	
	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
#ARRAY1	1	10	-	-	-	-
#ARRAY2	1	10	-	-	-	-
#X-ARRAY3	1	eXtensible	-	-	-	-
#X-ARRAY4	1	eXtensible	1	5	-	-
#X-ARRAY5	eXtensible	10	-	-	-	-
#X-ARRAY6	1	10	100	eXtensible	eXtensible	1000

#### Examples of array definitions:

```
\#ARRAY2(I4/10) /* a one-dimensional array with 10 occurrences (1:10) \#X-ARRAY4(I4/*,1:5) /* a two-dimensional array \#X-ARRAY6(I4/1:10,100:*,*:1000) /* a three-dimensional array
```

#### Variable Arrays in a Parameter Data Area

In a parameter data area, you may specify an array with a variable number of occurrences. This is done with the index notation 1: V.

```
Example 1: #ARR01 (A5/1:V)

Example 2: #ARR02 (I2/1:V,1:V)
```

A parameter array which contains a variable index notation 1: V can only be redefined in the length of

■ its elementary field length, if the 1: V index is right-most; for example:

```
#ARR(A6/1:V) can be redefined up to a length of 6 bytes
#ARR(A6/1:2,1:V) can be redefined up to a length of 6 bytes
#ARR(A6/1:2,1:3,1:V) can be redefined up to a length of 6 bytes
```

• the product of the right-most fixed occurrences and the elementary field length; for example:

```
\#ARR(A6/1:V,1:2) can be redefined up to a length of 2*6 = 12 bytes \#ARR(A6/1:V,1:3,1:2) can be redefined up to a length of 3*2*6 = 36 bytes \#ARR(A6/1:2,1:V,1:3) can be redefined up to a length of 3*6 = 18 bytes
```

A variable index notation 1: V cannot be used within a redefinition.

Example:

```
DEFINE DATA PARAMETER

1 #ARR(A6/1:V)

1 REDEFINE #ARR

2 #R-ARR(A1/1:V) /* (1:V) is not allowed in a REDEFINE block
END-DEFINE
```

As the number of occurrences is not known at compilation time, it must not be referenced with the index notation (\*) in the statements INPUT, WRITE, READ WORK FILE, WRITE WORK FILE. Index notation (\*) may be applied either to all dimensions or to none.

Valid examples:

```
#ARRO1 (*)
#ARRO2 (*,*)
#ARRO1 (1)
#ARRO2 (5,#FIELDX)
#ARRO2 (1,1:3)
```

Invalid example:

```
#ARRAYY (1,*) /* not allowed
```

To avoid runtime errors, the maximum number of occurrences of such an array should be passed to the subprogram/subroutine/function via another parameter. Alternatively, you may use the system variable \*OCCURRENCE.



#### Notes:

- 1. If a parameter data area that contains an index 1: V is used as a local data area (that is, specified in a DEFINE DATA LOCAL statement), a variable named V must have been defined as CONSTANT.
- 2. In a dialog, an index 1: V cannot be used in conjunction with BY VALUE.

## 50 Initial-Value Definition

Restriction	3	54
Syntax Description	3	54

```
 \left\{ \begin{array}{l} \left\{ \begin{array}{l} \text{FULL LENGTH} \\ \text{LENGTH } n \end{array} \right\} < character-string > \\ < \left\{ \begin{array}{l} constant \\ system-variable \end{array} \right\} > \end{array} \right.
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The *init-definition* option is used to define the initial/constant values for a variable.



**Note:** If, in the *variable-definition* option, the keyword INIT was used for the initialization, the value may be modified by any statement that affects the content of a variable. If the keyword CONST was used for the initialization, any attempt to change the value will be rejected by the compiler.

See also Field Definitions, Initial Values in the Programming Guide.

### Restriction

For a redefined field, an *init-definition* is not permitted.

## **Syntax Description**

Syntax Element	Description
<constant></constant>	Constant Value Option:
	The constant value with which the variable is to be initialized; or the constant value to be assigned to the field.
	For further information, see <i>User-Defined Constants</i> in the <i>Programming Guide</i> .
<system-variable></system-variable>	System Variable Option:
	The initial value for a variable may also be the value of a Natural system variable, for example:
	DEFINE DATA LOCAL  1 #MYDATE (D) INIT <*DATX> END-DEFINE
	<b>Note:</b> When the variable is referenced in a RESET_INITIAL statement, the system variable is evaluated again; that is, it will be reset not to the value it contained when program execution started but to the value it contains when the RESET_INITIAL statement is executed.

Syntax Element	Description					
FULL LENGTH <character-string></character-string>	Character String Option for Alphanumeric/Unicode Variables:					
LENGTH n <character-string></character-string>	For a variable of the Natural data format A or U, a <code>character-string</code> (for example, 'ABC') can be used as an initial value which fills all or part of the variable field.					
	A character-string is a constant of the Natural data format A or U as described in Alphanumeric Constants and Unicode Constants in the Programming Guide.					
	FULL LENGTH Option:					
	With the FULL LENGTH option, a particular <i>character-string</i> is repeatedly moved to the specified field until the field is completely filled. In the following example, the entire field is filled with asterisks:					
	DEFINE DATA LOCAL 1 #FIELD (A25) INIT FULL LENGTH <'*'> END-DEFINE					
	LENGTH Option:					
	With the LENGTH <i>n</i> option, a particular <i>character-string</i> is repeatedly moved to the specified field until the first <i>n</i> positions of the field are filled. <i>n</i> must be a numeric constant. In the following example, the first four positions of the field are filled with exclamation marks:					
	DEFINE DATA LOCAL 1 #FIELD (A25) INIT LENGTH 4 <'!!'> END-DEFINE					

# 51 Initial/Constant Values for an Array

Restriction	3	58
Syntax Description		59

#### For selected occurrences:

```
 \left\{ \left[ \left( \left\{ \begin{array}{c} index[:index] \\ V \end{array} \right\} \right] \right\} \left\{ \left\{ \begin{array}{c} FULL \ LENGTH \\ LENGTH \ n \end{array} \right\} \left\langle character\_string, \dots \right\rangle \\ \left\langle \left[ \begin{array}{c} constant \\ system\_variable \end{array} \right], \dots \right\rangle \\ \dots \right\} \right\} \dots
```

#### For all occurrences:

```
 \left\{ \begin{array}{l} \left\{ \begin{array}{l} \mathsf{FULL} \ \mathsf{LENGTH} \\ \mathsf{LENGTH} \ n \end{array} \right\} < character-string > \\ \left\{ \left\{ \begin{array}{l} \mathit{constant} \\ \mathit{system-variable} \end{array} \right\} > \end{array} \right.
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The array-init-definition option is used to define the initial/constant values for an array.



**Note:** If, in the *variable-definition* option, the keyword INIT was used for the initialization, the value may be modified by any statement that affects the content of a variable. If the keyword CONST was used for the initialization, any attempt to change the value will be rejected by the compiler.

See also Field Definitions in the Programming Guide, particularly the following sections:

- Initial Values
- User-Defined Constants

### Restriction

For a redefined field, an *array-init-definition* is not permitted.

## **Syntax Description**

Syntax Element	Description					
ALL	ALL Option:					
	All occurrences of the array are initialized with the same value.					
	The ALL option cannot be combined with any other initialization definitions.					
index	Index Option:					
	The array occurrences specified by <i>index</i> are initialized.					
	If a single index or an index range is used, you can only specify a unique value (constant or system-variable) which is assigned to all occurrences.					
	Examples:					
	DEFINE DATA LOCAL 1 $\#FLD1$ (A4/1:4) INIT (1:3) <'A'> /* A fills occurrences $\leftrightarrow$ (1:3)					
	1 #FLD2 (A4/1:4) INIT (*) <'B'> /* B fills all occurrences 1 #FLD3 (A4/1:2,1:4) INIT (2,3) <'C'> /* C fills occurrence ↔ (2,3) END-DEFINE					
V	Index Notation V:					
	The special index notation $\forall$ is used to fill a consecutive sequence of array occurrences with individual values ( $constant$ or $system-variable$ ).					
	You can specify the $\forall$ notation for one dimension of an array only. The number of values provided must not exceed the number of occurrences of the specified dimension.					
	You can omit the $\forall$ notation for a one-dimensional array because the $\forall$ index is then used by default.					
	Example showing which values fill which occurrences when $\forall$ is used:					
	DEFINE DATA LOCAL 1 #FLD4 (A4/1:3) INIT (V) <'A','B'> /* A fills (1) B ↔ fills (2)					
	1 #FLD5 (A4/1:2,1:3) INIT (1,V) <'C','D'> /* C, D fill ↔ (1,1:2)					
	(2,V) <'F','G','H'> /* F, G, H fill $\leftrightarrow$ (2,1:3)					
	END-DEFINE					

Syntax Element	Description
constant	Constant Value Option:
	The constant (value) with which the array is to be initialized.
	Occurrences for which no values are specified, are initialized with a <b>default value</b> .
	In a list of consecutive occurrences, you can skip single occurrences by specifying commas (,) only. However, you must end the list with a particular value for the last occurrence.
	For further information, see <i>User-Defined Constants</i> in the <i>Programming Guide</i> .
	<b>Note:</b> Multiple constant values/system variables must be separated either by the input delimiter character (as specified with the session parameter ID) or by a comma. If numbers are provided in the value list and a comma is defined as the decimal character (with the session parameter DC), either separate the comma from the value with an extra blank character or use the input delimiter character.
	Example with ID=; and DC=, delimiter settings:
	DEFINE DATA LOCAL  1 #FLD1 (A4/1:3) INIT <'A',,'C'>  1 #NUM1 (N4,2/1:3) INIT <1 , 2 , 3>  1 #NUM2 (N4,2/1:3) INIT <1;2;3>  END-DEFINE
system-variable	System Variable Option:
	The initial value for an array can also be the value of a Natural system variable.
	See also the <i>Note</i> for <i>constant</i> .
FULL LENGTH	Character String Option for Alphanumeric/Unicode Variables:
<pre> &lt; character-string&gt;   LENGTH n   &lt; character-string&gt;</pre>	For a variable of the Natural data format A or U, a <i>character-string</i> (for example, 'ABC') can be used as an initial value which fills all or part of the variable field.
	A <i>character-string</i> is a constant of the Natural data format A or U as described in <i>Alphanumeric Constants</i> and <i>Unicode Constants</i> in the <i>Programming Guide</i> .
	FULL LENGTH Option:
	With the FULL LENGTH option, a particular <i>character-string</i> is repeatedly moved to the specified array occurrence until the occurrence is completely filled.
	LENGTH Option:
	With the LENGTH <i>n</i> option, a particular <i>character-string</i> is repeatedly moved to the specified array occurrence until the first <i>n</i> positions of the occurrence are filled.

Syntax Element	Description
	Example showing which values fill which occurrences:
	DEFINE DATA LOCAL
	1 $\#$ FLD1 (A6/1:3) INIT ALL FULL LENGTH <'X'> /* XXXXXXX in all $\leftrightarrow$
	OCC.
	1 $\#$ FLD2 (A6/1:3) INIT ALL LENGTH 5 <'NO'> /* NONON in all $\leftrightarrow$
	OCC.
	1 #FLD3 (A6/1:3) INIT (1:2) LENGTH 4 < 'AB'> /* ABAB in occ $\leftarrow$
	(1:2)
	1 #FLD4 (A6/1:3) INIT (V) FULL LENGTH <'X','Y'>/* XXXXXX in occ. $\leftarrow$
	(1),
	/* YYYYYY in occ. ↔
	(2)
	END-DEFINE
	Within one $array$ -init-definition, only FULL LENGTH or LENGTH $n$ can be specified; both notations must not be mixed.



**Note**: For further example definitions of assigning initial values to arrays, see *Example 2 - DEFINE DATA (Array Definition/Initialization)*.

## EM, HD, PM Parameters for Field/Variable

0 ( 5 ) (	,	00
Syntax Description		პხ <sup>2</sup>

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

The *emhdpm* option is used to define additional parameters to be in effect for a field/variable.



**Note:** If for a database field you specify neither an edit mask (EM= or EMU=) nor a header (HD=), the default edit mask and default header as defined in the data definition module (**DDM**) will be used. However, if you specify one of the two, the other's default from the DDM will *not* be used.

## **Syntax Description**

Syntax Element	Description					
EM=value	Edit Mask:					
	The EM parameter may be used to define an edit mask used when the field is displayed with an I/O statement.					
	For further information, see the session parameter EM in the Parameter Reference.					
EMU=value	Unicode Edit Mask:					
	The EMU parameter may be used to define a Unicode edit mask used when the field is displayed with an I/O statement.					
	For further information, see the session parameter EMU in the <i>Parameter Reference</i> .					
HD='text'	Header Definition:					
	The $\ensuremath{HD}$ parameter may be used to define the header to be used as the default header for the field.					
	For further information, see the session parameter HD in the <i>Parameter Reference</i> .					
PM=value	Print Mode:					
	The PM parameter may be used to set the print mode, which indicates how fields are to be output.					
	For further information, see the session parameter PM in the Parameter Reference.					

# **53** Examples of DEFINE DATA Statement Usage

■ Example 1 - DEFINE DATA LOCAL (Local Data Definition)	366
Example 2 - DEFINE DATA LOCAL (Array Definition/Initialization)	
Example 3 - DEFINE DATA (View Definition, Array Redefinition)	
Example 4 - DEFINE DATA (Global, Parameter and Local Data Areas)	
Example 5 - DEFINE DATA (Initialization)	
Example 6 - DEFINE DATA (Variable Array)	

The following topics are covered:

## **Example 1 - DEFINE DATA LOCAL (Local Data Definition)**

```
** Example 'DDAEX1': DEFINE DATA
***********************
DEFINE DATA LOCAL
1 #VAR1
        (A15)
1 #VAR2
 2 #VAR2A (N4.1) INIT <1111>
 2 #VAR2B (N6.2) INIT <222222>
1 REDEFINE #VAR2
 2 #VAR2C (A2)
 2 #VAR2D (A2)
 2 #VAR2E (A6)
END-DEFINE
WRITE NOTITLE '=' #VAR2A / '=' #VAR2B /
           '=' #VAR2C / '=' #VAR2D / '=' #VAR2E
END
```

#### **Output of Program DDAEX1:**

```
#VAR2A: 1111.0

#VAR2B: 222222.00

#VAR2C: 11

#VAR2D: 11

#VAR2E: 022222
```

## **Example 2 - DEFINE DATA LOCAL (Array Definition/Initialization)**

```
** EXAMPLE 'DDAEX2': DEFINE DATA (array definition/initialization)
*******************
DEFINE DATA LOCAL
1 #A01 (A5/1:4) INIT <'A','B',,'D'>
                     <'A','B'>
1 #A02 (A5/1:4) INIT (V)
                       <'D'>
                  (4)
1 #A03 (A5/1:4) INIT (*)
                      <'A'>
                       <'B'>
1 #A04 (A5/1:4) INIT (2)
                  (3)
                       <'C'>
1 #A05 (A5/1:4) INIT (2:3) <'X'>
                  (4)
                       <'D'>
1 #A06 (A5/1:4) INIT (*)
                       <'X'>
```

```
(3) <'C'>
**-----
1 #A10 (A5/1:4) INIT FULL LENGTH <'X'>
1 #A11 (A5/1:4) INIT FULL LENGTH <,'B',,'D'>
1 #A12 (A5/1:4) INIT (V) FULL LENGTH <'A', 'B'>
1 #A13 (A5/1:4) INIT (2) FULL LENGTH <'B'>
1 #A14 (A5/1:4) INIT (*) FULL LENGTH <'X'>
**-----
                   LENGTH 2
1 #A20 (A5/1:4) INIT
                                   <'A'>
1 #A21 (A5/1:4) INIT (2) LENGTH 2
                                    <'B'>
                    (3) LENGTH 3
                                    <'C'>
1 #A22 (A5/1:4) INIT (3:4) LENGTH 2
                                    <'X'>
1 #A23 (A5/1:4) INIT (V) LENGTH 2 <,'B',,'D'>
**-----
                         <'Z'>
1 #A30 (A5/1:4) INIT ALL
1 #A31 (A5/1:4) INIT ALL FULL LENGTH <'Z'>
1 #A32 (A5/1:4) INIT ALL LENGTH 2 <'Z'>
**_____
1 #B01 (A5/1:2,1:4) INIT (2,V) <'A','B',,'D'>
1 #B02 (A5/1:2,1:4) INIT (1,*) <'X'>
                       (1,2) \langle B' \rangle
                       (2,3) < F'>
1 #B03 (A5/1:2,1:4) INIT (1,1:2) <'X'>
                       (1,4) <'Y'>
1 #B04 (A5/1:2,1:4) INIT (V,1) <'A1','A2'>
1 #B05 (A5/1:2,1:4) INIT (V,*) <'X','Y'>
**----
1 #B10 (A5/1:2,1:4) INIT ALL <'Z'>
1 #B11 (A5/1:2,1:4) INIT (1,*) FULL LENGTH <'Z'>
1 #B12 (A5/1:2,1:4) INIT (*,*) FULL LENGTH <'Z'>
1 #B13 (A5/1:2,1:4) INIT (1,*) LENGTH 2 <'Z'>
1 #B14 (A5/1:2,1:4) INIT (1,V) FULL LENGTH <'A',,'C'>
                       (2,V) FULL LENGTH <'E','F'>
1 #B15 (A5/1:2,1:4) INIT (1,*) FULL LENGTH <'X'>
                       (2,*) FULL LENGTH <'Y'>
                       (2,4) FULL LENGTH \langle 'Z' \rangle
END-DEFINE
**----
WRITE 7X '(1) (2) (3) (4)'
WRITE (AD=V) '=' #A01(*)
WRITE (AD=V) '=' #A02(*)
WRITE (AD=V) '=' #A03(*)
WRITE (AD=V) '=' \#A04(*)
WRITE (AD=V) '=' #A05(*)
WRITE (AD=V) '=' #A06(*)
SKIP 1
WRITE (AD=V) '=' #A10(*)
WRITE (AD=V) '=' #A11(*)
WRITE (AD=V) '=' #A12(*)
WRITE (AD=V) '=' #A13(*)
WRITE (AD=V) '=' \#A14(*)
```

```
SKIP 1
WRITE (AD=V) '=' #A20(*)
WRITE (AD=V) '=' #A21(*)
WRITE (AD=V) '=' \#A22(*)
WRITE (AD=V) '=' #A23(*)
SKIP 1
WRITE (AD=V) '=' #A30(*)
WRITE (AD=V) '=' #A31(*)
WRITE (AD=V) '=' #A32(*)
SKIP 1
**=====
WRITE 6X '(1,1) (1,2) (1,3) (1,4) (2,1) (2,2) (2,3) (2,4)'
WRITE (AD=V) '=' #B01(1,*) 2X #B01(2,*)
WRITE (AD=V) '=' #B02(1,*) 2X #B02(2,*)
WRITE (AD=V) '=' \#B03(1,*) 2X \#B03(2,*)
WRITE (AD=V) '=' #B04(1,*) 2X #B04(2,*)
WRITE (AD=V) '=' #B05(1,*) 2X #B05(2,*)
SKIP 1
WRITE (AD=V) '=' #B10(1,*) 2X #B10(2,*)
WRITE (AD=V) '=' #B11(1,*) 2X #B11(2,*)
WRITE (AD=V) '=' #B12(1,*) 2X #B12(2,*)
WRITE (AD=V) '=' #B13(1,*) 2X #B13(2,*)
WRITE (AD=V) '=' #B14(1,*) 2X #B14(2,*)
WRITE (AD=V) '=' #B15(1,*) 2X #B15(2,*)
END
```

## Output of Program DDAEX2:

Page	1							
	(1)	(2)	(3)	(4)				
#A01:	A	В		D				
#A02:	A	В		D				
#A03:	A	A	A	A				
#A04:		В	С					
#A05:		Х	X	D				
<b>#</b> A06:	X	X	С	X				
	XXXXX							
#A10:	AAAAA							
#A11:		BBBBB		DDDDD				
#A12:	AAAAA	BBBBB						
#A13:	3232323232	BBBBB						
#A14:	AAAAA	XXXXX	XXXXX	XXXXX				
#A20:	AA							
#A21:		BB	ccc					
#A22:		22	XX	XX				
#A23:		BB	m	DD				
# <b>H</b> 25.		DD		DD				
#A30:	Z	Z	Z	Z				
#A31:	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ				
#A32:	ZZ	ZZ	ZZ	ZZ				
	(1,1)	(1,2)	(1,3)	(1,4)	(2,1)	(2,2)	(2,3)	(2,4)
#B01:					A	В		D
#B02:	X	В	X	X			F	
#B03:	X	X		Y				
#B04:	A1				A2			
#B05:	X	X	X	X	Y	Y	Y	Y
#B10:	Z	Z	Z	Z	Z	Z	Z	Z
#B11:	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ				
#B12:	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ	ZZZZZ
#B13:	ZZ	ZZ	ZZ	ZZ				
#B14:	AAAAA		ccccc		EEEEE	FFFFF		
#B15:	XXXXX	XXXXX	XXXXX	XXXXX	YYYYY	үүүүү	YYYYY	ZZZZZ

## **Example 3 - DEFINE DATA (View Definition, Array Redefinition)**

```
** Example 'DDAEX3': DEFINE DATA (view definition, array redefinition)
*************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 NAME
  2 ADDRESS-LINE (A20/2)
  2 PHONE
1 #ARRAY
          (A75/1:4)
1 REDEFINE #ARRAY
  2 #ALINE (A25/1:4,1:3)
1 #X
          (N2) INIT <1>
1 #Y
           (N2) INIT <1>
END-DEFINE
FORMAT PS=20
LIMIT 5
FIND EMPLOY-VIEW WITH NAME = 'SMITH'
  MOVE NAME
                     TO #ALINE (#X,#Y)
  MOVE ADDRESS-LINE(1) TO #ALINE (#X+1, #Y)
  MOVE ADDRESS-LINE(2) TO \#ALINE (\#X+2,\#Y)
  MOVE PHONE
                     TO #ALINE (#X+3,#Y)
  IF \#Y = 3
   RESET INITIAL #Y
   PERFORM PRINT
  ELSE
   ADD 1 TO #Y
  END-IF
  AT END OF DATA
   PERFORM PRINT
  END-ENDDATA
END-FIND
DEFINE SUBROUTINE PRINT
  WRITE NOTITLE (AD=OI) #ARRAY(*)
  RESET #ARRAY(*)
  SKIP 1
END-SUBROUTINE
END
```

#### **Output of Program DDAEX3:**

SMITH ENGLANDSVEJ 222 554349	SMITH 3152 SHETLAND ROAD MILWAUKEE 877-4563	SMITH 14100 ESWORTHY RD. MONTERREY 994-2260
SMITH 5 HAWTHORN OAK BROOK 150-9351	SMITH 13002 NEW ARDEN COUR SILVER SPRING 639-8963	

## **Example 4 - DEFINE DATA (Global, Parameter and Local Data Areas)**

```
** Example 'DDAEX4': DEFINE DATA (global and local data area definition)

********************

DEFINE DATA
GLOBAL

USING DDAEX4G

LOCAL

1 #FIELD1 (A10)

1 #FIELD2 (N5)

END-DEFINE

*

MOVE 'HELLO' TO #FIELD1

MOVE 123 TO #FIELD2

*

CALLNAT 'DDAEX4N' #FIELD1 #FIELD2

*

END
```

#### Global Data Area DDAEX4G Used by Program DDAEX4:

```
1 GLOBAL-FIELD A 10
```

#### Subprogram DDAEX4N Called by Program DDAEX4:

```
** Example 'DDAEX4N': DEFINE DATA PARAMETER (called by DDAEX4)

*****************

DEFINE DATA

PARAMETER

1 #FIELDA (A10)

1 #FIELDB (N5)

END-DEFINE

*

WRITE '=' #FIELDA '=' #FIELDB

END
```

#### **Output of Program DDAEX4:**

```
Page 1 05-01-12 08:55:53 #FIELDA: HELLO #FIELDB: 123
```

### **Example 5 - DEFINE DATA (Initialization)**

```
** Example 'DDAEX5': DEFINE DATA (initialization)

***********************

DEFINE DATA LOCAL

1 #START-DATE (D) INIT <*DATX>

1 #UNDERLINE (A50) INIT FULL LENGTH <'_'>

1 #SCALE (A65) INIT LENGTH 65 <'....+..../'>
END-DEFINE

*

WRITE NOTITLE #START-DATE (DF=L)

/ #UNDERLINE
/ #SCALE

END
```

#### **Output of Program DDAEX5:**

```
2005-01-12
```

## **Example 6 - DEFINE DATA (Variable Array)**

```
** Example 'DDAEX6': DEFINE DATA (variable array with (1:V))

******************

DEFINE DATA LOCAL

1 #ARRAY (A1/1:10)

1 #MAX-ARR (P3)

END-DEFINE

*

#ARRAY (1) := 'R'

#ARRAY (2) := 'E'

#ARRAY (3) := 'D'

#MAX-ARR := 4

*

WRITE #ARRAY(*)

*

CALLNAT 'DDAEX6N' #ARRAY(1:4) #MAX-ARR

*
```

```
WRITE #ARRAY(*)

*

#MAX-ARR := 5

*

CALLNAT 'DDAEX6N' #ARRAY(1:5) #MAX-ARR

*

WRITE #ARRAY(*)

*

END
```

#### Subprogram DDAEX6N Called by Program DDAEX6:

```
** Example 'DDAEX6N': DEFINE DATA (variable array with (1:V))
*************************
DEFINE DATA
PARAMETER
1 #STRING (A1/1:V)
1 #MAX
        (P3)
END-DEFINE
IF \#MAX = 4
 MOVE 'B' TO #STRING (1)
 MOVE 'L' TO #STRING (2)
 MOVE 'U' TO #STRING (3)
 MOVE 'E' TO #STRING (4)
END-IF
IF \#MAX = 5
 MOVE 'W' TO #STRING (1)
 MOVE 'H' TO #STRING (2)
 MOVE 'I' TO #STRING (3)
 MOVE 'T' TO #STRING (4)
 MOVE 'E' TO #STRING (5)
END-IF
END
```

#### **Output of Program DDAEX4:**

```
Page 1 05-01-12 09:06:43

R E D
B L U E
W H I T E
```

# VII

■ 54 DEFINE FUNCTION	377
■ 55 DEFINE PRINTER	
■ 56 DEFINE PROTOTYPE	
■ 57 DEFINE SUBROUTINE	
58 DEFINE WINDOW	
■ 59 DEFINE WORK FILE	427

# 54 DEFINE FUNCTION

Function	378
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```
DEFINE FUNCTION function-name
[return-data-definition]
[function-data-definition]
statement...
END-FUNCTION
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statement: DEFINE PROTOTYPE

# **Function**

The DEFINE FUNCTION statement is used to define a function which is stored as a Natural object of the type function. A function object may contain only one DEFINE FUNCTION statement.

The DEFINE FUNCTION statement defines the function name, the parameters, the local and application-independent variables, the function result and the statements forming the operation logic. These statements are executed when the function is called.

For further information, see the following sections in the *Programming Guide*:

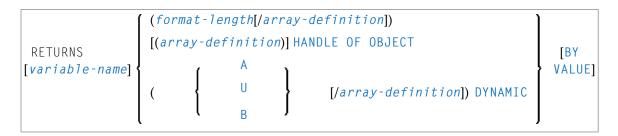
- Natural object type Function
- Function Call

# **Syntax Description**

Syntax Element	Description
function-name	Function Name:
	function-name is the name of the function to be called. It must comply with the naming conventions for user-defined variables described in the Using Natural documentation.
	function-name is not necessarily the same as the name of the stored object that contains the function definition.
	You may not use the same function name twice in one library.
return-data-definition	Return Data Definition Clause:
	For details on this clause, see <i>Return Data Definition</i> .
function-data-definition	Function Data Definition Clause:

Syntax Element	Description
	For details on this clause, see Function Data Definition.
statement	Statement(s) to be Executed:
	Defines the operation section which is executed when the function is called. It forms the function logic.
END-FUNCTION	End of DEFINE FUNCTION Statement:
	The Natural reserved word END-FUNCTION must be used to terminate the DEFINE FUNCTION statement.

#### **Return Data Definition**



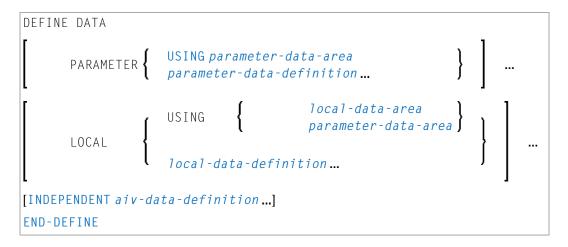
The return-data-definition clause defines the format/length and, if applicable, the array structure of the result value returned by the function.

# Syntax Element Description:

Syntax Element	Description
variable-name	Return Value Name:
	Optionally, you may specify a name which is used to access the return field within the function coding. If no such name is specified, the function name is used instead.
format-length	Format/Length Definition:
	The format and length of the result field.
	For information on format/length definition of user-defined variables, see <i>Format and Length of User-Defined Variables</i> in the <i>Programming Guide</i> .
array-definition	Array Dimension Definition:
	With array-definition, you define the lower and upper bounds of a dimension in an array-definition, if the function result is an array field.
	For further information, see DEFINE DATA statement, <i>Array Dimension Definition</i> .
HANDLE OF OBJECT	Handle of Object:
	Used in conjunction with NaturalX.

Syntax Element	Description
	For further information, see NaturalX in the Programming Guide.
A, U or B	Data Type:
	Alphanumeric (A), Unicode (U) or binary (B) for a dynamic result.
DYNAMIC	Dynamic Variable:
	The function result may be defined as DYNAMIC.
	For information on processing dynamic variables, see <i>Introduction to Dynamic Variables</i> and <i>Fields</i> in the <i>Programming Guide</i> .
BY VALUE	BY VALUE Option:
	If BY VALUE is specified, the format/length of the "sending" field (defined inside the <i>return-data-definition</i> clause) and the "receiving" field (which receives the result at the place where the function is called) must only be transfer compatible.
	The format/length of the "receiving" field is either
	defined via an explicit (IR=) clause in the function call; or
	defined with a DEFINE PROTOTYPE statement; or
	■ taken over from the RETURNS field of the function object, which must already exist.
	For data transfer compatibility the rules outlined in <i>Rules for Arithmetic Assignment</i> and <i>Data Transfer</i> in the <i>Programming Guide</i> apply.
	If BY VALUE is not specified, the format and length of the "receiving" field must exactly match the characteristics of the "sending" field.

#### **Function Data Definition**



The function-data-definition clause defines the parameters which are to be provided when the function is called, and the data fields used by the function, such as local and application-independent variables. A global data area (GDA) cannot be referenced inside the function definition.

# Syntax Element Description:

Syntax Element	Description
PARAMETER USING	PDA Name:
parameter-data-area	Specify the name of the parameter data area (PDA) that contains data elements which are used as parameters in a function call.
	See also <i>Defining Parameter Data</i> in the DEFINE DATA statement description.
PARAMETER	Parameter Data Definition:
parameter-data-definition	Instead of defining a parameter data area, parameter data can also be defined directly within a function call.
	See also <i>Parameter Data Definition</i> in the DEFINE DATA statement description.
LOCAL USING	LDA Name:
local-data-area	Specify the name of the local data area (LDA) to be referenced.
	See also <i>Defining Local Data</i> in the DEFINE DATA statement description.
LOCAL USING	PDA Name:
parameter-data-area	Specify the name of a parameter data area (PDA).
	<b>Note:</b> A data area referenced with DEFINE DATA LOCAL may also be a
	parameter data area (PDA). By using a PDA as an LDA you can avoid the extra effort of creating an LDA that has the same structure as the PDA.
	See also <i>Defining Local Data</i> in the DEFINE DATA statement description.
LOCAL	Local Data Definition:
local-data-definition	For information on how to define elements or fields within the statement itself, that is, without using an LDA or PDA, see the section <i>Local Data Definition</i> in the DEFINE DATA statement description.
INDEPENDENT	AIV Data Definition:
aiv-data-definition	Can be used to define a single or multiple application-independent variables (AIVs).
	See <i>Defining Application-Independent Variables</i> in the DEFINE DATA statement description.
END-DEFINE	End of Clause:
	The Natural reserved word END-DEFINE must be used to end the function-data-definition clause.
	1

# **Examples**

- Example 1 DEFINE FUNCTION
- Example 2 DEFINE FUNCTION with Result Value Array

## **Example 1 - DEFINE FUNCTION**

```
** Example 'DFUEX1': DEFINE FUNCTION

*********************

DEFINE FUNCTION F#FIRST-CHAR

RETURNS #RESULT (A1)

DEFINE DATA PARAMETER

1 #PARM (A10)

END-DEFINE

/*

#RESULT := #PARM /* First character as return value.

END-FUNCTION

*
END-FUNCTION
```

The function F#FIRST-CHAR is used in the example program DPTEX2 in library SYSEXSYN. See *Examples* in the DEFINE PROTOTYPE statement description.

## **Example 2 - DEFINE FUNCTION with Result Value Array**

```
** Example 'DFUEX2': DEFINE FUNCTION

*******************************

DEFINE FUNCTION F#FACTOR

RETURNS (I2/1:3)

DEFINE DATA PARAMETER

1 #VALUE (I2)

END-DEFINE

/*

F#FACTOR(1) := #VALUE * 1

F#FACTOR(2) := #VALUE * 2

F#FACTOR(3) := #VALUE * 3

/*

END-FUNCTION

*

END
```

The function F#FACTOR is used in the example program DPTEX1 in library SYSEXSYN. See *Examples* in the DEFINE PROTOTYPE statement description.

# 55 DEFINE PRINTER

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```
DEFINE PRINTER

([logical-printer-name=]n)

[OUTPUT operand1]

PROFILE operand2
CODEPAGE operand2
FORMS operand2
NAME operand2
DISP operand2
CLASS operand2
COPIES operand3
PRTY operand4

...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

# **Function**

The DEFINE PRINTER statement is used to assign a symbolic name to a report number and to control the allocation of a report to a logical destination. This provides you with additional flexibility when creating output for various logical print queues.

When this statement is executed and the specified printer is already open, the statement will implicitly cause that printer to be closed. To explicitly close a printer, however, you should use the CLOSE PRINTER statement.

For further information on the DEFINE PRINTER statement, see *Unicode and Code Page Support in the Natural Programming Language*, section *Statements*.

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure						P	os	sib	le	Fo	rm	at	S	Referencing Permitted	Dynamic Definition
operand1	C	S				A	U								yes	no
operand2	C	S				A	U								yes	no
operand3	C	S						N							yes	no
operand4	С	S						N	Р	I					yes	no

# Syntax Element Description:

Syntax Element	Description
(n)	Printer Number:
	All print files to be used during a session must be preassigned to an access method by means of subparameter AM (Type of Access Method) of profile parameter PRINT or automatically by definition in the JCL (with AM=STD only).
	The printer number $n$ may be a value in the range of 0 - 31. This is the number also to be used in a DISPLAY / WRITE or CLOSE PRINTER statement.
	Printer number 0 indicates the hardcopy printer. Some access methods do not support the hardcopy printer, for example, AM=PC.
logical-printer-	Name Logical Printer Name:
	Optionally you can assign a logical name <code>logical-printer-name</code> to printer <code>n</code> . This name can be used for the <code>rep</code> notation in a <code>DISPLAY</code> / <code>WRITE</code> statement.
	Naming conventions for <code>logical-printer-name</code> are the same as for user-defined variables. Multiple logical names may be assigned to the same printer number. Unlike the value of the <code>OUTPUT</code> operand (see below), <code>logical-printer-name</code> is evaluated at compile time and therefore independent of the program control flow.
OUTPUT operand1	Printer Name:
	As operand1 you can specify one of the following:
	the printer name within the online spooling system,
	the print file name to be assigned to the printer number,
	the name of an additional printer, or
	a remote JES printer.
	See also Printer Name for Additional Reports and Remote Destinations
	The 8-byte logical printer name can be defined initially by keyword subparameter DEST of profile parameter PRINT. Its default value depends on the access method type and may be overwritten by <code>operand1</code> .

Syntax Element	Description
	operand1 can be 1 to 253 characters long. If operand1 is a variable, its length must be at least 8 bytes. You can specify either a printer or a logical or physical data set name. The possible format depends on the operating system environment and the access method defined by keyword subparameter AM of profile parameter PRINT for this printer number.
	If the specified name is already defined for a different printer number and this printer is unused; that is, in closed state, the print output will be routed to this printer if keyword subparameter ROUTE=0N of profile parameter PRINT was specified for the specified printer number. If no printer name matches with <code>operand1</code> , the unused printer with the highest number is used and its name will be overwritten by <code>operand1</code> . Print routing is not visible to the user by means of the <code>SYSFILE</code> command.
	Information on operating-system- or TP-monitor-dependent printer naming conventions is included in the following sections:
	Printer Name under z/OS Batch, TSO and Server
	Printer Name under z/VSE Batch
	Printer Name under BS2000 Batch and TIAM
	Printer Name under CICS
	Printer Name under Com-plete
	■ Printer Name under Com-plete/SMARTS
	Printer Name under Natural Advanced Facilities
	Printer Name for Additional Reports and Remote Destinations
	With the following clauses, you can provide printing control information to be interpreted by the spooling system of the TP monitor or operating system respectively. You can specify one or more of these clauses, but each of them only once.
PROFILE operand2	Name of Printer Control Characters Table:
	With the PROFILE clause, you specify the name of a printer control characters table as <i>operand2</i> . The maximum length is 8 bytes.
	You define the printer control characters table by the profile parameter CCTAB (Printer Escape Sequence Definition).
	<b>Note:</b> With Natural Advanced Facilities, the printer control characters table can be maintained online as described in the <i>Natural Advanced Facilities</i> documentation.
CODEPAGE operand2	Name of Codepage:
	CODEPAGE denotes the name (format/length: A64) of a codepage as specified in the NATCONFG module.

Syntax Element	Description
	CODEPAGE is ignored if it does not apply to the respective OUTPUT destination.

## **Spooling System Parameters**

With the following clauses, you can provide values for parameters of the TP monitor's spooling system. The default value of these clauses can be set with the corresponding keyword subparameters of profile parameter PRINT. See *PRINT Keyword Subparameters for DEFINE PRINTER Statement* in the *Parameter Reference*.

When a printer is closed, all options are reset to their default values. If the definitions are not clear in a Natural environment, Software AG recommends to set them in each module using DEFINE PRINTER statement.

## Syntax Element Description:

Syntax Element	Description	
FORMS operand2	Form:	
	Maximum length of operand: 8 bytes.	
	The default value of this clause can be set with subparameter FORMS of profile parameter PRINT.	
NAME operand2	Listname:	
	Maximum length of operand: 8 bytes.	
	The default value of this clause can be set with subparameter NAME of profile parameter PRINT.	
DISP operand2	Disposition:	
	Maximum length of operand: 4 bytes.	
	For the DISP clause, the possible values for operand2 are DEL, HOLD, KEEP and LEAV.	
	The default value of this clause can be set with keyword subparameter DISP of profile parameter PRINT. If the DISP clause is omitted (or incorrectly specified), DEL applies by default.	
CLASS operand2	Spool Class:	
	Maximum length of operand: 1 byte.	
	The default value of this clause can be set with keyword subparameter CLASS of profile parameter PRINT.	
COPIES operand3	Number of Copies:	
	operand3 must be an integer value.	

Syntax Element	Description	
	The default value of this clause can be set with keyword subparameter COPIES of profile parameter PRINT.	
PRTY operand4	Listing Priority:  Possible values: 1 - 255. operand4 must be an integer value.  The default value of this clause can be set with keyword subparameter PRTY of profile parameter PRINT.	

# Printer Name under z/OS Batch, TSO and Server

This section covers the following topics:

- Logical Data Set Names
- Physical Data Set Names
- HFS File
- JES Spool File Class
- NULLFILE
- Allocation and De-Allocation of Data Sets
- Print Files in Server Environments

For a printer number that is defined with access method AM=STD, you can use <code>operand1</code> to specify a logical or a physical data set name to be assigned to that printer number.

*operand1* can be 1 to 253 characters long and can be one of the following:

- a logical data set name (DD name, 1 to 8 characters);
- a physical data set name of a cataloged data set (1 to 44 characters), or a physical data set member name (1 to 44 characters for the data set name, plus 1 to 8 characters in parentheses for the member name);
- a path name and member name of an HFS file (1 to 253 characters) in an MVS UNIX Services environment;
- a JES spool file class;
- NULLFILE (to indicate a dummy data set).

#### **Logical Data Set Names**

For example:

```
DEFINE PRINTER (21) OUTPUT 'SYSPRINT'
```

The specified data set with DD-name SYSPRINT must have been allocated before the DEFINE PRINTER statement is executed. For further information, see *Allocation and De-Allocation of Data Sets*.

The allocation can be done via JCL, CLIST (TSO) or dynamic allocation (SVC 99). For dynamic allocation you can use the application programming interface USR2021N in library SYSEXT.

The data set name specified in the DEFINE PRINTER statement overrides the name specified with the keyword subparameter DEST of profile parameter PRINT.

Optionally, the data set name may be prefixed by DDN= to indicate that it is a DD-name and to avoid name conflicts with additional reports. For example:

```
DEFINE PRINTER (22) OUTPUT 'DDN=SOURCE'
```

#### **Physical Data Set Names**

For example:

```
DEFINE PRINTER (23) OUTPUT 'TEST.PRINT.FILE'
```

The specified data set must exist in cataloged form. When the DEFINE PRINTER statement is executed, the data set is allocated dynamically by SVC 99 with the current DD-name and JCL option DISP=SHR. For further information, see *Allocation and De-Allocation of Data Sets*.

If the data set name is 8 characters or shorter and does not contain a period (.), it might be misinterpreted as a DD-name. To avoid this, prefix the name with DSN=. For example:

```
DEFINE PRINTER (22) OUTPUT 'DSN=PRINTXYZ'
```

If the data set is a PDS member, you specify the PDS member name (1 to 8 characters) in parentheses after the data set name (1 to 44 characters). For example:

```
DEFINE PRINTER (4) OUTPUT 'TEST.PRINT.PDS(TEST1)'
```

If the specified member does not exist, a new member of that name will be created.

#### **HFS File**

For example:

```
DEFINE PRINTER (14) OUTPUT '/u/nat/rec/test.txt'
```

The specified path name must exist. When the DEFINE PRINTER statement is executed, the HFS file is allocated dynamically. If the specified member does not exist, a new member of that name will be created.

For the dynamic allocation of the data set, the following z/OS path options are used:

```
PATHOPTS=(OCREAT,OTRUNC,ORDWR)
PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP)
FILEDATA=TEXT
```

When an HFS file is closed, it is automatically de-allocated by z/OS (regardless of the setting of keyword subparameter FREE of profile parameter PRINT).

#### JES Spool File Class

To create a JES spool data set, you specify SYSOUT=x (where x is the desired spool file class). For the default spool file class, you specify SYSOUT=x.

**Examples:** 

```
DEFINE PRINTER (10) OUTPUT 'SYSOUT=A'
DEFINE PRINTER (12) OUTPUT 'SYSOUT=*'
```

To specify additional parameters for the dynamic allocation, use application programming interface USR2021N in library SYSEXT instead of the DEFINE PRINTER statement.

#### **NULLFILE**

To allocate a dummy data set, you specify NULLFILE as *operand1*:

```
DEFINE PRINTER (n) OUTPUT 'NULLFILE
```

This corresponds to the JCL definition:

## // DD-name DD DUMMY

#### Allocation and De-Allocation of Data Sets

When the DEFINE PRINTER statement is executed and a physical data set name, HFS file, spool file class or dummy data set has been specified, the corresponding data set is allocated dynamically. If the logical print file is already open, it will be closed automatically, except when the keyword subparameter CLOSE=FIN (Time of Closure) of profile parameter PRINT has been specified, in which case an error will be issued. Moreover, an existing data set allocated with the same current DD-name is automatically de-allocated before the new data set is allocated.

To avoid unnecessary overhead by unsuccessful premature opening of print files not yet allocated at the start of the program, print files should be defined with keyword subparameter OPEN=ACC (open at first access) of profile parameter PRINT.

In the case of an HFS file, or a print file defined with the keyword subparameter FREE=0N of profile parameter PRINT, the print file is automatically de-allocated as soon as it has been closed.

As an alternative for the dynamic allocation and de-allocation of data sets, the application programming interface USR2021N in library SYSEXT is provided. This API also allows you to specify additional parameters for dynamic allocation.

#### **Print Files in Server Environments**

In server environments, errors may occur if multiple Natural sessions attempt to allocate or open a data set with the same DD-name. To avoid this, you either specify the print file with keyword subparameter DEST=\* of profile parameter PRINT, or you specify OUTPUT '\*' in the DEFINE PRINTER statement; Natural then generates a unique DD-name at the physical data set allocation when the first DEFINE PRINTER statement for that print file is executed.

All print files whose DD-names begin with CM are shared by all sessions in a server environment. A shared print file is opened by the first session, and is physically closed when the server is terminated. For further information, see the section *Natural as a Server* in the *Operations* documentation.

# Printer Name under z/VSE Batch

For a printer number that is defined with the access method AM=STD, operand1 can be:

- a logical data set name (DD-name, 1 to 7 characters);
- NULLFILE (to indicate a dummy data set).

## **Logical Data Set Names**

Example:

DEFINE PRINTER (2) OUTPUT 'SYSOUT1'

The specified data set SYSOUT1 must have been defined in the JCL or in the z/VSE standard or partition labels.

The data set name specified in the DEFINE PRINTER statement overrides the name specified with keyword subparameter DEST of the PRINT profile parameter.

Optionally, the data set name may be prefixed by DDN= to indicate that it is a DD-name. For example:

DEFINE PRINTER (5) OUTPUT 'DDN=MYPRINT'

#### **NULLFILE**

To allocate a dummy data set, you specify NULLFILE as *operand1*:

DEFINE PRINTER (n) OUTPUT 'NULLFILE

## Printer Name under BS2000 Batch and TIAM

For a printer number that is defined with the access method AM=STD, you can use *operand1* to specify a file name, link name or system file that is allocated to this printer number.

In this case, *operand1* can have a length of from 1 to 253 characters and one of the following meanings:

- Link Name
- File Name
- Generic File Name
- File Name and Link Name
- Generic File Name and Link Name
- System File SYSOUT
- System File SYSLST
- System File SYSLSTnn nn=01,...,99
- System File SYSLSTnn with Implicit Allocation

■ \*DUMMY

The following rules apply:

- 1. File name and link name can be specified as positional parameters or keyword parameters. The corresponding keywords are FILE= and LINK=. Mixing positional and keyword parameters is allowed but not recommended.
- 2. A string with a length of 1 to 8 characters without commas is interpreted as a link name. This notation is compatible with earlier versions of Natural. Example:

```
DEFINE PRINTER (1) OUTPUT 'P01'
```

The corresponding definition with a keyword subparameter is:

```
DEFINE PRINTER (1) OUTPUT 'LINK=P01'
```

3. A string of 9 to 54 characters without commas is interpreted as a file name. Example:

```
DEFINE PRINTER (2) OUTPUT 'NATURALvr.TEST.PRINTERO2'
```

where *vr* represents the relevant product version.

The corresponding definition with a keyword subparameter is:

```
DEFINE PRINTER (2) OUTPUT 'FILE=NATURALvr.TEST.PRINTER02
```

- 4. The following input is interpreted without considering the length and therefore forms exceptions to Rules 2 and 3:
  - keyword input: LINK=, FILE=
  - \*DUMMY
  - NULLFILE (equivalent to \*DUMMY)
  - +
  - **\***\*\*
  - SYSOUT
  - SYSLST or SYSLST(nn)

Example: DEFINE PRINTER (7) OUTPUT 'FILE=Y' is a valid file allocation and not a link name, although the string of characters contains fewer than 9 characters.

5. Generic file names are formed as follows:

Pnn.userid.tsn.date.time.number

#### where

nn	is a report number
userid	is a Natural user-ID, 8 characters
tsn	is the BS2000 TSN of the current task, 4 digits
date	is DDMMYYYY
time	is HHIISS
number	is a sequential number, 5 digits

6. Generic link names are formed as follows:

#### **NPF**nnnn

where *nnnnn* is a 5-digit number that is increased by one after every generation of a dynamic link name.

7. Changing the file allocation for a printer number causes an implicit CLOSE of the print file allocated so far.

You are strongly recommended, in all cases except when you only specify a link name (for example: P01), to work with keyword parameters. This avoids conflicts of names with additional reports and is essential for file names with fewer than 9 characters.

## Examples:

```
DEFINE PRINTER (1) OUTPUT 'LINK=SOURCE'
DEFINE PRINTER (1) OUTPUT 'FILE=SOURCE'
DEFINE PRINTER (1) OUTPUT 'SOURCE'
```

#### **Link Name**

#### Example:

```
DEFINE PRINTER (1) OUTPUT 'LINKPO1'
```

means the same as

#### DEFINE PRINTER (1) OUTPUT 'LINK=LINKPO1'

A file with the link LINKPO1 must exist at runtime. This can be created either by using JCL before starting Natural or by dynamic allocation from the current application. For dynamic allocation, the application programming interface USR2029 in the library can be used. If, before execution, the link was active as a destination to another file, for example PO1, this will be released or retained depending on the value of the keyword subparameter FREE of profile parameter PRINT (possible values are 0N and OFF). Release is done via an explicit RELEASE call to the BS2000 command processor.

#### **File Name**

Example:

```
DEFINE PRINTER (2) OUTPUT 'NATURAL vr. TEST. PRINTER 02'
```

where *vr* represents the relevant product version.

means the same as

```
DEFINE PRINTER (2) OUTPUT 'FILE=NATURAL vr. TEST. PRINTER02'
```

The file specified in *operand1* is set up using a FILE macro call and inherits the link name that was valid for the corresponding print file before execution of the DEFINE PRINTER statement.

#### **Generic File Name**

Example:

```
DEFINE PRINTER (21) OUTPUT '*'
```

means the same as

```
DEFINE PRINTER (21) OUTPUT 'FILE=*'
```

A file with a name created according to Rule 4 is set up using a FILE macro call and inherits the link name that was valid for the corresponding print file before execution of the DEFINE PRINTER statement.

```
DEFINE PRINTER (22) OUTPUT 'FILE=*, LINK=GENFLK22'
```

A file with a name created according to Rule 4 is set up with the specified link name using a FILE macro call.

#### File Name and Link Name

Example:

```
DEFINE PRINTER (11) OUTPUT 'NATURAL vr. TEST. PRINTER11, LNKP11'
```

where vr represents the relevant product version.

means the same as

```
DEFINE PRINTER (11) OUTPUT 'FILE=NATURAL vr. TEST. PRINTER 11, LINK=LNKP11'
```

which means the same as

```
DEFINE PRINTER (11) OUTPUT 'FILE=NATURALvr.TEST.PRINTER11,LNKP11'
```

The file specified in *operand1* is set up with the specified link name using a FILE macro call and allocated to the corresponding printer number.

#### **Generic File Name and Link Name**

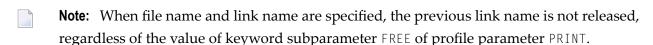
Example:

```
DEFINE PRINTER (27) OUTPUT '*,*'
```

means the same as

```
DEFINE PRINTER (27) OUTPUT 'FILE=*,LINK=*'
```

A file with a file name and link name created according to Rule 4 and Rule 5 is set up using a FILE macro call and allocated to the specified printer number (27).



#### System File SYSOUT

Example:

```
DEFINE PRINTER (14) OUTPUT 'SYSOUT'
```

Report 14 is written to SYSOUT.

Under TIAM: SYSOUT is by default output on the screen.

## System File SYSLST

Example:

DEFINE PRINTER (15) OUTPUT 'SYSLST'

Report 15 is written to the system file SYSLST.

System File SYSLSTnn - nn=01,...,99

Example:

DEFINE PRINTER (16) OUTPUT 'SYSLST16'

Report 16 is written to the system file SYSLST16.

### System File SYSLSTnn with Implicit Allocation

Examples:

DEFINE PRINTER (11) OUTPUT 'SYSLST=LST.PRINTER11'

The system file SYSLST is allocated to the file LST.PRINTER11; Report 11 is written to the system file SYSLST.

DEFINE PRINTER (13) OUTPUT 'SYSLST13=LST.PRINTER13'

The system file SYSLST13 is allocated to the file LST. PRINTER13; Report 13 is written to the system file SYSLST13.

DEFINE PRINTER (19) OUTPUT 'SYSLST19=\*'

The system file SYSLST19 is allocated to a file with a name generated according to Rule 4; Report 19 is written to the system file SYSLST19.

## **Printer Name under CICS**

For a printer number defined with the access method AM=CICS, *operand1* can be a transient data or temporary storage queue name (1 to 8 characters), depending on keyword subparameter TYPE of profile parameter PRINT for the printer. For TYPE=TD (transient data), only the first 4 characters of *operand1* are honored and the transient data destination must be predefined to CICS.

For further information, see also *Natural Print and Work Files under CICS* (in the *TP Monitor Interfaces* documentation).

# **Printer Name under Com-plete**

With AM=COMP, a valid printer number (TID) or a logical printer name can be assigned. For example:

```
DEFINE PRINTER (1) OUTPUT '11'
DEFINE PRINTER (2) OUTPUT 'P102'
```

# Printer Name under Com-plete/SMARTS

With AM=SMARTS, any printer name can be assigned. For example:

```
DEFINE PRINTER (14) OUTPUT '/nat/path/printer'
DEFINE PRINTER (14) OUTPUT '/nat/path/printer/file/'
DEFINE PRINTER (14) OUTPUT 'printer'
```

It depends on the MOUNT\_FS parameter of SMARTS whether the file is located on a SMARTS portable file system or on the native file system. The first element of the path (/nat/) determines the target file system.

If the string is terminated with a slash (/), the last element is taken as the name of the print file. Otherwise, the name of the file is generated from the UserID and a sequence number. If the string does not start with a slash, the path of the file is taken from the environment variable \$NAT\_PRINT\_ROOT.

The specified path name must exist. When the DEFINE PRINTER statement is executed, the file is allocated dynamically. If the specified member does not exist, a new member of that name will be created.

# **Printer Names under Natural Advanced Facilities**

For Natural Advanced Facilities users, the name of any predefined logical printer profile can be specified. This logical printer profile needs not belong to the currently active user profile. It may be any logical printer profile defined on the NATSPOOL file. It will be active only for the duration of the Natural program which contains the DEFINE PRINTER statement. For further information, see the *Natural Advanced Facilities* documentation.

# **Printer Name for Additional Reports and Remote Destinations**

Additional reports and remote print destinations can be assigned by default with the following names:

Report	Function
BROADCST	Output message line to a TP monitor terminal. Same function as MESSAGE (see below), except that under Com-plete, the message is not sent to the desired terminal until no transactions are active on that terminal.
CCONTROL	CCONTROL is the name of a special printer control table associated to the printer <i>n</i> -1; it must not be modified. For further information, refer to <i>Printer-Advance Control Characters</i> (in the <i>Operations</i> documentation).
CONNECT	Output into a Con-nect folder.
	Note for Natural installation: The NATPCNT module of Natural must be linked to the Natural nucleus.
DUMMY	Output to be deleted.
HARDCOPY	Output to the current hardcopy device.
INCORE	Output into the NSPF incore database.
INFOLINE	Output to the Natural infoline. For details on the infoline, see the Natural terminal command %X.
MESSAGE	Output message line to a TP monitor terminal. The first 8 bytes of a message must contain the target terminal ID. TSO require the user ID instead of the terminal ID. An example program MSGSW is supplied in the library SYSEXTP.
SOURCE	Output to the Natural source area.
WORKPOOL	Output into the Natural ISPF workpool.

## **Printing Data in a Remote JES Environment**

You can use the write-to-spool file feature (see the *Operations* documentation) to route data through a remote JES node and send it to a user or print it on a device defined in the remote JES environment.

# **Examples**

- Example 1 Printer Name Definition for Com-plete
- Example 2 Printer Name Definition for Batch Environment
- Example 3 Print Output to Infoline

Example 4 - Using a Session with Predefined Printer

### **Example 1 - Printer Name Definition for Com-plete**

```
/* PRINTER NAME DEFINITION FOR COM-PLETE

*
DEFINE PRINTER (1) OUTPUT 'TID100'
WRITE (1) 'PRINTED ON PRINTER TID100'
END
```

#### **Example 2 - Printer Name Definition for Batch Environment**

```
/* OUTPUT ON 'SYSPRINT' (FOR BATCH ENVIRONMENTS)

*
DEFINE PRINTER (REPORT1 = 1) OUTPUT 'SYSPRINT'
WRITE (REPORT1) 'REPORT 1 PRINTED ON PRINTER SYSPRINT'

*
/* OUTPUT TO DEFAULT PRINTER DESTINATION
/* DEFINED WITH PROFILE PARAMETER 'PRINT', SUBPARAMETER 'DEST'

*
DEFINE PRINTER (REPORT2 = 2)
WRITE (REPORT2) 'REPORT PRINTED TO DESTINATION'
```

## **Example 3 - Print Output to Infoline**

# **Output of Program DPIEX1:**

```
EXECUTING DPIEX1 BY HTR

Page 1 05-01-13 14:54:33

TEST OUTPUT
```

## **Example 4 - Using a Session with Predefined Printer**

# 56 DEFINE PROTOTYPE

Function	404
Syntax Description	405
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```
DEFINE PROTOTYPE [FOR] prototype-name

UNKNOWN
[return-data-definition]
[parameter-definition]
same-as-clause
USING FUNCTION[DEFINITION[OF]]
function-name

END-PROTOTYPE
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statement: DEFINE FUNCTION

# **Function**

The DEFINE PROTOTYPE statement is used to specify the properties for calling a function including the following:

- the parameters to be passed in the function call,
- the result value to be returned by the function call, and
- whether the function is called with the function name defined in the DEFINE FUNCTION statement, or with an alphanumeric variable that contains the function name.

This information is used to resolve a function call within a Natural object at compile time.

A DEFINE PROTOTYPE statement is only needed for a function call if any of the following is true:

- The specified function name is an alphanumeric variable which contains the name of the function to be called at execution time.
- An (IR=) clause is not specified in the function call and a cataloged object of the called function is not available.
- The parameters provided in the function call are to be validated and the cataloged object of the called function is not available.

The DEFINE PROTOTYPE statement can be included in a copycode object if the function is to be called from multiple objects.

For further information, see the following sections in the *Programming Guide*:

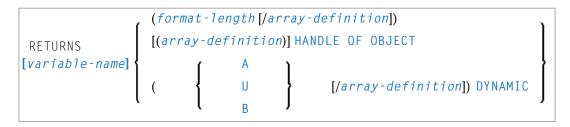
Natural object type Function

■ Function Call

# **Syntax Description**

Syntax Element	Description
[VARIABLE]	Prototype Name:
prototype-name	<pre>prototype-name is either of the following:</pre>
	the name of the prototype whose parameter and result field definitions are to be used. This name typically matches the <i>function-name</i> in the DEFINE FUNCTION statement of the referenced function;
	the name of an alphanumeric field specified as <i>function-name</i> in a function call if the keyword VARIABLE is specified. This field must contain the name of the function to be called at execution time.
	An array index expression must not be specified with the field name.
UNKNOWN	UNKNOWN Option:
	The keyword UNKNOWN specifies that the function interface is currently undefined. In this case, the cataloged object (if available) will not be used to extract the function result and the parameter description. When a function call is embedded in a Natural statement, this requires to give the result layout explicitly with an (IR=) clause. In addition, parameters provided in the function call are not checked.
return-data-definition	See Return Data Definition below.
parameter-definition	See Parameter Definition below.
same-as-clause	See SAME AS Clause below.
USING FUNCTION	USING FUNCTION Clause:
[DEFINITION [OF]]	function-name is the name of an existing cataloged object of the type
function-name	function. The parameters and the result field definitions of this function are used to resolve the function call.
END-PROTOTYPE	End of DEFINE PROTOTYPE Statement:
	The Natural reserved word END-PROTOTYPE must be used to terminate the DEFINE PROTOTYPE statement.

#### **Return Data Definition**



The return-data-definition clause defines the format/length and, if applicable, the array structure of the return value.

When no return data definition is specified, a function call can only be used within a statement if an explicit (IR=) clause is provided. If such a clause is missing, the function can only be called as a statement, but not in place of an operand within a statement.

Syntax Element Description:

Syntax Element	Description	
variable-name	Return Value Name:	
	The optional <i>variable-name</i> has no meaning. It is just there to have a syntax structure similar to the <i>Return Data Definition</i> clause of the DEFINE FUNCTION statement.	
format-length	Format/Length Definition:	
	The format and length of the result field.	
	For information on format/length definition of user-defined variables, see <i>Format and Length of User-Defined Variables</i> in the <i>Programming Guide</i> .	
array-definition	Array Dimension Definition:	
	With array-definition, you define the lower and upper bounds of a dimension in an array-definition, if the function result is an array field.	
	For further information, see <i>Array Dimension Definition</i> in the description of the DEFINE DATA statement.	
HANDLE OF OBJECT	Handle of Object:	
	Used in conjunction with NaturalX.	
	For further information, see <i>NaturalX</i> in the <i>Programming Guide</i> .	
A, U or B	Data Type:	
	Alphanumeric (A), Unicode (U) or binary (B) for a dynamic result.	
DYNAMIC	Dynamic Variable:	
	The function result may be defined as DYNAMIC.	

Syntax Element	Description
	For information on processing dynamic variables, see <i>Introduction to Dynamic Variables</i> and <i>Fields</i> in the <i>Programming Guide</i> .

## **Parameter Definition**

The parameter-definition clause defines the parameters which are to be provided in a function call. This definition layout is checked against the parameters given in a function call. If this clause is omitted, this declares the function as free of parameters. In this case, every attempt to provide parameters in the function call is rejected.

The identifiers used to name the parameter fields have no meaning. They are just there to have a syntax structure similar to the DEFINE DATA PARAMETER syntax.

Syntax Element Description:

Syntax Element	Description
PARAMETER UNKNOWN	UNKNOWN Option:
	With this option, no parameter is specified and the parameter check in
	the function call is disabled. As a consequence, any number of parameters
	in the function call will be accepted.
USING parameter-data-area	PDA Name:
	The name of the parameter-data-area that contains data elements
	which are used as parameters in a function call.
	See also <i>Defining Parameter Data</i> in the DEFINE DATA statement description.
parameter-data-definition	Parameter Data Definition:
	Instead of defining a parameter data area, parameter data can also be defined directly within a function call.
	See also <i>Parameter Data Definition</i> in the DEFINE DATA statement description.
END-DEFINE	End of Clause:

Syntax Element	Description
	The Natural reserved word END-DEFINE must be used to end the parameter-definition clause.

#### **SAME AS Clause**

```
SAME AS [PROTOTYPE] prototype-name
```

With the SAME AS clause you can use the parameter and result field definitions of another prototype which has been defined before in the same Natural object.

# **Examples**

- Example 1 DEFINE PROTOTYPE with a Defined Function Name
- Example 2 DEFINE PROTOTYPE with a Variable Function Name

## **Example 1 - DEFINE PROTOTYPE with a Defined Function Name**

This is a prototype definition for a function named F#FACTOR where the prototype-name corresponds to the function-name specified in the referenced DEFINE FUNCTION statement. The result returned by the function is of format (I2/1:3), and a single parameter of format (I2) is required.

```
** Example 'DPTEX1': DEFINE PROTOTYPE and function call
**************

DEFINE DATA LOCAL
    1 #NUM (I2)
END-DEFINE

*

DEFINE PROTOTYPE F#FACTOR
    RETURNS (I2/1:3)
    DEFINE DATA PARAMETER
    1 #VALUE (I2)
    END-DEFINE
END-PROTOTYPE

*
#NUM := 3
*

WRITE 'Function call:' F#FACTOR(<#NUM>)(*)
*
END
```

The function F#FACTOR is defined in the example function DFUEX2 in library SYSEXSYN. See *Examples* in the DEFINE FUNCTION statement description.

## Output of Program DPTEX1:

```
Function call: 3 6 9
```

#### Example 2 - DEFINE PROTOTYPE with a Variable Function Name

Due to the keyword VARIABLE, this prototype specifies a function call where the referenced <code>prototype-name</code> is an alphanumeric variable which contains the function name at execution time.

```
** Example 'DPTEX2': DEFINE PROTOTYPE and function call
***********************
DEFINE DATA LOCAL
 1 #NAME (A20)
 1 #TEXT (A10)
END-DEFINE
DEFINE PROTOTYPE VARIABLE #NAME
 RETURNS #RETURN (A1)
 DEFINE DATA PARAMETER
   1 #IN (A10)
 END-DEFINE
END-PROTOTYPE
#NAME := 'F#FIRST-CHAR'
#TEXT := 'ABCDEFGHIJ'
WRITE 'First character:' #NAME(<#TEXT>)
END
```

The function F#FIRST-CHAR is defined in the example function DFUEX1 in library SYSEXSYN. See *Examples* in the DEFINE FUNCTION statement description.

#### Output of Program DPTEX2:

```
First character: A
```

## 57 DEFINE SUBROUTINE

Function	4	12
Restrictions	4	13
Syntax Description	4	14
Examples		

```
DEFINE [SUBROUTINE] subroutine-name

statement ...

{
    END-SUBROUTINE (structured mode only)
    RETURN (reporting mode only)
}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL | CALL | FILE | CALL | LOOP | CALLNAT | ESCAPE | FETCH | PERFORM

Belongs to Function Group: Invoking Programs and Routines

## **Function**

The DEFINE SUBROUTINE statement is used to define a Natural subroutine. A subroutine is invoked with a PERFORM statement.

#### Inline/External Subroutines

A subroutine may be defined within the object which contains the PERFORM statement that invokes the subroutine (inline subroutine); or it may be defined external to the object that contains the PERFORM statement (external subroutine). An inline subroutine may be defined before or after the first PERFORM statement which references it.



**Note:** Although the structuring of a program function into multiple external subroutines is recommended for achieving a clear program structure, please note that a subroutine should always contain a larger function block because the invocation of the external subroutine represents an additional overhead as compared with inline code or subroutines.

#### Data Available in a Subroutine

#### **Inline Subroutines**

No explicit parameters can be passed from the invoking program via the PERFORM statement to an internal subroutine.

An inline subroutine has access to the currently established global data area as well as to the local data area used by the invoking program.

### **External Subroutines**

An external subroutine has access to the currently established global data area. In addition, parameters can be passed directly with the PERFORM statement from the invoking object to the external subroutine; thus, you may reduce the size of the global data area.

An external subroutine has no access to the local data area defined in the calling program; however, an external subroutine may have its own local data area.

## Restrictions

- Any processing loop initiated within a subroutine must be closed before END-SUBROUTINE is issued.
- An inline subroutine must not contain another DEFINE SUBROUTINE statement (see *Example 1* below).
- An external subroutine (that is, an object of type subroutine) must not contain more than one DEFINE SUBROUTINE statement block (see *Example 2* below). However, an external DEFINE SUBROUTINE block may contain further inline subroutines (see *Example 1* below).
- You may not use the name of an external subroutine twice in one library.

#### Example 1

The following construction is possible in an object of type subroutine, but not in any other object (where SUBRO1 would be considered an inline subroutine):

```
DEFINE SUBROUTINE SUBRO1
...
PERFORM SUBRO2
PERFORM SUBRO3
...
DEFINE SUBROUTINE SUBRO2
/* inline subroutine...
END-SUBROUTINE
...
DEFINE SUBROUTINE SUBRO3
/* inline subroutine...
END-SUBROUTINE
END-SUBROUTINE
```

#### Example 2 (invalid):

The following construction is *not* allowed in an object of type subroutine:

```
DEFINE SUBROUTINE SUBRO1
...
END-SUBROUTINE
DEFINE SUBROUTINE SUBRO2
...
END-SUBROUTINE
END-SUBROUTINE
```

## **Syntax Description**

Syntax Element	Description
subroutine-name	Name of Subroutine:
	For a subroutine name (maximum 32 characters), the same naming conventions apply as for user-defined variables; see <i>Naming Conventions for User-Defined Variables</i> in the <i>Using Natural</i> documentation.
	The subroutine name is independent of the name of the module in which the subroutine is defined (it may but need not be the same).
statement	Statement(s) to be Executed: In place of statement, you must supply one or several suitable statements, depending on the situation. For an example of a statement, see <i>Examples</i> below.
END-SUBROUTINE	End of DEFINE SUBROUTINE Statement:
RETURN	In structured mode, the subroutine definition is terminated with END-SUBROUTINE.
	In reporting mode, RETURN may be used to terminate a subroutine.

## **Examples**

■ Example 1 - Define Subroutine

#### Example 2 - Sample Structure for External Subroutine Using GDA Fields

### **Example 1 - Define Subroutine**

```
** Example 'DSREX1S': DEFINE SUBROUTINE (structured mode)
*************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 ADDRESS-LINE (A20/2)
 2 PHONE
1 #ARRAY
          (A75/1:4)
1 REDEFINE #ARRAY
 2 #ALINE (A25/1:4,1:3)
1 #X
          (N2) INIT <1>
1 #Y (N2) INIT <1>
END-DEFINE
FORMAT PS=20
LIMIT 5
FIND EMPLOY-VIEW WITH NAME = 'SMITH'
                     TO \#ALINE (\#X, \#Y)
 MOVE NAME
 MOVE ADDRESS-LINE(1) TO #ALINE (#X+1, #Y)
 MOVE ADDRESS-LINE(2) TO #ALINE (#X+2, #Y)
 MOVE PHONE
                    TO #ALINE (#X+3,#Y)
 IF \#Y = 3
   RESET INITIAL #Y
   PERFORM PRINT
 ELSE
   ADD 1 TO #Y
 END-IF
 AT END OF DATA
   PERFORM PRINT
 END-ENDDATA
END-FIND
DEFINE SUBROUTINE PRINT
 WRITE NOTITLE (AD=OI) #ARRAY(*)
 RESET #ARRAY(*)
 SKIP 1
END-SUBROUTINE
END
```

#### **Output of Program DSREX1S:**

SMITH ENGLANDSVEJ 222 554349	SMITH 3152 SHETLAND ROAD MILWAUKEE 877-4563	SMITH 14100 ESWORTHY RD. MONTERREY 994-2260
SMITH 5 HAWTHORN OAK BROOK 150-9351	SMITH 13002 NEW ARDEN COUR SILVER SPRING 639-8963	

Equivalent reporting-mode example: DSREX1R.

## **Example 2 - Sample Structure for External Subroutine Using GDA Fields**

```
** Example 'DSREX2': DEFINE SUBROUTINE (using GDA fields)

***************************

DEFINE DATA

GLOBAL

USING DSREX2G

END-DEFINE

*

INPUT 'Enter value in GDA field' GDA-FIELD1

*

* Call external subroutine in DSREX2S

*

PERFORM DSREX2-SUB

*

END
```

## Global Data Area DSREX2G Used by Program DSREX2:

```
1 GDA-FIELD1 A 2
```

#### **Subroutine DSREX2S Called by Program DSREX2:**

```
** Example 'DSREX2S': SUBROUTINE (external subroutine using global data)

*******************

DEFINE DATA

GLOBAL

USING DSREX2G

END-DEFINE

*

DEFINE SUBROUTINE DSREX2-SUB

*

WRITE 'IN SUBROUTINE' *PROGRAM '=' GDA-FIELD1

*

END-SUBROUTINE
```

\* END

## 58 DEFINE WINDOW

Function	420
Syntax Description	
Protection of Input Fields in a Window	
Invoking Different Windows	
Example	

```
DEFINE WINDOW window-name

\[
\begin{align*}
\text{AUTO} \\
\text{QUARTER} \\
\text{operand1* operand2} \\
\text{EFT} \\
\text{BASE} \\
\begin{align*}
\text{CURSOR} \\
\text{TOP} \\
\text{BOTTOM} \\
\text{operand3/ operand4} \\
\text{[REVERSED [(CD=background-color)]]} \\
\text{[TITLE operand5]} \\
\text{CONTROL} \\
\text{WINDOW} \\
\text{SCREEN} \\
\text{FRAMED} \\
\end{align*}
\text{[\text{QN] [(CD=frame-color)] [position-clause]} \\
\text{OFF} \end{align*}
\]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: INPUT | REINPUT | SET WINDOW

Belongs to Function Group: Screen Generation for Interactive Processing

## **Function**

The DEFINE WINDOW statement is used to specify the size, position and attributes of a window.

A window is that segment of a logical page, built by a program, which is displayed on the terminal screen. There is always a window present, although you may not be aware of its existence: unless specified differently, the size of the window is identical to the physical size of your terminal screen.

A DEFINE WINDOW statement does not activate a window; this is done with a SET WINDOW statement or with the WINDOW clause of an INPUT statement.

See also *Windows* in the *Screen Design* section of *Designing Application User Interfaces* in the *Programming Guide*.



**Note:** There is always only *one* Natural window, that is, the most recent window. Any previous windows may still be visible on the screen, but are no longer active and are ignored by Natural. You may enter input only in the most recent window. If there is not enough space to enter input, the window size must be adjusted first.

## **Syntax Description**

## Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure	Possible Formats						rma	Referencing Permitted			
operand1	C	S						N	Р	Ι					yes	no
operand2	С	S						N	Р	Ι					yes	no
operand3	С	S						N	Р	Ι					yes	no
operand4	С	S						N	Р	Ι					yes	no
operand5	С	S				A	U								yes	no

## Syntax Element Description:

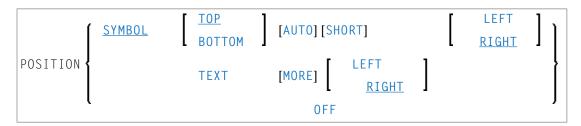
Syntax Element	Description
window-name	The window-name identifies the window. The name may be up to 32 characters long. For a window name, the same naming conventions apply as for user-defined variables, see Naming Conventions for User-Defined Variables in the Using Natural documentation.
SIZE	With the SIZE clause, you specify the size of the window.
	<b>Note:</b> On mainframe computers, Natural requires additional columns for so-called
	attribute bytes to be able to display data on the screen (on other platforms, such attribute bytes are not needed). Consequently, on mainframe computers the screen area overlaid by a window is wider, and the size of the page segment visible inside a window is smaller than on other platforms.
	Example: Assume a window whose size is defined as SIZE 5 * 15 (that is, with a width of 15 columns):
	On mainframe computers, the screen area overlaid by the window is 16 columns; the size of what is visible inside the window is 14 columns without frame, and 10 columns with frame respectively.
	On other platforms, the screen area overlaid by the window is 15 columns; the size of what is visible inside the window is 15 columns without frame, and 13 columns with frame respectively.
SIZE AUTO	The size of the window is determined automatically by Natural at runtime. The size is determined by the data generated into the window as follows:
	■ The number of window lines will be the number of INPUT lines generated (plus possibly the PF-key lines, message line, and infoline/statistics line).
	■ The number of window columns is determined by the longest INPUT line: Natural scans, starting from the ends of the lines, for the rightmost significant byte in a

Syntax Element	Description
	line. This may cause an input-only or modifiable field ( AD=A or AD=M ) to be truncated; to avoid this, you either put a single-character text string after such a field or explicitly set the window size with the following:
	SIZE operand1 * operand2
	If you omit the SIZE clause, SIZE AUTO applies by default.
	<b>Note:</b> The title is not part of the window data. Therefore, if the window size has
	been determined as described above <i>and</i> the title is longer than the window, it will be truncated.
SIZE QUARTER	The size of the window will be one quarter of the physical screen.
SIZE operand1 * operand2	The size of the window will be $n$ lines by $n$ columns. The number of lines is determined by $operand1$ , the number of columns by $operand2$ . Neither of the two operands must contain decimal digits.
	If the window is FRAMED, the specified size will be inclusive of the frame.
	The minimum possible window size is:
	without frame: 2 lines by 10 columns,
	with frame: 4 lines by 13 columns.
	The maximum possible window size is the size of the physical screen.
BASE	With the BASE clause, you determine the position of the window on the physical screen. If you omit the BASE clause, BASE CURSOR applies by default.
BASE CURSOR	Places the top left corner of the window at the current cursor position. The cursor position is the physical position of the cursor on the screen. If the size of the window makes it impossible to place the window at the cursor position, Natural automatically places the window as close as possible to the desired position.
BASE TOP/BOTTOM LEFT/RIGHT	Places the window at the top-left, bottom-left, top-right, or bottom-right corner respectively of the physical screen.
BASE operand3/operand4	This places the top left corner of the window at the specified line/column of the physical screen. The line number is determined by <code>operand3</code> , the column number by <code>operand4</code> . Neither of the two operands must contain decimal digits.
	If the size of the window makes it impossible to place the window at the specified position, you will get an error message.
REVERSED	REVERSED will cause the window to be displayed in reverse video (if the screen used supports this feature; if it does not, REVERSED will be ignored).
REVERSED CD=	This will cause the window to be displayed in reverse video and the background
background-color	of the window in the specified color (if the screen used supports these features; if it does not, the respective specification will be ignored).

Syntax Element	Description
	For information on valid color codes, see session parameter CD in the <i>Parameter Reference</i> .
TITLE operand5	With the TITLE clause, you may specify a heading for the window. The specified title (operand5) will be displayed centered in the top frame-line of the window. The title can be specified either as a text constant (in apostrophes) or as the content of a user-defined variable. If the title is longer than the window, it will be truncated. The title is only displayed if the window is FRAMED; if FRAMED OFF is specified for the window, the TITLE clause will be ignored.
	<b>Note:</b> If the title contains trailing blanks, these will be removed. If the first character
	of the title is a blank, one blank will automatically be appended to the title.
CONTROL	With the CONTROL clause, you determine whether the PF-key lines, the message line and the statistics line are displayed in the window or on the full physical screen.
CONTROL WINDOW	CONTROL WINDOW causes the lines to be displayed inside the window.
	If you omit the CONTROL clause, CONTROL WINDOW applies by default.
CONTROL SCREEN	CONTROL SCREEN causes the lines to be displayed on the full physical screen outside the window.
FRAMED	By default, that is, if you omit the FRAMED clause, the window is framed.
	The top and bottom frame lines are cursor-sensitive: where applicable, you can page forward, backward, left or right within the window by simply placing the cursor over the appropriate symbol ( $\langle , -, +, \text{ or } \rangle$ ; see <i>position-clause</i> below) and then pressing ENTER. If no symbols are displayed, you can page backward and forward within the window by placing the cursor in the top frame line (for backward positioning) or bottom frame line (for forward positioning) and then pressing ENTER.
	<b>Note:</b> If the window size is smaller than 4 lines by 12 (or 13 on mainframe
	computers) columns, the frame will not be visible.
FRAMED OFF	If you specify FRAMED OFF, the framing and everything attached to the frame (window title and position information) will be switched off.
FRAMED (CD=frame-color)	This causes the frame of the window to be displayed in the specified color (if the screen used is a color screen; if it is not, the color specification will be ignored).
	For information on valid color codes, see session parameter CD (in the <i>Parameter Reference</i> ).
	<b>Note:</b> In Natural for Windows, this specification is ignored.
position-clause	The POSITION clause is only evaluated on mainframe computers; on all other platforms it is ignored. For details, refer to <i>Position Clause</i> below.

#### **POSITION Clause**

The POSITION clause is only evaluated on mainframe computers; on all other platforms it is ignored.



The POSITION clause causes information on the position of the window on the logical page to be displayed in the frame of the window. This applies only if the logical page is larger than the window; if it is not, the POSITION clause will be ignored. The position information indicates in which directions the logical page extends above, below, to the left and to the right of the current window.

If the POSITION clause is omitted, POSITION SYMBOL TOP RIGHT applies by default.

## Syntax Element Description:

Syntax Element	Description
POSITION SYMBOL	Causes the position information to be displayed in form of symbols: More: < - + >. The information is displayed in the top and/or bottom frame line.
TOP/BOTTOM	Determines whether the position information is displayed in the top or bottom frame line.
AUTO	Is only applicable if the logical page is fully visible in the window as far as its horizontal size is concerned, that is, if only a minus sign character (-) and/or a plus sign character (+) are to be displayed. In this case, AUTO automatically switches from the symbols to the words Top, Bottom and More respectively.
SHORT	Causes the word More: before the symbols < - + > to be suppressed.
LEFT/RIGHT	Determines whether the position information is displayed in the left or right part of the frame line.
POSITION TEXT	Causes the position information to be displayed in text form. The information is displayed in the top and/or bottom frame line with the words More, Top and Bottom. The text is language-dependent and may also be displayed in another language if the language code is set accordingly.
POSITION TEXT MORE	Suppresses the words Top and Bottom and only displays the word More where applicable, i.e., in the top or bottom frame line or both.
LEFT/RIGHT	Determines whether the position information is displayed in the left or right part of the top frame line.
POSITION OFF	Causes the position information to be suppressed; no position information will be displayed.

## Protection of Input Fields in a Window

The following rules apply to input fields (with AD=A or AD=M) which are not entirely within the window:

- Input fields whose beginning is not inside the window are always made protected.
- Input fields which begin inside and end outside the window are only made protected if the values they contain cannot be displayed completely in the window. Please note that in this case it is decisive whether the *value length*, not the *field length*, exceeds the window size. Filler characters (as specified with the profile parameter FC) do not count as part of the value.

If you wish to access input fields thus protected, you have to adjust the window size accordingly so that the beginning of the field/end of the value is within the window.

## **Invoking Different Windows**

A DEFINE WINDOW statement must not be placed within a logical condition statement block. To invoke different windows depending on a condition, use different SET WINDOW statements (or INPUT statements with a WINDOW clause respectively) in a condition.

## **Example**

```
** Example 'DWDEX1': DEFINE WINDOW

*************************

DEFINE DATA LOCAL

01 #I (P3)

END-DEFINE

*

SET KEY PF1='%W<<' PF2='%W>>' PF4='%W--' PF5='%W++'

*

DEFINE WINDOW WIND1

SIZE QUARTER

BASE TOP RIGHT

FRAMED ON POSITION SYMBOL AUTO

*

SET WINDOW 'WIND1'

FOR #I = 1 TO 10

WRITE 25X #I 'THIS IS SOME LONG TEXT' #I

END-FOR

*

END
```

#### **Output of Program DWDEX1:**

```
+-----More: + >+
> r
                                   ! Page 1
                                                                    !
All ....+....1....+....2....+....3.. !
                                                                    !
 0010 ** Example 'DWDEX1': DEFINE WIND !
                                                            1 THIS !
 0020 ************
                                                             2 THIS !
 0030 DEFINE DATA LOCAL
                                                             3 THIS !
 0040 01 #I (P3)
                                                             4 THIS !
 0050 END-DEFINE
                                                             5 THIS !
 0060 *
                                                             6 THIS !
 0070 SET KEY PF1='%W<<' PF2='%W>>' PF !
                                                             7 THIS !
 0080 *
                                 ! MORE
 0090 DEFINE WINDOW WIND1
 0100 SIZE QUARTER
 0110
          BASE TOP RIGHT
 0120
          FRAMED ON POSITION SYMBOL AUTO
 0130 *
 0140 SET WINDOW 'WIND1'
 0150 FOR \#I = 1 TO 10
 0160 WRITE 25X #I 'THIS IS SOME LONG TEXT' #I
 0170 END-FOR
 0180 *
 0190 END
 0200
  ....+...1....+...2...+...3....+...4....+...5....+... S 19 L 1
```

## 59 DEFINE WORK FILE

■ Function	428
Syntax Description	428
■ Work File Name under z/OS Batch, TSO and Server	
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DEFINE WORK FILE n  $\left\{\begin{array}{l} operand1 \text{ [TYPE } operand2] \\ \text{TYPE } operand2 \end{array}\right\}$  [ATTRIBUTES  $\{operand3\}...$ ]

**Note:** The elements shown in square brackets [...] are optional, however, at least one of them must be specified with this statement.

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CLOSE WORK FILE | READ WORK FILE | WRITE WORK FILE

Belongs to Function Group: Control of Work Files / PC Files

## **Function**

The statement DEFINE WORK FILE is used to assign a file name to a Natural work file number within a Natural application. This allows you to make or change work file assignments dynamically within a Natural session or overwrite work file assignments made at another level.

When this statement is executed and the specified work file is already open, the statement will implicitly close the work file.

All work files to be used during a session must be preassigned to an access method by means of keyword subparameter AM of profile parameter WORK or automatically by definition in the JCL.



**Note**: For Unicode and code page support on mainframe platforms, see *Work Files and Print Files* in the *Unicode and Code Page Support* documentation.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure						Pos	ssi	ble	F	orr	na	ts	Referencing Permitted	Dynamic Definition
operand1	С	S				A	U							yes	no
operand2	С	S				A	U							yes	no
operand3	С	S				Α	U							yes	no

Syntax Element Description:

Syntax Element	Description							
DEFINE WORK FILE n	Work File Number:  n is the work file number (1 to 32). This is the number to be used in a WRITE WORK FILE,  READ WORK FILE or CLOSE WORK FILE statement.							
operand1	Work File Name: operand1 is the name of the work file.							
	As operand1 you can specify the name of the data set to be assigned to the work file number.							
	operand1 can be 1 to 253 characters long. You can specify either a logical or a physical data set name. The possible format depends on the operating system environment and the access method defined by keyword subparameter AM of profile parameter WORK. Some access methods do not support a work file name as operand1, for example, AM=COMP and AM=PC.							
	name specified with the previously perform	of operand1 is determined by taking the current formed DEFINE WORK FILE statement for this E WORK FILE statement was performed, the ter module.						
	<b>Note:</b> If <i>operand1</i> is not specified, the befor Windows/UNIX/OpenVMS is different	pehavior of Natural for Mainframes and Natural ent.						
	Information on operating-system- or TP-is included in the following sections:	monitor-dependent work file naming conventions						
	■ Work File Name under z/OS Batch, T	SO and Server						
	■ Work File Name under z/VSE Batch							
	■ Work File Name under BS2000 Batch	and TIAM						
	■ Work File Name under CICS							
	■ Work File Name under Com-plete/SM	IARTS						
TYPE operand2	TYPE Clause:							
	operand2 specifies the type of work file	e.						
	The value of operand2 is handled in a quotes or provided in an alphanumeric	case insensitive way and must be enclosed in variable.						
	UNFORMATTED	A completely unformatted file. No formatting information is written (neither for fields nor for records).						
		UNFORMATTED treats a work file as a byte-stream with no record boundaries. Note that type UNFORMATTED will be rejected by Entire Connection.						

Syntax Element	Description	
		Format: UNFORMATTED
	FORMATTED	FORMATTED defines a regular record-oriented work file, which is subject to the same handling as in previous Natural versions.
ATTRIBUTES Clause:		
{operand3}		l for Open Systems; in Natural for Mainframes it

## Examples:

```
DEFINE WORK FILE 17 #FILE TYPE 'UNFORMATTED'
#TYPE := 'FORMATTED'
DEFINE WORK FILE 18 #FILE TYPE #TYPE
```

## Work File Name under z/OS Batch, TSO and Server

The following topics are covered:

- Work File Name operand1
- Allocation and De-Allocation of Data Sets
- Work Files in Server Environments

#### Work File Name - operand1

Under z/OS, for a work-file number that is defined with the access method AM=STD, operand1 can be:

- a logical data set name (DD name, 1 to 8 characters);
- a physical data set name of a cataloged data set (1 to 44 characters) or a physical data set member name;
- a path name and member name of an HFS file (1 to 253 characters) in an MVS UNIX Services environment;
- a JES spool file class;
- NULLFILE.

## Logical Data Example: Set Names DEFINE WORK FILE 21 'SYSOUT1' The specified data set SYSOUT1 must have been allocated before the DEFINE WORK FILE statement is executed. The allocation can be done via JCL, CLIST (TCO) or dynamic allocation (SVC 99). For dynamic allocation you can use the application programming interface USR2021N, which is located in library SYSEXT. The data set name specified in the DEFINE WORK FILE statement overrides the name specified with keyword subparameter DEST of profile parameter WORK. Optionally, the data set name may be prefixed by DDN= to indicate that it is a DD name. For example: DEFINE WORK FILE 22 'DDN=MYWORK' Physical Data Example: Set Names DEFINE WORK FILE 23 'TEST.WORK.FILE' The specified data set must exist in cataloged form. When the DEFINE WORK FILE statement is executed, the data set is allocated dynamically by SVC 99 with the current DD name and option DISP=SHR. If the data set name is 8 characters or shorter and does not contain a period (.), it might be misinterpreted as a DD name. To avoid this, prefix the name with DSN=. For example: DEFINE WORK FILE 22 'DSN=WORKXYZ' If the data set is a PDS member, you specify the PDS member name (1 to 8 characters) in parentheses after the data set name (1 to 44 characters). For example: DEFINE WORK FILE 4 'TEST.WORK.PDS(TEST1)' If the specified member does not exist, a new member of that name will be created. **HFS Files** Example: DEFINE WORK FILE 14 '/u/nat/rec/test.txt' The specified path name must exist. When the DEFINE WORK FILE statement is executed, the HFS file is allocated dynamically. If the specified member does not exist, a new member of that name will be created. For the dynamic allocation of the data set, the following z/OS path options are used:

	PATHOPTS=(OCREAT,OTRUNC,ORDWR) PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP) FILEDATA=TEXT
	When an HFS file is closed, it is automatically de-allocated by z/OS (regardless of the setting of keyword subparameter FREE of profile parameter WORK).
	To read an HFS file, you have to use the application programming interface USR2021N (dynamic data set allocation) instead of the DEFINE WORK FILE statement, because of the OTRUNC option. This option resets the HFS file at the first read access, which results in an empty file.
JES Spool File Class	To create a JES spool data set, you specify $SYSOUT=x$ (where $x$ is the desired spool file class). For the default spool file class, you specify $SYSOUT=*$ .
	Examples:
	DEFINE WORK FILE 10 'SYSOUT=A' DEFINE WORK FILE 12 'SYSOUT=*'
	To specify additional parameters for the dynamic allocation, use the application programming interface USR2021N (dynamic data set allocation) in the library SYSEXT instead of the DEFINE WORK FILE statement.
NULLFILE	To indicate a dummy data set.

## Allocation and De-Allocation of Data Sets

When the DEFINE WORK FILE statement is executed and a physical data set name, HFS file, spool file class or dummy data set has been specified, the corresponding data set is allocated automatically. If the logical file is already open, it will be closed automatically, except when the keyword subparameter CLOSE=FIN of profile parameter WORK has been specified, in which case an error will be issued. Moreover, an existing data set allocated with the same current DD name is automatically de-allocated before the new data set is allocated. To avoid unnecessary overhead by unsuccessful premature opening of work files not yet allocated at the start of the program, work files should be defined with keyword subparameter OPEN=ACC (open at first access) of profile parameter WORK.

In the case of an HFS file, or a work file defined with keyword subparameter FREE=0N of profile parameter WORK, the work file is automatically de-allocated as soon as it has been closed.

As an alternative for the dynamic allocation and de-allocation of data sets, the application programming interface USR2021N (dynamic data set allocation) in the library SYSEXT is provided. This API also allows you to specify additional parameters for dynamic allocation.

#### **Work Files in Server Environments**

In server environments, errors may occur if multiple Natural sessions attempt to allocate or open a data set with the same DD name. To avoid this, you either specify the work file with keyword subparameter DEST=\* of profile parameter WORK, or you specify DEFINE WORK FILE '\*' in your program before the actual DEFINE WORK FILE statement. Natural then generates a unique DD name at the physical data set allocation when the first DEFINE WORK FILE statement for that work file is executed.

All work files whose DD names begin with CM are shared by all sessions in a server environment. A shared work file opened for output by the first session is physically closed when the server is terminated. A shared work file opened for input is physically closed when the last session closes it, that is, when it receives an end-of-file condition. When a work file is read concurrently, one file record is supplied to one READ WORK FILE statement only.

## Work File Name under z/VSE Batch

Under z/VSE, for a work-file number that is defined with the access method AM=STD, operand1 can be:

- a logical data set name (DD name, 1 to 7 characters);
- NULLFILE (to indicate a dummy data set).

Logical Data Set Names	Example:
	DEFINE WORK FILE 21 'SYSOUT1'
	The specified data set SYSOUT1 must have been defined in the JCL or in the z/VSE standard or partition labels.
	The data set name specified in the <code>DEFINE WORK FILE</code> statement overrides the name specified with keyword subparameter <code>DEST</code> of profile parameter <code>WORK</code> .
	Optionally, the data set name may be prefixed by DDN= to indicate that it is a DD name. For example:
	DEFINE WORK FILE 22 'DDN=MYWORK'

NULLFILE	To allocate a dummy data set, you specify NULLFILE as operand1:
	DEFINE WORK FILE <i>n</i> 'NULLFILE'
	DEFINE WORK FILE // NOTEFILE

## Work File Name under BS2000 Batch and TIAM

Under BS2000, for a work-file number that is defined with the access method AM=STD, you can use *operand1* to specify a file name or a link name that is allocated to this work file.

In this case, operand1 can have a length of 1 to 253 characters and one of the following meanings:

- a BS2000 link name (1 to 8 characters)
- a BS2000 **file name** (9 to 54 characters)
- a generic BS2000 file name (wildcard)
- a BS2000 file name and link name
- a generic BS2000 file name and link name (wildcard)
- \*DUMMY

The following rules apply.

- 1. File name and link name can be specified as positional parameters or keyword parameters. The corresponding keywords are FILE= and LINK=. Mixing positional and keyword parameters is allowed but not recommended.
- 2. A string with a length of 1 to 8 characters without commas is interpreted as a link name. This notation is compatible with earlier versions of Natural. Example:

```
DEFINE WORK FILE 1 'W01'
```

The corresponding definition with a keyword parameter is:

```
DEFINE WORK FILE 1 'LINK=W01'
```

3. A string of 9 to 54 characters without commas is interpreted as a file name.

Example:

#### DEFINE WORK FILE 2 'NATURAL vr. TEST. WORKFILE 02'

where *vr* represents the relevant product version.

The corresponding definition with a keyword parameter is:

```
DEFINE WORK FILE 2 'FILE=NATURAL vr. TEST. WORKFILE 02'
```

- 4. The following input is interpreted without considering the length and therefore forms exceptions to Rules 2 and 3:
  - keyword input: LINK=, FILE=
  - \*DUMMY
  - NULLFILE (equivalent to \*DUMMY)
  - \*
  - **\***\*

Example: DEFINE WORK FILE 7 'FILE=Y' is a valid file allocation and not a link name, although the string of characters contains fewer than 9 characters.

5. Generic file names are formed as follows:

```
Wnn.userid.tsn.date.time.number
```

#### where

nn	is a work-file number
userid	is a Natural user-ID, 8 characters
tsn	is the BS2000 TSN of the current task, 4 digits
date	is DDMMYYYY
time	is HHIISS
number	is a number, 5 digits

6. Generic link names are formed as follows:

#### **NWF**nnnnn

nnnnn is a 5-digit number that is increased by one after every generation of a dynamic link name.

7. Changing the file allocation for a work-file number causes an implicit CLOSE of the work file allocated so far.

You are strongly recommended, in all cases except when you only specify a link name (for example: W01), to work with keyword parameters. This avoids conflicts of interpretation with additional reports and is essential for file names with fewer than 9 characters.

## Example:

DEFINE WORK FILE 3 'LINK=#W03'
DEFINE WORK FILE 3 'FILE=#W03'

Link Name	Example:	
	DEFINE WORK FILE 1 'LINKWO1'	
	means the same as	
	DEFINE WORK FILE 1 'LINK=LINKW01'	
	A file with the link LINKW01 must exist at runtime. This can be created either using JCL before starting Natural or by dynamic allocation from the current application. For dynamic allocation, the application programming interface USR2029N (dynamic file allocation) in the library SYSEXT can be used. If, before execution, the link was active on another file, for example: W01, this will be released or retained depending on the value of the profile parameter FREE (possible values are 0N and 0FF). Release is done via an explicit RELEASE call to the BS2000 command processor.	
File Name	Example:	
	DEFINE WORK FILE 2 'NATURAL <i>vr</i> .TEST.WORK02'	
	means the same as	
	DEFINE WORK FILE 2 'FILE=NATURAL vr. TEST. WORK 02'	
	where <i>vr</i> represents the relevant product version.	
	The file specified in <code>operand1</code> is set up using a <code>FILE</code> macro call and inherits the link name that was valid for the corresponding work file before execution of the <code>DEFINE</code> <code>WORK FILE</code> statement.	
Generic File Name	Example:	
ivaille	DEFINE WORK FILE 21 '*'	
	means the same as	

A file with a name created according to Rule 4 is set up using a FILE macro call and inherits the link name that was valid for the corresponding work file before execution of the DEFINE WORK FILE statement.  DEFINE WORK FILE 22 'FILE=*,LINK=WFLK22'  A file with a name created according to Rule 4 is set up with the specified link name, using a FILE macro call.  Example:  DEFINE WORK FILE 11 'NATURAL**v*.TEST.WORKF11,LNKW11'  means the same as  DEFINE WORK FILE 11 'FILE=NATURAL**v*.TEST.WORKF11,LINK=LNKW11'  which means the same as  DEFINE WORK FILE 11 'FILE=NATURAL**v*.TEST.WORKF11,LNKW11'  where *v**r* represents the relevant product version.  The file given in *operand**1 is set up with the specified link name, using a FILE macro call and allocated to the corresponding work-file number.  Generic File Name and Link		DEETNE HOOK ETTE OF TELLE	
inherits the link name that was valid for the corresponding work file before execution of the DEFINE WORK FILE statement.  DEFINE WORK FILE 22 'FILE=*.LINK=WFLK22'  A file with a name created according to Rule 4 is set up with the specified link name, using a FILE macro call.  Example:  DEFINE WORK FILE 11 'NATURAL vr. TEST. WORKF11, LNKW11'  means the same as  DEFINE WORK FILE 11 'FILE=NATURAL vr. TEST. WORKF11, LINK=LNKW11'  which means the same as  DEFINE WORK FILE 11 'FILE=NATURAL vr. TEST. WORKF11, LNKW11'  where vr represents the relevant product version.  The file given in operand1 is set up with the specified link name, using a FILE macro call and allocated to the corresponding work-file number.  Generic File  Name and Link  DEFINE WORK FILE 27 '*,*'  means the same as  DEFINE WORK FILE 27 '*,*'  A file with a file name and link name created according to Rule 4 and Rule 5 is set up using a FILE macro call and allocated to the specified work file 27.  Note: When file name and link name are specified, the previous link name is not released, regardless of the value of keyword subparameter FREE of profile parameter WORK.		DEFINE WORK FILE 21 'FILE=*'	
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Link Name  DEFINE WORK FILE 11 'NATURAL vr. TEST. WORKF11, LNKW11'  means the same as  DEFINE WORK FILE 11 'FILE=NATURAL vr. TEST. WORKF11, LINK=LNKW11'  which means the same as  DEFINE WORK FILE 11 'FILE=NATURAL vr. TEST. WORKF11, LNKW11'  where vr represents the relevant product version.  The file given in operand1 is set up with the specified link name, using a FILE macro call and allocated to the corresponding work-file number.  Generic File Name and Link Name  Example:  DEFINE WORK FILE 27 '*,*'  means the same as  DEFINE WORK FILE 27 'FILE=*,LINK=*'  A file with a file name and link name created according to Rule 4 and Rule 5 is set up using a FILE macro call and allocated to the specified work file 27.  Note: When file name and link name are specified, the previous link name is not released, regardless of the value of keyword subparameter FREE of profile parameter WORK.			
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DEFINE WORK FILE 11 'FILE=NATURAL vr. TEST. WORKF11, LINK=LNKW11'  which means the same as  DEFINE WORK FILE 11 'FILE=NATURAL vr. TEST. WORKF11, LNKW11'  where vr represents the relevant product version.  The file given in operand1 is set up with the specified link name, using a FILE macro call and allocated to the corresponding work-file number.  Generic File Name and Link Name  Example:  DEFINE WORK FILE 27 '*,*'  means the same as  DEFINE WORK FILE 27 'FILE=*,LINK=*'  A file with a file name and link name created according to Rule 4 and Rule 5 is set up using a FILE macro call and allocated to the specified work file 27.  Note: When file name and link name are specified, the previous link name is not released, regardless of the value of keyword subparameter FREE of profile parameter WORK.	Link ivanic	DEFINE WORK FILE 11 'NATURAL <i>vr</i> .TEST.WORKF11,LNKW11'	
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regardless of the value of keyword subparameter FREE of profile parameter WORK.			
		<b>Note:</b> When file name and link name are specified, the previous link name is not released,	
*DUMMY To indicate a dummy data set.		regardless of the value of keyword subparameter FREE of profile parameter WORK.	
	*DUMMY	To indicate a dummy data set.	

## Work File Name under CICS

For a work-file number defined with access method AM=CICS, *operand1* can be a transient data or temporary storage queue name (1 to 8 characters), depending on keyword subparameter TYPE of profile parameter WORK for the work file. For TYPE=TD, only the first 4 characters of *operand1* are honored and the transient data destination must be predefined to CICS.

For further information on work files, see *Natural Print and Work Files under CICS* in the *TP Monitor Interfaces* documentation.

## Work File Name under Com-plete/SMARTS

Under Com-plete with access method AM=SMARTS, PFS files are available. Any work file name can be assigned, even if it has not been defined to Natural. For example:

```
DEFINE WORK (14) '/nat/path/workfile'
DEFINE WORK (14) 'workfile'
```

It depends on the MOUNT\_FS parameter of SMARTS whether the file is located on a SMARTS portable file system or on the native file system. The first element of the path (/nat/) determines the target file system.

If the string does not start with a slash (/), the path of the file is taken from the environment variable \$NAT\_WORK\_ROOT.

The specified path name must exist. When the DEFINE WORK FILE statement is executed, the file is allocated dynamically. If the specified member does not exist, a new member of that name will be created.

## VIII

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## 60 DELETE

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DELETE [RECORD] [IN] [STATEMENT] [(r)]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The DELETE statement is used to delete a record from a database.

#### **Hold Status**

The use of the DELETE statement causes each record selected in the corresponding FIND or READ statement to be placed in exclusive hold.

Record hold logic is explained in the section *Database Update - Transaction Processing* (in the *Programming Guide*).

## Restriction

A DELETE statement cannot be specified in the same statement line as a FIND, READ, or GET statement.

## **Syntax Description**

Syntax Element	Description
(r)	Statement Reference:
	The notation $(r)$ is used to reference the statement which was used to select/read the record to be deleted.
	If no statement reference is specified, the DELETE statement will reference the innermost active processing loop in which a database record was selected/read.

## **Database-Specific Considerations**

DL/I Databases	The DELETE statement is used to delete a segment from a DL/I database, which also results in the deletion of all descendants of the segment.	
	Due to GSAM restrictions, the UPDATE statement cannot be used for GSAM databases.	
VSAM Databases	The DELETE statement is not valid for VSAM entry-sequenced data sets (ESDS).	
SQL Databases	The DELETE statement is used to delete a row from the database table. It corresponds with the SQL statement DELETE WHERE CURRENT OF CURSOR-NAME, that is, only the row which was read last can be deleted.	
	With most SQL databases, a row that was read with a FIND SORTED BY or READ LOGICAL statement cannot be deleted.	

## **Examples**

- Example 1
- Example 2

## Example 1

In this example, all records with the name ALDEN are deleted.

```
** Example 'DELEX1': DELETE
**
**
CAUTION: Executing this example will modify the database records!
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
END-DEFINE
FIND EMPLOY-VIEW WITH NAME = 'ALDEN'
 /*
 DELETE
 END TRANSACTION
 /*
 AT END OF DATA
   WRITE NOTITLE *NUMBER 'RECORDS DELETED'
 END-ENDDATA
END-FIND
END
```

## Example 2

If no records are found in the VEHICLES file for the person named ALDEN, the EMPLOYEE record for ALDEN is deleted.

```
** Example 'DELEX2': DELETE
**
**
CAUTION: Executing this example will modify the database records!
*************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
1 VEHIC-VIEW VIEW OF VEHICLES
 2 PERSONNEL-ID
END-DEFINE
EMPL. FIND EMPLOY-VIEW WITH NAME = 'ALDEN'
 /*
VEHC. FIND VEHIC-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (EMPL.)
   IF NO RECORDS FOUND
     DELETE (EMPL.)
     END TRANSACTION
   END-NOREC
 END-FIND
 /*
END-FIND
END
```

# 61 DELETE (SQL)

Function	446
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Belongs to Function Group: Database Access and Update

See also *DELETE* - *SQL* in the *Natural for DB2* part of the *Database Management System Interfaces* documentation:

## **Function**

The SQL DELETE statement is used to delete either rows in a table without using a cursor ("searched" DELETE) or rows in a table to which a cursor is positioned ("positioned" DELETE).

Two different structures are possible.

## Syntax 1 - Searched DELETE

The "searched" DELETE statement is a stand-alone statement not related to any SELECT statement. With a single statement you can delete zero, one, multiple or all rows of a table. The rows to be deleted are determined by a *search-condition* that is applied to the table. Optionally, the table name can be assigned a *correlation-name*.



**Note:** The number of rows that have actually been deleted with a "searched" DELETE can be ascertained by using the system variable \*ROWCOUNT; see *System Variables* documentation.

Common Set Syntax:

```
DELETE FROM table-name [correlation-name] [WHERE search-condition]
```

#### Extended Set Syntax:

```
DELETE FROM table-name [period-clause] [correlation-name]

[include-columns [SET assignment-clause]]

[WHERE search-condition]

[RR RS RS RS CS CS REPLOCKED DATA] [QUERYNO integer]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Syntax Element Description:

Syntax Element	Description	
FROM table-name	FROM Clause:	
	This clause specifies the table from which the rows are to be deleted.	
period-clause	*	
	Specifies that a period clause applies to the target of the update operation. For further information, see <i>Period Clause</i> in the section <i>Basic Syntactical Items</i> .	
correlation-name	Correlation Name:	
	Optional. The table name can be assigned	ed a correlation-name.
include-columns	Include Columns Clause:	
	Optional. Specifies a set of columns that are included, along with the columns that are included along with the columns that are in	
	For further details, see <i>include-columns</i> .	
SET	SET Assignment Clause:	
assignment-clause	Introduces the assignment of values to the included columns of the include-columns clause. See assignment clause of SQL UPDATE statement.	
WHERE	WHERE Clause:	
search-condition	This clause is used to specify the selection criteria for the rows to be deleted.	
	If no WHERE clause is specified, the entire table is deleted.	
WITH Isolation Level Clause:		
	This clause belongs to the SQL Extende	d Set.
	This clause enables the explicit specification the row to be deleted.	ion of the isolation level used when locating
	CS	Cursor Stability
	RR	Repeatable Read
	RS	Read Stability
SKIP LOCKED DATA	SKIP LOCKED DATA Clause:	
	This clause specifies that rows are skipped when incompatible locks are held on the row by other transactions.	
QUERYNO integer	QUERYNO Clause:	
	This clause belongs to the <b>SQL Extended Set</b> .  This clause explicitly specifies the number to be used in EXPLAIN output and records for this statement. The number is used as QUERYNO column in the PLAN_TABLE for the rows that contain information on this statement.	

# **Syntax 2 - Positioned DELETE**

The "positioned" DELETE statement always refers to a cursor within a database loop. Therefore the table referenced by a positioned DELETE statement must be the same as the one referenced by the corresponding SELECT statement, otherwise an error message is returned. A positioned DELETE cannot be used with a non-cursor selection.

The functionality of the positioned DELETE statement corresponds to that of the "native" Natural DELETE statement.

Common Set Syntax:

DELETE FROM table-name WHERE CURRENT OF CURSOR [(r)]

Extended Set Syntax:

DELETE FROM 
$$table$$
-name where current of cursor  $[(r)]$  FOR ROW  $\{[:]host$ -variable of rowset  $[(r)]$ 

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Syntax Element Description:

Syntax Element	Description
FROM table-name WHERE CURRENT OF CURSOR	FROM Clause:
	This clause specifies the table from which the rows are to be deleted.
(r)	Statement Reference:
	The ( $r$ ) notation is used to reference the statement which was used to select the row to be deleted. If no statement reference is specified, the <code>DELETE</code> statement is related to the innermost active processing loop in which a database record was selected.
FOR ROW OF ROWSET	FOR ROW OF ROWSET Clause:  This clause belongs to the SQL Extended Set.  The optional FOR ROW OF ROWSET clause for positioned SQL DELETE statements specifies which row of the current rowset has to be deleted. It should only be specified if the DELETE statement is related to a SELECT statement which uses rowset positioning and which has column arrays in its INTO clause, see <a href="into-clause">into-clause</a> . If this clause is omitted, all rows of the current rowset are deleted.

# 62 DISPLAY

Function	450
Syntax Description	
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DISPLAY [(rep)] [options] {[/...] [output-format] output-element} ...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

# **Function**

The DISPLAY statement is used to specify the fields to be output on a report in column format. A column is created for each field and a field header is placed over the column.



**Note:** The statements WRITE and PRINT can be used to produce output in free (non-column) format.

See also the following topics (in the *Programming Guide*):

- Report Format and Control
- Statements DISPLAY and WRITE
- Index Notation for Multiple-Value Fields and Periodic Groups
- Column Headers
- Layout of an Output Page

# **Syntax Description**

Syntax Element	Description
(rep)	Report Specification:
	The notation ( rep) may be used to specify the identification of the report for which the DISPLAY statement is applicable.
	As report identification, a value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If (rep) is not specified, the statement will apply to the first report (Report 0).
	If this printer file is defined to Natural as PC, the report will be downloaded to the PC, see <i>Example 8</i> .

Syntax Element	Description
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .
options	Display Options:
	For details, see <i>Display Options</i> below.
output-format	Output Format Definitions:
	For details, see <i>Output Format Definitions</i> below.
/	Line Advance - Slash Notation:
	When specified within a text element, a slash (/) causes a line advance for the text displayed.
	When specified between output elements, it causes the output element specified by the slash (/) to be placed vertically within the same column. The header for this column will be constructed by placing the headers of the vertically displayed elements vertically above the column.
	See also the following topics in the <i>Programming Guide</i> :
	■ Line Advance - Slash Notation
	Example 1 - Line Advance in DISPLAY Statement
	Suppressing Column Headers - Slash Notation
output-element	Output Element:
	For details, see <i>Output Element</i> below.

# **Display Options**



# Syntax Element Description:

Syntax Element	Description	
NOTITLE	Default Page Title Suppression:	
	By default, Natural generates a single title line for each page resulting from a DISPLAY statement. This title contains the page number, the time of day, and the date. Time of day is set at the beginning of the program execution (TP mode) or at the beginning of the job (batch mode). The default title line may be overridden by using a WRITE TITLE statement, or it may be suppressed by specifying the keyword NOTITLE in the DISPLAY statement.  Examples:	

Syntax Element	Description	
	■ Default title will be produced:	
	DISPLAY NAME	
	■ User title will be produced:	
	DISPLAY NAME WRITE TITLE 'user-title'	
	■ No title will be produced:	
	DISPLAY NOTITLE NAME	
	<b>Note:</b> If the NOTITLE option is used, it applies to all DISPLAY, PRINT and WRITE	
	statements within the same object which write data to the same report.	
NOHDR	Column Headers:	
	Column headers are produced for each field specified in the DISPLAY statement using the following rules:	
	■ The header text may be explicitly specified in the DISPLAY statement before the field name. For example:	
	DISPLAY 'EMPLOYEE' NAME 'SALARY' SALARY	
	■ If you do not specify an explicit header for a field, the <b>header</b> as defined in the DEFINE DATA statement will be used.	
	■ If for a database field no header is defined in the DEFINE DATA statement, the default header as defined in the DDM will be used.	
	■ If no default header is defined in the DDM, the field name will be used as header.	
	■ If for a user-defined variable no header is defined in the DEFINE DATA statement, the variable name will be used as header. See also the DEFINE DATA statement for header definition.	
	DISPLAY NAME SALARY #NEW-SALARY	
	<ul> <li>Natural always underlines column headings and generates one blank line between the underlining and the data being displayed.</li> </ul>	
	■ If there are multiple DISPLAY statements in a program, the first DISPLAY statement determines the column header(s) to be used; this is evaluated at compilation time.	
	Column Header Suppression:	
	To suppress the column header for a single field	

Syntax Element	Description	
	Specify the following characters (apostrophe-slash-apostrophe) before the field name:	
	'/'	
	For example:	
	DISPLAY '/' NAME 'SALARY' SALARY	
	To suppress all column headers	
	■ Specify the keyword NOHDR:	
	DISPLAY NOHDR NAME SALARY	
	Note:	
	1. NOHDR only takes effect for the first DISPLAY statement, as subsequent DISPLAY statements cannot create column headers anyhow.	
	2. If both NOTITLE and NOHDR are used, they must be specified in the following order: DISPLAY NOTITLE NOHDR NAME SALARY	
GIVE SYSTEM	Natural System Function Usage:	
FUNCTIONS	The GIVE SYSTEM FUNCTIONS clause is used to make available the following Natural system functions: AVER, COUNT, MAX, MIN, NAVER, NCOUNT, NMIN, SUM, TOTAL. These are evaluated when the DISPLAY statement containing the GIVE SYSTEM FUNCTIONS clause is executed.	
	These functions may then be referred to in a statement executed as a result of an end-of-page condition.	
	Note:	
	1. Only one DISPLAY statement per report may contain a GIVE SYSTEM FUNCTIONS clause. When system functions are evaluated from a DISPLAY statement, they are evaluated on a page basis, which means that all functions (except TOTAL) are reset to zero when a new page is initiated.	
	2. When system functions are used within a DISPLAY statement within a subroutine, the end-of-page processing must occur within the same routine.	
	3. In place of the keyword GIVE, the keyword GIVING may be used.	
	See also Example 2 - DISPLAY Statement Using GIVE SYSTEM FUNCTIONS Clause.	
statement-paramet	Parameter Definition at Statement Level:	

Description	
One or more parameters, enclosed within parentheses, may be specified at statement level, that is, immediately after the DISPLAY statement.	
Each parameter specified will override the corresponding parameter previously specified in a <code>GLOBALS</code> command, <code>SET GLOBALS</code> (Reporting Mode only) or <code>FORMAT</code> statement.	
If more than one parameter is specified, they must be separated by one or more blanks from one another. Each parameter specification must not be split between two statement lines.	
<b>Note:</b> The parameter settings applied here will only be regarded for variable fields, but they have no effect on text-constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element, see <i>Parameter Definition at Element (Field) Level</i> .	
See also:	
■ List of Parameters	
Example of Parameter Usage at Statement and Element (Field) Level	
Example 7 - DISPLAY Statement Using Parameters on Statement/Element Level	

# **List of Parameters**

The following parameters can be specified with the  ${\tt DISPLAY}$  statement

Parameter Name	Explanation	Specification possible at statement level (S), at element level (E) or both (SE)
AD	Attribute Definition	SE
AL	Alphanumeric Length for Output	SE
ВХ	Box Definition	SE
CD	Color Definition	SE
CV	Control Variable	SE
DF	Date Format	SE
DL	Display Length for Output	SE
DY	Dynamic Attributes	SE
EM	Edit Mask	SE
EMU	Unicode Edit Mask	E
ES	Empty Line Suppression	S
FC	Filler Character	SE
FL	Floating Point Mantissa Length	SE

Parameter Name	Explanation	Specification possible at statement level (S), at element level (E) or both (SE)
GC	Filler Character for Group Headers	SE
НС	Header Centering	SE
HW	Heading Width	SE
IC	Insertion Character	SE
ICU	Unicode Insertion Character	SE
IS	Identical Suppress	SE
LC	Leading Characters	SE
LCU	Unicode Leading Characters	SE
LS	Line Size	S
MC	Multiple-Value Field Count	S
MP	Maximum Number of Pages of a Report	S
NL	Numeric Length for Output	SE
PC	Periodic Group Count	S
PM	Print Mode	SE
PS	Page Size	S
SF	Spacing Factor	SE
SG	Sign Position	SE
TC	Trailing Characters	SE
TCU	Unicode Trailing Characters	SE
UC	Underlining Character	SE
ZP	Zero Printing	SE

The individual parameters are described in the *Parameter Reference* (session parameters).

See also the following topics in the *Programming Guide*:

- Centering of Column Headers HC Parameter
- Width of Column Headers HW Parameter
- Filler Characters for Headers Parameters FC and GC
- Underlining Character for Titles and Headers UC Parameter

## Example of Parameter Usage at Statement and Element (Field) Level

```
DEFINE DATA LOCAL
                                                          /*
1 VARI (A4) INIT <'1234'>
                                                                 Output
END-DEFINE
                                                          /*
                                                                Produced
                                                          /*
DISPLAY NOHDR
                         'Text'
                                              VARI
                                                                Text 1234
                                                                Text 4321
DISPLAY NOHDR (PM=I)
                        'Text'
                                                          /*
                                              VARI
DISPLAY NOHDR
                         'Text' (PM=I)
                                              VARI (PM=I)/*
                                                                txeT 4321
DISPLAY NOHDR
                         'Text' (PM=I)
                                              VARI
                                                                txeT 1234
END
```

### **Output Format Definitions**

```
\begin{bmatrix} nX \\ nT \\ x/y \\ T*field-name \\ P*field-name \end{bmatrix} \begin{bmatrix} \left\{ \begin{array}{c} 'text' \\ 'c'(n) \end{array} \right\} & [(attributes)] \end{bmatrix} ....
\begin{bmatrix} VERTICALLY \\ [HORIZONTALLY] \end{bmatrix} AS \left\{ \begin{array}{c} 'text' [(attributes)] [CAPTIONED] \\ [CAPTIONED] \end{array} \right\} \\ \end{bmatrix} [/...]
```

## **Field Positioning Notations**

Syntax Element	Description
nX	Column Spacing:
	This notation inserts $n$ spaces between columns. $n$ must not be zero.
	Example:
	DISPLAY NAME 5X SALARY
	See also:
	Example 1 - DISPLAY Statement Using nX and nT Notation (below)
	■ Column Spacing - SF Parameter and nX Notation (in the Programming Guide)
nΤ	Tab Setting:
	The $n$ $\top$ notation causes positioning (tabulation) to display position $n$ . Backward positioning is not permitted.

Syntax Element	Description							
	In the following example, NAME is displayed beginning in position 25, and SALARY beginning in position 50:							
	DISPLAY 25T NAME 50T SALARY							
	See also:							
	■ Example 1 - DISPLAY Statement Using nX and nT Notation (below)							
	■ Tab Setting - nT Notation (in the Programming Guide)							
x/y	x/y Positioning:							
	The $x/y$ notation causes the next element to be placed $x$ lines below the output of the last statement, beginning in column $y$ . $y$ must not be zero. Backward positioning is not permitted.							
T*field-name	Field Related Positioning:							
	The T* notation is used to position to a specific print position of a field used in a previous DISPLAY statement. Backward positioning is not permitted.							
P*field-name	Field and Line Related Positioning:							
	The P* notation is used to position to a specific print position and line of a field used in a previous DISPLAY statement. It is most often used in conjunction with vertical display mode. Backward positioning is not permitted.							
	See also:							
	■ Example 3 - DISPLAY Statement Using P* Notation (below)							
	■ Tab Notation P*field (in the Programming Guide)							

# Override Column Heading Assignment

Syntax Element	Description
'text'	Text Assignment:
	If placed immediately before a field, the text enclosed by single quotes overrides the column heading.
	The slash character '/' before a field causes the header for the field to be suppressed.

Syntax Element	Description										
	DISPLAY 'EMPLOYEE' NAME 'MARITAL/STATUS' MAR-STAT										
	If multiple ' $text$ ' elements are specified before a field name, the $last$ ' $text$ ' element will be used as the column header and the other text elements will be placed before the value of the field within the column.										
	See also:  Define Your Own Column Headers (in the Programming Guide)										
	■ Text Notation, Defining a Text to Be Used with a Statement (in the Programming Guide)										
	■ Example 4 - DISPLAY Statement Using 'text', 'c(n)' and Attribute Notation (below)										
'c'(n)	Character Repetition:										
	The character enclosed by single quotes is displayed $n$ times immediately before the field value. For example:										
	DISPLAY '*' (5) '=' NAME										
	results in										
	**** SMITH										
	See also:										
	■ Text Notation, Defining a Character to Be Displayed n Times before a Field Value (in the Programming Guide)										
	■ Example 4 - DISPLAY Statement Using 'text', 'c(n)' and Attribute Notation (below)										

# **Output Attributes**

attributes indicates the output attributes to be used for text display. Attributes can be:

```
AD=ad-value...

BX=bx-value...

CD=cd-value

PM=pm-value...

ad-value

cd-value

}...
```

#### Where:

ad-value, bx-value, cd-value and pm-value denote the possible values of the corresponding session parameters AD, BX, CD and PM described in the relevant sections of the *Parameter Reference* documentation.

The compiler actually accepts more than one attribute value for an output field. For example, you can specify: AD=BDI. In such a case, however, only the last value applies. In the given example, only the value I becomes effective and the output field is displayed intensified.

For an alphanumeric/Unicode constant (Natural data format A or U), you can specify <code>ad-value</code> and/or <code>cd-value</code> without preceding <code>CD=</code> or <code>AD=</code>, respectively. The single value entered is then checked against all possible <code>CD</code> values first. For example: a value of <code>IRE</code> will be interpreted as intensifed/red but not as intensified/right-justified/mandatory. You cannot combine a single <code>cd-value</code> or <code>ad-value</code> with a value preceded by <code>CD=</code> or <code>AD=</code>.

#### Vertical/Horizontal Display

The VERT clause may be used to cause multiple field values to be positioned underneath one another in the same column. In vertical mode, a new column may be initiated by specifying the keyword VERT or HORIZ.

The column heading in vertical mode is controlled using the entry or entries specified with the AS clause as described below.

Syntax Element	Description
<u>VERT</u> ICALLY	DISPLAY VERT without AS Clause: Vertical column orientation. No column heading is produced if the AS clause is omitted.
	DISPLAY VERT NAME SALARY  For an example, see DISPLAY VERT without AS Clause in the Programming Guide.
AS 'text'	DISPLAY VERT AS 'text' Clause:  Vertical column orientation. If AS 'text' is specified, the text enclosed by single quotes is used as the column heading.  For an example, see DISPLAY VERT AS 'text' in the Programming Guide.  The slash character / in the character string of 'text' will cause multiple lines of column headings.  DISPLAY VERT AS 'LAST/NAME' NAME

Syntax Element	Description
AS 'text' CAPTIONED	DISPLAY VERT AS 'text' CAPTIONED Clause:  Vertical column orientation. If AS 'text' CAPTIONED is specified, 'text' is used as the column heading and the standard heading text or field name is inserted immediately before the field value in each detail display line.  DISPLAY VERT AS 'PERSONS/SELECTED' CAPTIONED NAME FIRST-NAME  For an example, see DISPLAY VERT AS 'text' CAPTIONED in the Programming Guide.
AS CAPTIONED	DISPLAY VERT AS CAPTIONED Clause:  Vertical column orientation. If AS CAPTIONED is specified, the standard heading text for the field (either heading text or the field name) will be used as the column heading.  DISPLAY VERT AS CAPTIONED NAME FIRST-NAME
<u>HORIZ</u> ONTALLY	DISPLAY HORIZ Clause: Horizontal column orientation. This is the default display mode.

Vertical and horizontal column orientation may be intermixed by using the respective keyword.

To suspend vertical display for a single output element, you may place a dash (-) in front of the element. For example:

#### DISPLAY VERT NAME - FIRST-NAME SALARY

In the above example, FIRST-NAME will be output horizontally next to NAME, while SALARY will be output vertically again, i.e. below NAME.

The standard display mode is horizontal. A column is constructed for each field to be displayed.

Column headings are obtained and used by Natural according to the following priority:

- 1. heading 'text' supplied in the DISPLAY statement;
- 2. the default heading defined in the DDM (database fields), or the name of a user-defined variable;
- 3. the field name as defined in the DDM (if no heading text was defined for the database field).

For group names, a group heading is produced for the entire group. When specifying a group, only the heading for the entire group may be overridden by a user-specified heading.

The maximum number of column header lines is 15.

Line size overflow is not permitted for output resulting from a DISPLAY statement. If a line overflow occurs, an error message is issued.

For more information about vertical/horizontal display usage, see:

- Example 5 DISPLAY Statement Using Horizontal Display
- Example 6 DISPLAY Statement Using Vertical and Horizontal Display
- DISPLAY VERT AS CAPTIONED and HORIZ (in the Programming Guide)

# **Output Element**

```
{ 'text' [(attributes)]
    'c'(n) [(attributes)] ...
    nX
    nT
    x/y
['='] {operand1 [(parameters)]}
```

# Operand Definition Table:

Operand	Possible Structure			Possible Formats								ts		Referencing	<b>Dynamic Definition</b>		
																Permitted	
operand1	S	A	G	N	Α	N	Р	ΙI	FE	3 I	D 7	ΓΙ	7	G	O	yes	no

# Syntax Element Description

Syntax Element	Description							
nX	Column Spacing:							
	This is the same as under <i>Output Format Definitions</i> (see above).							
nΤ	Tab Setting:							
	This is the same as under <i>Output Format Definitions</i> (see above).							
x/y	x/y Positioning:							
	This is the same as under <i>Output Format Definitions</i> (see above).							
'text'	Text Assignment:							
	This is the same as under <i>Output Format Definitions</i> (see above).							
'c'(n)	Character Repetition:							
	This is the same as under <i>Output Format Definitions</i> (see above).							

Syntax Element	Description
'text' '=' 'c' (n) '='	If ' $text$ ' '=' is placed immediately before the field, $text$ is output immediately before the field value. This applies analogously with ' $c$ ' ( $n$ ) '='.
	DISPLAY '****' '=' NAME
attributes	Output Attributes:
	This is the same as under <i>Output Attributes</i> (see above).
operand1	The field to be displayed.
	<b>Note:</b> For DL/I databases: The DL/I AIX fields can be displayed only if a PCB is used with
	the AIX specified in the parameter PROCSEQ. Otherwise, an error message is returned by Natural at runtime.
parameters	Parameter Definition at Element (Field) Level:
	One or more parameters, enclosed within parentheses, may be specified at element (field) level, that is, immediately after <code>operand1</code> . Each parameter specified in this manner will override the corresponding parameter previously specified at statement level or in a <code>GLOBALS</code> command, <code>SET GLOBALS</code> (in Reporting Mode only) or <code>FORMAT</code> statement.
	If more than one parameter is specified, one or more blanks must be placed between each entry. An entry must not be split between two statement lines.
	See also:
	■ List of Parameters
	Example of Parameter Usage at Statement and Element (Field) Level

# **Defaults Applicable for a DISPLAY Statement**

The following defaults are applicable for a DISPLAY statement:

#### Report Width

The width of the report defaults to the value set when Natural is installed. This default value is normally 132 in batch mode or the line length of the terminal in TP mode. It may be overridden with the session parameter LS. In TP mode, line size (LS) and page size (PS) parameters are set by Natural based on the physical characteristics of the terminal type in use.

#### ■ Terminal Screen Output

When the DISPLAY output is displayed on a terminal (emulation) screen, the output begins in physical Column 2 (because Column 1 must be reserved for possible use as an attribute position on a 3270-type terminal).

### Printout on Paper

When the DISPLAY output is printed on paper, the printout begins in the leftmost column (Column 1).

# ■ Spacing Factor

The default spacing factor between elements is one position. There is a minimum of one space between columns (reserved for terminal attributes). This default may be overridden with the session parameter SF.

#### ■ Field Output

The length of the field or the field heading, whichever is greater, determines the column width for the report (unless the HW parameter is used).

- If the field is longer than the heading, the heading will be centered over the column unless the HC=L or HC=R parameter is used to produce a left-justified or right-justified heading.
- If the heading is longer than the field, the field will be left-justified under the heading.
- The values contained in the field are left-justified for alphanumeric fields and right-justified for numeric fields.
- Numeric fields may be displayed left-justified by specifying AD=L.
- Alphanumeric fields may be displayed right-justified by specifying AD=R.
- In a vertical display, the longest data value or heading among all fields determines the column width (unless the HW parameter is used).

#### Sign

One extra high-order print position is reserved for a sign when printing a numeric field. The session parameter SG may be used to suppress the sign position.

## Page Overflow

Page overflow is checked before execution of a DISPLAY statement. No new page title or trailer information is generated during the execution of a DISPLAY statement.

# **Examples**

- Example 1 DISPLAY Statement Using nX and nT Notation
- Example 2 DISPLAY Statement Using GIVE SYSTEM FUNCTIONS Clause
- Example 3 DISPLAY Statement Using P\* Notation
- Example 4 DISPLAY Statement Using 'text', 'c(n)' and Attribute Notation
- Example 5 DISPLAY Statement Using Horizontal Display
- Example 6 DISPLAY Statement Using Vertical and Horizontal Display
- Example 7 DISPLAY Statement Using Parameters on Statement/Element Level

Example 8 - Report Specification with Output File Defined to Natural as PC

## Example 1 - DISPLAY Statement Using nX and nT Notation

```
** Example 'DISEX1': DISPLAY (with nX, nT notation)

************************

DEFINE DATA LOCAL

1 EMPL-VIEW VIEW OF EMPLOYEES

2 NAME

2 JOB-TITLE
END-DEFINE

*

LIMIT 4

READ EMPL-VIEW BY NAME

DISPLAY NOTITLE 5X NAME 50T JOB-TITLE
END-READ

*

END
```

#### **Output of Program DISEX1:**

NAME	CURRENT POSITION
ABELLAN	MAQUINISTA
ACHIESON ADAM ADKINSON	DATA BASE ADMINISTRATOR CHEF DE SERVICE PROGRAMMER

## **Example 2 - DISPLAY Statement Using GIVE SYSTEM FUNCTIONS Clause**

```
** Example 'DISEX2': DISPLAY (with GIVE SYSTEM FUNCTIONS)
***********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
 2 SALARY (1)
 2 CURR-CODE (1)
END-DEFINE
LIMIT 15
FORMAT PS=15
READ EMPLOY-VIEW
 DISPLAY GIVE SYSTEM FUNCTIONS
        PERSONNEL-ID NAME FIRST-NAME SALARY (1) CURR-CODE (1)
 AT END OF PAGE
```

```
WRITE / 'SALARY STATISTICS:'

/ 7X 'MAXIMUM:' MAX(SALARY(1)) CURR-CODE (1)

/ 7X 'MINIMUM:' MIN(SALARY(1)) CURR-CODE (1)

/ 7X 'AVERAGE:' AVER(SALARY(1)) CURR-CODE (1)

END-ENDPAGE
END-READ

*
END
```

### **Output of Program DISEX2:**

Page	1			0!	5-01-12	09:47:48
PERSONNEL ID	N.	AME	FIRST-NAME	ANNUAL SALARY	CURRENCY CODE	
50005500 50005300 50004900 50004600 50004200 50004100 50003800 50006900 50007600	BLOND MAIZIERE CAOUDAL VERDIE VAUZELLE CHAPUIS JOUSSELIN BAILLET MARX		ALEXANDRE ELISABETH ALBERT BERNARD BERNARD ROBERT DANIEL PATRICK JEAN-MARIE	172000 166900 167350 170100 159790 169900 171990 188000 365700	FRA FRA FRA FRA FRA FRA	
MI	ATISTICS: XIMUM: NIMUM: ERAGE:	365700 FR 159790 FR 192414 FR	4			

### Example 3 - DISPLAY Statement Using P\* Notation

```
** Example 'DISEX3': DISPLAY (with P* notation)
************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 SALARY (1)
 2 BIRTH
2 CITY
END-DEFINE
LIMIT 2
READ EMPL-VIEW BY CITY FROM 'N'
DISPLAY NOTITLE NAME CITY
        VERT AS 'BIRTH/SALARY' BIRTH (EM=YYYY-MM-DD) SALARY (1)
 SKIP 1
 AT BREAK OF CITY
   DISPLAY P*SALARY (1) AVER(SALARY (1))
```

```
SKIP 1
END-BREAK
END-READ
END
```

# **Output of Program DISEX3:**

	NAME 	CITY BIRTH SALAR	
WILCOX	NASHVILL		- 01 3000
MORRISON	NASHVILL		7-10 5000
		37	000

# Example 4 - DISPLAY Statement Using 'text', 'c(n)' and Attribute Notation

```
** Example 'DISEX4': DISPLAY (with 'c(n)' notation and attribute)
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 DEPT
 2 LEAVE-DUE
 2 NAME
END-DEFINE
LIMIT 4
READ EMPL-VIEW BY DEPT FROM 'T'
  IF LEAVE-DUE GT 40
  DISPLAY NOTITLE
           'EMPLOYEE' NAME
                                         /* OVERRIDE STANDARD HEADER
           'LEAVE ACCUMULATED' LEAVE-DUE /* OVERRIDE STANDARD HEADER
                                          /* DISPLAY 10 '*' INTENSIFIED
           '*'(10)(I)
  ELSE
   DISPLAY NAME LEAVE-DUE
  END-IF
END-READ
END
```

# **Output of Program DISEX4:**

EMPLOYEE	LEAVE ACCUMULATED	
1 A 1/ E N D A	22	
LAVENDA	33	
BOYER	33	
CORREARD	45	*****
BOUVIER	19	

## **Example 5 - DISPLAY Statement Using Horizontal Display**

```
** Example 'DISEX5': DISPLAY (horizontal display)

**************************

DEFINE DATA LOCAL

1 EMPL-VIEW VIEW OF EMPLOYEES

2 NAME

2 JOB-TITLE

2 SALARY (1:2)

2 CURR-CODE (1:2)

END-DEFINE

*

LIMIT 4

READ EMPL-VIEW BY NAME

DISPLAY NOTITLE NAME JOB-TITLE SALARY (1:2) CURR-CODE (1:2)

SKIP 1

END-READ

*

END
```

### **Output of Program DISEX5:**

NAME	CURRENT POSITION	ANNUAL SALARY	CURRENCY CODE
ABELLAN	MAQUINISTA	1450000	
		1392000	PIA
ACHIESON	DATA BASE ADMINISTRATOR	11300	
		10500	UKL
ADAM	CHEF DE SERVICE	159980	FRA
		0	
ADKINSON	PROGRAMMER	34500	
		31700	USD

## **Example 6 - DISPLAY Statement Using Vertical and Horizontal Display**

```
** Example 'DISEX6': DISPLAY (vertical and horizontal display)
**********************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 CITY
 2 JOB-TITLE
 2 SALARY (1:2)
 2 CURR-CODE (1:2)
END-DEFINE
LIMIT 1
READ EMPL-VIEW BY NAME
DISPLAY NOTITLE VERT AS CAPTIONED
        NAME CITY 'POSITION' JOB-TITLE
        HORIZ 'SALARY' SALARY (1:2) 'CURRENCY' CURR-CODE (1:2)
 /*
 SKIP 1
END-READ
END
```

#### **Output of Program DISEX6:**

# Example 7 - DISPLAY Statement Using Parameters on Statement/Element Level

```
PERSONNEL-ID NAME TELEPHONE (LC=< TC=>)
END-READ
END
```

#### **Output of Program DISEX7:**

PERSONNEL ID	NAME	++++++++++++++TELEPHONE++++++++++++++						
			AREA CODE	TELEPHONE				
60008339	ABELLAN	<1	>	<4356726	>			
30000231	ACHIESON	<0332	>	<523341	>			
50005800	ADAM	<1033	>	<44864858	>			

# Example 8 - Report Specification with Output File Defined to Natural as PC

```
** Example 'PCDIEX1': DISPLAY and WRITE to PC
** NOTE: Example requires that Natural Connection is installed.
**********************
DEFINE DATA LOCAL
01 PERS VIEW OF EMPLOYEES
 02 PERSONNEL-ID
 02 NAME
 02 CITY
END-DEFINE
FIND PERS WITH CITY = 'NEW YORK'
                                        /* Data selection
 WRITE (7) TITLE LEFT 'List of employees in New York' /
                   /* (7) designates the output file (here the PC).
 DISPLAY (7)
   'Location' CITY
   'Surname'
             NAME
   'ID'
              PERSONNEL-ID
END-FIND
END
```

# 63 DIVIDE

Function	472
Syntax 1 - DIVIDE Statement without GIVING Clause	472
Syntax 2 - DIVIDE Statement with GIVING Clause	473
Syntax 3 - DIVIDE Statement with REMAINDER Clause	
Example	

Related Statements: ADD | COMPRESS | COMPUTE | EXAMINE | MOVE | MOVE ALL | MULTIPLY | RESET | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

# **Function**

The DIVIDE statement is used to divide an arithmetic expression or operand into two operands.



**Note**: Concerning Division by Zero: If an attempt is made to use a divisor (*operand1*) which is zero, either an error message or a result equal to zero will be returned; this depends on the setting of the session parameter ZD (described in the *Parameter Reference* documentation).

# Syntax 1 - DIVIDE Statement without GIVING Clause

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols* .

Operand Definition Table:

Operand	Po	ssib	le St	ructure	Possible Formats	Referencing Permitted	Dynamic Definition	
operand1	С	S	A	N	NPIF	yes	no	
operand2		S	A	M	NPIF	yes	no	

Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 INTO operand2	Operands:
	operand1 is the divisor, operand2 is the dividend. The result is stored in operand2 (result field), hence the statement is equivalent to:

Syntax Element	Description
	operand2 := operand2 / operand1
	If an arithmetic-expression is used, operand2 must not be an array range.
	The number of decimal positions for the result of the division is evaluated from the result field (that is, <code>operand2</code> ).
	For the precision of the result, see <i>Rules for Arithmetic Assignments</i> , <i>Precision of Results of Arithmetic Operations</i> in the <i>Programming Guide</i> .
ROUNDED	ROUNDED Option:
	If you specify the keyword ROUNDED, the result will be rounded.
	For information on rounding, see <i>Rules for Arithmetic Assignment</i> , <i>Field Truncation and Field Rounding</i> in the <i>Programming Guide</i> .

# Syntax 2 - DIVIDE Statement with GIVING Clause

DIVIDE	(arithmetic-expression)	l INTO	(arithmetic-expression) operand2	GIVING
[ROUNDED]	operand1	J INIO ,	operand2	operand3

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

# Operand Definition Table:

Operand	Po	ssib	le St	ructure		Possible Formats						Referencing Permitted	Dynamic Definition			
operand1	C	S	A	N			N	Р	Ι	F					yes	no
operand2	C	S	A	N			N	Р	Ι	F					yes	no
operand3		S	A		A	U	N	Р	Ι	F	B*				yes	yes

<sup>\*</sup> Format B of operand3 may be used only with a length of less than or equal to 4.

# Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 INTO operand2 GIVING operand3	Operands:  operand1 is the divisor, operand2 is the dividend.  The result of the division is stored in operand3, hence the statement is equivalent to:

Syntax Element	Description
	operand3 := operand2 / operand1
	The number of decimal positions for the result of the division is evaluated from the result field (that is, operand3).
	For the precision of the result, see <i>Rules for Arithmetic Assignments, Precision of Results of Arithmetic Operations</i> in the <i>Programming Guide</i> .
ROUNDED	ROUNDED Option:
	If you specify the keyword ROUNDED, the result will be rounded.
	For information on rounding, see <i>Rules for Arithmetic Assignment</i> , <i>Field Truncation and Field Rounding</i> in the <i>Programming Guide</i> .

# Syntax 3 - DIVIDE Statement with REMAINDER Clause

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

### Operand Definition Table:

Operand	Po	ssib	le St	ructure	Possible Forn	nats	Referencing	Dynamic
							Permitted	Definition
operand1	C	S	A	N	ΝΡΙ		yes	no
operand2	C	S	A	N	ΝΡΙ		yes	no
operand3		S	A		AUNPIFB*	T	yes	yes
operand4		S	A		AUNPIFB*	T	yes	yes

<sup>\*</sup> Format B of operand3 and operand4 may be used only with a length of less than or equal to 4.

### Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See <i>Arithmetic Expression</i> in the COMPUTE statement.
operand1 operand2	Operands:  operand1 is the divisor, operand2 is the dividend.
	If the GIVING clause is not used, the result is stored in operand2.

Syntax Element	Description								
	If operand2 is a constant or a non-modifiable Natural system variable, the GIVING clause is required.								
GIVING operand3	GIVING Clause:								
	If this clause is used, <code>operand2</code> will not be modified and the result will be stored in <code>operand3</code> .								
	The number of decimal positions for the result of the division is evaluated from the result field (that is, <code>operand2</code> if no <code>GIVING</code> clause is used, or <code>operand3</code> if the <code>GIVING</code> clause is used).								
	For the precision of the result, see <i>Rules for Arithmetic Assignments, Precision of Results of Arithmetic Operations</i> (in the <i>Programming Guide</i> ).								
REMAINDER operand4	REMAINDER Clause:								
	The remainder of the division is placed into the field specified in operand4.								
	■ If the GIVING clause is used, the statement is equivalent to:								
	<pre>operand3 := operand2 / operand1 operand4 := operand2 - (operand3 * operand1)</pre>								
	None of the four operands may be an array range.								
	■ If the GIVING clause is not used, the statement is equivalent to:								
	<pre>temporary := operand2 operand2 := operand2 / operand1 operand4 := temporary - (operand2 * operand1)</pre>								
	where <i>temporary</i> is a temporary field with the same format/length as <i>operand2</i> .								
	For each of these steps, the rules described in <i>Precision of Results of Arithmetic Operations</i> in the <i>Programming Guide</i> apply.								

# **Example**

```
** Example 'DIVEX1': DIVIDE

************************

DEFINE DATA LOCAL

1 #A (N7) INIT <20>

1 #B (N7)

1 #C (N3.2)

1 #D (N1)

1 #E (N1) INIT <3>

1 #F (N1)
```

```
END-DEFINE

*

DIVIDE 5 INTO #A

WRITE NOTITLE 'DIVIDE 5 INTO #A' 20X '=' #A

*

RESET INITIAL #A

DIVIDE 5 INTO #A GIVING #B

WRITE 'DIVIDE 5 INTO #A GIVING #B' 10X '=' #B

*

DIVIDE 3 INTO 3.10 GIVING #C

WRITE 'DIVIDE 3 INTO 3.10 GIVING #C' 8X '=' #C

*

DIVIDE 3 INTO 3.1 GIVING #D

WRITE 'DIVIDE 3 INTO 3.1 GIVING #D' 9X '=' #D

*

DIVIDE 2 INTO #E REMAINDER #F

WRITE 'DIVIDE 2 INTO #E REMAINDER #F' 7X '=' #E '=' #F

*

END
```

### **Output of Program DIVEX1:**

```
DIVIDE 5 INTO #A #A: 4

DIVIDE 5 INTO #A GIVING #B #B: 4

DIVIDE 3 INTO 3.10 GIVING #C #C: 1.03

DIVIDE 3 INTO 3.1 GIVING #D #D: 1

DIVIDE 2 INTO #E REMAINDER #F #E: 1 #F: 1
```

# 64 DO/DOEND

Function	478
Restrictions	478
Example	479

```
DO statement...DOEND
```

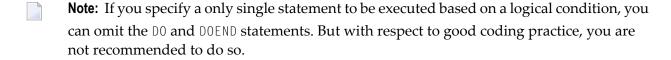
For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Reporting Mode Statements

# **Function**

The DO and DOEND statements are used in reporting mode to specify a group of statements to be executed based on a logical condition as specified in any of the statements listed below.

- AT BREAK
- AT END OF DATA
- AT END OF PAGE
- AT START OF DATA
- AT TOP OF PAGE
- BEFORE BREAK PROCESSING
- FIND ... IF NO RECORDS FOUND
- IF
- IF SELECTION
- ON ERROR
- READ WORK FILE ... AT END OF FILE



# **Restrictions**

- The DO and DOEND statements are only valid in reporting mode.
- WRITE TITLE, WRITE TRAILER, and the AT condition statements AT BREAK, AT END OF DATA, AT END OF PAGE, AT START OF DATA, AT TOP OF PAGE are not permitted within a DO/DOEND statement group.
- A loop-initiating statement may be used within a DO/DOEND statement group provided that the loop is closed prior to the DOEND statement.

# **Example**

```
** Example 'DOEEX1': DO/DOEND
************************
EMP. FIND EMPLOYEES WITH CITY = 'MILWAUKEE'
 VEH. FIND VEHICLES WITH PERSONNEL-ID = PERSONNEL-ID
   IF NO RECORDS FOUND DO
     ESCAPE
   DOEND
   DISPLAY PERSONNEL-ID (EMP.) NAME (EMP.)
           SALARY (EMP.,1)
          MAKE (VEH.) MAINT-COST (VEH.,1)
   AT END OF DATA DO
     WRITE NOTITLE
       / 10X 'AVG SALARY:'
             T*SALARY (1) AVER(SALARY (1))
       / 10X 'AVG MAINTENANCE (ZERO VALUES EXCLUDED):'
             T*MAINT-COST (1) NAVER(MAINT-COST (1))
   DOEND
   /*
 L00P
L00P
END
```

## **Output of Program DOEEX1:**

PERSONNEL ID	NAME	ANNUAL SALARY	MAKE	MAINT-COST
20021100 20027800 20027800 20030600	JONES LAWLER LAWLER NORDYKE	31000 GENERAL 29000 GENERAL 29000 TOYOTA 47000 FORD		140 0 86 194
	AVG SALARY: AVG MAINTENANCE (ZERO	35666 VALUES EXCLUDED):		140

# 65 DOWNLOAD PC FILE

Function	482
Syntax Description	482
Examples	483

```
 \left\{ \begin{array}{l} \mathsf{DOWNLOAD} \\ \mathsf{WRITE} \end{array} \right\} \left\{ \begin{array}{l} \mathsf{PC} \\ \mathsf{WORK} \end{array} \right\} \left[ \begin{array}{l} \mathsf{[FILE]} \\ \mathit{work-file-number} \end{array} \left\{ \begin{array}{l} \mathsf{[VARIABLE]} \ \mathit{operand1} \\ \mathsf{COMMAND} \ \mathit{operand2} \end{array} \right\} \quad \left\{ \begin{array}{l} \mathsf{SYNC} \\ \mathsf{ASYNC} \end{array} \right\} \quad \left\{ \begin{array}{l} \mathsf{SYNC} \\ \mathsf{ASYNC} \end{array} \right\}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CLOSE PC FILE | UPLOAD PC FILE | WRITE WORK FILE

Belongs to Function Group: Control of Work Files / PC Files

# **Function**

This statement is used to transfer data from a mainframe platform to the PC.

See also the Natural Connection and Entire Connection documentation

# **Syntax Description**

Operand Definition Table:

Operand	Pos	sibl	e Stı	uctu	ire												Referencing Permitted	Dynamic Definition
operand1	C	S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C	yes	no
operand2	С	S				A											yes	yes

Neither Format C not G is valid for Natural Connection.

Syntax Element Description:

Syntax Element	Description								
work-file-number	Work File Number:								
	The work file number to be used. This number must correspond to one of the work file numbers for the PC as defined to Natural.								
VARIABLE	Variable Format:								
	The records in the PC file will be written in variable format. Note that variable records cannot be converted to PC spreadsheet formats.								
operand1	Field Specification:								
	With operand1 you specify the fields to be downloaded to the PC.								

Syntax Element	Description								
COMMAND	COMMAND Clause:								
	With the COMMAND clause, you can send PC commands (that is, any command that can be entered in the command line of Entire Connection on the PC) from the mainframe to the PC.								
	Entire Connection checks whether the command sent is valid or not. A command that cannot be recognized by the PC is rejected. In this case, Natural issues the error message that the downloaded command was rejected by the PC.								
	You can use the COMMAND clause, for example, to execute Entire Connection tasks from the mainframe. If you have the task DIR which lists PC directory information, you can initiate this directly out of your Natural program on the mainframe with the following statement:								
	DOWNLOAD PC FILE 7 COMMAND 'DIR'								
	In <i>Example 2</i> below, the COMMAND clause is used to define the name of the PC file that is to receive the downloaded data. In this way, you can avoid prompting for the name of the file.								
operand2	COMMAND Specification:								
	With <i>operand2</i> , you specify the DOS command or Entire Connection task that is to be executed on the PC. <i>operand2</i> must be an alphanumeric constant or variable.								
SYNC	SYNC Option:								
	With SYNC, you specify that the PC returns control to Natural after executing and terminating COMMAND. SYNC can be used, for example, to ensure that the command SET PCFILE has been executed before a file transfer starts.								
ASYNC	ASYNC Option:								
	With ASYNC, you specify that the PC immediately returns control to Natural, regardless of whether the execution of COMMAND has terminated or not.								

# **Examples**

■ Example 1 - Use of DOWNLOAD PC FILE Statement

■ Example 2 - Use of COMMAND Clause

#### Example 1 - Use of DOWNLOAD PC FILE Statement

The following program demonstrates the use of the DOWNLOAD PC FILE statement. The data is first selected and then downloaded to the PC by using Work File 7.

#### **Output of Program PCDOEX1:**

When you run the program, a window appears in which you specify the name of the PC file into which the data is to be downloaded. The data is then downloaded to the PC.

#### **Example 2 - Use of COMMAND Clause**

The following program demonstrates the use of the COMMAND clause in the DOWNLOAD PC FILE statement. The name of the receiving PC file is first defined. Then the data is selected and downloaded to this file.

```
** Example 'PCDOEX2': DOWNLOAD PC FILE
**
** NOTE: Example requires that Natural Connection is installed.
************************
DEFINE DATA LOCAL
01 PERS VIEW OF EMPLOYEES
 02 PERSONNEL-ID
 02 NAME
 02 CITY
                                           /* Variable for transfer
01 CMD (A80)
END-DEFINE
                                           /* of the PC command
MOVE 'SET PCFILE 7 DOWN DATA PERS.NCD' TO CMD /* PC command to define
DOWNLOAD PC FILE 6 COMMAND CMD
                                           /* Command download
```

```
*
FIND PERS WITH CITY = 'NEW YORK' /* Data selection
DOWNLOAD PC FILE 7 CITY NAME PERSONNEL-ID /* Data download
END-FIND
END
```

**Note:** The PC file number in two successive DOWNLOAD PC FILE statements must be different.

## **Output of Program PCDOEX2:**

When you run the program, the data is downloaded to the PC file that was specified in the program. A window does not appear.

# 66 EJECT

Function	488
Syntax Description	488
Processing	490
Example	

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

# **Function**

The EJECT statement may be used to control page advance/page ejection.

# **Syntax Description**

Two different structures are possible for this statement.

- EJECT Syntax 1
- EJECT Syntax 2

For an explanation of the symbols used in the syntax diagrams below, see *Syntax Symbols*.

# **EJECT - Syntax 1**

EJECT 
$$\left\{\begin{array}{c} ON \\ OFF \end{array}\right\}$$
 [(rep)]

Syntax Element Description:

Syntax Element	Description										
EJECT	With Report Specification - Online and Batch Modes:										
ON/OFF (rep)	EJECT OFF (rep)	Causes no page advance (except as specified with Syntax 2 of the EJECT statement) for the specified report to be executed.									
	EJECT ON (rep)	Causes page advances for the specified report to be executed.									
EJECT ON/OFF	Without Report Specification - Batch Mode only:										
	1	ON/OFF may be used in batch mode to control page ated during the execution of a program.									

Syntax Element	Description						
	EJECT ON	Causes Natural to generate a page eject between the source program listing, the output report and the message					
		EXECUTION COMPLETED					
		. This is the default setting.					
	EJECT OFF	Causes Natural to suppress page breaks between the above output. EJECT OFF remains in effect until revoked with a subsequent EJECT ON statement.					
(rep)	Report Specification:						
	The notation $(rep)$ may be used to specify the identification of the report for which the statement is applicable.						
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE statement may be specified.						
If ( rep) is not specified, the EJECT statement will be applicable to the first report ( For information on how to control the format of an output report created with Natura Format and Control in the Programming Guide.							

## **EJECT - Syntax 2**

This form of the EJECT statement may be used to cause a page advance without a title or heading line being generated on the next page and without TOP/END PAGE processing.



## Operand Definition Table:

Operand	Po	ssibl	le St	ructı	ure	Possible Formats						Referencing Permitted	Dynamic Definition
operand1	C	S				N	PΙ					yes	no

Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	The notation ( $rep$ ) may be used to specify the identification of the report for which the EJECT statement is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If ( $rep$ ) is not specified, the EJECT statement will be applicable to the first report (Report 0).
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .
IF LESS THAN	IF LESS THAN LINES LEFT Clause:
operand1 LINES	
LEFT	A page advance will be performed only when the current line for the page is greater than the page size minus <code>operand1</code> . The value for <code>operand1</code> may be specified as a numeric constant or as a variable.

# **Processing**

The execution of an EJECT statement does not cause any statements used with an AT TOP OF PAGE, AT END OF PAGE, WRITE TITLE or WRITE TRAILER statement to be executed. It does not affect system functions evaluated by DISPLAY GIVE SYSTEM FUNCTIONS.

EJECT causes a new physical page only. It causes the Natural system variable \*LINE-COUNT to be set to 1 but has no effect on the setting of the Natural system variable \*PAGE-NUMBER.

# **Example**

```
** Example 'EJTEX1': EJECT

*********************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 CITY

2 NAME

2 JOB-TITLE
END-DEFINE

*

FORMAT PS=15
LIMIT 9

READ EMPLOY-VIEW BY CITY

/*
AT START OF DATA
```

```
EJECT
    WRITE /// 20T '%' (29) /
                                                 47T '%%' /
              20T '%%'
              20T '%%' 3X 'REPORT OF EMPLOYEES' 47T '%%' /
              20T '%%' 3X ' SORTED BY CITY ' 47T '%%' /
              20T '%%'
                                                47T '%%' /
              20T '%' (29) /
    EJECT
  END-START
  EJECT WHEN LESS THAN 3 LINES LEFT
  WRITE '*' (64)
  DISPLAY NOTITLE NOHDR CITY NAME JOB-TITLE 5X *LINE-COUNT
  WRITE '*' (64)
END-READ
END
```

### **Output of Program EJTEX1:**

#### **After pressing ENTER:**

```
******************
                               2
AIKFN
        SFNK0
                PROGRAMMER
*********************
***********************
                               5
        GODEFROY
********************
*********************
        CANALE
                               8
********************
********************
        PLOUG
                              11
********************
*******************
        HAMMOND
                SECRETARY
                              14
********************
```

# After pressing ENTER:

******	******	*****	
ALBUQUERQUE	ROLLING	MANAGER	2
******	******	*****	
******	******	*****	
ALBUQUERQUE	FREEMAN	MANAGER	5
******	******	*****	
******	******	*****	
ALBUQUERQUE	LINCOLN	ANALYST	8
******	*****	*****	
******	*****	*****	
ALFRETON	GOLDBERG	JUNIOR	11
******	*****	*****	

# 67 END

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For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

# **Function**

The END statement is used to mark the physical end of a Natural program. No symbols may follow the END statement.

In reporting mode, any processing loop which is currently active (that is, which has not been closed with a LOOP statement) is closed by the END statement.

### **Considerations for Program Execution**

When an END statement is executed in a main program (that is, a program executing on Level 1), final end-page processing is performed as well as final break processing for user-initiated breaks (PERFORM BREAK PROCESSING) which have not been associated with a processing loop by specifying a reference notation (r).

When an END statement is executed in a subprogram, or in a program invoked with FETCH RETURN, control will be returned to the invoking program without any final processing.

# **Syntax Description**

Syntax Element	Description
END	Keyword:
	The Natural reserved keyword END is normally used to mark the physical end of a Natural program.
	Period:
	Instead of the Natural reserved keyword END, a period (.) may be used. It must be preceded by at least one blank if other statements are contained in the same line.

# **Examples**

For some typical examples, see *Examples of DEFINE DATA Statement Usage*.

# 68 END TRANSACTION

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END [OF] TRANSACTION [operand1...]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | FIND | GET | GET SAME | GET TRANSACTION DATA | FIND HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

# **Function**

The END TRANSACTION statement is used to indicate the end of a logical transaction. A logical transaction is the smallest logical unit of work (as defined by the user) which must be performed in its entirety to ensure that the information contained in the database is logically consistent.

Successful execution of an END TRANSACTION statement ensures that all updates performed during the transaction have been or will be physically applied to the database regardless of subsequent user, Natural, database or operating system interruption. Updates performed within a transaction for which the END TRANSACTION statement has not been successfully completed will be backed out automatically.

The END TRANSACTION statement also results in the release of all records placed in hold status during the transaction.

The END TRANSACTION statement can be executed based upon a logical condition.

For further information, see the section *Database Update - Transaction Processing* (in the *Programming Guide*).

## Restriction

This statement cannot be used with Entire System Server.

# **Syntax Description**

#### Operand Definition Table:

Operand	Possible Structure							Po	SS	ibl	e I	Foi	ma	ats		Referencing Permitted	Dynamic Definition	
operand1	С	S			N	A	U	N	Р	Ι	F	В	D	T			yes	no

#### Syntax Element Description:

Syntax Elemei	nt Description
operand1	Storage of Transaction Data:
	For a transaction applied to an Adabas database, or to a DL/I database in a batch-oriented BMP region (in IMS environments only), you may also use this statement to store transaction-related information. These transaction data must not exceed 2000 bytes. They may be read with a GET_TRANSACTION_DATA statement.  The transaction data are written to the database specified with the profile parameter ETDB.
	If the ETDB parameter is not specified, the transaction data are written to the database specified with the profile parameter UDB, except on mainframe computers: here, they are written to the database where the Natural Security system file (FSEC) is located (if FSEC is not specified, it is considered to be identical to the Natural system file, FNAT; if Natural Security is not installed, the transaction data are written to the database where FNAT is located).

# **Databases Affected**

An END TRANSACTION statement *without* transaction data (that is, without *operand1*) will only be executed if a database transaction under control of Natural has taken place. Depending on the setting of the Natural profile parameter ET, the statement will be executed only for the database affected by the transaction (ET=0FF), or for all databases that have been referenced since the last execution of a BACKOUT\_TRANSACTION or END\_TRANSACTION statement (ET=0N).

An END TRANSACTION statement with transaction data (that is, with specifying operand1) will always be executed and the transaction data be stored in a database as described in the following section. It depends on the setting of the ET parameter (see above) for which other databases the END TRANSACTION statement will be executed.

# **Database-Specific Considerations**

DL/I Databases	Because PSB scheduling is terminated by a Syncpoint request, Natural saves the PSB position before executing the END TRANSACTION statement. Before the next command execution, Natural re-schedules the PSB and tries to set the PCB position as it was before the END TRANSACTION statement. The PCB position might be shifted forward if any pointed segment had been deleted in the time period between the END TRANSACTION and the following command.
VSAM Databases	and the following command.  For information on the transaction logic that applies when accessing VSAM, see <i>Natural</i> for VSAM in the <i>Database Management System Interfaces</i> documentation.
SQL Databases	As most SQL databases close all cursors when a logical unit of work ends, an END TRANSACTION statement must not be placed within a database modification loop; instead, it has to be placed after such a loop.

# **Examples**

- Example 1 END TRANSACTION
- Example 2 END TRANSACTION with ET Data

#### **Example 1 - END TRANSACTION**

```
** Example 'ETREX1': END TRANSACTION
**
** CAUTION: Executing this example will modify the database records!
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 CITY
 2 COUNTRY
END-DEFINE
FIND EMPLOY-VIEW WITH CITY = 'BOSTON'
  ASSIGN COUNTRY = 'USA'
  UPDATE
  END TRANSACTION
  /*
  AT END OF DATA
   WRITE NOTITLE *NUMBER 'RECORDS UPDATED'
  END-ENDDATA
  /*
END-FIND
END
```

#### **Output of Program ETREX1:**

7 RECORDS UPDATED

#### **Example 2 - END TRANSACTION with ET Data**

```
** Example 'ETREX2': END TRANSACTION (with ET data)
**
** CAUTION: Executing this example will modify the database records!
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
 2 CITY
1 #PERS-NR (A8) INIT <' '>
END-DEFINE
REPEAT
  INPUT 'ENTER PERSONNEL NUMBER TO BE UPDATED: ' #PERS-NR
  IF #PERS-NR = ' '
    ESCAPE BOTTOM
  END-IF
  /*
  FIND EMPLOY-VIEW PERSONNEL-ID = #PERS-NR
    INPUT (AD=M) NAME / FIRST-NAME / CITY
    UPDATE
    END TRANSACTION #PERS-NR
 END-FIND
  /*
END-REPEAT
END
```

#### **Output of Program ETREX2:**

ENTER PERSONNEL NUMBER TO BE UPDATED: 20027800

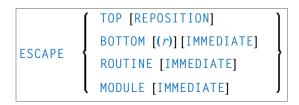
#### After entering and confirming the personnel number:

```
NAME LAWLER
FIRST-NAME SUNNY
CITY MILWAUKEE
```

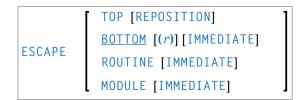
# 69 ESCAPE

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#### Structured Mode Syntax



#### **Reporting Mode Syntax**



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

#### **Related Statements:**

- FIND | FOR | HISTOGRAM | PARSE XML | READ | READ RESULT SET (SQL) | READ WORK FILE | READLOB | REPEAT | SORT
- CALL | CALL | FILE | CALL LOOP | CALLNAT | DEFINE SUBROUTINE | FETCH | PERFORM

#### Belongs to Function Group:

- Loop Execution
- Invoking Programs and Routines

## **Function**

The ESCAPE statement is used to interrupt the linear flow of execution of a processing loop or a routine.

With the keywords TOP, BOTTOM and ROUTINE you indicate where processing is to continue when the ESCAPE statement is encountered.

An ESCAPE TOP/BOTTOM statement, when encountered for processing, will internally refer to the innermost active processing loop. The ESCAPE statement need not be physically placed within the processing loop.

If an ESCAPE TOP/BOTTOM statement is placed in a routine (subroutine, subprogram, function, or a program invoked with FETCH RETURN), the routine(s) entered during execution of the processing loop will be terminated automatically.

#### **Additional Considerations**

More than one ESCAPE statement may be contained within the same processing loop.

The execution of an ESCAPE statement may be based on a logical condition. If an ESCAPE statement is encountered during processing of an AT END OF DATA, AT BREAK or AT END OF PAGE block, the execution of the special condition block will be terminated and ESCAPE processing will continue as required.

If an ESCAPE statement is encountered during processing of an if-no-records-found condition, no loop-end processing will be performed (equivalent to ESCAPE IMMEDIATE).

# **Syntax Description**

Syntax Element	Description
ESCAPE TOP	Top Option:
	TOP indicates that processing is to continue at the top of the processing loop. This starts the next repetition of the processing loop.
REPOSITION	Top Reposition Option:
	When an ESCAPE TOP REPOSITION statement is executed, Natural immediately continues processing at the top of the active READ loop, using the current value of the search variable as new start value.
	At the same time, ESCAPE TOP REPOSITION resets the system variable *COUNTER to zero.
	ESCAPE TOP REPOSITION can be specified within a READ statement loop accessing an Adabas, DL/I or VSAM database. The READ statement concerned must contain the option WITH REPOSITION.
ESCAPE BOTTON	Bottom Option:
	BOTTOM indicates that processing is to continue with the first statement following the processing loop. The loop is terminated and loop-end processing (final BREAK and END DATA) is executed for all loops being terminated.
	In reporting mode, ESCAPE BOTTOM is the default.
(r)	Statement Reference:
	Notation ( $r$ ): If BOTTOM is followed by a label or reference number, processing will continue with the first statement following the processing loop identified by the label or reference number.
	A label or a reference number can only be specified if the ESCAPE BOTTOM statement is physically placed within the referenced processing loop.

Syntax Element	Description
IMMEDIATE	Immediate Option:
	If you specify the keyword IMMEDIATE, no loop-end processing will be performed.
ESCAPE	Routine Option:
ROUTINE	This option indicates that the current Natural routine, which may have been invoked via a PERFORM, CALLNAT, FETCH RETURN, or as a main program, is to relinquish control.
	In the case of a subroutine, processing will continue with the first statement after the statement used to invoke the subroutine. In the case of a main program, Natural command mode will be entered.
	All loops currently active within the routine will be terminated and loop-end processing performed as well as final processing for user-initiated (PERFORM BREAK) processing. If the program containing the ESCAPE ROUTINE is executed as a main program (Level 1), final end-page processing is performed.
ESCAPE MODULE	Module Option:
	This option indicates that the entire current program level, with all internal subroutines, is to relinquish control. The control is then returned to the object of the former program level. If ESCAPE MODULE is used in a hierarchy of internal subroutines, it allows to escape all routines working at this level at once. If no internal subroutine is active, ESCAPE MODULE has the same result as ESCAPE ROUTINE.
	ESCAPE MODULE is only relevant in inline subroutines. In external subroutines, subprograms and invoked programs, it has the same effect as ESCAPE ROUTINE.
	As with ESCAPE ROUTINE, loop-end processing will be performed. However, if you specify the keyword IMMEDIATE, no loop-end processing will be performed.

# **Example**

```
** Example 'ESCEX1': ESCAPE

********************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 CITY

2 FIRST-NAME

2 NAME

2 NAME

2 AREA-CODE

2 PHONE

*

1 #CITY (A20) INIT <' '>

END-DEFINE

*

REPEAT
```

```
INPUT 'ENTER VALUE FOR CITY: ' #CITY
 / 'OR ''.'' TO TERMINATE
IF #CITY = '.'
   ESCAPE BOTTOM
  END-IF
  /*
  FND. FIND EMPLOY-VIEW WITH CITY = #CITY
   IF NO RECORDS FOUND
     WRITE 'NO RECORDS FOUND'
      ESCAPE BOTTOM (FND.)
   END-NOREC
   AT START OF DATA
      INPUT (AD=0) 'RECORDS FOUND:' *NUMBER //
                   'ENTER ''D'' TO DISPLAY RECORDS' #CNTL (AD=M)
     IF #CNTL NE 'D'
       ESCAPE BOTTOM (FND.)
      END-IF
   END-START
   /*
   DISPLAY NOTITLE NAME FIRST-NAME PHONE
 END-FIND
END-REPEAT
```

#### **Output of Program ESCEX1:**

```
ENTER VALUE FOR CITY: PARIS
(OR '.' TO TERMINATE)
```

#### After entering and confirming city name:

```
RECORDS FOUND: 26
ENTER 'D' TO DISPLAY RECORDS D
```

#### Result after entering and confirming D:

NAME	FIRST-NAME	TELEPHONE
MAIZIERE	ELISABETH	46758304
MARX	JEAN-MARIE	40738871
REIGNARD	JACQUELINE	48472153
RENAUD	MICHEL	46055008
REMOUE	GERMAINE	36929371
LAVENDA	SALOMON	40155905
BROUSSE	GUY	37502323
GIORDA	LOUIS	37497316
SIECA	FRANCOIS	40487413

CENSIER	BERNARD	38070268
DUC	JEAN-PAUL	38065261
CAHN	RAYMOND	43723961
MAZUY	ROBERT	44286899
FAURIE	HENRI	44341159
VALLY	ALAIN	47326249
BRETON	JEAN-MARIE	48467146
GIGLEUX	JACQUES	40477399
KORAB-BRZOZOWSKI	BOGDAN	45288048
XOLIN	CHRISTIAN	46060015
LEGRIS	ROGER	39341509
VVVV		

# 70 EXAMINE

Syntax 1 - EXAMINE	510
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Syntax 3 - EXAMINE for Unicode Graphemes	
■ Examples	

Related Statements: ADD | COMPRESS | COMPUTE | DIVIDE | MOVE | MOVE ALL | MULTIPLY | RESET | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

# Syntax 1 - EXAMINE

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## Syntax Description - Syntax 1

The EXAMINE statement is used to inspect the content of an alphanumeric or binary field, or a range of fields within an array, and to

- return the number of how many times a search-pattern was found;
- return the byte position where a search-pattern appears first;
- return the significant content length of a field; that is, the field length without trailing blanks;
- return the occurrence number (indices) of an array field, where a pattern was found first;
- replace a pattern by another pattern;
- delete a pattern.

Operand Definition Table:

Operand	Pos	ssib	le St	ructu	re		Possible Formats						Referencing Permitted	•		
operand1	C*	S	A			A	U				I	В			yes	no
operand2	C	S						N	Р	Ι	I	В*			yes	no
operand3	С	S						N	Р	Ι	I	В*			yes	no
operand4	С	S	A*			A	U				I	В			yes	no

<sup>\*</sup> operand1 can only be a constant if the GIVING clause is used, but not if the DELETE/REPLACE clause is used.

## Syntax Element Description:

Syntax Element	Description
DIRECTION-clause	DIRECTION Clause:
	This clause determines the search direction. For details, see <i>DIRECTION Clause</i> below.
operand1	Field to be Examined:
	operand1 is the field whose content is to be examined.
	If operand1 is a DYNAMIC variable, a REPLACE operation may cause its length to be increased or decreased; a DELETE operation may cause its length to be set to zero. The current length of a DYNAMIC variable can be ascertained by using the system variable *LENGTH.
POSITION-clause	POSITION Clause:
	This clause may be used to specify a starting and ending position within <code>operand1</code> (or the substring of <code>operand1</code> ) for the examination. For details, see <code>POSITION Clause</code> below.
operand4	Value to be Used for EXAMINE Operation:
	operand4 is the value which is searched for in the examined field(s). You may search for a single value or for multiple values.
	For more information on <i>operand4</i> and <i>operand6</i> , see <i>operand6</i> , which is used in the <i>DELETE REPLACE Clause</i> described below.
FULL	FULL Option:
	If FULL is specified for an operand, the entire value, including trailing blanks, will be processed. If FULL is not specified, trailing blanks in the operand will be ignored.
SUBSTRING	SUBSTRING Option:

<sup>\*</sup> operand4 can also be used as an array, see Search and Replace with Multiple Values.

<sup>\*</sup> Format B of operand2 and operand3 may be used only with a length of less than or equal to 4.

Syntax Element	Description
	Normally, the content of a field is examined from the beginning of the field to the end or to the last non-blank character.
	With the SUBSTRING option, you examine only a certain part of the field. After the field name (operand1) in the SUBSTRING clause, you specify first the starting position (operand2) and then the length (operand3) of the field portion to be examined.
	For example, to examine the 5th to 12th position inclusive of a field #A, you would specify:
	EXAMINE SUBSTRING(#A,5,8).
	Note:
	1. If you omit <i>operand2</i> , the starting position is assumed to be 1.
	2. If you omit <i>operand3</i> , the length is assumed to be from the starting position to the end of the field.
	3. If SUBSTRING is used in conjunction with a DYNAMIC variable, the field behaves like a fixed length variable; that is, the length (*LENGTH) does not change as a result of the EXAMINE operation, regardless of whether a DELETE or REPLACE operation was executed or not.
PATTERN	PATTERN Option:
	If you wish to examine the field for a value which contains "wild characters", that is symbols for positions not to be examined, you use the PATTERN option. operand4 may then include the following symbols for positions to be ignored:
	■ A period (.), question mark (?) or underscore (_) indicates a single position that is not to be examined.
	■ An asterisk (*) or a percent sign (%) indicates any number of positions not to be examined.
	Example: With PATTERN 'NAT*AL' you could examine the field for any value which contains NAT and AL no matter which and how many other characters are between NAT and AL (this would include the values NATURAL and NATIONAL as well as NATAL).
DELIMITERS-option	DELIMITERS Option:
	This option is used to scan for a value which exhibits delimiters. For details, see <i>DELIMITERS Option</i> below.
DELETE-REPLACE-clause	DELETE REPLACE Clause:
	The DELETE option of this clause is used to delete each search-value ( <i>operand4</i> ) found in <i>operand1</i> , whereas the REPLACE option is used to replace each search-value ( <i>operand4</i> ) found in <i>operand1</i> by the value specified in <i>operand6</i> . For details, see <i>DELETE REPLACE Clause</i> below.

Syntax Element	Description
GIVING-clause	For details, see GIVING Clause below.

#### **DIRECTION Clause**

The direction clause determines the search direction.



## **Operand Definition Table:**

Operand	Po	P	Possible Formats								Referencing Permitted	Dynamic Definition				
operand8	C	S				A1									yes	no

## Syntax Element Description:

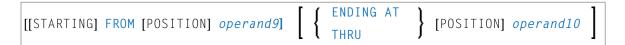
Syntax Elemei	nt Description
FORWARD	Examine in Left-to-Right Direction:
	If you specify FORWARD, the contents of the field are examined from left to right.
BACKWARD	Examine in Right-to-Left Direction:
	If you specify BACKWARD, the contents of the field are examined from right to left.
operand8	Alternative Specification:
	If you specify <i>operand8</i> , the search direction is determined by the contents of <i>operand8</i> . <i>operand8</i> must be defined with format/length A1. If <i>operand8</i> contains an F, then the search direction is FORWARD, if <i>operand8</i> contains a B, the search direction is BACKWARD. All other values are invalid and are rejected at compile time if <i>operand8</i> is a constant, or at run time if <i>operand8</i> is a variable.



**Note:** If the DIRECTION clause is not specified, the default direction is FORWARD.

#### **POSITION Clause**

The POSITION clause may be used to specify a starting and ending position within *operand1* (or the substring of *operand1*) for the examination.



#### Operand Definition Table:

Operand	Possible Structure					Possible Formats								Referencing Permitted	Dynamic Definition
operand9	C	S				N	P	Ι						yes	no
operand10	С	S				N	P	Ι						yes	no

#### Syntax Element Description:

Syntax Element	Description
FROM operand9	Starting Position:
	operand9 is used to define the starting position for the examination.
ENDING AT / THRU operand10	Ending Position:
	operand10 is used to define the ending position for the examination.

The starting position (*operand9*) and the ending position (*operand10*) are relative to *operand1* or the substring of *operand1*, and both are processed.

The search is performed starting from the starting position and ending at the ending position.

If the starting and/or ending position are not specified, the default position value applies. This value is determined by the search direction:

Direction	Default Starting Position	Default Ending Position
FORWARD	1 (first character)	length of operand1 (last character)
BACKWARD	length of operand1 (last character)	1 (first character)



**Note:** If the search direction is FORWARD and the start position is greater than the end position, or if the search direction is BACKWARD and the start position is less than the end position, no search is performed.

## **DELIMITERS Option**

```
{ ABSOLUTE | WITH [DELIMITERS] [operand5] }
```

## Operand Definition Table:

Operand	Po	Possible Formats							Referencing Permitted	Dynamic Definition				
operand5	C	S				A ا	U			В			yes	no

### Syntax Element Description:

Syntax Element	Description
ABSOLUTE	Absolute Scan Option:
	This is the default option. It results in an absolute scan of the field for the specified value regardless of what other characters may surround the value.
WITH DELIMITERS	WITH DELIMITERS Option:
	This option is used to scan for a value which is delimited by blanks or by any character that is neither a letter nor a numeric character.
	The definition of delimiters may be modified using the SCTAB profile parameter.
WITH DELIMITERS operand5	Specific Delimiter Option:
	This option is used to scan for a value which is delimited by the character or any of the characters specified in <code>operand5</code> . If the search value was found at the beginning or end of the examined field, only the right or left side has to be delimited by one of the <code>operand5</code> characters.

#### **DELETE/REPLACE Clause**



# Operand Definition Table:

Operand	Possible Structure					Possible Formats							S	Referencing Permitted	Dynamic Definition
operand6	С	S	A*			A	U			В				yes	no

<sup>\*</sup> operand6 can also be used as an array, see Search and Replace with Multiple Values.

### Syntax Element Description:

Syntax Element	Description
DELETE	DELETE Option:
	This option is used to delete the first (or all) occurrence(s) of the search-value (operand4) in the content of operand1.
REPLACE	REPLACE Option:
	This option is used to replace the first (or all) occurrence(s) of the search-value (operand4) in operand1 by the replace value specified in operand6.
FIRST	FIRST Option:
	If you specify the keyword FIRST, only the first identical value will be deleted/replaced.

#### Notes:

- 1. If the REPLACE operation results in more characters being generated than will fit into *operand1*, you will receive an error message.
- 2. If *operand1* is a dynamic variable, a REPLACE operation may cause its length to be increased or decreased; a DELETE operation may cause its length to be set to zero. The current length of a dynamic variable can be ascertained by using the system variable \*LENGTH. For general information on dynamic variables, see *Using Dynamic Variables*.

#### Search and Replace with Multiple Values

The search (operand4) and replace value (operand6) may also be defined as array fields. This allows to substitute multiple different patterns in the examined field (operand1), all with an unique EXAMINE statement. It is not necessary to have the same number of occurrences for the search and replace operand. All what is required is the transfer compatibility between these fields; that is, operand4:=operand6 must be a valid operation; see Assignment Operations with Arrays in the Programming Guide.

The operation logic for the multi-value search is as follows:

- The field to be examined (operand1) is passed through only a single time, either from left to right for direction FORWARD or from right to left for direction BACKWARD.
- Beginning with the first position, the values in the search array (operand4) are tested for a match, one after the other, starting with the array occurrence with the lowest index.
- If no search value was found, the comparison repeats on the next field position.
- If one of the searched patterns is detected in the examined field (operand1), it is substituted with the value of the replace array (operand6), which overlays the matching pattern in operand4, if a operand4:=operand6 would be executed.
- After a pattern replacement was performed, the compare process continues with the first occurrence for the search array, immediately after the inserted value. This means, a replaced pattern is skipped and may not be replaced a second time.

#### Example:

This example shows an HTML translation for the characters less than (<), greater than (>), and ampersand (&).

```
DEFINE DATA LOCAL

1 #HTML (A/1:3) DYNAMIC INIT <'&lt;','&gt;','&amp;'>

1 #TAB (A/1:3) DYNAMIC INIT <'<','>','&'>

1 #DOC(A) DYNAMIC /* document to be replaced

END-DEFINE

#DOC := 'a&lt;&lt;b&amp;b&gt;c&gt;'

WRITE #DOC (AL=30) 'before'

/* Replace #DOC using #HTML to #TAB (n:1 replacement)

EXAMINE #DOC FOR #HTML(*) REPLACE #TAB(*)

/* '&lt;' is replaced by '<' (4:1 replacement)

/* '&gt;' is replaced by '>' (4:1 replacement)

/* '&amp;' is replaced by '&' (5:1 replacement)

WRITE #DOC (AL=30) 'after'

END
```

See also Example 3 - EXAMINE AND REPLACE WITH MULTIPLE VALUES.

#### **GIVING Clause**

```
GIVING[IN] operand7
[GIVING] NUMBER[IN] operand7

[[GIVING] POSITION[IN] operand7]
[[GIVING] LENGTH[IN] operand7]
[[GIVING] INDEX[IN] operand7 ...3]
```

#### Operand Definition Table:

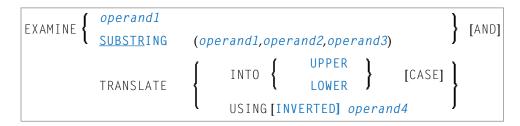
Operand	Possible S	Structure	Possible Formats	Referencing Permitted	Dynamic Definition
operand7	S		NPI	yes	yes

#### Syntax Element Description:

Syntax Element	Description
GIVING	GIVING Clause:
	If only the keyword GIVING is specified, this corresponds to GIVING NUMBER (default).
NUMBER	GIVING NUMBER Clause:
	Is used to obtain information on how many times the search value ( <i>operand4</i> ) was found in the field ( <i>operand1</i> ) whose content is to be examined.

Syntax Element	Description
POSITION	GIVING POSITION Clause:
	Is used to obtain the byte position within <i>operand1</i> (or the substring of <i>operand1</i> ) where the first value identical to <i>operand4</i> was found.
LENGTH	GIVING LENGTH Clause:
	Is used to obtain the remaining content length of <i>operand1</i> (or the substring of <i>operand1</i> ) after all delete/replace operations have been performed. Trailing blanks are ignored.
operand7	Number of Occurrences:
	The number of occurrences of the search-value. If the REPLACE FIRST or DELETE FIRST option is also used, the number will not exceed 1.
INDEX operand7	GIVING INDEX Clause:
3	This option is only applicable if the underlying field to be examined is an array field.
	GIVING INDEX is used to obtain the array occurrence number (index) of <i>operand1</i> in which the first search-value ( <i>operand4</i> ) was found.
	operand7 must be specified as many times as there are dimensions in operand1 (maximum three times). operand7 will return 0 if the search-value is found in none of the occurrences.
	<b>Note:</b> If the index range of <i>operand1</i> includes the occurrence 0 (for example, 0:5),
	a value of 0 in <i>operand7</i> is ambiguous. In this case, an additional GIVING NUMBER clause should be used to ascertain whether the search-value was actually found or not.

# **Syntax 2 - EXAMINE TRANSLATE**



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## Syntax Description - Syntax 2

The EXAMINE TRANSLATE statement is used to translate the characters contained in a field into uppercase or lower-case, or into other characters.

### Operand Definition Table:

Operand	Possible Structure							Pos	ssil	ble	F	orm	Referencing Permitted	Dynamic Definition		
operand1		S	A			A	U				]	В			yes	no
operand2	С	S						N	Р	I	]	В*			yes	no
operand3	С	S						N	Р	I	]	В*			yes	no
operand4		S	A			A	U				]	В			yes	no

<sup>\*</sup>Format B of operand2 and operand3 may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description
EXAMINE operand1	Complete Field Content Translation:
	operand1 is the field whose content is to be translated.
EXAMINE SUBSTRING	Partial Field Content Translation:
operand1 operand2 operand3	Normally, the entire content of a field is translated.
	With the SUBSTRING option, you translate only a certain part of the field. After the field name ( <i>operand1</i> ) in the SUBSTRING clause, you specify first the starting position ( <i>operand2</i> ) and then the length ( <i>operand3</i> ) of the field portion to be examined.
	For example, to translate the 5th to 12th position inclusive of a field $\# A$ , you would specify:
	EXAMINE SUBSTRING(#A,5,8) AND TRANSLATE
	<b>Note:</b> If you omit <i>operand2</i> , the starting position is assumed to be 1. If you
	omit <i>operand3</i> , the length is assumed to be from the starting position to the end of the field.
TRANSLATE INTO UPPER	Upper Case Translation:
CASE	The content of <i>operand1</i> will be translated into upper case.
TRANSLATE INTO LOWER	Lower Case Translation:
CASE	The content of <i>operand1</i> will be translated into lower case.
TRANSLATE USING operand4	Translation Table:

Syntax Element	Description
	operand4 is the translation table to be used for character translation. The table must be of format/length A2, U2 or B2.
	<b>Note:</b> If for a character to be translated more than one translation is defined
	in the translation table, the last of these translations applies.
INVERTED	INVERTED Option:
	If you specify the keyword INVERTED, the translation table (operand4) will be used inverted; that is, the translation direction will be reversed.

## **Syntax 3 - EXAMINE for Unicode Graphemes**

EXAMINE [FULL [VALUE [OF]]]	<pre>operand1 SUBSTRING (operand1, operand2, operand3)</pre>
[POSITION-clause	
[FOR]	CHARPOSITION operand4 CHARLENGTH operand5 CHARPOSITION operand4 CHARLENGTH operand5
{	[GIVING] POSITION [IN] operand6 [GIVING] LENGTH [IN] operand7  [GIVING] POSITION [IN] operand6  [GIVING] LENGTH [IN] operand7

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### Syntax Description - Syntax 3

A "grapheme" is what a user normally thinks of as a character. In most cases, a UTF-16 code unit (= U format character) is a grapheme, however, a grapheme can also consist of several code units. Examples are: a sequence of a base character followed by combining characters or a surrogate pair. For more information on graphemes and other Unicode terms, see *The Unicode Standard* at <a href="http://www.unicode.org/">http://www.unicode.org/</a>.

The EXAMINE statement for U format operands in general operates on code units. However, with the CHARPOSITION and CHARLENGTH clauses it is possible to obtain the starting position and length (in terms of code units) of a graphemes sequence. The returned code unit values can then be used in other statements/clauses which require code unit operands (for example, in a SUBSTRING clause).

For further information on this syntax of the EXAMINE statement, see also *Unicode and Code Page Support* in the *Natural Programming Language*, section *Statements*, *EXAMINE*.

Operand Definition Table:

Operand	Pos	ssib	le St	ruct	ure	Possible Formats									Referencing Permitted	Dynamic Definition	
operand1	C	S	A			U										yes	no
operand2	C	S					N	Р	Ι		B*					yes	no
operand3	С	S					N	Р	Ι		В*					yes	no
operand4	С	S					N	Р	Ι							yes	no
operand5	С	S					N	Р	Ι							yes	no
operand6		S					N	Р	Ι							yes	no
operand7		S					N	Р	Ι							yes	no

<sup>\*</sup> Format B of operand2 and operand3 may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description
FULL	FULL Option:
	If FULL is specified for an operand, the entire value, including trailing blanks, will be processed. If FULL is not specified, trailing blanks in the operand will be ignored.
SUBSTRING operand1	SUBSTRING Clause:
operand2 operand3	Normally, the content of a field is examined from the beginning of the field to the end or to the last non-blank character.
	With the SUBSTRING option, you examine only a certain part of the field. After the field name ( <i>operand1</i> ) in the SUBSTRING clause, you specify first the starting position ( <i>operand2</i> ) and then the length ( <i>operand3</i> ) of the field portion to be examined. <i>operand2</i> and <i>operand3</i> are specified in terms of code units.
	For example, to examine the 5th to 12th position inclusive of a field $\#A$ , you would specify:
	EXAMINE SUBSTRING (#A,5,8)
	Note:
	1. If you omit <i>operand2</i> , the starting position is assumed to be 1.
	2. If you omit <i>operand3</i> , the length is assumed to be from the starting position to the end of the field.
	3. If SUBSTRING is used in conjunction with a DYNAMIC variable, the field behaves like a fixed length variable; that is, the length (*LENGTH) does not change as a result of the EXAMINE operation, regardless of whether a DELETE or REPLACE operation was executed or not.
POSITION-clause	POSITION Clause:

Syntax Element	Description
	FROM and THRU positions are given in terms of code units. For further information, see <i>POSITION Clause</i> under <i>Syntax 1</i> .
CHARPOSITION operand4	CHARPOSITION Clause:
	operand4 defines the starting position (in terms of Unicode graphemes) of the grapheme sequence. The according position in terms of code units is returned in operand6. This clause can be omitted if the CHARLENGTH clause is specified; in this case the starting position 1 is assumed.
CHARLENGTH	CHARLENGTH Clause:
operand5	operand5 defines the length (in terms of Unicode graphemes) of the grapheme sequence. The length of the grapheme sequence in terms of code units is returned in operand7. This clause can be omitted if the CHARPOSITION clause is specified; in this case the length from the starting position up to the end of the string is returned.
	GIVING POSITION Clause:
operand6	operand6 receives the starting position (in terms of code units) of the grapheme sequence defined by operand4 and operand5. If operand1 has less than operand4 graphemes, 0 is returned. This clause can be omitted if the GIVING LENGTH clause is specified.
GIVING LENGTH IN	GIVING LENGTH Clause:
operand7	operand7 receives the length (in terms of code units) of the grapheme sequence defined by operand4 and operand5. If operand1 has less than operand4+operand5 graphemes, 0 is returned. This clause can be omitted if the GIVING POSITION clause is specified.



### Notes:

- 1. Either the CHARPOSITION or the CHARLENGTH clause or both must be specified.
- 2. Either the GIVING POSITION or GIVING LENGTH clause or both must be specified.

# **Examples**

- Example 1 EXAMINE
- Example 2 EXAMINE TRANSLATE
- Example 3 EXAMINE AND REPLACE WITH MULTIPLE VALUES

### ■ Example 4 - EXAMINE for Unicode Graphemes

### **Example 1 - EXAMINE**

```
** Example 'EXMEX1': EXAMINE
**************************
DEFINE DATA LOCAL
1 #TEXT
         (A45)
1 #ARRAY (A5/1:3)
1 #A
         (A3)
1 #START (N2)
1 #NUM
         (N2)
1 #NUM1
         (N2)
1 #NUM2
         (N2)
1 #NUM3
        (N2)
1 #POS
         (N2)
1 #P0S1
       (N2)
1 #LENG
         (N2)
1 #INDEX (N2)
END-DEFINE
MOVE 'ABC A B C .A. .B. .C. -A- -B- -C- ' TO ∦TEXT
WRITE / 'EXAMPLE 1 (DELIMITER, GIVING NUMBER)'
WRITE NOTITLE '#TEXT: ' #TEXT
EXAMINE #TEXT FOR 'A' GIVING NUMBER #NUM1
EXAMINE #TEXT FOR 'A' WITH DELIMITER GIVING NUMBER #NUM2
EXAMINE #TEXT FOR 'A' WITH DELIMITER '.' GIVING NUMBER #NUM3
WRITE 'EXAMINE #TEXT FOR "A" ' 57T 'Number found: ' #NUM1
WRITE 'EXAMINE #TEXT FOR "A" WITH DELIMITER' 57T 'Number found:' #NUM2
WRITE 'EXAMINE #TEXT FOR "A" WITH DELIMITER "."'
 57T 'Number found: ' #NUM3
WRITE / 'EXAMPLE 2 (DELIMITER, REPLACE, GIVING NUMBER)'
WRITE 'EXAMINE #TEXT FOR "A" WITH DELIMITER "-" REPLACE WITH "*"'
WRITE 'Before: ' #TEXT
EXAMINE #TEXT FOR 'A' WITH DELIMITER '-' REPLACE WITH '*'
       GIVING NUMBER #NUM
WRITE 'After: ' #TEXT 57T 'Number found:' #NUM
NEWPAGE
WRITE / 'EXAMPLE 3 (REPLACE, GIVING NUMBER)'
                #TEXT FOR " " REPLACE WITH "+"'
WRITE 'EXAMINE
WRITE 'Before:' #TEXT
EXAMINE #TEXT FOR ' ' REPLACE WITH '+' GIVING NUMBER #NUM
WRITE 'After: ' #TEXT 57T 'Number found:' #NUM
WRITE / 'EXAMPLE 4 (FULL, REPLACE, GIVING NUMBER)'
WRITE 'EXAMINE FULL #TEXT FOR " " REPLACE WITH "+"'
```

```
WRITE 'Before: ' #TEXT
EXAMINE FULL #TEXT FOR ' ' REPLACE WITH '+' GIVING NUMBER #NUM
WRITE 'After: ' #TEXT 57T 'Number found:' #NUM
WRITE / 'EXAMPLE 5 (DELETE, GIVING POSITION)'
WRITE 'EXAMINE #TEXT FOR "+" DELETE GIVING POSITION #POS'
WRITE 'Before:' #TEXT
EXAMINE #TEXT FOR '+' DELETE GIVING POSITION #POS
WRITE 'After: ' #TEXT 57T 'Position found:' #POS
WRITE / 'EXAMPLE 6 (DELETE, GIVING LENGTH)'
WRITE 'EXAMINE #TEXT FOR "A" DELETE GIVING LENGTH #LENG'
WRITE 'Before: ' #TEXT
EXAMINE #TEXT FOR 'A' DELETE GIVING LENGTH #LENG
WRITE 'After: ' #TEXT 57T 'Length found:' #LENG
NEWPAGE
MOVE 'ABC ABC .A. .B. .C. -A- -B- -C- ' TO #TEXT
WRITE / 'EXAMPLE 7 (PATTERN, REPLACE, GIVING NUMBER)'
WRITE 'EXAMINE #TEXT FOR
                              ".A." AND REPLACE "***"'
WRITE 'Before:' #TEXT
                         '.A.' AND REPLACE '***' GIVING NUMBER #NUM
EXAMINE #TEXT FOR
WRITE 'After: ' #TEXT 57T 'Number found:' #NUM
MOVE 'ABC ABC .A. .B. .C. -A- -B- -C- ' TO #TEXT
WRITE 'EXAMINE #TEXT FOR PATTERN ".A." AND REPLACE "***"
WRITE 'Before: ' #TEXT
EXAMINE #TEXT FOR PATTERN '.A.' AND REPLACE '***' GIVING NUMBER #NUM
WRITE 'After: ' #TEXT 57T 'Number found:' #NUM
MOVE 'ABC ABC .A. .B. .C. -A- -B- -C- ' TO #TEXT
#A := 'B C'
#POS := 6
#LENG:= 25
WRITE / 'EXAMPLE 8 (SUBSTRING, REPLACE, GIVING POSITION)'
WRITE '#A := "B C" ; #POS := 6 ; #LENG:= 25 '
WRITE 'EXAMINE SUBSTRING(#TEXT, #POS, #LENG) FOR #A AND REPLACE "***"
WRITE 'Before:' #TEXT
EXAMINE SUBSTRING(#TEXT, #POS, #LENG) FOR #A AND REPLACE '***'
       GIVING POSITION #POS1
WRITE 'After: ' #TEXT 57T 'Position found:' #POS1
NEWPAGE
MOVE 'ABC ABC .A. .B. .C. -A- -B- -C- ' TO #TEXT
```

```
WRITE / 'EXAMPLE 9 (DELETE. GIVING NUMBER. GIVING POSITION. '-
        'GIVING LENGTH)'
WRITE 'EXAMINE #TEXT FOR "." DELETE GIVING NUMBER #NUM'
WRITE 30T 'GIVING POSITION #POS'
WRITE 30T 'GIVING LENGTH #LENG'
WRITE 'Before: ' #TEXT
EXAMINE #TEXT FOR '.' DELETE GIVING NUMBER #NUM
                             GIVING POSITION #POS
                             GIVING LENGTH
                                           #LENG
WRITE 'After: ' #TEXT
WRITE 'Number found: ' #NUM
WRITE 'Position found:' #POS
WRITE 'Length found: ' #LENG
MOVE 'ABC ' TO #ARRAY (1)
MOVE '.A.B.' TO #ARRAY (2)
MOVE '-A-B-' TO \#ARRAY (3)
WRITE / 'EXAMPLE 10 (GIVING NUMBER, GIVING POSITION, GIVING INDEX)'
WRITE '#ARRAY(1):' #ARRAY(1)
WRITE '#ARRAY(2):' #ARRAY(2)
WRITE '#ARRAY(3):' #ARRAY(3)
WRITE 'EXAMINE #ARRAY(*) FOR "B" GIVING NUMBER #NUM'
WRITE 27T 'GIVING POSITION #POS'
WRITE 27T 'GIVING INDEX
                         #INDEX'
EXAMINE #ARRAY(*) FOR 'B' GIVING NUMBER
                                          #NUM
                          GIVING POSITION #POS
                          GIVING INDEX
                                          #INDEX
WRITE 'Number found: ' #NUM
WRITE 'Position found:' #POS
WRITE 'Index found: ' #INDEX
END
```

### **Output of Program EXMEX1:**

```
EXAMPLE 1 (DELIMITER, GIVING NUMBER)
#TEXT: ABC A B C .A. .B. .C. -A- -B- -C-
EXAMINE #TEXT FOR 'A'
                                                    Number found:
                                                                  4
EXAMINE #TEXT FOR 'A' WITH DELIMITER
                                                    Number found:
                                                                  3
EXAMINE #TEXT FOR 'A' WITH DELIMITER '.'
                                                    Number found:
                                                                 1
EXAMPLE 2 (DELIMITER, REPLACE, GIVING NUMBER)
EXAMINE #TEXT FOR 'A' WITH DELIMITER '-' REPLACE WITH '*'
            A B C .A. .B. .C. -A- -B- -C-
Before: ABC
                                   -*- -B- -C-
After: ABC
            A B C .A. .B. .C.
                                                   Number found:
                                                                 1
EXAMPLE 3 (REPLACE, GIVING NUMBER)
           #TEXT FOR ' ' REPLACE WITH '+'
Before: ABC ABC .A. .B. .C.
                                   -*- -B- -C-
```

```
After: ABC+++A+B+C+++.A.++.B.++.C.++++-*-++-B-++-C-
                                                     Number found: 20
EXAMPLE 4 (FULL, REPLACE, GIVING NUMBER)
EXAMINE FULL #TEXT FOR ' ' REPLACE WITH '+'
Before: ABC+++A+B+C+++.A.++.B.++.C.++++-*-++-B-++-C-
After: ABC+++A+B+C+++.A.++.B.++.C.++++-*-++-B-++-C-+ Number found: 1
EXAMPLE 5 (DELETE, GIVING POSITION)
EXAMINE #TEXT FOR '+' DELETE GIVING POSITION #POS
Before: ABC+++A+B+C+++.A.++.B.++.C.++++-*-++-B-++-C-+
After: ABCABC.A..B..C.-*--B--C-
                                                     Position found: 4
EXAMPLE 6 (DELETE, GIVING LENGTH)
EXAMINE #TEXT FOR 'A' DELETE GIVING LENGTH #LENG
Before: ABCABC.A..B..C.-*--B--C-
After: BCBC...B..C.-*--B--C-
                                                     Length found: 21
EXAMPLE 7 (PATTERN, REPLACE, GIVING NUMBER)
                    '.A.' AND REPLACE '***'
EXAMINE #TEXT FOR
                    .A. .B. .C.
Before: ABC A B C
                                    - A - - B - - C -
After: ABC ABC *** .B. .C.
                                                     Number found:
                                    - A - - B - - C -
                                                                  1
EXAMINE #TEXT FOR PATTERN '.A.' AND REPLACE '***'
Before: ABC ABC .A. .B. .C. -A- -B- -C-
After: ABC ***B C *** .B. .C.
                                    *** -B- -C-
                                                   Number found:
                                                                    3
EXAMPLE 8 (SUBSTRING, REPLACE, GIVING POSITION)
\#A := 'B C' : \#POS := 6 : \#LENG := 25
EXAMINE SUBSTRING(#TEXT, #POS, #LENG) FOR #A AND REPLACE '***'
Before: ABC ABC .A. .B. .C. -A- -B- -C-
After: ABC A *** .A. .B. .C.
                                   -A- -B- -C- Position found:
EXAMPLE 9 (DELETE, GIVING NUMBER, GIVING POSITION, GIVING LENGTH)
EXAMINE #TEXT FOR '.' DELETE GIVING NUMBER #NUM
                           GIVING POSITION #POS
                           GIVING LENGTH #LENG
Before: ABC ABC .A. .B. .C. -A- -B- -C-
After: ABC A B C
                  A B C -A- -B- -C-
Number found:
               6
Position found: 15
Length found:
               38
EXAMPLE 10 (GIVING NUMBER, GIVING POSITION, GIVING INDEX)
#ARRAY(1): ABC
#ARRAY(2): .A.B.
#ARRAY(3): -A-B-
EXAMINE #ARRAY(*) FOR 'B' GIVING NUMBER
                                       #NUM
                        GIVING POSITION #POS
                        GIVING INDEX
                                       #INDEX
Number found:
                 3
Position found:
                 2
Index found:
```

### **Example 2 - EXAMINE TRANSLATE**

```
** Example 'EXMEX2': EXAMINE TRANSLATE
**********************
DEFINE DATA LOCAL
1 #TEXT (A50)
1 #TAB (A2/1:10)
1 #POS (N2)
1 #LENG (N2)
END-DEFINE
MOVE 'ABC A B C .A. .B. .C. -A- -B- -C- ' TO #TEXT
MOVE 'AX' TO #TAB(1)
MOVE 'BY' TO #TAB(2)
MOVE 'CZ' TO #TAB(3)
WRITE NOTITLE / 'EXAMPLE 1 (WITH TRANSLATION TABLE)'
WRITE 'EXAMINE #TEXT TRANSLATE USING #TAB(*)'
WRITE 'Before:' #TEXT
EXAMINE #TEXT TRANSLATE USING #TAB(*)
WRITE 'After: ' #TEXT
WRITE / 'EXAMPLE 2 (WITH INVERTED TRANSLATION TABLE)'
WRITE 'EXAMINE #TEXT TRANSLATE USING INVERTED #TAB(*)'
WRITE 'Before:' #TEXT
EXAMINE #TEXT TRANSLATE USING INVERTED #TAB(*)
WRITE 'After: ' #TEXT
\#POS := 13
#LENG:= 15
WRITE / 'EXAMPLE 3 (WITH LOWER CASE TRANSLATION)'
WRITE '#POS := 13 ; #LENG:= 15 '
WRITE 'EXAMINE SUBSTRING(#TEXT, #POS, #LENG) TRANSLATE INTO LOWER CASE'
WRITE 'Before: ' #TEXT
EXAMINE SUBSTRING(#TEXT, #POS, #LENG) TRANSLATE INTO LOWER CASE
WRITE 'After: ' #TEXT
END
```

#### **Output of Program EXMEX2:**

```
EXAMPLE 1 (WITH TRANSLATION TABLE)
EXAMINE #TEXT TRANSLATE USING #TAB(*)
Before: ABC ABC .A. .B. .C. -A- -B- -C-
After: XYZ X Y Z .X. .Y. .Z.
                                    - X - - Y - - Z -
EXAMPLE 2 (WITH INVERTED TRANSLATION TABLE)
EXAMINE #TEXT TRANSLATE USING INVERTED #TAB(*)
Before: XYZ X Y Z .X. .Y. .Z.
                                    - X - - Y - - Z -
After: ABC
           A B C .A. .B. .C.
                                     - A - - B - - C -
EXAMPLE 3 (WITH LOWER CASE TRANSLATION)
\#POS := 13 ; \#LENG := 15
EXAMINE SUBSTRING(#TEXT, #POS, #LENG) TRANSLATE INTO LOWER CASE
Before: ABC A B C
                   .A. .B. .C.
                                    - A - - B - - C -
After: ABC ABC .a. .b. .c.
                                     - A - - B - - C -
```

### **Example 3 - EXAMINE AND REPLACE WITH MULTIPLE VALUES**

```
* EXAMPLE 'EXMEX3': EXAMINE AND REPLACE WITH MULTIPLE VALUES
**************************
* This example shows a translation of the pattern
* 'AA', 'Aa' and 'aA' into '++',
* 'BB', 'Bb' and 'bB' into '--' and
* 'CC', 'Cc' and 'cC' into '**'.
***********************
DEFINE DATA LOCAL
1 #SV (A2/1:3,1:3) INIT (1,V) <'AA','BB','CC'>
                        (2.V) <'Aa','Bb','Cc'>
                        (3,V) <'aA','bB','cC'>
                             <'++','--','**'>
1 #RV (A2/1:3)
                   INIT
                   INIT <'AAABbbbbbBCCCccCaaaA'>
1 #STRING (A20)
1 #NUM (N2)
END-DEFINE
WRITE NOTITLE / 'EXAMINE #STRING FOR #SV(*,*) AND REPLACE WITH #RV(*)' /
WRITE 'Before:' #STRING /* shows 'AAABbbbbBCCCcccCaaaA'
EXAMINE #STRING FOR #SV(*,*) AND REPLACE WITH #RV(*)
      GIVING NUMBER #NUM
WRITE 'After: ' #STRING /* shows '++A--bb--***c**aa++'
 40T 'Number found: ' #NUM
```

### **Output of Program EXMEX3:**

```
EXAMINE #STRING FOR #SV(*,*) AND REPLACE WITH #RV(*)

Before: AAABbbbbBCCCcccCaaaA

After: ++A--bb--***c**aa++ Number found: 7
```

### **Example 4 - EXAMINE for Unicode Graphemes**

This example demonstrates the analysis of a Unicode string containing the characters  $\ddot{a}$  und  $\ddot{u}$ . Both characters are defined as base character followed by a combining character:  $\ddot{a}$  is coded with U+0061 followed by U+0308, and  $\ddot{u}$  is coded with U+0075 followed by U+0308.

```
DEFINE DATA LOCAL
1 #U (U20)
1 #START (I2)
1 #POS (I2)
1 #LEN (I2)
END-DEFINE
#U := U'AB'-UH'00610308'-U'CD'-UH'00750308'-U'EF'
REPEAT
 \#START := \#START + 1
 EXAMINE #U FOR CHARPOSITION #START
                   CHARLENGTH
             GIVING POSITION IN #POS
                      LENGTH IN #LEN
  INPUT (AD=0) MARK POSITION #POS IN FIELD *#U
             UNICODE-STRING: ' #U (AD=MI)
 // '
              CHARACTER NO.: ' #START (EM=9)
 / 'STARTS AT BYTE POSITION:' #POS (EM=9)
 / ' AND THE LENGTH IS: ' #LEN
                                     (EM=9)
WHILE #POS NE O
END-REPEAT
END
```

### Output:

Mainframe Environments:	Windows, UNIX and OpenVMS Environments (with Natural Web I/O Interface):
UNICODE-STRING: ABa?CDu?EF	UNICODE-STRING: ABäCDüEF
CHARACTER NO.: 1	CHARACTER NO.: 1
STARTS AT BYTE POSITION: 1	STARTS AT BYTE POSITION: 1
AND THE LENGTH IS: 1	AND THE LENGTH IS: 1
Press ENTER to continue.	Press ENTER to continue.
UNICODE-STRING: ABa?CDu?EF	UNICODE-STRING: ABäCDüEF
CHARACTER NO.: 2	CHARACTER NO.: 2
STARTS AT BYTE POSITION: 2	STARTS AT BYTE POSITION: 2
AND THE LENGTH IS: 1	AND THE LENGTH IS: 1
Press ENTER to continue.	Press ENTER to continue.
Note that the character in position 3 is a combin	ing character sequence and is two code units long.
UNICODE-STRING: ABa?CDu?EF	UNICODE-STRING: AB <b>ä</b> CDüEF
CHARACTER NO.: 3	CHARACTER NO.: 3
STARTS AT BYTE POSITION: 3	STARTS AT BYTE POSITION: 3
AND THE LENGTH IS: 2	AND THE LENGTH IS: 2
And so on.	And so on.

# 71 EXPAND

Function	532
Syntax Description	

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related statements: REDUCE | RESIZE

Belongs to Function Group: Memory Management Control for Dynamic Variables or X-Arrays

## **Function**

The EXPAND statement is used to expand:

- the allocated length of a dynamic variable (dynamic-clause), or
- the number of occurrences of X-arrays (array-clause).

For further information, see the following sections in the *Programming Guide*:

- Using Dynamic Variables
- Allocating/Freeing Memory Space for a Dynamic Variable
- *X-Arrays*
- Storage Management of X-Group Arrays

# **Syntax Description**

Operand Definition Table:

Operand	Po	ssi	ble Stri	ire	Possible Formats													Referencing Permitted	Dynamic Definition	
operand1		S	A			A	U					В							no	no
operand2	C	S								Ι									no	no
operand3			A	G		A	U	N	Р	Ι	F	В	D	Т	L	C	G	О	yes	no
operand4	C	S						N	Р	Ι									no	no
operand5		S								I4									no	yes

Syntax Element Description:

Syntax Element	Description
dynamic-clause	Dynamic Clause:
	The EXPAND DYNAMIC VARIABLE statement expands the allocated length of a dynamic variable (operand1) to the value specified with operand2. For more information, see <i>Dynamic Clause</i> below.
operand1	Dynamic Variable:
	operand1 is the dynamic variable for which the size is to be expanded.
operand2	Target Length of Dynamic Variable:
	operand2 is used to specify the length to which the dynamic variable is to be expanded. The value specified must be a non-negative integer constant or a variable of type integer.
array-clause	Array Clause:
	The EXPAND ARRAY statement increases the number of occurrences of the X-array (operand3) to the upper and lower bound specified with (dim[,dim[,dim]]). For more information, see <i>Array Clause</i> below.
operand3	X-Array:
	<i>operand3</i> is the X-array for which the number of occurrences may be increased. The index notation of the array is optional. As index notation only the complete range notation * is allowed for each dimension.
dim	Dimension:
operand4	The lower and upper bound notation ( <i>operand4</i> or asterisk) to which the X-array should be expanded is specified here. If the current value of the upper or lower bound should be used, an asterisk (*) may be specified in place of <i>operand4</i> . For more information, see <i>Dimension</i> below.
GIVING operand5	GIVING Clause:
	If the GIVING clause is not specified, Natural runtime error processing is triggered if an error occurs.
	If the GIVING clause is specified, <i>operand5</i> contains the Natural message number if an error occurred, or zero upon success.

### **Dynamic Clause**

```
[SIZE OF] DYNAMIC [VARIABLE] operand1 TO operand2
```

The EXPAND DYNAMIC VARIABLE statement expands the allocated size of a dynamic variable (*operand1*) to the value specified with *operand2*.

If operand2 is less than the currently allocated length of operand1, the statement will be ignored for this dynamic variable. The currently allocated length (\*LENGTH) of the dynamic variable is not modified.

### **Array Clause**

```
[AND RESET][OCCURRENCES OF] ARRAY operand3 TO (dim[,dim[,dim]])
```

The EXPAND ARRAY statement increases the number of occurrences of the X-array (operand3) to the upper and lower bound specified with TO (dim[,dim[,dim]]).

The RESET option resets all occurrences of the expanded X-array to its default zero value. By default (no RESET option), the actual values are kept and the expanded (new) occurrences are reset.

When using the EXPAND statement, it is only possible to increase the number of occurrences. If the requested number is smaller than the currently allocated number of occurrences, it will simply be ignored.

An upper or lower bound used in an EXPAND statement must be exactly the same as the corresponding upper or lower bound defined for the array.

#### Example:

```
DEFINE DATA LOCAL
1 #a(I4/1:*)
1 \# g(1:*)
  2 #ga(I4/1:*)
1 #i(i4)
END-DEFINE
/* allocating \#a(1:10)
EXPAND ARRAY #a TO (1:10)
                              /* #a is allocated 10
EXPAND ARRAY #a TO (*:10)
                               /* occurrences.
/* allocating \#ga(1:10,1:20)
EXPAND ARRAY #g TO (1:10)
                              /* 1st dimension is set to (1:10)
EXPAND ARRAY #ga TO (*:*,1:20) /* 1st dimension is dependent and
                                /* therefore kept with (*:*)
                                /* 2nd dimension is set to (1:20)
```

```
EXPAND ARRAY \#a TO (5:10) /* This is rejected because the lower index /* must be 1 or *

EXPAND ARRAY \#a TO (\#a:10) /* This is rejected because the lower index /* must be 1 or *

EXPAND ARRAY \#a TO (1:10,1:20) /* (1:10) for the 1st dimension is rejected /* because the dimension is dependent and /* must be specified with (*:*).
```

For further information, see the following topics in the *Programming Guide*:

- Storage Management of X-Arrays
- Storage Management of X-Group Arrays

#### **Dimension**

Each of the dimensions (dim) specified in the *Array Clause* is defined using the following syntax:

The lower and upper bound notation (*operand4* or asterisk) to which the X-array should be expanded is specified here. If the current value of the upper or lower bound should be used, an asterisk (\*) may be specified in place of *operand4*. Instead of \*:\*, you may also specify a single asterisk.

The number of dimensions (dim) must exactly match the defined number of dimensions of the X-array (1, 2 or 3).

If the number of occurrences for a specified dimension is less than the number of the currently allocated occurrences, the number of occurrences is not changed for the corresponding dimension.

# IX

■ 72 FETCH	539
■ 73 FIND	545
■ 74 FOR	585
■ 75 FORMAT	591
■ 76 GET	597
■ 77 GET SAME	603
■ 78 GET TRANSACTION DATA	607
■ 79 HISTOGRAM	
■ 80 IF	623
■ 81 IF SELECTION	627
■ 82 IGNORE	631
■ 83 INCLUDE	633

# **FETCH**

Function	54	1(
Syntax Description		
Example		

```
FETCH [ { REPEAT RETURN } ] operand1 [operand2 [(parameter)]]...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL | CALL | FILE | CALL LOOP | CALLNAT | DEFINE SUBROUTINE | ESCAPE | FETCH | PERFORM

Belongs to Function Group: Invoking Programs and Routines

### **Function**

The FETCH statement is used to execute a Natural object program written as a main program. The program to be loaded must have been previously stored in the Natural system file with a CATALOG or STOW command. Execution of the FETCH statement does not overwrite any source program in the Natural source work area.

For Natural RPC: See *Notes on Natural Statements on the Server* (in the *Natural RPC (Remote Procedure Call)* documentation).

#### **Additional Considerations**

In addition to the parameters passed explicitly with FETCH, the fetched program also has access to the established global data area.

The FETCH statement may cause the internal execution of an END\_TRANSACTION statement based on the setting of the Natural profile parameter OPRB (Database Open/Close Processing) as set by the Natural administrator. If a logical transaction is to span multiple Natural programs, the Natural administrator should be consulted to ensure that the OPRB parameter is set correctly.

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure			ure	Possible Formats							orm	ats	6	Referencing Permitted	Dynamic Definition		
operand1	C	S				A											yes	no
operand2	С	S	A	G		A	U	N	Р	Ι	F	В	D	T	L	G	yes	yes

Syntax Element Description:

Syntax Element	Description
REPEAT	REPEAT Option:
	The REPEAT option causes Natural to suppress the prompt for user input for each INPUT statement issued during the execution of the FETCHed program. It may be used to send information about the execution of the program to the terminal without the user having to reply with ENTER.
RETURN	RETURN Option:
	Without the specification of RETURN, the execution of the program issuing the FETCH statement will be terminated immediately and the fetched program will be activated as a "main program" (Level 1).
	If a program is invoked with FETCH RETURN, the execution of the invoking program will be suspended - not terminated - and the FETCHed program will be activated as a "subordinate program" on a higher level. Control is returned to the invoking program when an END or ESCAPE ROUTINE statement is encountered in the FETCHed program. Processing is continued with the statement following the FETCH RETURN statement.
operand1	Program Name:
	The name of the program module (maximum 8 characters) can be specified as an alphanumeric constant or the content of an alphanumeric variable of length 1 to 8. The case of the specified name is not translated.
	Natural will attempt to locate the program in the library currently active at the time the FETCH statement is issued. If the program is not found, Natural will attempt to locate the program in the steplibs. If the program is still not found, an error message will be issued.
	The program name may contain an ampersand (&); at execution time, this character will be replaced by the one-character code corresponding to the current value of the system variable *LANGUAGE. This makes it possible, for example, to invoke different programs for the processing of input, depending on the language in which input is provided.
operand2	Passing Parameter Fields:
	The FETCH statement may also be used to pass parameter fields to the invoked program. A parameter field may be defined with any format. The parameters are converted to a format suitable for a corresponding INPUT field. All parameters are placed on the top of the Natural stack.
	The parameter fields can be read by the FETCHed program using an INPUT statement. The first INPUT statement will result in the insertion of all parameter field values into the fields specified in the INPUT statement. The INPUT statement must have the sign position specification (session parameter SG=0N) for parameter fields defined with numeric format, because each parameter field defined with numeric format in the FETCH statement will receive a sign position if its value is negative.
	If more parameters are passed than are read by the next INPUT statement, the extra parameters are ignored. The number of parameters may be obtained with the Natural system variable *DATA.

Syntax Element	Description
	<b>Note:</b> If <i>operand2</i> is a time variable (format T), only the time component of the variable
	content is passed, but not the date component.
parameter	Date Format:
	If <i>operand2</i> is a date variable, you can specify the session parameter DF (Date Format) as <i>parameter</i> for this variable.

## **Example**

### **Invoking Program:**

```
** Example 'FETEX1': FETCH (with parameter)
*************************
DEFINE DATA LOCAL
1 #PNUM (N8)
1 #FNC (A1)
END-DEFINE
INPUT 10X 'SELECTION MENU FOR EMPLOYEES SYSTEM' /
     10X '-' (35) //
     10X 'ADD
                  (A)'/
     10X 'UPDATE
                  (U)'/
     10X 'DELETE (D)' /
     10X 'STOP
                 (.)' //
     10X 'PLEASE ENTER FUNCTION: ' #FNC ///
     10X 'PERSONNEL NUMBER: ' #PNUM
DECIDE ON EVERY VALUE OF #FNC
 VALUE 'A', 'U', 'D'
   IF \#PNUM = 0
     REINPUT 'PLEASE ENTER A VALID NUMBER' MARK *#PNUM
   END-IF
 VALUE 'A'
   FETCH 'FETEXAD' #PNUM
 VALUE 'U'
   FETCH 'FETEXUP' #PNUM
 VALUE 'D'
   FETCH 'FETEXDE' #PNUM
 VALUE '.'
   STOP
   REINPUT 'PLEASE ENTER A VALID FUNCTION' MARK *#FNC
END-DECIDE
END
```

### **Invoked Program FETEXAD:**

```
** Example 'FETEXAD': FETCH (called by FETEX1)

******************

DEFINE DATA LOCAL

1 #PERS-NR (N8)

END-DEFINE

*

INPUT #PERS-NR

WRITE *PROGRAM 'Record added with personnel number:' #PERS-NR

*

END
```

### **Invoked Program FETEXUP:**

```
** Example 'FETEXUP': FETCH (called by FETEX1)

***********************

DEFINE DATA LOCAL

1  #PERS-NR (N8)

END-DEFINE

*

INPUT #PERS-NR

WRITE *PROGRAM 'Record updated with personnel number:' #PERS-NR

*

END
```

### **Invoked Program FETEXDE:**

```
** Example 'FETEXDE': FETCH (called by FETEX1)

***********************

DEFINE DATA LOCAL

1 #PERS-NR (N8)

END-DEFINE

*

INPUT #PERS-NR

WRITE *PROGRAM 'Record deleted with personnel number:' #PERS-NR

END
```

## **Output of Program FETEX1:**

```
ADD (A)
UPDATE (U)
DELETE (D)
STOP (.)

PLEASE ENTER FUNCTION: D

PERSONNEL NUMBER: 1150304
```

## After entering and confirming function and personnel number:

```
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FETEXDE Record deleted with personnel number: 1150304
```

Statements Statements

# 73 FIND

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Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | GET | GET SAME | GET TRANSACTION | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | READLOB | RETRY | STORE | UPDATE | U

Belongs to Function Group: Database Access and Update

## **Function**

The FIND statement is used to select a set of records from the database based on search criteria consisting of fields defined as descriptors (keys).

This statement causes a processing loop to be initiated and then executed for each record selected. Each field in each record may be referenced within the processing loop. It is not necessary to issue a READ statement following the FIND in order to reference the fields within each record selected.

See also the following sections in the *Programming Guide*:

- FIND Statement
- Loop Processing
- Referencing of Database Fields Using (r) Notation

### **Database-Specific Considerations**

Database	Explanation
DL/I	When accessing a field starting after the last byte of the given segment occurrence, the storage copy of this field is filled according to its format (numeric, blank, etc.). The term segment occurrences should be substituted for the term records as used in this description of the FIND statement.
VSAM	The FIND statement is only valid for key-sequenced (KSDS) and entry-sequenced (ESDS) VSAM data sets. For ESDS, an alternate index for the base cluster must be defined.
SQL	FIND FIRST as well as the PASSWORD, CIPHER, COUPLED and RETAIN clauses are not permitted.  FIND UNIQUE is not permitted. (Exception: FIND UNIQUE can be used for primary keys; however, this is only permitted for compatibility reasons and should not be used.)  The SORTED BY clause corresponds with the SQL clause ORDER BY.  The basic search criteria for an SQL-database table may be specified in the same manner as for an Adabas file. The term record used in this context corresponds with the SQL term "row".

### System Variables Available with the FIND Statement

The Natural system variables \*ISN, \*NUMBER, and \*COUNTER are automatically created for each FIND statement issued. A reference number must be supplied if the system variable was referenced outside the current processing loop or through a FIND UNIQUE, FIND FIRST, or FIND NUMBER statement. The format/length of each of these system variables is P10; this format/length cannot be changed.

System Variable	Availability/Usage						
*ISN	Adabas						
	*ISN contains the Adabas internal sequence number (ISN) of the record currently being processed.						
	*ISN is not available for the FIND NUMBER statement.						
	■ VSAM						
See *ISN for VSAM in the System Variables documentation.							
	■ DL/I and SQL						
	*ISN is not available.						
	■ Entire System Server						
	*ISN is not available.						
*NUMBER	See system variable *NUMBER in the System Variables documentation.						
	With Entire System Server, *NUMBER is not available.						
*COUNTER	The system variable *COUNTER contains the number of times the processing loop has been entered.						

See also Example 13 - Using System Variables with the FIND Statement.

### **Issuing Multiple FIND Statements**

Multiple FIND statements may be issued to create nested loops whereby an inner loop is entered for each record selected in the outer loop.

See also Example 14 - Multiple FIND Statements.

## Restrictions

With Entire System Server, FIND NUMBER and FIND UNIQUE as well as the PASSWORD, CIPHER, COUPLED and RETAIN clauses are not permitted.

# Syntax 1 - FIND Statement with Processing Loop

```
ALL
                                       [MULTI-FETCH-clause][RECORDS][IN][FILE] view-name
FIND
         [PASSWORD=operand2]
         [CIPHER=operand3]
         [WITH] [[LIMIT] (operand4)] basic-search-criteria
         [COUPLED-clause]... 4/42
         [STARTING WITH ISN=operand5]
         [SORTED-BY-clause]
         [RETAIN-clause]
         [[IN] SHARED HOLD [MODE=option]]
         [SKIP [RECORDS] IN HOLD]
         [WHERE-clause]
         [IF-NO-RECORDS-FOUND-clause]
         statement...
END-FIND
                                       (structured mode only)
I 00P
                                       (reporting mode only)
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

# Syntax 2 - FIND Statement without Processing Loop

```
[SORTED-BY-clause] (only for FIND FIRST)

[RETAIN-clause]

[WHERE-clause]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

# **Syntax Description**

### Operand Definition Table:

Operand	Po	ssib	le St	ructure	Possibl	e Formats	Referencing Permitted	Dynamic Definition
operand1	С	S			ΝPΙ	B*	yes	no
operand2	С	S		A	A		yes	no
operand3	С	S			N		yes	no
operand4	С	S			NPI	B*	yes	no
operand5	С	S			NPI	B*	yes	no

<sup>\*</sup> Format B of operand1, operand4 and operand5 may be used only with a length of less than or equal to 4.

### Syntax Element Description:

Syntax Element	Description
ALL/operand1	Processing Limit:
	The number of records to be processed from the selected set may be limited by specifying <code>operand1</code> (enclosed in parentheses, immediately after the keyword <code>FIND</code> ) - either as a numeric constant (in the range from 0 to 4294967295) or as the name of a numeric variable.
	ALL may be optionally specified. It emphasizes that all selected records are to be processed.
	If you specify a limit with <i>operand1</i> , this limit applies to the FIND loop being initiated. Records rejected for processing by the WHERE clause are not counted against this limit.

Syntax Element	Description
	FIND (5) IN EMPLOYEES WITH
	MOVE 10 TO #CNT(N2) FIND (#CNT) EMPLOYEES WITH
	For this statement, the specified limit has priority over a limit set with a LIMIT statement.
	If a smaller limit is set with the $LT$ parameter, the $LT$ limit applies.
	Note:
	1. If you wish to process a 4-digit number of records, specify it with a leading zero: (0 nnnn); because Natural interprets every 4-digit number enclosed in parentheses as a line-number reference to a statement.
	2. <i>operand1</i> has no influence on the size of an ISN set that is to be retained by a RETAIN clause. <i>operand1</i> is evaluated when the FIND loop is entered. If the value of <i>operand1</i> is modified within the FIND loop, this does not affect the number of records processed.
FIND FIRST   FIND NUMBER	FIND FIRST, FIND NUMBER, FIND UNIQUE Option:
FIND UNIQUE	These options are used
	to select the first record of a selected set (see <i>FIND FIRST</i> ),
	to determine the number of records in a selected set (see <i>FIND NUMBER</i> ), or
	to ensure that only one record satisfies a selection criterion (see FIND UNIQUE).
	For a detailed description of these options, see below.
MULTI-FETCH-clause	MULTI-FETCH Clause:
	For Adabas databases, Natural offers a MULTI - FETCH clause that allows you to read more than one record per database access. For further information, see <i>MULTI-FETCH Clause</i> .
view-name	View Name:
	The name of a view as defined either within a DEFINE DATA block or in a separate global or local data.
	In reporting mode, view-name is the name of a DDM if no DEFINE DATA LOCAL statement is used.
PASSWORD=operand2	PASSWORD Clause:
	The PASSWORD clause applies only for Adabas or VSAM databases. This clause is not permitted with Entire System Server.

Syntax Element	Description
	The PASSWORD clause is used to provide a password ( <i>operand2</i> ) when reading/writing data from an Adabas or VSAM file which is password protected. If you require access to a password-protected file, contact the person responsible for database security concerning password usage/assignment.
	If the password is specified as a constant, the PASSWORD clause should always be coded at the very beginning of a source-code line; and there should be no blank between the keyword PASSWORD and the equal sign; this ensures that the password is not visible/displayable in the source code of the program. In TP mode, you may enter the PASSWORD clause invisible by entering the terminal command %* before you type in the PASSWORD clause.
	If the PASSWORD clause is omitted, the default password specified with the PASSW statement applies.
	The password value must not be changed during the execution of a processing loop.
	See also Example 1 - PASSWORD Clause.
CIPHER=operand3	CIPHER Clause:
	The CIPHER clause only applies to Adabas databases. This clause is not permitted with Entire System Server.
	The CIPHER clause is used to provide a cipher key (operand3) when retrieving data from Adabas files which are enciphered. If you require access to an enciphered file, contact the person responsible for database security concerning cipher key usage/assignment.
	The cipher key may be specified as a numeric constant with 8 digits or as a user-defined variable with format/length N8.
	If the cipher key is specified as a constant, the CIPHER clause should always be coded at the very beginning of a source-code line; this ensures that the cipher key is not visible/displayable in the source code of the program. In TP mode, you may enter the CIPHER clause invisible by entering the Natural terminal command %* before you type in the CIPHER clause.
	The value of the cipher key must not be changed during the processing of a loop initiated by a FIND statement.
	See also <i>Example 2 - CIPHER Clause</i> .
WITH LIMIT operand4	WITH Clause:
basic-search-criteria	The WITH clause is required. It is used to specify the basic-search-criteria (see Search Criteria for Adabas Files) consisting of key fields (descriptors) defined in the database.

Syntax Element	Description
	The following database-specific considerations apply.
	■ For Adabas files:
	You may use Adabas descriptors, subdescriptors, superdescriptors, hyperdescriptors, and phonetic descriptors within a WITH clause. A non-descriptor (that is, a field marked in the DDM with N) can also be specified.
	■ For DL/I files:
	You may only use key fields marked with $\ensuremath{\mathbb{D}}$ in the DDM.
	For VSAM files:
	You may use VSAM key fields only.
	The number of records to be selected as a result of a WITH clause may be limited by specifying the keyword LIMIT together with a numeric constant or a user-defined variable, enclosed within parentheses, which contains the limit value (operand4, range from 1 to 4294967295). If the number of records selected exceeds the limit, the program will be terminated with an error message.
	<b>Note:</b> If the limit is to be a 4-digit number, specify it with a leading zero
	(0 nnnn); because Natural interprets every 4-digit number enclosed in parentheses as a line-number reference to a statement.
COUPLED-clause	COUPLED Clause:
	This clause may be used to specify a search which involves the use of the Adabas coupling facility. See <i>COUPLED Clause</i> .
STARTING WITH ISN=operand5	STARTING WITH Clause:
	This clause may be used for repositioning within a FIND loop whose processing has been interrupted. See <i>STARTING WITH Clause</i> .
SORTED-BY-clause	SORTED BY Clause:
	This clause may be used to cause Adabas to sort the selected records based on the sequence of one to three descriptors. See <i>SORTED BY Clause</i> .
RETAIN-clause	RETAIN Clause:
	This clause may be used to retain the result of an extensive search in large files for further processing. See <i>RETAIN Clause</i> .
[[IN] SHARED HOLD	SHARED HOLD Clause
[MODE=option]]	<b>Note:</b> This clause can be used only for access to Adabas.
	This clause can be used to place records being read in a "shared hold" state. A record can be put in shared hold by many users at the same

Syntax Element	Description		
	being updated, becar users. This ensures of update the record w	time. As long as a record is in a shared hold state, it is protected from being updated, because it cannot be set into an exclusive hold by parallel users. This ensures data consistency for the record data, as no one can update the record while it is being processed.  Especially if the same record is fetched with multiple statements to read	
	different MU/PE occ a LOB field in a piec	currences (GET SAME state remeal technique (READLO ntee data stability over th	ment) or to browse over B statement), the shared
	it is a basic and important this "soft lock". Since aspects, different op	d state is an efficient way to prtant matter when to releate this question depends outions can be selected with	ase the record again from n individual application the MODE subclause.
	MODE Option	Hold Period	Explanation
	C	Only at the moment of reading the record.	Ensures only that the record version being read has been committed by the last user who updated the record. This option does not really set a lock in hold state, but checks only that the record is not in exclusive hold by another user at time of read.
	Q	a sequence is read.	Releases the record from shared hold when  the next record is read in the loop sequence or  the loop is terminated or  an END TRANSACTION or BACKOUT TRANSACTION is executed.
	S	Until the logical transaction is terminated.	Releases the record from shared hold when a logical transaction is terminated with an END TRANSACTION or BACKOUT TRANSACTION statement.

concurrently by other users until it has been released from hold again.  If the MODE subclause is not specified, MODE=C is the default.  See also Example 15 - SHARED HOLD Clause below.  SKIP RECORDS Clause:  Note: This clause can be used only for access to Adabas.  Whenever a record is going to be read with hold, a Natural error NAT3145 (Adabas response code 145) might happen if the record is in hold by another user at this time. This occurs if a shared hold is requested and the record is in exclusive hold or if an exclusive hold is requested and the record is in either exclusive or shared hold.  Although error NAT3145 is surely the right reaction to assure a "clean data processing", sometimes it might be useful if a record in hold could be skipped. If it is alright that such a record will not be processed and the loop processing should continue, the SKIP RECORDS clause should be used.  If the SKIP RECORDS clause is applied, Natural first tries to read the record with hold.  If the record is already in hold and a Natural error NAT3145 would occur,  In o error processing is initiated;  the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic;  the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause  This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the wITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.	Syntax Element	Description	
See also Example 15 - SHARED HOLD Clause below.  SKIP RECORDS IN HOLD  SKIP RECORDS Clause:  Note: This clause can be used only for access to Adabas.  Whenever a record is going to be read with hold, a Natural error NAT3145 (Adabas response code 145) might happen if the record is in hold by another user at this time. This occurs if a shared hold is requested and the record is in exclusive hold or if an exclusive hold is requested and the record is in either exclusive or shared hold.  Although error NAT3145 is surely the right reaction to assure a "clean data processing", sometimes it might be useful if a record in hold could be skipped. If it is alright that such a record will not be processed and the loop processing should continue, the SKIP RECORDS clause should be used.  If the SKIP RECORDS clause is applied, Natural first tries to read the record with hold.  If the record is already in hold and a Natural error NAT3145 would occur,  no error processing is initiated;  the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic;  the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause:  This clause may be used to specify an additional selection criterion (logical-condition), See WHERE Clause.  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIM statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.		MODE=Q and MODE=S ensure that the record being read cannot be updated concurrently by other users until it has been released from hold again.	
SKIP RECORDS IN HOLD  SKIP RECORDS Clause:  Note: This clause can be used only for access to Adabas.  Whenever a record is going to be read with hold, a Natural error NAT3145 (Adabas response code 145) might happen if the record is in hold by another user at this time. This occurs if a shared hold is requested and the record is in exclusive hold or if an exclusive hold is requested and the record is in exclusive or shared hold.  Although error NAT3145 is surely the right reaction to assure a "clean data processing", sometimes it might be useful if a record in hold could be skipped. If it is alright that such a record will not be processed and the loop processing should continue, the SKIP RECORDS clause should be used.  If the SKIP RECORDS clause is applied, Natural first tries to read the record with hold.  If the record is already in hold and a Natural error NAT3145 would occur,  no error processing is initiated;  the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic;  the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause:  This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF NO RECORDS FOUND Clause:  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.		If the MODE subclause is not specified, MODE=C is the default.	
Note: This clause can be used only for access to Adabas.  Whenever a record is going to be read with hold, a Natural error NAT3145 (Adabas response code 145) might happen if the record is in hold by another user at this time. This occurs if a shared hold is requested and the record is in exclusive hold or if an exclusive hold is requested and the record is in exclusive hold or if an exclusive hold is requested and the record is in either exclusive or shared hold.  Although error NAT3145 is surely the right reaction to assure a "clean data processing", sometimes it might be useful if a record in hold could be skipped. If it is alright that such a record will not be processed and the loop processing should continue, the SKIP RECORDS clause should be used.  If the SKIP RECORDS clause is applied, Natural first tries to read the record with hold.  If the record is already in hold and a Natural error NAT3145 would occur,  no error processing is initiated;  the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic;  the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause  This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FING statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.		See also <i>Example 15 - SHARED HOLD Clause</i> below.	
Whenever a record is going to be read with hold, a Natural error NAT3145 (Adabas response code 145) might happen if the record is in hold by another user at this time. This occurs if a shared hold is requested and the record is in exclusive hold or if an exclusive hold is requested and the record is in either exclusive or shared hold.  Although error NAT3145 is surely the right reaction to assure a "clean data processing", sometimes it might be useful if a record in hold could be skipped. If it is alright that such a record will not be processed and the loop processing should continue, the SKIP RECORDS clause should be used.  If the SKIP RECORDS clause is applied, Natural first tries to read the record with hold.  If the record is already in hold and a Natural error NAT3145 would occur,  no error processing is initiated; the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic; the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause: This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF NO RECORDS FOUND Clause.  This clause may be used to cause a processing loop initiated with a FINE statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.	SKIP RECORDS IN HOLD		
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record with hold.  If the record is already in hold and a Natural error NAT3145 would occur,  no error processing is initiated; the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic; the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause: This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF-NO-RECORDS-FOUND-clause This clause may be used to cause a processing loop initiated with a FINE statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.		the loop processing should continue, the SKIP RECORDS clause should	
occur,  no error processing is initiated;  the record (currently in hold by another user) is instantly re-fetched without hold, but not processed in terms of the program logic;  the record which comes next after the skipped record is read with hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE Clause:  This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF -NO-RECORDS-FOUND-clause  This clause may be used to cause a processing loop initiated with a FINE statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.			
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hold and the processing continues.  See also Example 16 - SKIP RECORDS Clause.  WHERE - clause:  This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF -NO-RECORDS-FOUND-clause  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.			
WHERE-clause  This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF-NO-RECORDS-FOUND-clause  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.		1	
This clause may be used to specify an additional selection criterion (logical-condition). See WHERE Clause.  IF-NO-RECORDS-FOUND-clause  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.		See also Example 16 - SKIP RECORDS Clause.	
(logical-condition). See WHERE Clause.  IF-NO-RECORDS-FOUND-clause  IF NO RECORDS FOUND Clause:  This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See IF NO RECORDS FOUND Clause.	WHERE-clause	WHERE Clause:	
This clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See <i>IF NO RECORDS FOUND Clause</i> .		* *	
statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause. See <i>IF NO RECORDS FOUND Clause</i> .	IF-NO-RECORDS-FOUND-clause	IF NO RECORDS FOUND Clause:	
END-FIND End of FIND Statement:		criteria specified in the WITH clause and the WHERE clause. See <i>IF NO</i>	
	END-FIND	End of FIND Statement:	

Syntax Element	Description
LOOP	In structured mode with processing loop, the Natural reserved keyword END-FIND must be used to end the FIND statement.
	In reporting mode with processing loop, the Natural statement LOOP is used to end the FIND statement.

#### **FIND FIRST**

The FIND FIRST statement may be used to select and process the first record which meets the WITH and WHERE criteria.

For Adabas databases, the record processed will be the record with the lowest Adabas ISN from the set of qualifying records.

This statement does *not* initiate a processing loop.

#### **Restrictions with FIND FIRST**

- FIND FIRST can only be used in reporting mode.
- FIND FIRST is not available for DL/I and SQL databases.

#### System Variables Available with FIND FIRST

The following Natural system variables are available with the FIND FIRST statement:

System Variab	le Explanation
*ISN	The system variable *ISN contains the Adabas ISN of the selected record. *ISN will be zero if no record is found after the evaluation of the WITH and WHERE criteria.
	*ISN is not available for VSAM databases or with Entire System Server.
*NUMBER	The system variable *NUMBER contains the number of records found after the evaluation of the WITH criterion and before evaluation of any WHERE criteria. *NUMBER will be zero if no record meets the WITH criterion.  *NUMBER is not available with Entire System Server.
*COUNTER	The system variable *COUNTER contains 1 if a record was found; contains 0 if no record was found.

Example of FIND FIRST Statement: See the program FNDFIR (reporting mode)

#### FIND NUMBER

The FIND NUMBER statement is used to determine the number of records which satisfy the WITH/WHERE criteria specified. It does *not* result in the initiation of a processing loop and *no data fields from the database are made available*.



**Note:** Use of the WHERE clause may result in significant overhead.

#### **Restrictions with FIND NUMBER**

- The WHERE clause can only be used in reporting mode.
- FIND NUMBER is not available for DL/I databases or with Entire System Server.

#### System Variables Available with FIND NUMBER

The following Natural system variables are available with the FIND NUMBER statement:

System Variable	Explanation
*NUMBER	The system variable $*NUMBER$ contains the number of records found after the evaluation of the WITH criterion.
	The system variable *COUNTER contains the number of records found after the evaluation of the WHERE criterion.
	*COUNTER is only available if the FIND NUMBER statement contains a WHERE clause.

Example for FIND NUMBER: See the program FNDNUM (reporting mode).

#### FIND UNIQUE

The FIND UNIQUE statement may be used to ensure that only one record is selected for processing. It does *not* result in the initiation of a processing loop. If a WHERE clause is specified, an automatic internal processing loop is created to evaluate the WHERE clause.

If no records or more than one record satisfy the criteria, an error message will be issued. This condition can be tested with the ON ERROR statement.

#### Restrictions with FIND UNIQUE

- FIND UNIQUE can only be used in reporting mode.
- FIND UNIQUE is not available for DL/I databases or with Entire System Server.
- For SQL databases, FIND UNIQUE cannot be used. (Exception: On mainframe computers, FIND UNIQUE can be used for primary keys; however, this is only permitted for compatibility reasons and should not be used.)

## System Variables Available with FIND UNIQUE

System Variable	Explanation
*ISN	The system variable $*ISN$ contains the unique ISN number of the record, which itself must be unique.
*NUMBER	The system variable *NUMBER always contains 1 for a valid FIND UNIQUE execution.  *NUMBER may contain any other positive value (= 0 or >= 2) if an error has occurred. This error condition may be used by the ON ERROR statement. *NUMBER is not allowed if the WHERE clause is missing.
*COUNTER	The system variable *COUNTER contains the number of records found after the evaluation of the WHERE criterion. *COUNTER is not allowed if the WHERE clause is missing.

Example for FIND UNIQUE: See the Program FNDUNQ (reporting mode).

#### **MULTI-FETCH Clause**

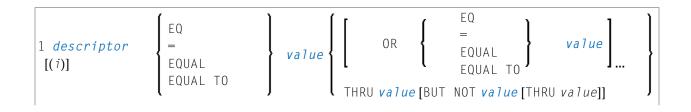


**Note:** This clause can only be used for Adabas or DB2 databases.

$$\begin{array}{c} \text{MULTI-FETCH} & \left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ \text{[OF] multi-fetch-factor} \end{array} \right\} \end{array}$$

For more information, see the section MULTI-FETCH Clause (Adabas) in the Programming Guide or Multiple Row Processing (SQL) in the Natural for DB2 part of the Database Management System Interfaces documentation.

#### **Search Criteria for Adabas Files**



```
ΕQ
                  EQUAL
                  EQUAL TO
                  NE
                  <>
                  NOT =
                  NOT EQ
                  NOTEQUAL
                  NOT EQUAL
                  NOT EQUAL TO
                  LT
                  LESS THAN
                  <
                                   value
descriptor [(i)]
                  GE
                  GREATER
                  EQUAL
                  >=
                  NOT <
                  NOT LT
                  GT
                  GREATER THAN
                  LE
                  LESS EQUAL
                  NOT >
                  NOT GT
3 set-name
```

## Operand Definition Table:

Operand	Possible Structure			Possible Formats									Referencing	_			
																Permitted	Definition
descriptor		S	A		A	N	Р	I	F	В	D	Т	L			no	no
value	C	S			A	N	Р	Ι	F	В	D	Т	L			yes	no
set-name	C	S			A											no	no

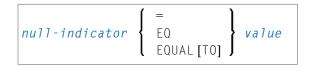
Syntax Element Description:

Syntax Element	Description
descriptor	Descriptor:
	Adabas descriptor, subdescriptor, superdescriptor, hyperdescriptor, or phonetic descriptor. A field marked as non-descriptor in the DDM can also be specified.
( j )	Index Specification:
	A descriptor contained within a periodic group may be specified with or without an index. If no index is specified, the record will be selected if the value specified is located in any occurrence. If an index is specified, the record is selected only if the value is located in the occurrence specified by the index. The index specified must be a constant. An index range must not be used.
	No index must be specified for a descriptor which is a multiple-value field. The record will be selected if the value is located in the record regardless of the position of the value.
value	Search Value:
	The formats of the descriptor and the search value must be compatible.
set-name	Set Name:
	Identifies a set of records previously selected with a FIND statement in which the RETAIN clause was specified. The set referenced in a FIND must have been created from the same physical Adabas file. set - name may be specified as a text constant (maximum 32 characters) or as the content of an alphanumeric variable.
	set-name cannot be used with Entire System Server.

#### See also:

- Example 3 Basic Search Criteria in WITH Clause
- Example 4 Basic Search Criteria with Multiple-Value Field

## **Search Criterion with Null Indicator**



Operand Definition Table:

Operand	Po	F	os	sil	ble	Fo	rma	ats	Referencing Permitted	Dynamic Definition			
null-indicator		S					I			П		no	no
value	С	S			N	Р	Ι	F	3			yes	no

Syntax Element Description:

Syntax Element	Description									
null-indicator	The null indicato	The null indicator.								
value	Possible Values	Meaning								
	- 1	The corresponding field contains no value.								
	0	The corresponding field does contain a value.								

#### **Connecting Search Criteria (for Adabas Files)**

basic-search-criteria can be combined using the Boolean operators AND, OR, and NOT. Parentheses may also be used to control the order of evaluation. The order of evaluation is as follows:

- 1. ( ): Parentheses
- 2. NOT: Negation (only for basic-search-criteria of form [2]).
- 3. AND: AND operation
- 4. OR: OR operation

basic-search-criteria may be connected by logical operators to form a complex search-expression. The syntax for such a complex search-expression is as follows:



See also Example 5 - Various Samples of Complex Search Expression in WITH Clause.

#### **Descriptor-Key Usage**

Adabas users may use database fields which are defined as descriptors to construct basic search criteria.

#### Subdescriptors, Superdescriptors, Hyperdescriptors and Phonetic Descriptors

With Adabas, subdescriptors, superdescriptors, hyperdescriptors and phonetic descriptors may be used to construct search criteria.

- A subdescriptor is a descriptor formed from a portion of a field.
- A superdescriptor is a descriptor whose value is formed from one or more fields or portions of fields.
- A hyperdescriptor is a descriptor which is formed using a user-defined algorithm.
- A phonetic descriptor is a descriptor which allows the user to perform a phonetic search on a field (for example, a person's name). A phonetic search results in the return of all values which sound similar to the search value.

Which fields may be used as descriptors, subdescriptors, superdescriptors, hyperdescriptors and phonetic descriptors with which file is defined in the corresponding DDM.

#### Values for Subdescriptors, Superdescriptors, Phonetic Descriptors

Values used with these types of descriptors must be compatible with the internal format of the descriptor. The internal format of a subdescriptor is the same as the format of the field from which the subdescriptor is derived. The internal format of a superdescriptor is binary if all of the fields from which it is derived are defined with numeric format; otherwise, the format is alphanumeric. Phonetic descriptors always have alphanumeric format.

Values for subdescriptors and superdescriptors may be specified in the following ways:

- Numeric or hexadecimal constants may be specified. A hexadecimal constant must be used for a value for a superdescriptor which has binary format (see above).
- Values in user-defined variable fields may be specified using the REDEFINE statement to select the portions that form the subdescriptor or superdescriptor value.

#### Using Descriptors Contained within a Database Array

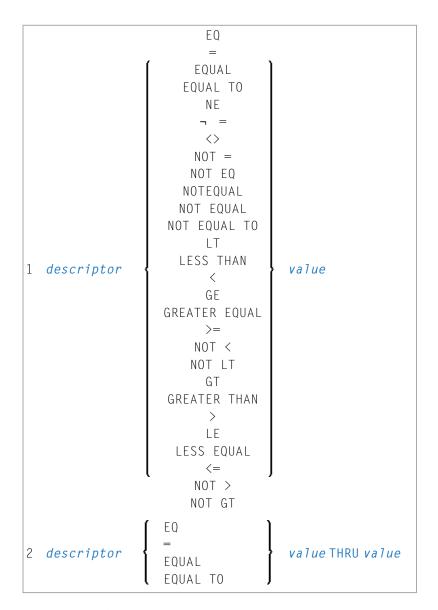
A descriptor which is contained within a database array may also be used in the construction of basic search criterion. For Adabas databases, such a descriptor may be a multiple-value field or a field contained within a periodic group.

A descriptor contained within a periodic group may be specified with or without an index. If no index is specified, the record will be selected if the value specified is located in any occurrence. If an index is specified, the record is selected only if the value is located in the occurrence specified by the index. The index specified must be a constant. An index range must not be used.

No index must be specified for a descriptor which is a multiple-value field. The record will be selected if the value is located in the record regardless of the position of the value.

See also Example 6 - Various Samples Using Database Arrays.

## Search Criteria for VSAM Files - basic-search-criteria



## Operand Definition Table:

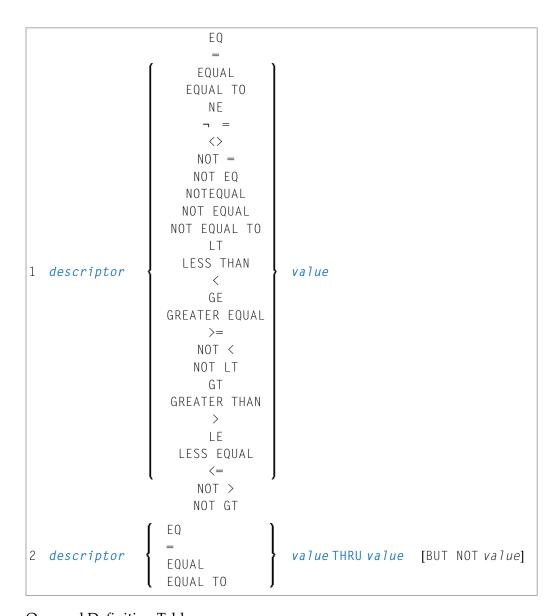
Operand	Po	ssib		Po	ssi	ble	For	mat	S	Referencing Permitted	Dynamic Definition		
descriptor		S	A		A	N	Р		В			no	no
value	С	S			A	N	Р		В			yes	no

Syntax Element Description:

Syntax Element	Description
descriptor	Descriptor:
	The descriptor must be defined in a VSAM file as a VSAM key field and is marked in the DDM with P for primary key or A for alternate key.
value	Search Value:
	The search value.

The formats of the *descriptor* and the search *value* must be compatible.

#### Search Criteria for DL/I Files - basic-search-criteria



Operand Definition Table:

Operand	Po	ssib		Po	SS	ible	e Fo	rma	s	Referencing Permitted	Dynamic Definition		
descriptor		S	A		A	N	Р		В			no	no
value	С	S			Α	N	Р		В			yes	no

Syntax Element Description:

Syntax Element	Description
descriptor	Descriptor:
	The descriptor must be a field defined in DL/I and is marked in the DDM with D.
value	Search Value:
	The search value.

For HDAM databases, only the following basic-search-criterion is possible:

## **Connecting Search Criteria - for DL/I Files**

```
[NOT] \left\{ \begin{array}{c} \textit{basic-search-criteria} \\ \textit{(search-expression)} \end{array} \right\} \left[ \begin{array}{c} \mathsf{OR} \\ \mathsf{AND} \end{array} \right\} \ \textit{search-expression} \right]_{\dots}
```

basic-search-criteria that refer to different segment types must not be connected with the OR logical operator.

#### **Examples:**

#### **Invalid Example:**

FIND OFFERING WITH COURSEN-COURSE > 1 OR LOCATION = 'DARMSTADT'

#### **COUPLED Clause**

This clause only applies to Adabas databases.

This clause is not permitted with Entire System Server.

#### Operand Definition Table:

Operand	Possible Structure			е	Possible Formats						Referencing Permitted	Dynamic Definition	
descriptor1		S	A		A	N	Р		В			no	no
descriptor2		S	A		A	N	Р		В			no	no



**Note:** Without the VIA clause, the COUPLED clause may be specified up to 4 times; with the VIA clause, it may be specified up to 42 times.

The COUPLED clause is used to specify a search which involves the use of the Adabas coupling facility. This facility permits database descriptors from different files to be specified in the search criterion of a single FIND statement.

The same Adabas file must not be used in two different FIND COUPLED clauses within the same FIND statement.

A set-name (see RETAIN Clause) must not be specified in the basic-search-criteria.

Database fields in a file specified within the COUPLED clause are not available for subsequent reference in the program unless another FIND or READ statement is issued separately against the coupled file.

**Note:** If the COUPLED clause is used, the main WITH clause may be omitted. If the main WITH clause is omitted, the keywords AND/OR of the COUPLED clause must not be specified.

#### Physical Coupling without VIA Clause

The files used in a COUPLED clause without VIA must be physically coupled using the appropriate Adabas utility (as described in the Adabas documentation).

See also Example 7 - Using Physically Coupled Files.

The reference to NAME in the DISPLAY statement of the above example is valid since this field is contained in the EMPLOYEES file, whereas a reference to MAKE would be invalid since MAKE is contained in the VEHICLES file, which was specified in the COUPLED clause.

In this example, records will be found only if EMPLOYEES and VEHICLES have been physically coupled.

#### Logical Coupling - VIA Clause

The option VIA descriptor1 = descriptor2 allows you to logically couple multiple Adabas files in a search query, where:

- descriptor1 is a field from the first view.
- descriptor2 is a field from the second view.

The two files need not be physically coupled in Adabas.

See also *Example 8 - VIA Clause*.

#### STARTING WITH Clause

This clause applies only to Adabas and VSAM databases; for VSAM, it is only valid for ESDS.

You can use this clause to specify as *operand5* an Adabas ISN (internal sequence number) or VSAM RBA (relative byte address) respectively, which is to be used as a start value for the selection of records. *operand5* must be in the range from 0 to 4294967295.

This clause may be used for repositioning within a FIND loop whose processing has been interrupted, to easily determine the next record with which processing is to continue. This is particularly useful if the next record cannot be identified uniquely by any of its descriptor values. It can also be useful in a distributed client/server application where the reading of the records is performed by a server program while further processing of the records is performed by a client program, and the records are not processed all in one go, but in batches.



**Note:** The start value actually used will not be the value of *operand5*, but the next higher value.

#### **Example:**

See the program FNDSISN in the library SYSEXSYN.

#### SORTED BY Clause

This clause only applies to Adabas and SQL databases.

This clause is not permitted with Entire System Server.

```
SORTED[BY] descriptor... 3 [DESCENDING]
```

The SORTED BY clause is used to cause Adabas to sort the selected records based on the sequence of one to three descriptors. The descriptors used for controlling the sort sequence may be different from those used for selection.

By default, the records are sorted in *ascending* sequence of values; if you want them to be in descending sequence, specify the keyword DESCENDING. The sort is performed using the Adabas inverted lists and does not result in any records being read.



**Note:** The use of this clause may result in significant overhead if any descriptor used to control the sort sequence contains a large number of values. This is because the entire value list may have to be scanned until all selected records have been located in the list. When a large number of records is to be sorted, you should use the SORT statement.

Adabas sort limits (see the ADARUN LS parameter in the Adabas documentation) are in effect when the SORTED BY clause is used.

A descriptor which is contained in a periodic group must not be specified in the SORTED BY clause. A multiple-value field (without an index) may be specified.

Non-descriptors may also be specified in the SORTED BY clause. However, this function is not available on mainframes.

If the SORTED BY clause is used, the RETAIN clause must not be used.

See also Example 9 - SORTED BY Clause.

#### Considerations for Combined Use of STARTING WITH and SORTED BY Clauses

If both the STARTING WITH and the SORTED BY clause are used in the same FIND statement and the underlying database is Adabas, the following should be considered.

#### With Adabas for Mainframes

On Adabas for Mainframes, the FIND statement is executed in the following steps:

- 1. All records matching the search criterion are gathered and put in ISN sequence.
- 2. The records are sorted by the descriptor specified in the SORTED BY clause.

- 3. The record whose ISN value is specified in the STARTING WITH clause is positioned in the "sorted-by-descriptor" record list.
- 4. The records following the record found under Step 3 are returned in the FIND loop.

#### With Adabas for OpenSystems

On Adabas for OpenSystems (UNIX, OpenVMS, Windows) the same statement is executed as follows:

- 1. All records matching the search criterion are gathered and put in ISN sequence.
- 2. The record whose ISN value is specified in the STARTING WITH clause is positioned in the "sorted-by-ISN" record list.
- 3. All records following the record found under Step 2 are sorted by the descriptor specified in the SORTED BY clause and returned in the FIND loop.

#### Example:

If the following program is executed with Adabas for Mainframes and Adabas for UNIX/Open-VMS/Windows:

```
DEFINE DATA LOCAL
1 V1 VIEW OF EMPLOYEES
  2 NAME
  2 FIRST-NAME
  2 CITY
1 #ISN (I4)
END-DEFINE
FORMAT NL=5 SG=OFF PS=43 AL=15
PRINT 'FIND' (I)
FIND V1 WITH NAME = 'B' THRU 'BALBIN'
  RETAIN AS 'SET1'
  IF *COUNTER = 4 THEN
   #ISN := *ISN
  END-IF
  DISPLAY *ISN V1
END-FIND
PRINT / 'FIND .. SORTED BY NAME' (I)
FIND V1 WITH 'SET1'
  SORTED BY NAME
  DISPLAY *ISN V1
END-FIND
PRINT / 'FIND .. STARTING WITH ISN = ' (I) \#ISN (AD=I)
FIND V1 WITH 'SET1'
  STARTING WITH ISN = \#ISN
  DISPLAY *ISN V1
END-FIND
```

The result is as follows:

#### **Results on Natural for Mainframes**

ISN	NAME	FIRST-NAME	CITY
		3' THRU 'BALBIN' PATRICK	
58 351	BAGAZJA BAECKER	MARJAN JOHANNES	MONTHERME FRANKFURT
370	BACHMANN	KARL HANS ENRIQUE	MUENCHEN
650	BAKER	SYLVIA PAULINE	OAK BROOK
	. SORTED BY NAME BACHMANN	E HANS	MUENCHEN
355	BAECKER	JOHANNES KARL MARJAN	SINDELFINGEN
12	BAILLET BAKER	PATRICK SYLVIA	LYS LEZ LANNOY
913 490	BAKER BALBIN	PAULINE ENRIQUE	DERBY BARCELONA
FIND .	. STARTING WITH BACHMANN	ISN = 355 HANS	MUENCHEN
650	BACHMANN BALBIN BAKER BAKER	SYLVIA	BARCELONA OAK BROOK DERBY
	STARTING WITH BAGAZJA	ISN = 355 SON	
12 650 913	BAILLET BAKER BAKER	PATRICK SYLVIA PAULINE	LYS LEZ LANNOY OAK BROOK DERBY
490	BALBIN	ENRIQUE	BARCELONA

#### Results on Natural for OpenSystems

ISN	NAME	FIRST-NAME	CITY
12 58 351 355 370 490 650	V1 WITH NAME = 'E BAILLET BAGAZJA BAECKER BAECKER BACHMANN BALBIN BAKER BAKER	PATRICK MARJAN JOHANNES KARL HANS ENRIQUE SYLVIA	LYS LEZ LANNOY MONTHERME FRANKFURT
370 351 355 58 12 650 913	SORTED BY NAMI BACHMANN BAECKER BAECKER BAGAZJA BAILLET BAKER BAKER BALBIN	HANS JOHANNES KARL MARJAN PATRICK SYLVIA PAULINE	SINDELFINGEN MONTHERME
370 490 650	STARTING WITH BACHMANN BALBIN BAKER BAKER	HANS ENRIQUE SYLVIA	OAK BROOK
370 650 913	RAKFR	HANS SYLVIA PAULINE	RTED BY NAME MUENCHEN OAK BROOK DERBY BARCELONA

A FIND statement with at most one of these options (SORTED BY or STARTING WITH ISN) always returns the same records in the same sequence, regardless under which system the statement is executed. If, however, both clauses are used together, the result returned depends on which Adabas platform is used to serve the database statement.

Therefore, if a Natural program is intended to be used on multiple platforms, the combination of a SORTED BY and STARTING WITH ISN clause in the same FIND statement should be avoided.

#### **RETAIN Clause**

This clause only applies to Adabas databases.

This clause is not permitted with Entire System Server.

RETAIN AS operand6

#### Operand Definition Table:

Operand	Poss	ible St	ructure	Possik		sib	ole Formats			its	Referencing Permitted	Dynamic Definition
operand6	C S			A							yes	no

#### Syntax Element Description:

Syntax Elemen	nt Description				
RETAIN AS	Retain Result:				
	By using the RETAIN clause, the result of an extensive search in large files can be retained for further processing.				
	The selection is retained as an ISN-set in the Adabas work file. The set may be used in subsequent FIND statements as a basic search criterion for further refinement of the set or for further processing of the records.				
	The set created is file-specific and may only be used in another FIND statement that processes the same file. The set may be referenced by any Natural program.				
operand6	Set Name:				
	The set name is used to identify the record set. It may be specified as an alphanumeric constant or as the content of an alphanumeric user-defined variable. Duplicate set names are not checked; consequently, if a duplicate set name is specified, the new set replaces the old set.				

See also *Example 10 - RETAIN Clause*.

#### **Releasing Sets**

There is no specific limit for the number of sets that can be retained or the number of ISNs in a set. It is recommended that the minimum number of ISN sets needed at one time be defined. Sets that are no longer needed should be released using the RELEASE SETS statement.

If they are not released with a RELEASE statement, retained sets exist until the end of the Natural session, or until a logon to another library, when they are released automatically. A set created by one program may be referenced by another program for processing or further refinement using additional search criteria.

#### **Updates by Other Users**

The records identified by the ISNs in a retained set are not locked against access and/or update by other users. Before you process records from the set, it is therefore useful to check whether the original search criteria which were used to create the set are still valid: This check is done with another FIND statement, using the set name in the WITH clause as a basic search criteria and specifying in a WHERE clause the original search criteria (that is, the basic search criteria as specified in the WITH clause of the FIND statement which was used to create the set).

#### Restriction

If the RETAIN clause is used, the SORTED BY clause must not be used.

#### **WHERE Clause**

```
WHERE logical-condition
```

The WHERE clause may be used to specify an additional selection criterion (<code>logical-condition</code>) which is evaluated *after* a value has been read and *before* any processing is performed on the value (including the AT BREAK evaluation).

The syntax for a *logical-condition* is described in the section *Logical Condition Criteria* in the *Programming Guide*.

If a processing limit is specified in a FIND statement containing a WHERE clause, records which are rejected as a result of the WHERE clause are *not* counted against the limit. These records are, however, counted against a global limit specified in the Natural session parameter LT, the GLOBALS command, or LIMIT statement.

See also Example 11 - WHERE Clause.

#### IF NO RECORDS FOUND Clause

#### **Structured Mode Syntax**

```
IF NO [RECORDS] [FOUND]
{
    ENTER
    statement...}
END-NOREC
```

## **Reporting Mode Syntax**

```
IF NO [RECORDS] [FOUND]

{    ENTER
    statement
    DO statement ... DOEND }
```

Syntax Element Description:

Syntax Element	Description				
IF NO RECORDS FOUND	IF NO RECORDS FOUND Clause:				
	The IF NO RECORDS FOUND clause may be used to cause a processing loop initiated with a FIND statement to be entered in the event that no records meet the selection criteria specified in the WITH clause and the WHERE clause.				
	If no records meet the specified WITH and WHERE criteria, the IF NO RECORDS FOUND clause causes the FIND processing loop to be executed once with an "empty" record.				
	If this is not desired, specify the statement ESCAPE BOTTOM within the IF NO RECORDS FOUND clause.				
ENTER	Statement Execution:				
statement	If one or more statements are specified with the <code>IF NO RECORDS FOUND</code> clause, the statements will be executed immediately before the processing loop is entered.				
	If no statements are to be executed before entering the loop, the keyword ENTER must be used.				
END-NOREC	End of IF NO RECORDS FOUND Clause:				
ENTER statement DO statement	In structured mode, the Natural reserved word END-NOREC must be used to end the IF NO RECORDS FOUND clause.				
DOEND	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the IF NO RECORDS FOUND clause. If you specify only a single statement or the keyword ENTER (see above), you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.				

See also Example 12 - IF NO RECORDS FOUND Clause.

#### **Database Values**

Unless other value assignments are made in the statements accompanying an IF NO RECORDS FOUND clause, Natural will reset to empty all database fields which reference the file specified in the current loop.

#### **Evaluation of System Functions**

Natural system functions are evaluated once for the empty record that is created for processing as a result of the IF NO RECORDS FOUND clause.

#### Restriction

This clause cannot be used with FIND FIRST, FIND NUMBER and FIND UNIQUE.

## **Examples**

- Example 1 PASSWORD Clause
- Example 2 CIPHER Clause
- Example 3 Basic Search Criteria in WITH Clause
- Example 4 Basic Search Criteria with Multiple-Value Field
- Example 5 Various Samples of Complex Search Expression in WITH Clause
- Example 6 Various Samples of Using Database Arrays
- Example 7 Using Physically Coupled Files
- Example 8 VIA Clause
- Example 9 SORTED BY Clause
- Example 10 RETAIN Clause
- Example 11 WHERE Clause
- Example 12 IF NO RECORDS FOUND Clause
- Example 13 Using System Variables with the FIND Statement
- Example 14 Multiple FIND Statements
- Example 15 SHARED HOLD Clause
- Example 16 SKIP RECORDS Clause

See also the example for FIND NUMBER: program FNDNUM.

#### **Example 1 - PASSWORD Clause**

```
** Example 'FNDPWD': FIND (with PASSWORD clause)

*****************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME

2 PERSONNEL-ID

*

1 #PASSWORD (A8)

END-DEFINE

*

INPUT 'ENTER PASSWORD FOR EMPLOYEE FILE:' #PASSWORD (AD=N)

LIMIT 2

*
```

```
FIND EMPLOY-VIEW PASSWORD = #PASSWORD

WITH NAME = 'SMITH'

DISPLAY NOTITLE NAME PERSONNEL-ID

END-FIND

*
END
```

#### **Output of Program FNDPWD:**

ENTER PASSWORD FOR EMPLOYEE FILE:

#### **Example 2 - CIPHER Clause**

```
** Example 'FNDCIP': FIND (with PASSWORD/CIPHER clause)
********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 PERSONNEL-ID
1 #PASSWORD (A8)
1 #CIPHER (N8)
END-DEFINE
LIMIT 2
INPUT 'ENTER PASSWORD FOR EMPLOYEE FILE: ' #PASSWORD (AD=N)
   / 'ENTER CIPHER KEY FOR EMPLOYEE FILE: ' #CIPHER (AD=N)
FIND EMPLOY-VIEW PASSWORD = #PASSWORD
               CIPHER = \#CIPHER
               WITH NAME = 'SMITH'
 DISPLAY NOTITLE NAME PERSONNEL-ID
END-FIND
END Output of Program FNDCIP:
```

ENTER PASSWORD FOR EMPLOYEE FILE:
ENTER CIPHER KEY FOR EMPLOYEE FILE:

#### **Example 3 - Basic Search Criteria in WITH Clause**

```
FIND STAFF WITH NAME = 'SMITH'
FIND STAFF WITH CITY NE 'BOSTON'
FIND STAFF WITH BIRTH = 610803
FIND STAFF WITH BIRTH = 610803 THRU 610811
FIND STAFF WITH NAME = 'O HARA' OR = 'JONES' OR = 'JACKSON'
FIND STAFF WITH PERSONNEL-ID = 100082 THRU 100100

BUT NOT 100087 THRU 100095
```

#### Example 4 - Basic Search Criteria with Multiple-Value Field

When the descriptor used in the basic search criteria is a multiple-value field, basically four different kinds of results can be obtained (the field MU-FIELD in the following examples is assumed to be a multiple-value field):

```
FIND XYZ-VIEW WITH MU-FIELD = 'A'
```

This statement returns records in which at least one occurrence of MU-FIELD has the value A.

```
FIND XYZ-VIEW WITH MU-FIELD NOT EQUAL 'A'
```

This statement returns records in which at least one occurrence of MU-FIELD does not have the value A

```
FIND XYZ-VIEW WITH NOT MU-FIELD NOT EQUAL 'A'
```

This statement returns records in which every occurrence of MU-FIELD has the value A.

```
FIND XYZ-VIEW WITH NOT MU-FIELD = 'A'
```

This statement returns records in which none of the occurrences of MU-FIELD has the value A.

#### **Example 5 - Various Samples of Complex Search Expression in WITH Clause**

```
FIND STAFF WITH BIRTH LT 19770101 AND DEPT = 'DEPT06'

FIND STAFF WITH JOB-TITLE = 'CLERK TYPIST'

AND (BIRTH GT 19560101 OR LANG = 'SPANISH')
```

```
FIND STAFF WITH JOB-TITLE = 'CLERK TYPIST'

AND NOT (BIRTH GT 19560101 OR LANG = 'SPANISH')
```

```
FIND STAFF WITH DEPT = 'ABC' THRU 'DEF'

AND CITY = 'WASHINGTON' OR = 'LOS ANGELES'

AND BIRTH GT 19360101
```

```
FIND CARS WITH MAKE = 'VOLKSWAGEN'

AND COLOR = 'RED' OR = 'BLUE' OR = 'BLACK'
```

#### **Example 6 - Various Samples of Using Database Arrays**

The following examples assume that the field SALARY is a descriptor contained within a periodic group, and the field LANG is a multiple-value field.

```
FIND EMPLOYEES WITH SALARY LT 20000
```

Results in a search of all occurrences of SALARY.

```
FIND EMPLOYEES WITH SALARY (1) LT 20000
```

Results in a search of the first occurrence only.

```
FIND EMPLOYEES WITH SALARY (1:4) LT 20000 /* invalid
```

A range specification must not be specified for a field within a periodic group used as a search criterion.

```
FIND EMPLOYEES WITH LANG = 'FRENCH'
```

Results in a search of all values of LANG.

```
FIND EMPLOYEES WITH LANG (1) = 'FRENCH' /* invalid
```

An index must not be specified for a multiple-value field used as a search criterion.

#### **Example 7 - Using Physically Coupled Files**

```
** Example 'FNDCPL': FIND (using coupled files)

** NOTE: Adabas files must be physically coupled when using the

** COUPLED clause without the VIA clause.

***************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME

1 VEHIC-VIEW VIEW OF VEHICLES

2 MAKE
```

```
END-DEFINE

*

FIND EMPLOY-VIEW WITH CITY = 'FRANKFURT'

AND COUPLED TO

VEHIC-VIEW WITH MAKE = 'VW'

DISPLAY NOTITLE NAME

END-FIND

*

END
```

#### **Example 8 - VIA Clause**

```
** Example 'FNDVIA': FIND (with VIA clause)

************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

2 FIRST-NAME

1 VEHIC-VIEW VIEW OF VEHICLES

2 PERSONNEL-ID

END-DEFINE

*

FIND EMPLOY-VIEW WITH NAME = 'ADKINSON'

AND COUPLED TO VEHIC-VIEW

VIA PERSONNEL-ID = PERSONNEL-ID WITH MAKE = 'VOLVO'

DISPLAY PERSONNEL-ID NAME FIRST-NAME

END-FIND

*

END
```

## **Output of Program FNDVIA:**

#### **Example 9 - SORTED BY Clause**

#### **Output of Program FNDSOR:**

NAME	FIRST-NAME	PERSONNEL ID
BAECKER	JOHANNES	11500345
BECKER	HERMANN	11100311
BERGMANN	HANS	11100301
BLAU	SARAH	11100305
BLOEMER	JOHANNES	11200312
DIEDRICHS	HUBERT	11600301
DOLLINGER	MARGA	11500322
FALTER	CLAUDIA	11300311
	HEIDE	11400311
FREI	REINHILD	11500301

## **Example 10 - RETAIN Clause**

```
** Example 'RELEX1': FIND (with RETAIN clause and RELEASE statement)

**************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 CITY

2 BIRTH

2 NAME

*

1 #BIRTH (D)

END-DEFINE
```

```
*
MOVE EDITED '19400101' TO #BIRTH (EM=YYYYMMDD)

*
FIND NUMBER EMPLOY-VIEW WITH BIRTH GT #BIRTH
RETAIN AS 'AGESET1'

IF *NUMBER = 0
STOP
END-IF

*
FIND EMPLOY-VIEW WITH 'AGESET1' AND CITY = 'NEW YORK'
DISPLAY NOTITLE NAME CITY BIRTH (EM=YYYY-MM-DD)
END-FIND

*
RELEASE SET 'AGESET1'

*
END
```

#### **Output of Example 10:**

NAME	CITY	DATE	
		0 F	
		BIRTH	
RUBIN	NEW YORK	1945-10-27	
WALLACE	NEW YORK	1945-08-04	

#### **Example 11 - WHERE Clause**

```
** Example 'FNDWHE': FIND (with WHERE clause)

*********************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

2 JOB-TITLE

2 CITY

END-DEFINE

*

FIND EMPLOY-VIEW WITH CITY = 'PARIS'

WHERE JOB-TITLE = 'INGENIEUR COMMERCIAL'

DISPLAY NOTITLE

CITY JOB-TITLE PERSONNEL-ID NAME

END-FIND

*

END
```

## **Output of Program FNDWHE:**

CITY	CURRENT POSITION	PERSONNEL ID	NAME
PARIS PARIS PARIS PARIS PARIS PARIS PARIS	INGENIEUR COMMERCIAL INGENIEUR COMMERCIAL INGENIEUR COMMERCIAL INGENIEUR COMMERCIAL INGENIEUR COMMERCIAL INGENIEUR COMMERCIAL	50004700 FA 50004400 VA 50002800 BR	HN ZUY URIE LLY ETON GLEUX
PARIS	INGENIEUR COMMERCIAL		RAB-BRZOZOWSKI

#### **Example 12 - IF NO RECORDS FOUND Clause**

```
** Example 'FNDIFN': FIND (using IF NO RECORDS FOUND)
**************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
1 VEHIC-VIEW VIEW OF VEHICLES
 2 PERSONNEL-ID
 2 MAKE
END-DEFINE
LIMIT 15
EMP. READ EMPLOY-VIEW BY NAME STARTING FROM 'JONES'
 VEH. FIND VEHIC-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (EMP.)
   IF NO RECORDS FOUND
     MOVE '*** NO CAR ***' TO MAKE
   END-NOREC
   DISPLAY NOTITLE
           NAME (EMP.) (IS=ON)
           FIRST-NAME (EMP.) (IS=ON)
           MAKE (VEH.)
 END-FIND
 /*
END-READ
END
```

## **Output of Program FNDIFN:**

NAME	FIRST-NAME	MAKE
JONES	VIRGINIA	CHRYSLER
	MARSHA	CHRYSLER
		CHRYSLER
	ROBERT	GENERAL MOTORS
	LILLY	FORD
		MG
	EDWARD	GENERAL MOTORS
	MARTHA	GENERAL MOTORS
	LAUREL	GENERAL MOTORS
	KEVIN	DATSUN
	GREGORY	FORD
JOPER	MANFRED	*** NO CAR ***
JOUSSELIN	DANIEL	RENAULT
JUBE	GABRIEL	*** NO CAR ***
JUNG	ERNST	*** NO CAR ***
JUNKIN	JEREMY	*** NO CAR ***
KAISER	REINER	*** NO CAR ***

## **Example 13 - Using System Variables with the FIND Statement**

```
** Example 'FNDVAR': FIND (using *ISN, *NUMBER, *COUNTER)

************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

2 CITY

END-DEFINE

*

LIMIT 3

FIND EMPLOY-VIEW WITH CITY = 'MADRID'

DISPLAY NOTITLE PERSONNEL-ID NAME

*ISN *NUMBER *COUNTER

END-FIND

*

END
```

#### **Output of Program FNDVAR**

PERSONNEL ID	NAME	ISN	NMBR (	CNT	
60000114	DE JUAN	400	41	1	
60000136	DE LA MADRID	401	41	2	
60000209	PINERO	405	41	3	

#### **Example 14 - Multiple FIND Statements**

In the following example, first all people named SMITH are selected from the EMPLOYEES file. Then the PERSONNEL-ID from the EMPLOYEES file is used as the search key for an access to the VEHICLES file.

```
** Example 'FNDMUL': FIND (with multiple files)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 PERSONNEL-ID
  2 NAME
 2 FIRST-NAME
1 VEHIC-VIEW VIEW OF VEHICLES
  2 PERSONNEL-ID
  2 MAKE
END-DEFINE
LIMIT 15
EMP. FIND EMPLOY-VIEW WITH NAME = 'SMITH'
  VEH. FIND VEHIC-VIEW WITH PERSONNEL-ID = EMP.PERSONNEL-ID
    IF NO RECORDS FOUND
     MOVE '*** NO CAR ***' TO MAKE
    END-NOREC
    DISPLAY NOTITLE
            EMP.NAME (IS=ON)
            EMP.FIRST-NAME (IS=ON)
            VEH.MAKE
  END-FIND
END-FIND
END
```

#### **Output of Program FNDMUL:**

The resulting report shows the NAME and FIRST-NAME (obtained from the EMPLOYEES file) of all people named SMITH as well as the MAKE of each car (obtained from the VEHICLES file) owned by these people.

NAM 	IE FIR	ST-NAME	MAKE
SMITH	GERHARD SEYMOUR MATILDA ANN TONI MARTIN THOMAS SUNNY MARK LOUISE MAXWELL ELSA CHARLY	FORD *** NO TOYOTA *** NO FORD *** NO FORD CHRYSI	CAR ***  CAR ***  LER  DES-BENZ  DES-BENZ  LER
	LEE FRANK		) CAR ***

## **Example 15 - SHARED HOLD Clause**

```
FIND EMPL-VIEW WITH NAME = ...

IN SHARED HOLD MODE=Q /* Record in shared hold until next record is read.

...

GET EMPL-VIEW *ISN /* The record remains unchanged!

...

END-FIND
```

## **Example 16 - SKIP RECORDS Clause**

```
FIND EMPL-VIEW WITH NAME = ... /* Records found are put in hold while reading.

SKIP RECORDS IN HOLD /* Records already held by other users are

... /* skipped to prevent error NAT3145.

UPDATE
END TRANSACTION
END-FIND
```

# FOR

Function	586
Syntax Description	
Example	

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: REPEAT | ESCAPE

Belongs to Function Group: Loop Execution

## **Function**

The FOR statement is used to initiate a processing loop and to control the number of times the loop is processed.

#### **Consistency Check**

Before the FOR loop is entered, the values of the operands are checked to ensure that they are consistent (that is, the value of <code>operand3</code> can be reached or exceeded by repeatedly adding <code>operand4</code> to <code>operand2</code>). If the values are not consistent, the FOR loop is not entered (however, no error message is output, except when the <code>STEP</code> value is zero).

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure				Possible Formats									Referencing Permitted	Dynamic Definition			
operand1		S						N	Р	Ι	F						yes	yes
operand2	С	S			N			N	Р	Ι	F						yes	no
arithmetic-expression		S						N	Р	Ι	F						no	no
operand3	С	S			N			N	Р	Ι	F						yes	no

Оре	erand	Po	ssil	ble	Structur	е	Possible Formats	8	Referencing Permitted	Dynamic Definition
op	erand4	С	S		N		NPIF		yes	no

## Syntax Element Description:

Syntax Element	Description
operand1	Loop Control Variable (operand1) and Initial Setting (operand2):
operand2	operand1 is used to control the number of times the processing loop is to be executed. It may be a database field or a user-defined variable.
	The value specified after the keyword FROM (operand2) is assigned to the loop control variable field before the processing loop is entered for the first time. This value is incremented (or decremented if the STEP value is negative) using the value specified after the STEP keyword (operand4) each additional time the loop is processed.
	The loop control variable value may be referenced during the execution of the processing loop and will contain the current value of the loop control variable.
	<b>Note:</b> The keywords [:]=, EQ or FROM can be omitted.
operand3	TO Value:
	The processing loop is terminated when <code>operand1</code> is greater than (or less than if the initial value of the <code>STEP</code> value was negative) the value specified for <code>operand3</code> .
	<b>Note:</b> The keyword T0 or TRU can be omitted.
STEP operand4	STEP Value:
	The STEP value may be positive or negative. If a STEP value is not specified, an increment of +1 is used.
	The compare operation will be adjusted to "less than" or "greater than" depending on the sign of the STEP value when the loop is entered for the first time.
	Note:
	1. operand4 must not be zero.
	2. The keyword STEP can be omitted.
(arithmetic-expression)	Arithmetic Expression:
	In place of operand2, operand3 or operand4, any arithmetic expression may be specified.

Syntax Element	Description
	Note:
	1. The arithmetic expressions must be enclosed in parentheses.
	2. The preceding keyword cannot be omitted.
	For further information on arithmetic expressions, see <pre>arithmetic-expression</pre> in the COMPUTE statement description.
END-FOR	End of FOR Statement:
LOOP	In structured mode, the Natural reserved word END-FOR must be used to end the FOR statement.
	In reporting mode, the Natural statement LOOP is used to end the FOR statement.

# **Example**

```
** Example 'FOREX1S': FOR (structured mode)
***********************
DEFINE DATA LOCAL
1 #INDEX (I1)
1 #ROOT (N2.7)
END-DEFINE
FOR #INDEX 1 TO 5
 COMPUTE \#ROOT = SQRT (\#INDEX)
 WRITE NOTITLE '=' #INDEX 3X '=' #ROOT
END-FOR
SKIP 1
FOR #INDEX 1 TO 5 STEP 2
 COMPUTE \#ROOT = SQRT (\#INDEX)
 WRITE '=' #INDEX 3X '=' #ROOT
END-FOR
END
```

## **Output of Program FOREX1S:**

```
#R00T:
#INDEX:
                     1.0000000
#INDEX: 2
            #R00T:
                    1.4142135
#INDEX: 3 #ROOT: 1.7320508
#INDEX:
       4 #ROOT:
                    2.0000000
#INDEX:
       5 #ROOT:
                     2.2360679
#INDEX:
         1
            #R00T:
                     1.0000000
#INDEX:
         3 #ROOT:
                     1.7320508
#INDEX:
         5
            #R00T:
                     2.2360679
```

Equivalent reporting-mode example: FOREX1R.

# 75 FORMAT

<ul> <li>Function</li></ul>		
■ Applicable Parameters	Function	592
■ Applicable Parameters	Syntax Description	592

```
FORMAT [(rep)] parameter ...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

### **Function**

The FORMAT statement is used to specify input and output parameter settings.

Settings specified with a FORMAT statement override (at compilation time) default settings in effect for the session that have been set by a GLOBALS command, SET GLOBALS statement, or by the Natural administrator.

These settings may in turn be overridden by parameters specified in a DISPLAY, INPUT, PRINT, WRITE, WRITE TITLE, or WRITE TRAILER statement.

The settings remain in effect until the end of a program or until another FORMAT statement is encountered.

A FORMAT statement does not generate any executable code in the Natural program. It is not executed in dependence of the logical flow of a program. It is evaluated during program compilation in order to set parameters for compiling DISPLAY, WRITE, PRINT and INPUT statements. The settings defined with a FORMAT statement are applicable to all DISPLAY, WRITE, PRINT and INPUT statements which follow.

## **Syntax Description**

Syntax Element	Description
(rep)	Report Specification:
	The notation ( $rep$ ) may be used to specify the identification of the report for which the FORMAT statement is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.

Syntax Element	Description												
	If ( rep) is not specified, the FORMAT statement will be applicable to the first report (Report 0).  For information on how to control the format of an output report created with Natural, see Report Format and Control (in the Programming Guide).												
parameter	Parameter(s):												
The parameters can be specified in any order and must be separated by one or mo A single entry must not be split between two statement lines.  Field sensitive parameter settings applied here will only be regarded for variable fin a INPUT, WRITE, DISPLAY or PRINT statement of the selected report. They do n for text-constants used in any of the mentioned statements.													
	Example:												
	DEFINE DATA LOCAL  1 VARI (A4) INIT <'1234'> /* Output END-DEFINE /* Produced FORMAT AD=U /* WRITE 'Text' VARI /* Text 1234 WRITE 'Text' (AD=U) VARI /* Text 1234 END												
	See also Applicable Parameters below.												

# **Applicable Parameters**

See the  ${\it Parameter \, Reference}$  for a detailed description of the session parameters which may be used.

Parameter	Description
AD	Attribute Definition
AL	Alphanumeric Length for Output
ВХ	Box Definition
CD	Color Definition
DF	Date Format
DL	Display Length for Output
EM	Edit Mask
ES	Empty Line Suppression
FC	Filler Character
FL	Floating Point Mantissa Length

Parameter	Description
GC	Filler Character for Group Heading
НС	Header Centering
HW	Heading Width
IC	Insertion Character
ICU	Unicode Insertion Character
ΙP	Input Prompting Text
IS	Identical Suppress
KD	Key Definition
LC	Leading Characters
LCU	Unicode Leading Characters
LS	Line Size
MC	Multiple-Value Field Count (Can only be used in reporting mode.)
MP	Maximum Number of Pages of a Report, see Note below.
MS	Manual Skip
NL	Numeric Length for Output
PC	Periodic Group Count (Can only be used in reporting mode.)
PM	Print Mode
PS	Page Size, see Note below.
SF	Spacing Factor
SG	Sign Position
TC	Trailing Characters
TCU	Unicode Trailing Characters
UC	Underlining Character
ZP	Zero Printing

**Note:** The parameters MP and PS do not take effect for a specific I/O statement, but apply to the complete output created for the report. If multiple settings for MP and PS are performed, the last definition is used.

See also Underlining Character for Titles and Headers - UC Parameter (in the Programming Guide).

## **Example**

```
** Example 'FMTEX1': FORMAT
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 CITY
 2 POST-CODE
 2 COUNTRY
END-DEFINE
FORMAT AL=7
           /* Alpha-numeric field output length
      FC=+
           /* Filler character for field header
      GC=*
             /* Filler character for group header
      HC=L
            /* Header left justified
      IC=<< /* Insert characters
      IS=ON /* Identical suppress on
      TC=>> /* Trailing character
      UC== /* Underline character
      ZP=OFF /* Zero print off
LIMIT 5
READ EMPLOY-VIEW BY NAME
 DISPLAY NOTITLE
         NAME 3X CITY 3X POST-CODE 3X COUNTRY
END-READ
END
```

#### **Output of Program FMTEX1:**

```
NAME++++++
             CITY++++++
                          POSTAL++++
                                       COUNTRY++++
                           ADDRESS++++
<<ABELLAN>>
            <<MADRID >>
                          <<28014 >>
                                       <<E >>
<<ACHIESO>>
             <<DERBY >>
                         <<DE3 4TR>>
                                       <<UK >>
             <<JOIGNY >>
                                       <<F >>
<<ADAM >>
                          <<89300 >>
<<ADKINSO>>
                          <<11201 >>
                                       <<USA>>
             <<BROOKLY>>
             <<BEVERLE>> <<90211 >>
```

# GET

Function	. 598
Restrictions	. 598
Syntax Description	. 599
Example	600

In structured mode and in reporting mode using a DEFINE DATA LOCAL statement, the following syntax applies:

In reporting mode using no DEFINE DATA LOCAL statement, the following syntax applies:

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET SAME | GET TRANSACTION | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | READLOB | RETRY | STORE | UPDATE |

Belongs to Function Group: Database Access and Update

### **Function**

The GET statement is used to read a record with a given Adabas Internal Sequence Number (ISN).

The GET statement does not cause a processing loop to be initiated.

## Restrictions

- The GET statement cannot be used for DL/I and SQL databases.
- The GET statement cannot be used with Entire System Server.

# **Syntax Description**

## Operand Definition Table:

Operand	Po	ssib	le St	ruct	Possible Formats											Referencing Permitted	Dynamic Definition	
operand1	C	S				Α											yes	no
operand2	С	S					N										no	no
operand3	С	S			N		N	Р	Ι		В*						yes	no
operand4		S	A			A	N	Р	Ι	F	В	D	T	L			yes	yes

<sup>\*</sup> Format B of  $\it{operand3}$  may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description						
view-name	View Name:						
	In structured mode and in reporting mode using a DEFINE DATA LOCAL statement, the name of a view as defined either directly within a DEFINE DATA statement or in a separate global or local data area.						
ddm-name	DDM Name:						
	In reporting mode using no DEFINE DATA LOCAL statement, the name of the data definition module (DDM) is referenced.						
PASSWORD=operand1	PASSWORD Clause/CIPHER Clause:						
CIPHER=operand2	These clauses are applicable only to Adabas and VSAM databases.						
	The PASSWORD clause is used to provide a password when retrieving data from an Adabas file which is password protected.						
	The CIPHER clause is used to provide a cipher key when retrieving data from an Adabas file which is enciphered.						
	See the statements FIND and PASSW for further information.						
*ISN / operand3	Internal Sequence Number:						
	The ISN must be provided either in the form of a numeric constant or user-defined variable ( <i>operand3</i> ) in the range from 1 to 4294967295, or via the Natural system variable *ISN.						
	<b>Note:</b> For VSAM databases: For VSAM ESDS, the RBA must be contained in a						
	user-defined variable (numeric format) or must be specified as an integer constant.						

Syntax Element	Description
	The same rules apply to VSAM RRDS with the exception that the RRN must be provided instead of the RBA.
(r)	Statement Reference:
	The notation $(r)$ is used to specify the statement which contains the FIND or READ statement used to initially read the record.
	If $(r)$ is not specified, the GET statement will be related to the innermost active processing loop.
	( r) may be specified as a reference statement number or as a statement label.
operand4	Reference to Database Fields:
	In reporting mode, subsequent references to database fields that have been read with a GET statement can contain the label or line number of the GET statement.

# **Example**

```
** Example 'GETEX1': GET
*****************************
DEFINE DATA LOCAL
1 PERSONS VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
1 SALARY-INFO VIEW OF EMPLOYEES
 2 NAME
 2 CURR-CODE (1:1)
 2 SALARY
            (1:1)
1 #ISN-ARRAY (B4/1:10)
1 #LINE-NR
             (N2)
END-DEFINE
FORMAT PS=16
LIMIT 10
READ PERSONS BY NAME
 MOVE *COUNTER TO #LINE-NR
 MOVE *ISN
            TO #ISN-ARRAY (#LINE-NR)
 DISPLAY #LINE-NR PERSONNEL-ID NAME FIRST-NAME
 /*
 AT END OF PAGE
   INPUT / 'PLEASE SELECT LINE-NR FOR SALARY INFORMATION:' #LINE-NR
   IF \#LINE-NR = 1 THRU 10
     GET SALARY-INFO #ISN-ARRAY (#LINE-NR)
     WRITE / SALARY-INFO.NAME
             SALARY-INFO.SALARY
                                  (1)
```

```
SALARY-INFO.CURR-CODE (1)

END-IF

END-ENDPAGE

/*

END-READ
END
```

# **Output of Program GETEX1:**

Page	1			05-01-13	13:17:42
#LINE-NR	PERSONNEL ID	NAME	FIRST-NAME		
	60008339 30000231 50005800 20008800 20009800 20012700 20013800 20019600 20008600 20005700	ABELLAN ACHIESON ADAM ADKINSON	KEPA ROBERT SIMONE JEFF PHYLLIS HAZEL DAVID CHARLIE MARTHA TIMMIE		
ABELLAN		1450000 PTA			

# 77 GET SAME

Function	604
Restrictions	
Syntax Description	
Example	

#### **Structured Mode Syntax**

GET SAME [(r)]

#### **Reporting Mode Syntax**

GET SAME [(r)] [operand1 ...]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The GET SAME statement is used to re-read the record currently being processed. It is most frequently used to obtain database array values (periodic groups or multiple-value fields) if the number and range of existing or desired occurrences was not known when the record was initially read.

## Restrictions

- GET SAME is only valid for Natural users who are using Adabas or VSAM.
- GET SAME cannot be used with Entire System Server.
- For VSAM databases, GET SAME can only be applied to ESDS and RRDS. For ESDS, the RBA must be contained in a user-defined variable (numeric format) or be specified as an integer constant. The same applies to RRDS, except that the RRN must be provided instead of the RBA.
- An UPDATE or DELETE statement must not reference a GET SAME statement. These statements should instead make reference to the FIND, READ or GET statement used to read the record initially.

# **Syntax Description**

Operand Definition Table:

Operand		Pos	ssib	le St	Possible Formats								Referencing Permitted	Dynamic Definition		
operan	d1		S	A			A	U	N	Р		В			no	yes

Syntax Element Description:

Syntax Element	Description
(r)	Statement Reference:
	The notation $(r)$ is used to specify the statement which contains the FIND or READ statement used to initially read the record.
	If $(r)$ is not specified, the GET SAME statement will be related to the innermost active processing loop.
	(r) may be specified as a reference statement number or as a statement label.
operand1	Fields to Be Made Available:
	As operand1, you specify the field(s) to be made available as a result of the GET SAME statement.
	<b>Note:</b> operand1 cannot be specified if the field is defined in a DEFINE DATA statement.

# **Example**

```
MOVE 1 TO I
READ (10) POST-ADDRESS BY NAME
  COMPRESS NAME FIRST-NAME INTO #NAME WITH DELIMITER ','
  WRITE // 12T #NAME
  WRITE / 12T ADDRESS-LINE (I.1)
  /*
  IF C*ADDRESS-LINE > 1
   FOR I = 2 TO C*ADDRESS-LINE
      GET SAME
                                    /* READ NEXT OCCURRENCE
     WRITE 12T ADDRESS-LINE (I.1)
   END-FOR
  END-IF
  WRITE / POST-CODE CITY
 SKIP 3
END-READ
END
```

#### **Output of Program GSAEX1:**

```
Page 1 05-01-13 13:23:36

ABELLAN, KEPA
CASTELAN 23-C
28014 MADRID

ACHIESON, ROBERT
144 ALLESTREE LANE
DERBY
DERBYSHIRE

DE3 4TR DERBY
```

# 78 GET TRANSACTION DATA

	0.0
■ Function	60
■ Restriction	60
Syntax Description	
■ Example	

GET TRANSACTION [DATA] operand1...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

### **Function**

The GET TRANSACTION DATA statement is used to read the data saved with a previous END TRANSACTION statement.

GET TRANSACTION DATA does not create a processing loop.



**Note:** For DL/I: The GET TRANSACTION DATA statement retrieves checkpoint data saved by an END TRANSACTION statement.

#### System Variable \*ETID

The content of the Natural system variable \*ETID identifies the transaction data to be retrieved from the database.

#### No Transaction Data Stored

If the GET TRANSACTION DATA statement is issued and no transaction data are found, all fields specified in the GET TRANSACTION DATA statement will be filled with blanks regardless of format definition.



**Caution:** Make sure that arithmetic operations are not performed on "empty" transaction data, because this would result in an abnormal termination of the program.

## Restriction

The GET TRANSACTION DATA statement is only valid for transactions applied to Adabas databases, or to DL/I databases in a batch-oriented BMP region (in IMS TM environments only).

# **Syntax Description**

Operand Definition Table:

Operand	Possi	ble S	Struct	ure			Pos	ssik	ole I	For	rma	ts		Referencing Permitted	Dynamic Definition	on
operand1	S				A	U I	N	PΙ	F	В	D	Т		yes	yes	

Syntax Element Description:

Syntax Element	Description
operand1	Field Specification:
	The sequence, lengths and formats of the fields used in the <code>GET_TRANSACTION_DATA</code> statement must be identical to the sequence, lengths and formats of the fields specified with the corresponding <code>END_TRANSACTION</code> statement.
	<b>Note:</b> For DL/I: The first <i>operand1</i> must be an 8-byte checkpoint ID.

# **Example**

```
** Example 'GTREX1': GET TRANSACTION

**

** CAUTION: Executing this example will modify the database records!

***********************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

2 FIRST-NAME

2 MIDDLE-I

2 CITY

*

1 #PERS-NR (A8) INIT <' '>
END-DEFINE

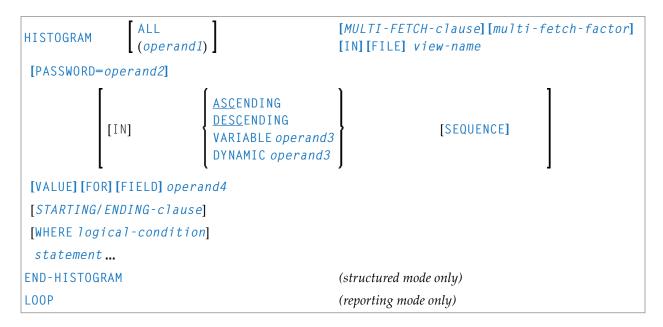
*

GET TRANSACTION DATA #PERS-NR
```

```
IF #PERS-NR NE ' '
  WRITE 'LAST TRANSACTION PROCESSED FROM PREVIOUS SESSION' #PERS-NR
END-IF
REPEAT
  /*
  INPUT 10X 'ENTER PERSONNEL NUMBER TO BE UPDATED: ' #PERS-NR
  IF #PERS-NR = ' '
   STOP
  END-IF
  /*
  FIND EMPLOY-VIEW WITH PERSONNEL-ID = #PERS-NR
   IF NO RECORDS FOUND
      REINPUT 'NO RECORD FOUND'
   END-NOREC
   INPUT (AD=M) PERSONNEL-ID (AD=0)
              / NAME
               / FIRST-NAME
               / CITY
   UPDATE
   END TRANSACTION #PERS-NR
  END-FIND
  /*
END-REPEAT
END
```

# 79 HISTOGRAM

■ Function	612
■ Restrictions	613
Syntax Description	613
System Variables Available with HISTOGRAM	
■ Examples	



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The HISTOGRAM statement is used to read the values of a database field which is defined as a descriptor, subdescriptor, or a superdescriptor. The values are read directly from the Adabas inverted lists or VSAM index. The HISTOGRAM statement causes a processing loop to be initiated but does not provide access to any database fields other than the field specified in the HISTOGRAM statement.

See also the following sections in the *Programming Guide*:

- HISTOGRAM Statement
- Loop Processing
- Referencing of Database Fields Using (r) Notation
- **Note:** For SQL databases: HISTOGRAM returns the number of rows which have the same value in a specific column.

# **Restrictions**

■ This statement cannot be used with DL/I databases or Entire System Server.

When applied to a VSAM database, the HISTOGRAM statement is only valid for KSDS and ESDS.

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure								Po	SS	ibl	e Fo	rm	ats				Referencing Permitted	Dynamic Definition
operand1	1 C S				NPIB*								T	yes	no				
operand2	С	S				Α												yes	no
operand3		S				A												yes	no
operand4		S				A	]	N	Р	Ι	F	В	D	Т	L			no	no

<sup>\*</sup> Format B of operand1 may be used only with a length of less than or equal to 4.

Syntax Element Description:

Syntax Element	Description
operand1 / ALL	Number of Descriptor Values:
	You can limit the number of descriptor values to be processed with the HISTOGRAM statement by specifying <i>operand1</i> - either as a numeric constant (0 - 4294967295) or as a user-defined variable (containing an integer value).
	ALL may optionally be specified to emphasize that all descriptor values are to be processed.
	For this statement, the specified limit has priority over a limit set with a LIMIT statement.
	If a smaller limit is set with the $L^T$ parameter (Limit for Processing Loops), the $L^T$ limit applies.
	<b>Note:</b> If you wish to process a 4-digit number of descriptor values, specify it
	with a leading zero (0nnnn); because Natural interprets every 4-digit number enclosed in parentheses as a line-number reference to a statement. operand1 is evaluated when the HISTOGRAM loop is entered. If the value of operand1 is modified within the HISTOGRAM loop, this does not affect the number of values read.

Syntax Element	Description						
MULTI-FETCH-clause	MULTI-FETCH Clause:						
	See MULTI-FETCH Clause below.						
view-name	View Name:						
	As <i>view-name</i> , you specify the name of a view, which is defined either within a DEFINE DATA statement or in a separate global or local data area.						
	The view must not contain any other fields apart from the field used in the HISTOGRAM statement (operand4).						
	If the field in the view is a periodic-group field or multiple-value field that is defined with an index range, only the first occurrence of that range is filled by the <code>HISTOGRAM</code> statement; all other occurrences are not affected by the execution of the <code>HISTOGRAM</code> statement.						
	In reporting mode, <i>view-name</i> is the name of a DDM if no DEFINE DATA LOCAL statement is used.						
PASSWORD=operand2	PASSWORD Clause:						
	The PASSWORD clause is used to provide a password ( <i>operand2</i> ) when retrieving data from an Adabas file which is password-protected. See the statements FIND and PASSW for further information.						
SEQUENCE	SEQUENCE Clause:						
	This clause can only be used for Adabas, VSAM and SQL databases.						
	With this clause, you can determine whether the records are to be read in ascending sequence or in descending sequence.						
	■ The default sequence is ascending (which may, but need not, be explicitly specified by using the keyword ASCENDING).						
	■ If the records are to be read in descending sequence, you specify the keyword DESCENDING.						
	■ If, instead of determining it in advance, you want to have the option of determining at runtime whether the records are to be read in ascending or descending sequence, you either specify the keyword VARIABLE or DYNAMIC, followed by a variable (operand3). operand3 has to be of format/length A1 and can contain the value A (for "ascending") or D (for "descending").						
	■ If keyword VARIABLE is used, the reading direction (value of operand3) is evaluated at start of the HISTOGRAM processing loop and remains same until the loop is terminated, regardless if the operand3 field is altered in the HISTOGRAM loop or not.						
	■ If keyword DYNAMIC is used, the reading direction (value of operand3) is evaluated before every record fetch in the HISTOGRAM processing loop and may be changed from record to record. This allows to change the						

Syntax Element	Description
	scroll sequence from ascending to descending (and vice versa) at any place in the <code>HISTOGRAM</code> loop.
	Examples of SEQUENCE clause:
	Example 2 - HISTOGRAM Statement with Records Read in Descending Sequence
	Example 3 - HISTOGRAM Statement Using Variable Sequence
operand4	Descriptor:
	As operand4, a descriptor, subdescriptor, superdescriptor or hyperdescriptor may be specified.
	A descriptor contained within a periodic group may be specified with or without an index. If no index is specified, the descriptor will be selected if the value specified is located in any occurrence. If an index is specified, the descriptor will be selected only if the value is located in the occurrence specified by the index. The index specified must be a constant. An index range must not be used.
	For a descriptor which is a multiple-value field an index must not be specified; the descriptor will be selected if the value is located in the record regardless of the position of the value.
STARTING-ENDING-clause	STARTING/ENDING Clause:
	Starting and ending values may be specified using the keywords STARTING and ENDING (or THRU) followed by a constant or a user-defined variable representing the value with which processing is to begin/end.
	For further information, see <i>Specifying Starting/Ending Values</i> below.
WHERE logical-condition	WHERE Clause:
	The WHERE clause may be used to specify an additional selection criteria (logical-condition) which is evaluated after a value has been read and before any processing is performed on the value (including the AT BREAK evaluation).
	The descriptor specified in the WHERE clause must be the same descriptor referenced in the <code>HISTOGRAM</code> statement. No other fields from the selected file are available for processing with a <code>HISTOGRAM</code> statement.
	The syntax for a <code>logical-condition</code> is described in the section <code>Logical Condition Criteria</code> (in the <code>Programming Guide</code> ).
END-HISTOGRAM	End of HISTOGRAM Statement:
LOOP	In structured mode, the Natural reserved word END-HISTOGRAM must be used to end the HISTOGRAM statement.

Syntax Element	Description
	In reporting mode, the Natural statement LOOP must be used to end the HISTOGRAM statement.

#### **MULTI-FETCH Clause**



**Note:** This clause can only be used for Adabas or DB2 databases.



For more information, see the section MULTI-FETCH Clause (Adabas) in the Programming Guide or Multiple Row Processing (SQL) in the Natural for DB2 part in the Database Management System Interfaces documentation.

### **Specifying Starting/Ending Values**

Starting and ending values may be specified using the keywords STARTING and ENDING (or THRU) followed by a constant or a user-defined variable representing the value with which processing is to begin/end.

If a starting value is specified and the value is not present, the next higher value is used as the starting value. If no higher value is present, the HISTOGRAM loop will not be entered.

If an ending value is specified, values will be read up to and including the ending value.

Hexadecimal constants may be specified as a starting or ending value for descriptors of format A or B.

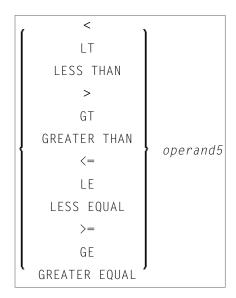
#### Syntax Option 1:



#### Syntax Option 2:



#### Syntax Option 3:



**Note:** If the comparators of Diagram 3 are used, the options ENDING AT, THRU and TO may not be used. These comparators are also valid for the READ statement.

### Operand Definition Table:

Operand	Po	ssib			P	OSS	sib	ole	Fo	rm	ats			Referencing Permitted	Dynamic Definition			
operand5	C	S			A	U	N	Р	Ι	F	В	D	T	L			yes	no
operand6	С	S			Α	U	N	Р	Ι	F	В	D	T	L			yes	no

## Syntax Element Description:

Syntax Element	Description
STARTING FROM ENDING AT	STARTING FROM / ENDING AT Clauses:
	The STARTING FROM and ENDING AT clauses are used to limit reading to a user-specified range of values.
	The STARTING FROM clause (= or EQ or EQUAL TO or [STARTING] FROM) determines the starting value for the read operation. If a starting value is specified, reading will
	begin with the value specified. If the starting value does not exist, the next higher (or lower for a DESCENDING read) value will be returned. If no higher (or lower for
	DESCENDING) value exists, the HISTOGRAM loop will not be entered.
	In order to limit the values to an end-value, you may specify an ENDING AT clause with
	the terms THRU, ENDING AT or TO, that imply an inclusive range. Whenever the descriptor
	field exceeds the end-value specified, an automatic loop termination is performed. Although the basic functionality of the TO, THRU and ENDING AT keywords looks quite
	similar, internally they differ in how they work.
THRU   ENDING	THRU / ENDING AT Option:
A	

Syntax Element	Description
	If THRU or ENDING AT is used, only the start-value is supplied to the database, but the end-value check is performed by the Natural runtime system, after the value is returned by the database.
	The THRU and ENDING AT options can be used for all databases which support the HISTOGRAM statements.
ТО	Range:  If the keyword T0 is used, both the start-value and the end-value are sent to the database and Natural does not perform checks for value ranges. If the end-value is exceeded, the database reacts in the same way as when "end-of-file" is reached and the database loop is exited. Since the complete range checking is done by the database, the lower-value (of the range) is always supplied in the start-value and the higher-value filled into the end-value, regardless whether you are browsing in ASCENDING or in DESCENDING order.



**Note:** The result of READ/HISTOGRAM THRU/ENDING AT might differ from the result of READ/HISTOGRAM TO if Natural and the accessed database reside on different platforms with different collating sequences.

# **System Variables Available with HISTOGRAM**

The Natural system variables \*ISN, \*NUMBER, and \*COUNTER are available with the HISTOGRAM statement.

\*NUMBER and \*ISN are only set after the evaluation of the WHERE clause. They must not be used in the logical condition of the WHERE clause.

System Variable	Explanation
*NUMBER	The system variable *NUMBER contains the number of database records that contain the last value read.
	For SQL databases, see *NUMBER for SQL Databases in the System Variables documentation.
*ISN	The system variable *ISN contains the number of the occurrence in which the descriptor value last read is contained. *ISN will contain 0 if the descriptor is not contained within a periodic group.
	*ISN is not available for SQL and VSAM databases.
*COUNTER	The system variable *COUNTER contains a count of the total number of values which have been read (after evaluation of the WHERE clause).

# **Examples**

- Example 1 HISTOGRAM Statement
- Example 2 HISTOGRAM Statement with Records Read in Descending Sequence
- Example 3 HISTOGRAM Statement Using Variable Sequence

#### **Example 1 - HISTOGRAM Statement**

```
** Example 'HSTEX1S': HISTOGRAM (structured mode)

********************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 CITY

END-DEFINE

*

LIMIT 8

HISTOGRAM EMPLOY-VIEW CITY STARTING FROM 'M'

DISPLAY NOTITLE

CITY 'NUMBER OF/PERSONS' *NUMBER *COUNTER

END-HISTOGRAM

*

END
```

### **Output of Program HSTEX1S:**

CITY	NUMBER OF PERSONS	CNT
MADISON	3	1
MADRID	41	2
MAILLY LE CAMP	1	3
MAMERS	1	4
MANSFIELD	4	5
MARSEILLE	2	6
MATLOCK	1	7
MELBOURNE	2	8

Equivalent reporting-mode example: HSTEX1R.

### Example 2 - HISTOGRAM Statement with Records Read in Descending Sequence

```
** Example 'HSTDSCND': HISTOGRAM (with DESCENDING)

*****************************

DEFINE DATA LOCAL

1 EMPL VIEW OF EMPLOYEES

2 NAME

END-DEFINE

*

HISTOGRAM (10) EMPL IN DESCENDING SEQUENCE FOR NAME FROM 'ZZZ'

DISPLAY NAME *NUMBER

END-HISTOGRAM

END
```

#### **Output of Program HSTDSCND:**

Page 1		05-01-13 13:41:03
NAME	NMBR	
NAME	NINDK	
ZINN	1	
YOT	1	
YNCLAN	1	
YATES	1	
YALCIN	1	
YACKX-COLTEAU	1	
XOLIN	1	
WYLLIS	2	
WULFRING	1	
WRIGHT	1	

### **Example 3 - HISTOGRAM Statement Using Variable Sequence**

```
** Example 'HSTVSEQ': HISTOGRAM (with VARIABLE SEQUENCE)

*******************

DEFINE DATA LOCAL

1 EMPL VIEW OF EMPLOYEES

2 NAME

*

1 #DIR (A1)

1 #STARTVAL (A20)

END-DEFINE

*

SET KEY PF3 PF7 PF8

*

MOVE 'ADKINSON' TO #STARTVAL

*

HISTOGRAM (9) EMPL FOR NAME FROM #STARTVAL

WRITE NAME *NUMBER
```

```
IF *COUNTER = 5
    MOVE NAME TO #STARTVAL
  END-IF
END-HISTOGRAM
#DIR := 'A'
REPEAT
  HISTOGRAM EMPL IN VARIABLE #DIR SEQUENCE
            FOR NAME FROM #STARTVAL
    MOVE NAME TO #STARTVAL
    INPUT NO ERASE (IP=OFF AD=0)
          15/01 NAME *NUMBER
               'Direction:' #DIR
          // 'Press PF3 to stop'
             ' PF7 to go step back'
             ' PF8 to go step forward'
' ENTER to continue in that direction'
    /*
    IF *PF-KEY = 'PF7' AND \#DIR = 'A'
     MOVE 'D' TO #DIR
     ESCAPE BOTTOM
    FND-TF
    IF *PF-KEY = 'PF8' AND #DIR = 'D'
     MOVE 'A' TO #DIR
      ESCAPE BOTTOM
    END-IF
    IF *PF-KEY = 'PF3'
     STOP
    END-IF
  END-HISTOGRAM
  IF *COUNTER(0250) = 0
   ST0P
  END-IF
END-REPEAT
END
```

#### **Output of Program HSTVSEQ:**

```
Page 1
                                                              05-01-13 13:50:31
ADKINSON
                               8
AFCKFRIF
                               1
                               2
AFANASSIEV
AHL
                               1
AKROYD
ALEMAN
ALESTIA
                               1
ALEXANDER
                               5
ALLEGRE
                               1
```

MORE		
MORE		

# After pressing ENTER:

Page 1		05-01-13	13:50:31
ADKINSON AECKERLE AFANASSIEV AHL AKROYD ALEMAN ALESTIA ALEXANDER ALLEGRE	8 1 2 1 1 1 1 5		
AKROYD	1		
Direction: A			
Press PF3 to stop PF7 to go step back PF8 to go step forward ENTER to continue in tha	at direction		

# 80 IF

Function	. 624
Syntax Description	
Example	. 625

#### **Structured Mode Syntax**

```
IF logical-condition
[THEN] statement ...
[ELSE statement ...]
END-IF
```

#### **Reporting Mode Syntax**

```
IF logical-condition
[THEN] {    statement
    DO statement ... DOEND }

[ ELSE {    statement
    DO statement ... DOEND } ]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DECIDE FOR | DECIDE ON | IF SELECTION | ON ERROR

Belongs to Function Group: Processing of Logical Conditions

## **Function**

The IF statement is used to control execution of a statement or group of statements based on a logical condition.



**Note:** If no action is to be performed in case the condition is met, you must specify the statement IGNORE in the THEN clause.

## **Syntax Description**

Syntax Element	Description		
IF logical-condition	Logical Condition Criterion:		
	The logical condition which is used to determine whether the statement or statements specified with the IF statement are to be executed.		
	Examples:		

Syntax Element	Description		
	IF #A = #B IF LEAVE-TAKEN GT 30 IF #SALARY(1) * 1.15 GT 5000 IF SALARY (4) = 5000 THRU 6000 IF DEPT = 'A10' OR = 'A20' OR = 'A30'		
	For further information, see the section <i>Logical Condition Criteria</i> (in the <i>Programming Guide</i> ).		
THEN statement	THEN Clause:		
	In the THEN clause, you specify the $statement(s)$ to be executed if the logical condition is true.		
ELSE statement	ELSE Clause:		
	In the ELSE clause, you specify the <i>statement</i> (s) to be executed if the logical condition is <i>not</i> true.		
END-IF	END of IF Statement:		
statement DO statement DOEND	In structured mode, the Natural reserved word END-IF must be used to end the IF statement.		
	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the clauses and the IF statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.		

# **Example**

```
** Example 'IFEXIS': IF (structured mode)

******************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

2 FIRST-NAME

2 SALARY (1)

2 BIRTH

1 VEHIC-VIEW VIEW OF VEHICLES

2 PERSONNEL-ID

2 MAKE

*

1 #BIRTH (D)

END-DEFINE

*

MOVE EDITED '19450101' TO #BIRTH (EM=YYYYMMDD)
```

```
SUSPEND IDENTICAL SUPPRESS
LIMIT 20
FND. FIND EMPLOY-VIEW WITH CITY = 'FRANKFURT'
          SORTED BY NAME BIRTH
  IF SALARY (1) LT 40000
   WRITE NOTITLE '****' NAME 30X 'SALARY LT 40000'
  ELSE
    IF BIRTH GT #BIRTH
      FIND VEHIC-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (FND.)
        DISPLAY (IS=ON)
                NAME BIRTH (EM=YYYY-MM-DD)
                SALARY (1) MAKE (AL=8)
      END-FIND
    END-IF
  END-IF
END-FIND
END
```

## **Output of Program IFEX1S:**

NAME	DATE OF BIRTH	ANNUAL SALARY	MAKE	
BAECKER	1956-01-05	74400	BMW	
**** BECKER				SALARY LT 40000
BLOEMER	1979-11-07	45200	FIAT	
FALTER	1954-05-23	70800	FORD	
**** FALTER				SALARY LT 40000
**** GROTHE				SALARY LT 40000
**** HEILBROCK				SALARY LT 40000
**** HESCHMANN				SALARY LT 40000
HUCH	1952-09-12	67200	MERCEDES	
**** KICKSTEIN				SALARY LT 40000
**** KLEENE				SALARY LT 40000
**** KRAMER				SALARY LT 40000

Equivalent reporting-mode example: **IFEX1R**.

# 81 IF SELECTION

Function	628
Syntax Description	
Example	

## Structured Mode Syntax

```
IF SELECTION [NOT UNIQUE [IN [FIELDS]]] operand1...
[THEN] statement...
[ELSE statement...]
END-IF
```

## **Reporting Mode Syntax**

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DECIDE FOR | DECIDE ON | IF

Belongs to Function Group: Processing of Logical Conditions

## **Function**

The IF SELECTION statement is used to verify that in a sequence of alphanumeric fields one and only one contains a value.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure	Possible Formats	Referencing Permitted   Dynamic Definition	
operand1	S A	AUULC	yes	no

Syntax Element Description:

Syntax Element	Description
operand1	Selection Field(s):
	As operand1 you specify the fields which are to be checked.
	If you specify an attribute control variable (Format C), it is considered to contain a value if its status has been changed to MODIFIED.
	<b>Note:</b> To check if a specific attribute control variable has been assigned the status
	MODIFIED, use the MODIFIED option of, for example, an IF statement. This enables you to check that exactly one field was <i>modified</i> .
THEN statement	THEN Clause:
	The statement(s) specified in the THEN clause will be executed if one of the following conditions is true:
	None of the fields specified in <i>operand1</i> contains a value.
	■ More than one of the fields specified in <i>operand1</i> contains a value.
	This statement is generally used to verify that a terminal user has entered only one function in response to a map displayed via an INPUT statement.
	<b>Note:</b> If <i>no</i> action is to be performed if one of the conditions is met, you specify the statement IGNORE in the THEN clause.
ELSE statement	ELSE Clause:
	In the ELSE clause, you specify the statement(s) to be executed if exactly one field contains a value.
END-IF	End of IF SELECTION Statement:
statement DO statement DOEND	In structured mode, the Natural reserved word END-IF must be used to end the IF SELECTION statement.
	In reporting mode, use the DO DOEND statements to supply one or several suitable statements, depending on the situation, and to end the clauses and the IF SELECTION statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.

## **Example**

```
** Example 'IFSEL': IF SELECTION
***********************
DEFINE DATA LOCAL
1 #A (A1)
1 #B (A1)
END-DEFINE
INPUT 'Select one function:' //
  9X 'Function A:' #A
  9X 'Function B:' #B
IF SELECTION NOT UNIQUE #A #B
 REINPUT 'Please enter one function only.'
END-IF
IF #A NE ' '
 WRITE 'Function A selected.'
END-IF
IF #B NE ' '
 WRITE 'Function B selected.'
END-IF
END
```

## **Output of Program IFSEL:**

```
Select one function:

Function A: Function B:
```

## After selecting and confirming function A:

```
Page 1 05-01-17 11:04:07 Function A selected.
```

# 82 IGNORE

Function	. 6	33	32
Example	. 6	33	32

IGNORE

## **Function**

The IGNORE statement is an "empty" statement which itself does not perform any function.

During the development phase of an application, you can insert IGNORE temporarily within statement blocks in which one or more statements are required, but which you intend to code later (for example, within AT BREAK or AT START OF DATA / AT END OF DATA). This allows you to continue programming in another part of the application without the as yet incomplete statement block leading to an error.

The IGNORE statement must also be used in condition statements, such as IF or DECIDE FOR, if no function is to be performed in the case of a condition being met.

## **Example**

```
...
AT TOP OF PAGE
IGNORE /* top-of-page processing still to be coded
END-TOPPAGE
...
```

# 83 INCLUDE

Function	634
Syntax Description	634
Examples	635

```
INCLUDE copycode-name [operand1]...99
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## **Function**

The INCLUDE statement is used to include source lines from an external object of type copycode into another object at compilation.

The INCLUDE statement is evaluated at *compilation* time. The source lines of the copycode will not be physically included in the source of the program that contains the INCLUDE statement, but they will be included during the program compilation and thus in the resulting object module.



**Caution:** A source code line which contains an INCLUDE statement must not contain any other statement.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure				Possible Formats							5	Referencing Permitted Dynamic Definiti	Dynamic Definition	
operand1	C					A	U							no	no

Syntax Element Description:

Syntax Element	Description
copycode-name	Copycode Name:
	As <i>copycode-name</i> you specify the name of the copycode whose source is to be included. The case of the specified name is not translated.
	copycode-name may contain an ampersand (&); at compile time, this character will be replaced by the one-character code corresponding to the current value of the Natural system variable *LANGUAGE. This feature allows the use of multilingual copycode names.
	The object you specify must be of the type copycode. The copycode must be contained either in the same library as the program which contains the INCLUDE statement or in the respective steplib (the default steplib is SYSTEM).
	When the source of a copycode is modified, all programs using that copycode must be compiled again to reflect the changed source in their object codes.
	The source code of the copycode must consist of syntactically complete statements.

Syntax Element	Description
operand1	Insert Values for Dynamic Insertion:
	You can dynamically insert values in the copycode which is included. These values are specified with <code>operand1</code> .
	In the copycode, the values are referenced with the following notation:
	& <i>n</i> &
	That is, you mark the position where a value is to be inserted with & n & . n is the sequential number of each value passed with the INCLUDE statement. For example, & 3 & would refer to the third value specified with the statement.
	For every & n& notation in the copycode you must specify a value in the INCLUDE statement. For example, if the copycode contains & 5 & , operand 1 must be specified at least five times.
	You may write one copy code parameter (&n&) after another without blanks (that is, &1&&2&&3&). This method is used to concatenate multiple copy code parameters to a source.
	A string may follow one or several copy code parameters without a blank (that is, &1&abc or &1&&2&abc). This method is used to concatenate a string to multiple copy code parameters.
	<b>Note:</b> Because $\&n\&$ is a valid part of an identifier, this notation may not be used as a copy
	code parameter substitution in other positions described above (i.e. abc&1& or &1&abc&2&). In other words, a string may only come after copy code parameters, not before or between.
	Values that are specified in the INCLUDE statement but not referenced in the copycode will be ignored.

## **Examples**

- Example 1 INCLUDE Statement Including Copycode
- Example 2 INCLUDE Statement Including Copycode with Parameters
- Example 3 INCLUDE Statement Using Nested Copycodes

■ Example 4 - INCLUDE Statement with Concatenated Parameters in Copycode

### **Example 1 - INCLUDE Statement Including Copycode**

#### Program containing the INCLUDE statement:

```
** Example 'INCEX1': INCLUDE (include copycode)

*****************

WRITE 'Before copycode'

*

INCLUDE INCEX1C

*

WRITE 'After copycode'

*

END
```

#### Copycode INCEX1C to be included:

```
** Example 'INCEX1C': INCLUDE (copycode used by INCEX1)

***********************

*
WRITE 'Inside copycode'
```

## **Output of Program INCEX1:**

```
Page 1 05-01-25 16:26:36

Before copycode
Inside copycode
After copycode
```

## **Example 2 - INCLUDE Statement Including Copycode with Parameters**

#### **Program INCEX2 containing the INCLUDE statement:**

```
** Example 'INCEX2': INCLUDE (include copycode with parameters)

*********************

DEFINE DATA LOCAL

1 EMPL-VIEW VIEW OF EMPLOYEES

2 NAME

END-DEFINE

*

INCLUDE INCEX2C 'EMPL-VIEW' 'NAME' '''ARCHER''' '20' '''BAILLET'''

*

END
```

#### Copycode INCEX2C to be included:

```
** Example 'INCEX2C': INCLUDE (copycode used by INCEX2)
* Transferred parameters from INCEX2:
* &1& : EMPL-VIEW
* &2& : NAME
* &3& : 'ARCHER'
* &4& : 20
* &5& : 'BAILLET'
READ (\&4\&) &1& BY &2& = &3&
 DISPLAY &2&
 IF &28 = &58
   WRITE 5X 'LAST RECORD FOUND' &2&
   STOP
 END-IF
END-READ
 Statements above will be completed to:
* READ (20) EMPL-VIEW BY NAME = 'ARCHER'
   DISPLAY NAME
   IF NAME = 'BAILLET'
     WRITE 5X 'LAST RECORD FOUND' NAME
     STOP
   END-IF
* END-READ
```

## **Output of Program INCEX2:**

```
Page 1
                                                              05-01-25 16:30:43
        NAME
ARCHER
ARCONADA
ARCONADA
ARNOLD
ASTIER
ATHERTON
ATHERTON
ATHERTON
AUBERT
BACHMANN
BAECKER
BAECKER
BAGAZJA
```

```
BAILLET
LAST RECORD FOUND BAILLET
```

## **Example 3 - INCLUDE Statement Using Nested Copycodes**

#### **Program containing INCLUDE statement:**

### Copycode INCEX31C to be included:

```
** Example 'INCEX31C': INCLUDE (copycode used by INCEX3)

*********************

* Transferred parameters from INCEX3:

* &1& : #A

* &2& : 5

*

**WRITE 'Copycode INCEX31C' '=' &1&
```

#### Copycode INCEX32C to be included:

```
** Example 'INCEX32C': INCLUDE (copycode used by INCEX3)

*****************

* Transferred parameters from INCEX3:

* &1& : '#A'

* &2& : '20'

* 
WRITE 'Copycode INCEX32C' &1& &2&

INCLUDE INCEX31C &1& &2&
```

#### **Output of Program INCEX3:**

```
Program INCEX3 #A: 123
Copycode INCEX31C #A: 5
Program INCEX3 #A: 300
Copycode INCEX32C #A 20
Copycode INCEX31C #A: 20
Program INCEX3 #A: 20
Program INCEX3 #A: 20
```

## Example 4 - INCLUDE Statement with Concatenated Parameters in Copycode

## **Program containing INCLUDE statement:**

```
** Example 'INCEX4': INCLUDE (with concatenated parameters in copycode)

*************************

DEFINE DATA LOCAL

1 #GROUP

2 ABC(A10) INIT <'1234567890'>
END-DEFINE

*

INCLUDE INCEX4C '#GROUP.' 'ABC' 'AB'

END
```

## **Copycode INCEX4C to be included:**

## **Output of Program INCEX4:**

```
Page 1 05-01-25 16:37:59

ABC: 1234567890

ABC: 1234567890

ABC: 1234567890

ABC: 1234567890
```

## X

## **INPUT**

The syntax is described separately. See:

- INPUT Syntax 1 Dynamic Screen Layout Specification
- INPUT Syntax 2 Using Predefined Map Layout

See also *Screen Design / Windows* in the *Programming Guide*.

Related Statements: DEFINE WINDOW | REINPUT | SET WINDOW

Belongs to Function Group: Screen Generation for Interactive Processing

## **Function**

The INPUT statement is used in interactive mode to create a formatted screen or map for data entry.

It may also be used in conjunction with the Natural stack (see the STACK statement) and to provide user data for programs being executed in batch mode.

For Natural RPC: See *Notes on Natural Statements on the Server* in the *Natural RPC (Remote Procedure Call)* documentation.

## **Input Modes**

The INPUT statement may be used in screen, forms, or keyword/delimiter mode. Screen mode is generally used with video terminals/screens. Forms mode may be used with TTY terminals. Delimiter mode is used with TTY terminals, and also in batch mode. The default mode is screen mode.

You can change the input mode with the session parameter IM or the terminal commands %F and %D.

#### Screen Mode

In screen mode, execution of the INPUT statement results in the display of a screen according to the fields and positioning notation specified. The message line of the screen is used by Natural for error messages. The position of the message line (top or bottom of screen) may be controlled by the terminal command %M. The terminal user may position to specific fields using the various tabulation keys.

As Natural allows for screen window processing, the layout of the logical screen map may be larger (theoretically 250 characters per line and 250 lines, but limited by the internal screen buffer) than the physical screen size.

The windowing terminal command %W may be used to modify logical and physical window position and size (see the terminal command %W for details of window handling).

For input fields (AD=A or AD=M) that are not fully displayed on the physical screen, the following rules apply:

- Input fields whose beginning is not inside the window are always made protected.
- Input fields which begin inside and end outside the window are only made protected if the values they contain cannot be displayed completely in the window. Please note that in this case it is decisive whether the value length, not the field length, exceeds the window size. Filler characters (as specified with the profile parameter FC or session parameter AD) do not count as part of the value.
- Before an input field thus protected can be accessed and processed, the window size must be adjusted so as to fully display the field or value respectively (see the terminal command %W).

#### Non-Screen Modes

The INPUT statement may be used for an operation on line-oriented devices or for the processing of batch input from sequential files.

The same map layouts as defined for screen mode operation can also be processed in non-screen mode.

Forms mode and keyword/delimiter mode are also available to process the input either by simulating the screen layout in line mode or by just processing the data without any map layout.

See also:

- Using the INPUT Statement in Non-Screen Modes
- Using the INPUT Statement in Batch Mode
- Processing Data from the Natural Stack

## **Entering Data in Response to an INPUT Statement**

Data for an alphanumeric field must be entered left-justified. Any character, including a blank, is meaningful. The data are assigned one character per byte to the internal field. Data entered for an alphanumeric field are not validated.

Lower and upper case translation are controlled by the terminal commands %L and %U as well as the attributes AD=T and AD=W.

Data for a numeric field may be placed anywhere in the input field. Leading and/or trailing blanks, leading zeros, a leading sign and one decimal point are permitted. Natural adjusts the value according to the internal definition of the field. If SG=0FF is specified, Natural does not assume or allocate a position for a sign position. Data for a field defined with format P must be entered in decimal form. Natural will convert decimal to packed wherever necessary. A field containing all blanks is interpreted as a zero value. Data for a numeric field are validated by Natural to ensure that the value consists only of leading and/or trailing blanks, an optional leading sign, an optional decimal point, and numeric characters. If no decimal point is entered, it is assumed to be to the right of the value entered.

Data for a binary field must be entered for all positions (two characters per byte). Only valid hexadecimal characters (0 - 9, A - F) may be used. A blank (H'20' in ASCII or H'40' in EBCDIC respectively) is valid and is converted to binary zeros. Data for a binary field are validated by Natural for hexadecimal characters.

Data for format L fields may be entered as blank (false) or non-blank (true).

Data for format F, D, and T are entered according to the rules stated for F, D, and T constants.

#### Numeric Edit Mask Free Mode

Within a field element, you may format the representation of the field content with an edit mask. The edit mask is used for two purposes:

- to build the layout for displaying the field on the screen;
- when a string has been modified and ENTER has been pressed, to extract the field data from the string entered.

The advantage of improving the format of the field data displayed with additional insert characters may actually be a disadvantage, because a new data value entered has to perfectly match the format of the edit mask.

#### **Example:**

```
SET GLOBALS ID=; DC=,
RESET N (N7,3)
INPUT N (AD=M EM=Z'.'ZZZ'.'ZZZ,999EUR)
END
```

Output value	is displayed as:	Input value	must be entered as:	leads to an input error if entered as:
0	,000EUR	1	1,000EUR	1
				1EUR
				01,000EUR
1234	1.234,000EUR	1234567	1.234.567,000EUR	1234567
				1.234.567
				1.234.567EUR
0,123	,123EUR	1,234	1,234EUR	1,234

Another option for entering numeric fields with the edit mask is to use an alternative INPUT mode, which is called the edit mask free mode. When activated (either at session startup with the profile parameter EMFM or in a running Natural session via the terminal command %FM+), all or some of the edit mask insert characters may be left out from input.

However, when a contiguous string of insertion characters appears in the edit mask (like EUR in the example below), you may only supply or leave out the string completely. The number of optional or mandatory digits (edit-mask character  $\mathbb Z$  and  $\mathbb P$ ) to be supplied is not affected.

#### **Example with Edit Mask Free Mode activated:**

```
SET GLOBALS ID=; DC=,
SET CONTROL 'FM+' /* activate numeric Edit Mask Free Mode
RESET N (N7,3)
INPUT N (AD=M EM=Z'.'ZZZ'.'ZZZ,999EUR)
END
```

Input value	can be entered as:	leads to an error if entered as:
1	1	1EUR
	1,0	
	001	
	1,00EUR	
	0.001	
	1,EUR	
1234567	1234567	1.234.567EUR
	1.234.567	
	1234.567	
	1234567,0	
	1.234.567,0	
	1.234.567,EUR	

Input value	can be entered as:	leads to an error if entered as:
	1.234.567,0EUR 1.234.567,000EUR	
1,234	1,234 1,234EUR 001,234 0.001,234EUR 00001,234EUR	1,234EU



**Note:** The edit mask free mode applies only for INPUT, but is ignored in a MOVE EDITED statement.

## **SB - Selection Box**

Selection boxes in an INPUT statement are available on mainframe computers only. On Windows, selection boxes may be defined in the map editor only. On UNIX and OpenVMS, selection boxes cannot be defined and are ignored, if they are imported from a Windows or mainframe environment.

Selection boxes can be attached to input fields. They are a comfortable alternative to help routines attached to fields, since you can code a selection box direct in your program. You do not need an extra program as with help routines.

For more information, see the session parameter SB in the *Parameter Reference*.

#### Error Correction

If the value entered in an input field does not correspond to the format or edit mask of the field, Natural displays an error message (without terminating the program execution) and positions the cursor in the field in error. The user may then enter a valid value, whereupon processing continues.

## Split-Screen Feature

In general, each INPUT statement generates a new page (or terminal screen) of output. Any INPUT statement which is specified within an AT\_END\_OF\_PAGE statement will not produce a new screen. This feature allows for the creation of a split screen where the upper portion of the screen may be used to display multiple lines and the lower portion can be used to create an input map for communication. The profile parameter PS (page size) should be used, either in a SET\_GLOBALS or FORMAT statement, to set the logical page size to ensure that the input map is built on the same physical screen.

The first INPUT line will be placed after the last displayed line. If the NO ERASE option is used, the first INPUT line will be placed at the top of the page.

## **System Variables with the INPUT Statement**

For information on relevant system variables, see the section *Input/Output Related System Variables* in the *System Variables* documentation.

## 

## **INPUT Syntax 1 - Dynamic Screen Layout Specification**

INPUT Syntax 1 - Description	. 64	18
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This form of the INPUT statement is used to create a layout of an INPUT screen, or to create an INPUT data layout which is to be read in batch mode from a sequential input file.

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## **INPUT Syntax 1 - Description**

Operand Definition Table:

Operand	Pos	ssib	le St	ruct	ure			P	os	sik	le I	orr	nat	S		Referencing Permitted	Dynamic Definition
operand1		S	A	G	N	A	U	N	Р	I :	FE	BD	T	L	G	yes	yes

Syntax Element Description:

Syntax Element	Description
INPUT	INPUT WINDOW='window-name' Option:
WINDOW='window-name'	TATEL ALL ALL ALL ALL ALL ALL ALL ALL ALL A
	With this option, you indicate that the INPUT statement is to be executed for the
	specified window. The specified window must be defined in a DEFINE WINDOW
	statement; see Example 2 - INPUT Statement with DEFINE WINDOW
	Statement.
	The specified window is only active for the duration of that INPUT statement,
	and is automatically deactivated when the INPUT statement has been executed.
	See also the statements DEFINE WINDOW and SET WINDOW.
NO ERASE	NO ERASE Option:

Syntax Element	Description												
	This option causes a screen map of an INPUT statement to be overlaid onto an existing screen without erasing the screen contents.												
	Screen as used here refers to a logical screen rather than a physical screen.												
	All unprotected fields that existed on the screen are converted to protected (display only) fields. The old data remain on the screen until the new layout is displayed. If a field from the new screen content partially overlays an existing field, the one character before the new field and the next character in the existing field will be replaced by a blank.												
statement-parameters	Statement Parameter(s):												
	One or more parameters, enclosed within parentheses, may be specified immediately after the INPUT statement or an element being displayed.												
	For a list of parameters that can be specified with the INPUT statement, refer to the section <i>Statement Parameters</i> .												
	Each parameter specified in this manner will override any previous parameter specified in a <code>GLOBALS</code> command, <code>SET GLOBALS</code> or <code>FORMAT</code> statement. If more than one parameter is specified, one or more blanks must be present between each entry. An entry may not be split between two statement lines.												
	The parameter settings applied here will only be regarded for variable fields, but they have no effect on text-constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element.												
	Example:												
	DEFINE DATA LOCAL 1 VARI (A4) INIT <'1234'>												
	Examples of using parameters at the statement and element level are provided below.												
WITH TEXT-option	WITH TEXT Option: This option is used to provide text which is to be displayed in the message line; see WITH TEXT Option below.												
MARK-option	MARK Option:												
	See the section <i>MARK Option</i> below.												
ALARM-option	Alarm Option:												

Syntax Element	Description
	See the section <i>Alarm Option</i> below.
Other syntax elements ( $nX$ , $nT$ , $x/y$ , $operand1$ , etc.)	Field Positioning, Text Specification, Attribute Assignment:
,, g, aa., e.e.,	See the section <i>Field Positioning, Text Specification, Attribute Assignment</i> below.

## **Statement Parameters**

Parameters that can be speci	fied with the INPUT statement	Specification (S = at statement level, E = at element level)
AD	Attribute Definition	SE
AL	Alphanumeric Length for Output	SE
ВХ	Box Definition	SE
CD	Color Definition	SE
CV	Control Variable	SE
DF	Date Format	SE
DL	Display Length for Output	SE
DY	Dynamic Attributes	SE
EM	Edit Mask	SE
EMU	Unicode Edit Mask	Е
FL	Floating Point Mantissa Length	SE
HE	Helproutine	SE
IP	Input Prompting Text	SE
LS	Line Size	S
MC	Multiple-Value Field Count	S
MS	Manual Skip	S
NL	Numeric Length for Output	SE
PC	Periodic Group Count	S
PM	Print Mode	SE
PS	Page Size *	S
SB	Selection Box	Е
SG	Sign Position	SE
ZP	Zero Printing	SE

<sup>\*</sup> If the number of occurrences of an array exceeds the PS value, a NAT0303 error will be output.

The individual session parameters are described in the *Parameter Reference*.

## **WITH TEXT Option**

[WITH] TEXT 
$$\left\{ \begin{array}{c} * \ operand1 \\ operand2 \end{array} \right\}$$
 [(attributes)][,operand3] ... 7

## Operand Definition Table:

Operand	Possible Structure							Po	SS	sib	le F	orn	nat	S		Referencing Permitted	Dynamic Definition
operand1	С	S					N	Р	Ι		B*					yes	yes
operand2	С	S				A										yes	yes
operand3	С	S				A	N	Р	Ι	F	В	D	Т	L		yes	yes

<sup>\*</sup> Format B of operand1 may be used only with a length of less than or equal to 4.

WITH TEXT is used to provide text which is to be displayed in the message line. This is usually a message indicating what action should be taken to process the screen or to correct an error.

Syntax Element Description:

Syntax Element	Description
operand1	Message Text Number:
	operand1 represents the number of a message text that is to be retrieved from a Natural message file.
	You can retrieve either user-defined messages or Natural system messages:
	■ If you specify a positive value of up to four digits (for example: 954), you will retrieve user-defined messages.
	■ If you specify a negative value of up to four digits (for example: -954), you will retrieve Natural system messages.
	See also <i>Example 4 - WITH TEXT Options</i> in the description of the REINPUT statement.
	Natural message files are created and maintained with the SYSERR utility as described in the relevant documentation.
operand2	Message Text:
	operand2 represents the message to be placed in the message line.
	See also <i>Example 4 - WITH TEXT Options</i> in the description of the REINPUT statement.
attributes	Output Attributes:
	It is possible to assign various output attributes for <code>operand1/2</code> . These attributes and the syntax that may be used are described in the section <code>Output Attributes</code> below.

Syntax Element	Description
operand3	Dynamic Replacement of Message Text:
	operand3 represents a numeric or text constant or the name of a variable.
	The values provided are used to replace parts of a message text that are either specified with <i>operand1</i> or <i>operand2</i> .
	The notation : $n$ : is used within the message text as a reference to $operand3$ contents, where $n$ represents the $operand3$ occurrence (1 - 7).
	See also <i>Example 4 - WITH TEXT Options</i> in the description of the REINPUT statement.
	<b>Note:</b> Multiple specifications of <i>operand3</i> must be separated from each other by a comma.
	If the comma is used as a decimal character (as defined with the session parameter DC) and numeric constants are specified as <code>operand3</code> , put blanks before and after the comma so that it cannot be misinterpreted as a decimal character. Alternatively, multiple specifications of <code>operand3</code> can be separated by the input delimiter character (as defined with the session parameter ID); however, this is not possible in the case of ID=/ (slash), because the slash has a different meaning in the INPUT statement syntax.
	Leading zeros or trailing blanks will be removed from the field value before it is displayed in a message.

## **Output Attributes**

attributes indicates the output attributes to be used for text display. Attributes can be:

```
AD=ad-value...
BX=bx-value...
CD=cd-value
PM=pm-value...
...

ad-value
cd-value
```

#### Where:

ad-value, bx-value, cd-value and pm-value denote the possible values of the corresponding session parameters AD, BX, CD and PM described in the relevant sections of the *Parameter Reference* documentation.

The compiler actually accepts more than one attribute value for an output field. For example, you can specify: AD=BDI. In such a case, however, only the last value applies. In the given example, only the value I becomes effective and the output field is displayed intensified.

For an alphanumeric/Unicode constant (Natural data format A or U), you can specify ad-value and/or cd-value without preceding CD= or AD=, respectively. The single value entered is then checked against all possible CD values first. For example: a value of IRE will be interpreted as in-

tensifed/red but not as intensified/right-justified/mandatory. You cannot combine a single cd-value or ad-value with a value preceded by CD= or AD=.

## **MARK Option**

With the MARK option, you can cause the cursor to be placed at any non-protected field on screen. In addition, you can specify the position of the cursor within that field. By default, that is, when the MARK option is omitted, the cursor is placed at the beginning of the first non-protected field.

#### Operand Definition Table:

Operand	Possible Structure					P	089	sib	le l	For	m	ats	•	Referencing Permitted	Dynamic Definition
operand4	С	S				N	P	I						yes	yes
operand1	С	S	A			N	Р	Ι						yes	yes

## Syntax Element Description:

Syntax Element	Description
operand1	Field Reference Number:
	operand1 specifies the number of the field where the cursor is to be positioned in.
	Each field attribute AD=A or AD=M (that is, non-protected field) specified in an INPUT statement is assigned a field reference number, beginning with 1.
*fieldname	Field Name for Referencing:
	Instead of the field reference number, the field name may be used to position to a field, using the $*field$ ame notation.
operand4	Cursor Position within Referenced Field:
	With MARK POSITION, you can have the cursor placed at a specific position - as specified with operand4 - within a field specified with operand1 or *fieldname.
	operand4 must not contain decimal digits.

## **Examples:**

```
MARK #NUMBER /* Field number

MARK 3 /* Third map field

MARK *#FIELD1 /* Map field

MARK POSITION 3 IN #NUMBER /* Third character in field number
```

See also *Example 3 - INPUT Statement with MARK POSITION Option* at the end of this section.

## **ALARM Option**

This option causes the sound alarm feature of the terminal to be activated when the INPUT statement is executed. The appropriate hardware must be available to be able to use this feature.

[AND] [SOUND] ALARM

#### **Default Prompting Text**

Unless the session parameter IP (input prompting) is set to IP=0FF, the field name of the field used in an INPUT statement will be displayed preceding the field value (forms mode) or as a prompting keyword to select the field (keyword/delimiter mode). This default field name may be overridden by specifying either a ' text' element (which replaces the default name) or '-' (which suppresses the display of the default field name) immediately preceding the field name.

#### Field Positioning, Text Specification, Attribute Assignment

Several notations are available for field positioning, attribute assignment, and text creation.

Syntax Element Description:

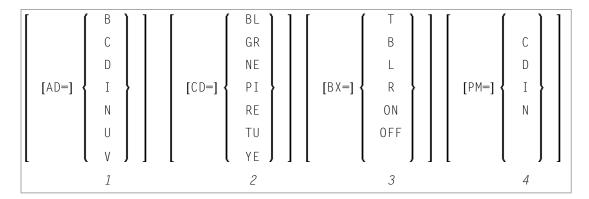
Syntax Element	Description
nX	Insert Option:
	This option causes $n$ spaces to be inserted between fields.
	<b>Note:</b> This notation inserts $n$ spaces between columns. $n$ must not be zero.
nТ	Tabulator Option:
	This option causes positioning (tabulation) to print position $n$ .
x/y	Positioning Option:
	Places the next element on line <i>x</i> , beginning in column <i>y</i> . <i>y</i> must not be zero. Backward positioning in the same line is not permitted.
'text'	Write Protection:

Syntax Element	Description
	Causes $text$ to be displayed write protected; see also $Text$ Notation, Defining a $Text$ to $Be$ Used with a $Statement$ .
'c' (n)	Character Repetition:
	Identical to ' text', except that the character c is displayed n times. n must be 1 - 132; see also <i>Text Notation</i> , <i>Defining a Character to Be Displayed n Times before a Field Value</i> .
attributes	Display Attributes:
	Attributes to be used for display. See <i>Attributes</i> below.
1 _ 1	Minus Sign:
	When placed before a field, '-' suppresses the generation of a field name as prompting text.
	<b>Note:</b> Any text string before a field will replace the field name as prompting text.
'='	Equal Sign:
	When placed before a field, '=' results in the display of the field heading followed by the field contents.
'/'	Slash Sign:
	When placed between fields or text elements, '/' causes positioning to the beginning of the next print line.
	The contents of fields may be specified for input, output only, and output for modification using the attribute settings AD=A, AD=O, and AD=M respectively. The default is AD=A. All fields specified with AD=A (input only) or AD=M (output for modification) will create unprotected fields on the screen. A value for such a field may be entered by the user. For TTY devices, output for modification fields will occupy twice the size of the field (one for output, one for input) so that a new value may be entered. An input field (with AD=A or AD=M) specified as non-displayable will always start on a new line on a TTY device.
	Example:
	INPUT #A (AD=A) #B (AD=O) #C (AD=M)
	#A is an input field which is unprotected, i.e., a value is to be entered for the field.
	# B is a field which is to be displayed write-protected, that is, no value may be entered for the field.
	$\#\mathbb{C}$ is a field whose current value is to be displayed, and the value may be modified by entering a new value for the field.
*IN, *OUT	Field Attribute Definition:
and *OUTIN	Equivalent to the attributes AD=A, AD=O, AD=M respectively.

Syntax Element	Description
	<b>Note:</b> If a non-modifiable system variable is used in an INPUT statement, the value will
	be displayed as an output-only field AD=0 or *0UT attribute.
operand1	Field(s) to be Used:
	operand1 represents the field to be used. Database fields or user-defined variables may be specified.
	Natural directly maps the content of each field from the data area to the INPUT statement, no move operation is necessary.
	When the content of a database field is modified as a result of INPUT processing, only the value as contained in the data area is modified. Appropriate database UPDATE / STORE statements must be used to change the content of the database.
	When the name of a group of database fields is referenced in an INPUT statement, all fields belonging to that group will be individually used as input fields.
	When reference is made to a range of occurrences within an array, all occurrences are individually processed as input fields, but no prompting text will be created for each individual occurrence, only for the first one.
	On mainframe computers, arrays with ranges that allow to vary the number of occurrences at execution time may not be specified.
parameter(s)	Parameter(s):
	One or more parameters, enclosed within parentheses, may be specified immediately after <code>operand1</code> (see table and example below).
	Each parameter specified will override any previous parameter specified in a GLOBALS command, SET GLOBALS (in Reporting Mode) or FORMAT statement. If more than one parameter is specified, they must be separated by one or more blanks from one another. Each parameter specification must not be split between two statement lines.
	The parameter settings applied here will only be regarded for variable fields, but they have no effect on text constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element.
	For information on the individual parameters, see the table in the section <i>Statement Parameters</i> .
	<b>Note:</b> The session parameter EM will be referenced dynamically in the DDM if an edit
	mask is defined for a database field. Edit masks may be specified for output and input fields. When an edit mask is defined for an input field, the data for the field must be entered according to the edit mask specification.

## Attributes

The following attributes may be used:



- 1. Display attributes; see the session parameter AD (in the *Parameter Reference*).
- 2. Color attributes; see the session parameter CD (in the *Parameter Reference*).
- 3. Outlining attributes; see the session parameter BX (in the *Parameter Reference*).
- 4. Print mode attributes; see the session parameter PM (in the *Parameter Reference*).

## **Examples - Syntax 1**

- Example 1 INPUT Statement
- Example 2 INPUT Statement with DEFINE WINDOW Statement
- Example 3 INPUT Statement with MARK POSITION Option

#### **Example 1 - INPUT Statement**

```
** Example 'IPTEX1': INPUT
                        ***********
DEFINE DATA LOCAL
1 #FNC (A1)
END-DEFINE
INPUT 10X 'SELECTION MENU FOR EMPLOYEES SYSTEM' /
     10X '-' (35) //
     10X 'ADD
                  (A)'/
     10X 'UPDATE
                  (U)'/
                  (D)' /
     10X 'DELETE
     10X 'STOP
                  (.)' //
     10X 'PLEASE ENTER FUNCTION: ' #FNC
DECIDE ON EVERY VALUE OF #FNC
 VALUE 'A' /* invoke the object containing the add function here
   WRITE 'Add function selected.'
 VALUE 'U' /* invoke the object containing the update function here
   WRITE 'Update function selected.'
 VALUE 'D' /* invoke the object containing the delete function here
   WRITE 'Delete function selected.'
```

```
VALUE '.'

STOP

NONE

REINPUT 'Please enter a valid function.' MARK *#FNC

END-DECIDE

*
END
```

### **Output of Program IPTEX1:**

```
SELECTION MENU FOR EMPLOYEES SYSTEM

ADD (A)
UPDATE (U)
DELETE (D)
STOP (.)

PLEASE ENTER FUNCTION:
```

#### **Example 2 - INPUT Statement with DEFINE WINDOW Statement**

```
** Example 'INPEX1': INPUT (with DEFINE WINDOW statement)

***********************

DEFINE DATA LOCAL

1 #STRING (A15)

END-DEFINE

*

DEFINE WINDOW WIND1

SIZE 10 * 40

BASE 5 / 10

FRAMED ON POSITION TEXT

*

INPUT WINDOW='WIND1'

'PLEASE ENTER HERE:' / #STRING

*

END
```

#### **Output of Program INPEX1:**

## **Example 3 - INPUT Statement with MARK POSITION Option**

```
** Example 'INPEX2': INPUT (with POSITION)

********************

DEFINE DATA LOCAL

1 #START (A30)

END-DEFINE

*

ASSIGN #START = 'EXAM_'

*

INPUT (AD=M) MARK POSITION 5 IN *#START

/ 'PLEASE COMPLETE START VALUE FOR SEARCH'

/ 5X #START

END
```

## **Output of Program INPEX2:**

```
PLEASE COMPLETE START VALUE FOR SEARCH
#START EXAM[]
```

# 85 INPUT Syntax 2 - Using Predefined Map Layout

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This form of the INPUT statement is used to perform input processing using a map layout that has been created using the Natural map editor.

Map layouts can be used in two ways:

- the program does not provide a parameter list;
- the program does provide a parameter list (operand1).

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## INPUT USING MAP without Parameter List

The following requirements must be met when INPUT USING MAP is used without parameter list:

- The map-name must be specified as an alphanumeric constant (up to 8 characters).
- The map used in this manner must have been created prior to the compilation of the program which references the map.
- The names of the fields to be processed are taken dynamically from the map source definition at compilation time. The field names used in both program and map must be identical.
- All fields to be referenced in the INPUT statement must be accessible at that point.
- In structured mode, fields must have been previously defined (database fields must be properly referenced to processing loops or views).
- In reporting mode, user-defined variables may be newly defined in the map.
- When the map layout is changed, the programs using the map need not be recataloged. However, when array structures or names, formats/lengths of fields are changed, or fields are added/deleted in the map, the programs using the map must be recataloged.
- The map source must be available at program compilation; otherwise the INPUT USING MAP statement cannot be compiled.
  - **Note:** If you wish to compile the program even if the map is not yet available, specify NO PARAMETER: the INPUT USING MAP can then be compiled even if the map is not yet available.

## **INPUT Fields Defined in the Program**

By specifying the names of the fields to be processed within the program (operand1), it is possible to have the names of the fields in the program differ from the names of the fields in the map.

The sequence of fields in the program must match the map sequence. Please note that the map editor sorts the fields as specified in the map in alphabetical order by field name. For more information, see the map editor description in your Natural Editors documentation.

The program editor line command . I(mapname) can be used to obtain a complete INPUT USING MAP statement with a parameter list derived from the fields defined in the specified map.

When the layout of the map is changed, the program using the map need not be recataloged. However, when field names, field formats/lengths, or array structures in the map are changed or fields are added or deleted in the map, the program must be recataloged.

A check is made at execution time to ensure that the format and length of the fields as specified in the program match the fields as specified in the map. If both layouts do not agree, an error message is produced.

## **INPUT Syntax 2 - Description**

### Operand Definition Table:

Operand	Possible Structure			ure	Possible Formats							nats	•		Referencing Permitted	Dynamic Definition		
map-name	C	S				A	U										yes	no
operand1		S	A			A	U	N	Р	I F	В	D	Т	L	C		yes	yes

### Syntax Element Description:

Syntax Element	Description
INPUT	INPUT WINDOW='window-name' Option:
WINDOW='window-name'	
	This option is described under <i>Syntax 1</i> of the INPUT statement.
WITH	WITH TEXT/MARK/ALARM Options:
TEXT/MARK/ALARM-options	
	These options are described under <i>Syntax 1</i> of the INPUT statement; see
	WITH TEXT Option, MARK Option, ALARM Option.
USING MAP map-name	USING MAP Clause:

Syntax Element	Description
	USING MAP invokes a map definition which has been previously stored in a Natural system file using the map editor.
	The map-name may be a 1- to 8-character alphanumeric constant or user-defined variable. If a variable is used, it must have been previously defined. The case of the specified name is not translated. The map name may contain an ampersand (&); at execution time, this character will be replaced by the one-character code corresponding to the current value of the Natural system variable *LANGUAGE. This feature allows the use of multi-lingual maps.
	The execution of the INPUT statement causes the corresponding map to replace the current contents of the screen, unless the NO ERASE option is specified, in which case the map will overlay the current contents of the screen.
NO ERASE	NO ERASE Option:
	This option is described under <i>Syntax 1</i> of the INPUT statement; see NO ERASE.
operand1	Field Specification:
	A list of database fields and/or user-defined variables. The fields must agree in number, sequence, format, length and (for arrays) number of occurrences with the fields in the referenced map; otherwise, an error occurs.
	When the content of a database field is modified as a result of INPUT processing, only the value as contained in the data area is modified. Appropriate database UPDATE / STORE statements must be used to change the content of the database.

## **Using the INPUT Statement in Non-Screen Modes**

You can change the input mode with the session parameter  ${\tt IM}$  or the terminal commands  ${\tt \%F}$  and  ${\tt \%D}.$ 

#### Forms Mode

The terminal command %F causes forms mode to be in effect.

In forms mode (profile/session parameter IM=F), Natural will display all output text of the map layout on the terminal field by field according to the positioning parameters. This permits the user to enter data on a field by field basis. When all data are entered, the hardcopy output is produced exactly as it would have appeared on the screen.

In forms mode, entering %R permits the operator to retype the entire form in case of an error. The input is processed as in the first execution of the INPUT statement.

### Keyword/Delimiter Mode

The terminal command %D causes keyword/delimiter mode to be in effect.

In keyword/delimiter mode (profile/session parameter IM=D), data can be entered using keywords or positional input values.

#### **General Validation Rules**

Data entered in keyword/delimiter mode are validated as for screen mode. An error message will be returned if an attempt is made to enter more characters than defined for a field.

If the INPUT statement is to be processed in keyword/delimiter mode on a buffered (3270-type) terminal or a workstation, all data to be assigned to one INPUT statement must be entered on one screen. ENTER is only to be used when all data to the INPUT statement have been entered.

### **Keyword Input**

Using keyword input, the terminal operator may enter data for the individual fields using the prompting text that, in forms mode, would have been displayed before the value as a keyword to identify the field. The keyword must be followed by the input assign character (IA parameter), followed immediately by the data. Any spaces following the assign character are taken as data up to the delimiter character (ID parameter). A delimiter character is not required after the last data element. Keyword data for the different fields may be entered in any order separated by the delimiter character. If the operator types in a keyword which is not defined in the INPUT statement, an error message will be returned. Data need not be entered for all input fields. Fields for which no data are entered are set to blank for alphanumeric fields and zero for numeric and hexadecimal fields.

A keyword and the corresponding input field must be on the same logical line. If their aggregate length exceeds the line size, adjust the line size (LS parameter) accordingly so that keyword and field fit onto one line.

### **Indexed Input**

Using indexed input, the terminal operator may enter data for the individual input fields using their ordinal values prefixed with a percent character (%). This index specification must be followed by the input assign character (IA parameter), followed immediately by the data.

Indexed data for the different fields may be entered in any order separated by the delimiter character (ID parameter). If the specified ordinal value does not correspond to that of any existing input field, an error message will be returned. Data need not be entered for all input fields. Fields for which no data are entered are set to blank for alphanumeric fields and zero for numeric and hexadecimal fields.

### **Positional Input**

Using positional value input, the terminal operator enters only data for all input fields separated by the currently defined input delimiter character (ID parameter). The sequence of fields for input must correspond to the sequence of the fields in the INPUT statement.

The user may switch from positional to keyword input by entering a number of values in positional input separated by the delimiter character and then switching to keyword mode for selected fields by specifying keywords in front of the values.

After a keyword has been used to position to a field, any non-keyword input following the keyword will be processed as positional input to be assigned to fields following the previously selected field in the INPUT statement.

### Example of Keyword, Indexed and Positional Input

If you execute the following program

from the command line with any of the following commands, assuming the comma (,) is used as the delimiter character

PGM1	FLD1=AA,FLD3=CC	keyword input
PGM1	%1=AA,%3=CC	indexed input
PGM1	AA,,CC	positional input
PGM1	AA,FLD3=CC	positional input combined with keyword
PGM1	AA,FLD2=,CC	positional input combined with keyword

PGM1 AA,%3=CC	combined positional and indexed input
---------------	---------------------------------------

you will always receive the following output

```
FLD1 AA
FLD2
FLD3 CC
```

## **Processing Data from the Natural Stack**

Data elements that have been placed in the Natural stack via a FETCH, RUN or STACK statement will be processed by the next INPUT statement encountered for execution.

The INPUT statement will process the data in keyword/delimiter mode as described above.

If data elements are not available to fill all input fields, fields will be filled with blank/zero depending on the field format. If more data elements are specified than input fields exist, the remaining data are ignored.

When a field is filled with data from the stack, the field attributes do not apply to the data.

The Natural system variable \*DATA may be referenced to determine the number of data elements currently available in the Natural stack.

## **Using the INPUT Statement in Batch Mode**

The following topics are covered below:

- In Batch Forms Mode
- In Batch Keyword/Delimiter Mode
- Use of Terminal Commands in Batch Mode

### In Batch Forms Mode

In batch forms mode, the INPUT map is displayed. A data record is read for each line containing one or more AD=A and/or AD=M fields, and the data contained in the record are assigned to the appropriate field (or fields).

Input data fields are assumed to be contiguous. Unless the delimiter character is used, input data must be entered in the exact length according to the internal definition of the field. For numeric fields, space must be allowed for a sign (if SG=0N) and decimal point when appropriate.

Data may optionally be entered using the delimiter character to separate the values of the individual fields. In this case, data need not be entered in the exact number of positions according to the internal definition but are processed from left to right beginning in position 1. The rules for data entry are the same as described under *Entering Data in Response to an INPUT Statement*. In addition, the assign character may be used to specify that the contents of an \*OUTIN field are not to be reset.

### In Batch Keyword/Delimiter Mode

Keyword/delimiter mode, when used in batch mode, functions the same as **keyword/delimiter mode** in TP mode with the following exceptions:

- The entire input map may be printed under the control of the terminal command %0.
- \*OUTIN fields retain their original values unless explicitly changed.

#### **Use of Terminal Commands in Batch Mode**

The following Natural terminal commands may be used when using the INPUT statement in batch mode on a mainframe computer:

Command	Explanation
%*	Record Suppression. When entered in position one and two of a record, ** causes the printing of the next input record to be suppressed.
	DATA RECORD  %* SUPPRESSED DATA RECORD
%	Record Continuation. When % is entered as the last non-blank character of a record, the next input record will be treated as a continuation record.
	DATA, RECORD, WITH, CONTINUATION, % CONTINUATION RECORD
	INPUT V1 V2 V3 V4 V5 V6 DISPLAY V1 V2 V3 V4 V5 V6
	will produce the following output:

Command	Explanation
	DATA RECORD WITH CONTINUATION CONTINUATION RECORD
%/	End-of-file. When entered in the first two positions of a record (without any trailing non-blank characters), %/ causes an end-of-file condition.
%%	Set restart point in input data stream.
%.	Reading of input values for the current INPUT statement will be terminated.
%Knn	Simulate PF keys.
%KP <i>n</i>	Simulate PA keys.
This command causes printing of maps used to read input data to be suppressed.	

See the *Terminal Commands* documentation for further information.

Additional JCL statements are required when using the INPUT statement for data entry in batch mode. The Natural administrator should be contacted to ensure that these statements have been provided before attempting to execute Natural in batch mode.

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# 86 INSERT (SQL)

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### Common Set Syntax:

```
INSERT INTO table-name  \left\{ \begin{array}{l} \text{(*)[VALUES-clause]} \\ \text{[(column-list)] VALUE-LIST} \end{array} \right\}
```

## Extended Set Syntax:

```
INSERT INTO table-name { (*) [OVERRIDING USER VALUE] [VALUES-clause]
[(column-list)][include-columns][OVERRIDING USER VALUE]
VALUE-LIST
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

See also *INSERT - SQL* in the *Natural for DB2* part of the *Database Management System Interfaces* documentation:

## **Function**

The SQL INSERT statement is used to add one or more new rows to a table.

## **Syntax Description**

Syntax Element	Description
INTO table-name	INTO Clause:
	In the INTO clause, the table is specified into which the new rows are to be inserted.
	See further information on table-name.
column-list	Column List:
	Syntax:
	column-name
	In the <code>column-list</code> , one or more <code>column-names</code> can be specified, which are to be supplied with values in the row currently inserted.
	If a <i>column-list</i> is specified, the sequence of the columns must match with the sequence of the values either specified in the <i>insert-item-list</i> or contained in the specified view (see below).

Syntax Element	Description
	If the <i>column-list</i> is omitted, the values in the <i>insert-item-list</i> or in the specified view are inserted according to an implicit list of all the columns in the order they exist in the table.
include-columns	Include Columns Clause:
	Specifies a set of columns that are included, along with the columns of $table$ -name, in the result table of the INSERT statement when it is nested in the FROM clause of a SELECT statement.
	For further details, see <i>include-columns</i> .
VALUES-clause	Values Clause:
	With the VALUES clause, you insert a <i>single</i> row into the table.
	See VALUES Clause below.
OVERRIDING USER VALUE	OVERRIDING USER VALUE Clause:
	This clause belongs to the SQL Extended Set.
	When you specify this clause, the value specified in the VALUES clause or produced by a fullselect for a column that is defined as GENERATED ALWAYS will be ignored.

#### **VALUES Clause**

With the VALUES clause, you insert a *single* row into the table. Depending on whether an asterisk (\*) or a *column-list* has been specified, the VALUES clause can take one of the following forms:

### **VALUES Clause with Preceding Asterisk Notation**

VALUES (VIEW view-name)

If asterisk notation is specified, a view *must* be specified in the VALUES clause. With the field values of this view, a new row is inserted into the specified table using the field names of the view as column names of the row.

### **VALUES Clause with Preceding Column List**

[(column-list)][OVERRIDING USER VALUE] VALUE-LIST

If a *column-list* is specified and a view is referenced in the VALUES clause, the number of items specified in the column list must correspond to the number of fields defined in the view within the *VALUE-LIST*.

If no column-list is specified, the fields defined in the view are inserted according to an implicit list of all the columns in the order they exist in the specified table.

### **VALUE-LIST**

## Common Set Syntax:

```
 \left\{ \begin{array}{l} \text{VALUES} \left\{ \begin{array}{l} \text{(VIEW view-name)} \\ \text{(insert-item-list)} \end{array} \right\} \left[ FOR-n-ROWS-clause \right] \right\}
```

## Extended Set Syntax:

```
 \left\{ \begin{array}{c} \text{(VIEW \it view-name)} \\ \text{(\it insert-item-list)} \end{array} \right\} \hspace{0.5cm} [\textit{FOR-n-ROWS-clause}] \\ \text{[WITH\_CTE \it common-table-expression,...]} \textit{select-expression} \left[ \begin{array}{c} \text{RR} \\ \text{RS} \\ \text{CS} \end{array} \right] \hspace{0.5cm} [\text{QUERYNO} \\ \textit{integer}] \end{array} \right\}
```

## Syntax Description:

Syntax Element	Description
VIEW view-name	View Name:
	With the field values of this view, a new row is inserted into the specified table using the field names of the view as column names of the row.
insert-item-list	INSERT Single Row:
	In the <code>insert-item-list</code> , you can specify one or more values to be assigned to the columns specified in the <code>column-list</code> . The sequence of the specified values must match the sequence of the columns.
	If no <i>column-list</i> is specified, the values in the <i>insert-item-list</i> are inserted according to an implicit list of all the columns in the order they exist in the table.
	The values to be specified in the insert-item-list can be constants, parameters, special-registers or NULL.
	See the section <i>Basic Syntactical Items</i> for information on <i>view-name</i> , <i>constant</i> and <i>parameter</i> . See also the information on <i>special-register</i> .
	If the value NULL has been assigned, this means that the addressed field is to receive no value (not even the value 0 or "blank").
	Example - INSERT Single Row:

Syntax Element	Description
	INSERT INTO SQL-PERSONNEL (NAME, AGE) VALUES ('ADKINSON', 35)
FOR-n-ROWS-clause	FOR n Rows Clause:
	Optional clause, see <i>FOR-n-ROWS-Clause</i> below.
WITH_CTE	WITH_CTE Clause:
common-table-expression	This clause belongs to the SQL Extended Set.
	This optional clause permits defining a result table which can be referenced in any FROM clause of the SELECT statement that follows. Multiple common-table-expressions can be specified following the single WITH_CTE keyword. Each common-table-expression can also be referenced in the FROM clause of subsequent common-table-expression.
	For more information, see <i>WITH_CTE common-table-expression</i> in the section <i>SELECT - SQL</i> .
select-expression	INSERT Multiple Rows:
	This clause belongs to the SQL Extended Set.
	With a <code>select-expression</code> , you insert <code>multiple</code> rows into a table. The <code>select-expression</code> is evaluated and each row of the result table is treated as if the values in this row were specified as values in a <code>VALUES Clause</code> of a single-row <code>INSERT</code> operation.
	For further information, see <i>Select Expressions</i> .
	Example - Insert Multiple Rows:
	INSERT INTO SQL-RETIREE (NAME, AGE, SEX) SELECT LASTNAME, AGE, SEX FROM SQL-EMPLOYEES WHERE AGE > 60
	<b>Note:</b> The number of rows that have actually been inserted can be ascertained by using the system variable *ROWCOUNT.
WITH RR/RS/CS	WITH Isolation Level Clause:
	This clause belongs to the SQL Extended Set.
	This clause allows the explicit specification of the isolation level used when locating the rows to be inserted.
	CS Cursor Stability
I .	L

Syntax Element	Description	
	RR	Repeatable Read
	RS	Read Stability
QUERYNO_integer	QUERYNO Clause:  This clause belongs to the SQL Exter  This clause explicitly specifies the nu and trace records for this statement.	

#### FOR-n-ROWS-Clause

FOR 
$$\left\{ \begin{array}{l} \text{[:]\_host-variable} \\ \text{integer} \end{array} \right\}$$
 ROWS [atomic-clause]

This clause is composed of the following subclauses:

FOR [:] hostvariable/integer ROWS Clause

FOR 
$$\left\{ \begin{array}{l} \text{[:]\_host-variable} \\ \text{integer} \end{array} \right\}$$
 ROWS

The specification of this clause is optional. It should only be specified, if

- compiler option DB2ARRY is specified and
- multiple rows are to be inserted from arrays specified in the *insert-item-list* of the *VALUES Clause*.

If specified, [:]\_hostvariable/integer determines the number of rows to be inserted into the DB2 table from the arrays specified in the insert-item-list of the VALUES Clause starting with the first occurrence.

The purpose of this clause is to improve the performance of programs inserting rows from Natural arrays in a loop. By using this clause, the rows contained in the arrays can be inserted by one SQL statement.

See example below.

See also the Natural for DB2 part of the Database Management System Interfaces documentation.

### **ATOMIC Clause**

```
ATOMIC NOT ATOMIC CONTINUE ON SQLEXCEPTION
```

This clause specifies whether the insertion of multiple rows should be treated by DB2 as an atomic operation or not.

It should only be specified, if

- compiler option DB2ARRY is specified and
- multiple rows are to be inserted from arrays specified in the <code>insert-item-list</code> of the <code>VALUES</code> <code>Clause</code>.

### Syntax Description:

Syntax Element	Description
ATOMIC	Specifies that in case of any error no row is inserted into the target table.  This is the default value.
NOT ATOMIC CONTINUE ON SQLEXCEPTION	Specifies that in case of errors all rows for which no error occurred are inserted while those rows for which errors occurred are discarded by DB2.

See the DB2 SQL REFERENCE for SQLCODEs returned in such cases.

## **Example**

```
DEFINE DATA LOCAL
01 NAME
               (A20/1:10)
                          INIT <'ZILLER1','ZILLER2','ZILLER3','ZILLER4'</pre>
                                 ,'ZILLER5','ZILLER6','ZILLER7','ZILLER8'
                                 ,'ZILLER9','ZILLERA'>
01 ADDRESS
               (A100/1:10) INIT <'ANGEL STREET 1', 'ANGEL STREET 2'
                                 ,'ANGEL STREET 3','ANGEL STREET 4'
                                 ,'ANGEL STREET 5','ANGEL STREET 6'
                                 ,'ANGEL STREET 7','ANGEL STREET 8'
                                 ,'ANGEL STREET 9','ANGEL STREET 10'>
01 DATENATD (D/1:10) INIT <D'1954-03-27',D'1954-03-27',D'1954-03-27'
                             ,D'1954-03-27',D'1954-03-27',D'1954-03-27'
                             ,D'1954-03-27',D'1954-03-27',D'1954-03-27'
                             ,D'1954-03-27'>
01 SALARY
               (P4.2/1:10) INIT <1000,2000,3000,4000,5000
                                 ,6000,7000,8000,9000,9999>
01 L§ADDRESS
               (I2/1:10) INIT <14,14,14,14,14,14,14,14,15>
```

```
01 N$ADDRESS (I2/1:10) INIT <00,00,00,00,00,00,00,00,00
01 ROWS
              (I4)
01 INDEX
             (I4)
01 V1 VIEW OF NAT-DEMO_ID
02 NAME
02 \text{ ADDRESS} (EM=X(20))
02 DATEOFBIRTH
02 SALARY
01 ROWCOUNT (I4)
END-DEFINE
OPTIONS DB2ARRY=ON
                                  /* <-- ENABLE DB2 ARRAY
ROWCOUNT := 10
INSERT INTO NAT-DEMO_ID
       (NAME, ADDRESS, DATEOFBIRTH, SALARY)
      VALUES
      (:NAME(*),
                                   /* <-- ARRAY
        :ADDRESS(*)
                                   /* <-- ARRAY
                                  /* <-- ARRAY
       INDICATOR :N§ADDRESS(*)
       LINDICATOR :L§ADDRESS(*), /* <-- ARRAY DB2 VCHAR
                                  /* <-- ARRAY NATURAL DATES
        :DATENATD(1:10),
                                  /* <-- ARRAY NATURAL PACKED
       :SALARY(01:10)
      )
      FOR : ROWCOUNT ROWS
SELECT * INTO VIEW V1 FROM NAT-DEMO_ID WHERE NAME > 'Z'
DISPLAY V1
                                   /* <-- VERIFY INSERT
END-SELECT
END
```

## 87 INTERFACE

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Syntax Description	6	82

INTERFACE interface-name
[property-definition]
[method-definition]
END-INTERFACE

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CREATE OBJECT | DEFINE CLASS | INTERFACE | METHOD | PROPERTY | SEND METHOD

Belongs to Function Group: Component Based Programming

## **Function**

In component-based programming, an interface is a collection of methods and properties that belong together semantically and represent a certain feature of a class.

You can define one or several interfaces for a class. Defining several interfaces allows you to structure/group methods according to what they do, for example, you put all methods that deal with persistency (load, store, update) in one interface and put other methods in other interfaces.

The INTERFACE statement is used to define an interface. It may only be used in a Natural class module and can be defined as follows:

- within a DEFINE CLASS statement. This form is used when the interface is only to be implemented in one class, or
- in a copycode which is included by the INTERFACE USING clause of the DEFINE CLASS statement. This form is used when the interface is to be implemented in more than one class.

The properties and methods that are associated with the interface are defined by the property and method definitions.

## **Syntax Description**

Syntax Element	Description
interface-name	Interface Name:
	This is the name to be assigned to the interface. The interface name can be up to a maximum of 32 characters long and must conform to the Natural naming conventions for user-defined variables; see <i>Naming Conventions for User-Defined</i>

Syntax Element	Description
	Variables in the Using Natural documentation. It must be unique per class and different from the class name.
	If the interface is planned to be used by clients written in different programming languages, the interface name should be chosen in a way that it does not conflict with the naming conventions that apply in these languages.
property-definition	Property Definition:
	The property definition is used to define a property of the interface. See <i>Property Definition</i> below.
method-definition	Method Definition:
	The method definition is used to define a method for the interface. See <i>Method Definition</i> below.
END-INTERFACE	End of INTERFACE Statement:
	The Natural reserved word END-INTERFACE must be used to end the INTERFACE statement.

### **Property Definition**

The property definition is used to define a property of the interface.

```
PROPERTY property-name

[(format-length/array-definition)]

[READONLY]

[IS operand]

END-PROPERTY
```

Properties are attributes of an object that can be accessed by clients. An object that represents an employee might for example have a Name property and a Department property. Retrieving or changing the name or department of the employee by accessing her Name or Department property is much simpler for a client than calling one method that returns the value and another method that changes the value.

Each property needs a variable in the object data area of the class to store its value - this is referred to as the object data variable. The property definition is used to make this variable accessible to clients. The property definition defines the name and format of the property and connects it to the object data variable. In the simplest case, the property takes the name and format of the object data variable itself. It is also possible to override the name and format within certain limits.

Syntax Element Description:

Syntax Element	Description
property-name	Property Name:
	This is the name to be assigned to the property. The property name can contain up to a maximum of 32 characters and must conform to the Natural naming conventions for user variables; see <i>Naming Conventions for User-Defined Variables</i> in the <i>Using Natural</i> documentation.
	If the property is planned to be used by clients written in different programming languages, the property name should be chosen in a way that it does not conflict with the naming conventions that apply in these languages.
format-length/array-definition	format-length/array-definition Option:
	This option defines the format of the property as it will be seen by clients.
	If format-length/array-definition is omitted, the format-length and array-definition will be taken from the object data variable assigned in the IS clause.
	If format-length/array-definition is specified, it must be data transfer-compatible both to and from the format of the object data variable specified in operand in the IS clause. In the case of a READONLY property, the data transfer-compatibility needs to hold only in one direction: with the object data variable as source operand and the property as destination operand. If an array-definition is specified, it must be equal in dimensions, occurrences per dimension, lower bounds and upper bounds to the array definition of the corresponding object data variable. This is expressed by specifying an asterisk for each dimension.
READONLY	READONLY Option:
	If the keyword READONLY is specified, the value of the property can only be read and not set. The format of the object data variable specified in <code>operand</code> in the IS clause must be data transfer-compatible to the format specified in <code>format-length/array-definition</code> . It does not have to be data transfer-compatible in the inverse direction.
	If the keyword READONLY is omitted, the property value can be both read and set.
IS operand	IS Clause:
	The <i>operand</i> in the IS clause assigns an object data variable as the place to store the property value. The assigned object data variable may not be a group. The variable is referenced in normal operand syntax. This means, if the object data variable is an array, it must

Syntax Element	Description
	be referenced with index notation. Only the full index range notation and asterisk notation is allowed.
	The IS clause should not be used if the INTERFACE statement will be included from a copycode member and reused in several classes. If you want to reuse the INTERFACE statement, you must assign the object data variable in a PROPERTY statement outside the INTERFACE statement.
	If the IS clause is omitted, the property is connected to the object data variable with the same name as the property. If a variable with this name is not defined or if it is a group, a syntax error results.
END-PROPERTY	End of Interface Property Definition:
	The Natural reserved word END-PROPERTY must be used to end the interface PROPERTY definition.

### **Examples**

Let the object data area contain the following data definitions:

```
1 Salary(p7.2)
1 SalaryHistory(p7.2/1:10)
```

Then the following property definitions are allowed:

```
property Salary
 end-property
 property Pay is Salary
 end-property
 property Pay(P7.2) is Salary
 end-property
 property Pay(N7.2) is Salary
 end-property
 property SalaryHistory
 end-property
 property OldPay is SalaryHistory(*)
 end-property
 property OldPay is SalaryHistory(1:10)
 end-property
 property OldPay(P7.2/*) is SalaryHistory(1:10)
 end-property
 property OldPay(N7.2/*) is SalaryHistory(*)
 end-property
```

The following property definitions are not allowed:

```
/* Not data transfer-compatible. */
  property Pay(L) is Salary
  end-property
  /* Not data transfer-compatible. */
  property OldPay(L/*) is SalaryHistory(*)
  end-property
  /* Not data transfer-compatible. */
  property OldPay(L/1:10) is SalaryHistory(1:10)
  end-property
  /* Assigns an array to a scalar. */
  property OldPay(P7.2) is SalaryHistory(1:10)
  end-property
  /* Takes only a sub-array. */
  property OldPay(P7.2/3:5) is SalaryHistory(*)
  end-property
  /* Index specification omitted in ODA variable SalaryHistory. */
  property OldPay is SalaryHistory
  end-property
  /* Only asterisk notation allowed in property format specification. */
  property OldPay(P7.2/1:10) is SalaryHistory(*)
  end-property
```

### **Method Definition**

The method definition is used to define a method for the interface.

```
METHOD method-name

[IS subprogram-name]

[ PARAMETER { USING parameter-data-area data-definition...} } ]...

END-METHOD
```

To make the interface reusable in different classes, include the interface definition from a copycode and define the subprogram after the interface definition with a METHOD statement. Then you can implement the method differently in different classes.

Syntax Element Description:

Syntax Element	Description
method-name	Method Name:  This is the name to be assigned to the method. The method name can contain a maximum of up to 32 characters and must conform to the Natural naming conventions; see <i>Naming Conventions for User-Defined Variables</i> in the <i>Using Natural</i> documentation. It must be unique per interface.

Syntax Element	Description
	If the method is planned to be used by clients written in different programming languages, the method name should be chosen in a way that it does not conflict with the naming conventions that apply in these languages.
IS	IS Clause:
subprogram-name	This clause can be used to specify the name of the subprogram that implements the method. The name of the subprogram consists of up to 8 characters. The default is method-name (if the IS clause is not specified).
PARAMETER	PARAMETER Clause:
	The PARAMETER clause specifies the parameters of the method, and has the same syntax as the PARAMETER clause of the DEFINE DATA statement.
	The parameters must match the parameters which are later used in the implementation of the subprogram. This is ensured best by using a parameter data area.
	Parameters that are marked BY VALUE in the parameter data area are input parameters of the method.
	Parameters which are not marked BY VALUE are passed "by reference" and are input/output parameters. This is the default.
	The first parameter that is marked BY VALUE RESULT is returned as the return value for the method. If more than one parameter is marked in this way, the others will be treated as input/output parameters.
	OPTIONAL parameters need not be specified when the method is called. They can be left unspecified by using the <i>n</i> X <b>notation</b> in the SEND METHOD statement.
END-METHOD	End of Method Definition:
	The Natural reserved word END-METHOD must be used to end the METHOD definition for the interface.

## 88 LIMIT

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LIMIT n

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION | HISTOGRAM | PASSW | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The LIMIT statement is used to limit the number of iterations of a processing loop initiated with a FIND, READ, or HISTOGRAM statement.

The limit remains in effect for all subsequent processing loops in the program until it is overridden by another LIMIT statement.

The LIMIT statement does not apply to individual statements in which a limit is explicitly specified (for example, FIND (n) ...).

If the limit is reached, processing stops and a message is displayed; see also the session parameter LE which determines the reaction when the limit for the processing loop is exceeded.

If no LIMIT statement is specified, the default global limit defined with the Natural profile parameter LT during Natural installation will be used.

### **Record Counting**

To determine whether a processing loop has reached the limit, each record read in the loop is counted against the limit. If the processing loop has reached the limit, the following will apply:

- A record that is rejected because of criteria specified in a FIND or READ statement WHERE clause is *not* counted against the limit.
- A record that is rejected as a result of an ACCEPT/REJECT statement is counted against the limit.

## **Syntax Description**

Syntax Element	Description
LIMIT n	Limit Specification:
	The limit $n$ must be specified as a numeric constant in the range from $0 - 4294967295$ (leading zeros are optional).
	The processing loop is not entered if the limit is set to zero.

## **Examples**

- Example 1 LIMIT Statement
- Example 2 LIMIT Statement (Valid for Two Database Loops)

## **Example 1 - LIMIT Statement**

```
** Example 'LMTEX1': LIMIT

*********************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

2 CITY

END-DEFINE

*

LIMIT 4

*

READ EMPLOY-VIEW BY NAME STARTING FROM 'BAKER'

DISPLAY NOTITLE

NAME PERSONNEL-ID CITY *COUNTER

END-READ

*

END
```

## **Output of Program LMTEX1:**

NAME	PERSONNEL ID	CITY	CNT
BAKER	20016700 0	AK BROOK	1
BAKER BALBIN BALL	60000110 B	ERBY ARCELONA ERBY	2 3 4

## **Example 2 - LIMIT Statement (Valid for Two Database Loops)**

```
** Example 'LMTEX2': LIMIT (valid for two database loops)

************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME
END-DEFINE

*

LIMIT 3

*

FIND EMPLOY-VIEW WITH NAME > 'A'

READ EMPLOY-VIEW BY NAME STARTING FROM 'BAKER'

DISPLAY NOTITLE 'CNT(0100)' *COUNTER(0100)

'CNT(0110)' *COUNTER(0110)

END-READ
END-FIND

*

END
```

## **Output of Program LMTEX2:**

CN	NT(0100)	CNT(0110)
	1	1
	1	2
	1	3
	2	1
	2	2
	2	3
	3	1
	3	2
	3	3
	ŭ.	ŭ .

## 89 LOOP

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[CLOSE] LOOP [(r)]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Reporting Mode Statements

## **Function**

The LOOP statement is used to close a processing loop. It causes processing of the current pass through the loop to be terminated and control to be returned to the beginning of the processing loop.

When the processing loop for which the LOOP statement is issued is terminated (that is, when all records have been processed or iterations have been performed), execution continues with the statement after the LOOP statement.

The LOOP statement is used with the following statements: CALL FILE, CALL LOOP, FIND, FOR, HISTOGRAM, PARSE XML, READ, READLOB, READ RESULT SET (SQL), READ WORK FILE, REPEAT, SELECT (SQL), SORT, UPLOAD PC FILE.

### **Database Variable References**

A LOOP statement, in addition to closing a processing loop, will eliminate all field references to FIND, FIND FIRST, FIND UNIQUE, READ and GET statements contained within the loop.

A field within a view may be referenced outside the processing loop by using the view name as a qualifier.

## Restriction

- This statement is for reporting mode only.
- A LOOP statement may not be specified based on a conditional statement such as IF or AT BREAK.

## **Syntax Description**

Syntax Element	Description
L00P (r)	Statement Reference Notation:
	The LOOP statement may be specified with a statement label or reference number (notation $(r)$ ), in which case all inner loops up to and including the loop initiated by the statement referenced will be closed. If no statement reference is specified, the innermost active processing loop will be closed.

### Notes:

- 1. In reporting mode, any processing loop which is currently active, that is, which has not explicitly been closed with a LOOP statement, will be closed automatically by an END statement.
- 2. You can omit the LOOP statement. But with respect to good coding practice, you are not recommended to do so.

## **Examples**

### Example 1

```
FIND ...

READ ...

READ ...

LOOP (0010) /* closes all loops
```

### Example 2

```
FIND ...

READ ...

READ ...

LOOP /* closes loop initiated on line 0030

LOOP /* closes loop initiated on line 0020

LOOP /* closes loop initiated on line 0010
```

## 90 MERGE (SQL)

Function	698
Restriction	698
Syntax Description	
Examples	703

```
MERGE INTO table-name [[AS] correlation-name]

[include-columns] USING source-table

ON search-condition

WHEN MATCHED THEN update-operation
WHEN NOT MATCHED THEN insert-operation

[NOT ATOMIC CONTINUE ON SQLEXCEPTION]

[QUERYNO integer]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

See also MERGE - SQL in the Natural for DB2 part of the Database Management System Interfaces documentation.

## **Function**

The MERGE statement updates a table using the specified input data. Rows in the target table that match the input data are updated as specified, and rows that do not exist in the target table are inserted.

The MERGE statement belongs to the SQL Extended Set.

## Restriction

This statement is available only with Natural for DB2.

## **Syntax Description**

Syntax Element	Description
MERGE INTO	MERGE INTO Clause:
	MERGE INTO initiates an SQL MERGE statement, which is a combination of an SQL INSERT and an SQL Searched UPDATE statement.
table-name	Table Name:
	Identifies the target of the INSERT or UPDATE operation of the MERGE statement.

Syntax Element	Description
	See table-name specification.
[AS] correlation-name	[AS] correlation-name Clause:
	Specifies an alternate name for the target table. The alternate name can be used as qualifier when referencing columns of the intermediate result table.
include-columns	Include Columns Clause:
	Specifies a set of columns that are included, along with the columns of the target table, in the result table of the MERGE statement if it is nested in the FROM clause in a SELECT statement. The included columns are appended to end of the column list identified by the target table.
	For further details, see <i>include-columns</i> .
USING source-table	USING source-table Clause:
	Specifies the values for the row data to merge into the target table. See <i>source-table</i> .
ON search-condition	ON search-condition Clause:
	Specifies join conditions between the <i>source-table</i> and the target table. Each column name in the search condition must name a column of the target table or <i>source-table</i> .
WHEN MATCHED THEN	WHEN MATCHED THEN update-operation Clause:
update-operation	Specifies the update-operation to be performed when the search-condition is true.
WHEN NOT MATCHED THEN	WHEN NOT MATCHED THEN insert-operation Clause:
insert-operation	Specifies the insert-operation to be performed when when the search-condition is true.
NOT ATOMIC CONTINUE ON	NOT ATOMIC CONTINUE ON SQLEXCEPTION Clause:
SQLEXCEPTION	Specifies whether merge processing continues in case an error occurred during processing one row of a set of source rows.
QUERYNO integer	QUERYNO integer Clause:
	Specifies the number for this SQL statement that is used in EXPLAIN output and DB2 trace records.

- source-table
- values-single-row
- values-multiple-row
- update-operation
- assignment-clause

• insert-operation

### source-table

Syntax Element	Description
VALUES	VALUES introduces the specification of values for the row data to merge into the target table.
values-single-row	Specifies a single row of source data. See <i>values-single-row</i> .
values-multiple-row	Specifies multiple rows of source data. See values-multiple-row.
[AS] correlation-name	Specifies a correlation name for the source table.
column-name	Specifies a column name to associate the input data to the UPDATE SET assignment-clause clause for an UPDATE operation or the VALUES clause for an INSERT operation.

# values-single-row

$$\left\{ \begin{array}{l} \left\{ \begin{array}{l} expression \\ \text{NULL} \end{array} \right\} \\ \left( \left\{ \begin{array}{l} expression \\ \text{NULL} \end{array} \right\} , ... \right) \end{array} \right\}$$

Syntax Element	Description
expression	Scalar Expression:
	Specifies a scalar expression as described in <i>Scalar Expressions</i> .
NULL	NULL Value:
	Specifies the null value.

# values-multiple-row

```
 \left\{ \begin{array}{l} \left\{ \begin{array}{l} expression \\ host-variable-array \\ \text{NULL} \end{array} \right\} \\ \left\{ \begin{array}{l} expression \\ host-variable-array \\ \text{NULL} \end{array} \right\} \\ \text{NULL} \end{array} \right\} \\ row \\ \left\{ \begin{array}{l} for \\ integer-constant \\ integer-constant \\ \end{array} \right\} \\ row \\ row
```

Syntax Element	Description							
expression	Scalar Expression:							
	Specifies a scalar expression as described in <i>Scalar Expressions</i> .							
host-variable-arra	Host-Variable Array:							
	Specifies a host variable array or an index range of an array. If host-variable-array is specified, the compiler option DB2ARRY has to be set to 0N. An optional indicator array can be specified for each host-variable-array by the keyword INDICATOR, that is, host-variable-array INDICATOR [:]indicator-array.							
NULL	NULL Value:							
	Specifies the null value.							
FOR ROWS	Number of Rows to Merge:							
	This clause specifies the number of rows to merge.							
	host-variable or integer-constant is assigned to a value k. k must be in the range of 0 to 32767 and must be lower than or equal to the minimum size of all specified host-variable-arrays.							

# update-operation

UPDATE SET assignment-clause

Syntax Element	Description
	Specifies the UPDATE operation to be performed when the search-condition evaluates to true.
	See assignment-clause below.

# assignment-clause

Syntax Element	Description
column-name	Specifies the column for which an insert value is provided.
expression	Specifies the new value for the column. An <i>expression</i> can contain references to columns of the <i>source-table</i> or target table. <i>expression</i> cannot contain references to included columns.
DEFAULT	Specifies the default value for the column. The value that is assigned depends on how the column is defined.
NULL	Specifies the null value as new value for the column.

# insert-operation

Syntax Element	Description						
INSERT	Specifies the INSERT operation to be performed when the search-condition evaluates to false.						
column-name	Specifies the column for which an insert value is provided.						
VALUES	Introduces one or more column values to insert.						
expression	Specifies the new value for the column.  An <i>expression</i> can contain references to columns of the source table. <i>expression</i> cannot						
	contain references to columns of the target table.						
DEFAULT	Specifies the default value for the column.						
	The value that is assigned depends on how the column is defined.						
NULL	Specifies the null value as new value for the column.						

# **Examples**

### Example 1:

Update the inventory at a car dealership. Add new car model to the inventory or update information about existing car model that is already in the inventory.

```
DEFINE DATA LOCAL

O1 #MODEL (A20)

O1 #DELTA (I4)

END-DEFINE

* Setup input host variables

ASSIGN #MODEL = 'Grand Turbo'

ASSIGN #DELTA := 5

* Insert/Update into INVENTORY table

MERGE INTO CDS-INVENTORY T

USING (VALUES (:#MODEL, :#DELTA)) AS S(MODEL, DELTA)

ON T.MODEL = S.MODEL

WHEN MATCHED THEN UPDATE SET T.QUANTITY = T.QUANTITY + S.DELTA

WHEN NOT MATCHED THEN INSERT VALUES (S.MODEL, S.DELTA)

END
```

### Example 2:

Update the inventory at a car dealership. Add new car models to the inventory and update information about car models that are already in the inventory. Input comes from Natural arrays. Array specific code is shown in bold face type.

```
OPTIONS DB2ARRY ON
DEFINE DATA LOCAL
01 #MODEL_ARR (A20/1:20)
01 #DELTA_ARR (I4/1:20))
01 #ROW-COUNT (I4)
01 #NUM-ERRORS (I4)
01 #SQLCODE (I4)
01 #SQLSTATE
               (A5)
01 #ROW-NUM
               (I4)
END-DEFINE
* Setup input host variables
ASSIGN #MODEL_ARR(1) = 'Grand Turbo'
ASSIGN \#DELTA\_ARR(1) := 5
ASSIGN #MODEL_ARR(2) = 'Blue Car'
ASSIGN \#DELTA\_ARR(2) := 3
* Insert/Update into INVENTORY table
CALLNAT 'NDBNOERR'
MERGE INTO CDS-INVENTORY T
```

```
USING (VALUES (:#MODEL_ARR(*), :#DELTA_ARR(*))
  FOR 20 ROWS)
 AS S(MODEL, DELTA)
ON T.MODEL = S.MODEL
WHEN MATCHED THEN UPDATE SET T.QUANTITY = T.QUANTITY + S.DELTA
WHEN NOT MATCHED THEN INSERT VALUES (S.MODEL, S.DELTA)
NOT ATOMIC CONTINUE ON SQLEXCEPTION
* Check outcome of MERGE
PROCESS SQL SYSIBM-SYSDUMMY1
  <<GET DIAGNOSTICS
  :#ROW-COUNT = ROW_COUNT
  ,:#NUM-ERRORS = NUMBER>>
                                       :' #ROW-COUNT /
:' #NUM-ERRORS
WRITE 'Number of rows merged
      'NUMBER OF ERRORS
IF #NUM-ERRORS > 0
  FOR \#I = 1 TO \#NUM-ERRORS
    PROCESS SQL SYSIBM-SYSDUMMY1
      <<GET DIAGNOSTICS CONDITION
      :#SQLCODE
                = DB2_RETURNED_SQLCODE,
      :#SQLSTATE = RETURNED_SQLSTATE,
      :#ROW_NUM = DB2_ROW_NUMBER>>
    PRINT 'DB2_RETURNED_SQLCODE: ' #SQLCODE
      'RETURNED_SQLSTATE:' #SQLSTATE
      'DB2_ROW_NUMBER:' #ROW_NUM (EM=99Z)
  END-FOR
END-IF
END TRANSACTION
END
```

# 91 METHOD

Function	70	)E
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METHOD method-name
OF [INTERFACE] interface-name
IS subprogram-name
END-METHOD

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CREATE OBJECT | DEFINE CLASS | INTERFACE | PROPERTY | SEND METHOD

Belongs to Function Group: Component Based Programming

# **Function**

The METHOD statement assigns a subprogram as the implementation to a method, *outside* an interface definition. It is used if the interface definition in question is included from a copycode and is to be implemented in a class-specific way.

The METHOD statement may only be used within the DEFINE CLASS statement and after the interface definition. The interface and method names specified must be defined in the INTERFACE clause of the DEFINE CLASS statement.

# **Syntax Description**

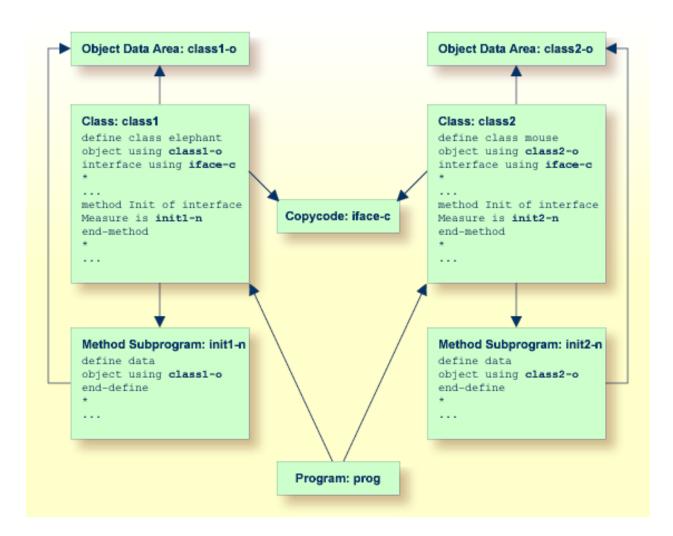
Syntax Element	Description							
method-name	Method Name:							
	This is the name assigned to the <i>method</i> .							
OF interface-name	Interface Name:							
	This is the name assigned to the <i>interface</i> .							
IS subprogram-name	IS Clause:							
	This clause can be used to specify the name of the subprogram that implements the method. The name of the subprogram consists of up to 8 characters. The default is <i>method-name</i> (if the IS clause is not specified).							
END-METHOD	End of Method Statement:							
	The Natural reserved word END-METHOD must be used to end the METHOD statement.							

# **Example**

The following example shows how the same interface is implemented differently in two classes and how the PROPERTY statement and the METHOD statement are used to achieve this.

The interface Measure is defined in the copycode <code>iface-c</code>. The classes <code>Elephant</code> and <code>Mouse</code> implement both the interface <code>Measure</code>. Therefore, they both include the copycode <code>iface-c</code>. But the classes implement the property <code>Height</code> using different variables from their respective object data areas, and they implement the method <code>Init</code> with different subprograms. They use the <code>PROPERTY</code> statement to assign the selected data area variable to the property and the <code>METHOD</code> statement to assign the selected subprogram to the method.

Now the program prog can create objects of both classes and initialize them using the same method Init, leaving the specifics of the initialization to the respective class implementation.



The following shows the complete contents of the Natural modules used in the example above:

### Copycode: iface-c

```
interface Measure

*
property Height(p5.2)
end-property
*
property Weight(i4)
end-property
*
method Init
end-method
*
end-interface
```

#### Class: class1

```
define class elephant
object using class1-o
interface using iface-c
*
property Height of interface Measure is height
end-property
*
property Weight of interface Measure is weight
end-property
*
method Init of interface Measure is init1-n
end-method
*
end-class
end
```

### LDA Object Data: class1-o

```
* *** Top of Data Area ***

1 HEIGHT P 5.2

1 WEIGHT I 2

* *** End of Data Area ***
```

### Method Subprogram: init1-n

```
define data
object using class1-o
end-define
*
height := 17.3
weight := 120
*
end
```

#### Class: class2

```
define class mouse
object using class2-0
interface using iface-c
*
property Height of interface Measure is size
end-property
*
property Weight of interface Measure is weight
end-property
*
method Init of interface Measure is init2-n
end-method
*
end-class
end
```

### LDA Object Data: class2-o

```
* *** Top of Data Area ***

1 SIZE P 3.2

1 WEIGHT I 1

* *** End of Data Area ***
```

### Method Subprogram: init2-n

```
define data
object using class2-o
end-define
*
size := 1.24
weight := 2
*
end
```

#### Program: prog

```
define data local
1 #o handle of object
1 #height(p5.2)
1 #weight(i4)
end-define
*
create object #o of class 'Elephant'
send "Init" to #o
#height := #o.Height
#weight := #o.Weight
write #height #weight
*
```

```
create object #o of class 'Mouse'
send "Init" to #o
#height := #o.Height
#weight := #o.Weight
write #height #weight
*
end
```

# MOVE

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For an explanation of the symbols used in the syntax diagrams below, see *Syntax Symbols*.

Related Statements: ADD | COMPRESS | COMPUTE | DIVIDE | EXAMINE | MULTIPLY | RESET | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

# **Function**

The MOVE statement is used to move the value of an operand to one or more operands (field or array).

A Natural system function may be used only if the MOVE statement is specified in conjunction with an AT BREAK, AT END OF DATA or AT END OF PAGE statement.

See also the section Rules for Arithmetic Assignment in the Programming Guide.

# Syntax 1 - MOVE

MOVE [ROUNDED] operand1 [(parameter)] TO operand2...

For an explanation of the symbols used in the syntax diagrams below, see *Syntax Symbols*.

Operand Definition Table:

Operand	Possible Structure					Possible Formats													Referencing Permitted	Dynamic Definition
operand1	C	S	A		N	A	U	N	Р	Ι	F	В	D	T	L	C	G	O	yes	no
operand2		S	A		M	A	U	N	Р	Ι	F	В	D	T	L	C	G	O	yes	yes

Syntax Element Description:

Syntax Element	Description
MOVE	MOVE ROUNDED Option:
ROUNDED	This option causes <i>operand2</i> to be rounded.
	ROUNDED is ignored if <code>operand2</code> is not numeric or if the source operand has the same or less precision digits than the target operand.
	See also Example 1 - Various Samples of MOVE Statement Usage.
operand1	Source and Target Operands:

Syntax Element	Description												
operand2	operand1 is the so	ource operand whose value is moved to the target operand operand2.											
	For the rules for data transfer and information on data conversion and transfer compatibility, see the section <i>Data Transfer</i> in the <i>Programming Guide</i> .												
	current length of a *LENGTH. For gene	ynamic variable, its length may be modified by the MOVE operation. The dynamic variable can be ascertained by using the system variable eral information on the dynamic variable, see the section <i>Using Dynamic</i> in the <i>Programming Guide</i> .											
	A MOVE statement v	with multiple target operands is identical to the corresponding individual											
	MOVE #SOURCE TO	O #TARGET1 #TARGET2											
	is identical to												
	MOVE #SOURCE TO MOVE #SOURCE TO												
parameter	Parameter Option:												
	parameter either specifies the session parameter PM or the session parameter DF:												
	PM=I	Right-to-Left Display Option:											
		In order to support languages whose writing direction is from right to left, you can specify PM=I so as to transfer the value of <code>operand1</code> in inverse (right-to-left) direction to <code>operand2</code> .											
		For example, as a result of the following statements, the content of #B would be ZYX:											
		MOVE 'XYZ' TO #A MOVE #A (PM=I) TO #B											
		PM=I can only be specified if operand2 has alphanumeric/Unicode format (Natural data format A or U).											
		Any trailing blanks in <i>operand1</i> will be removed (blanks and binary zeros are removed), then the value is reversed and moved to <i>operand2</i> . If <i>operand1</i> is not of alphanumeric/Unicode format, the value will be											
		converted to alphanumeric/Unicode format before it is reversed.											
		See also the use of PM=I in conjunction with MOVE LEFT/RIGHT JUSTIFIED.											
	DF=S I L	Date Format:											

Syntax Element	Description
	If operand1 is a date variable and operand2 is an alphanumeric/Unicode field, you can specify the session parameter DF as parameter for this date variable.

# **Syntax 2 - MOVE SUBSTRING**

```
 \begin{tabular}{ll} MOVE & & & operand 1 \\ & & & SUBSTRING (operand 1, operand 3, operand 4) \\ & & & TO \\ & & & & SUBSTRING (operand 2, operand 5, operand 6) \\ & & & & & ... \\ \end{tabular}
```

This syntax only applies if you want to move only part of the field contents (a substring) of a source and/or target operand. Otherwise, *Syntax 1* applies.

For an explanation of the symbols used in the syntax diagrams below, see *Syntax Symbols*.

### Operand Definition Table:

Operand	Po	ssib	le St	ructur			Pos	ssi	ble	F	orn	nat	S		Referencing Permitted	Dynamic Definition
operand1	C	S	A		A	U					В				yes	no
operand2		S	A		A	U					В				yes	no
operand3	С	S					N	Р	Ι		В*				yes	no
operand4	С	S					N	Р	Ι		В*				yes	no
operand5	С	S					N	Р	Ι		В*				yes	no
operand6	С	S					N	Р	I		В*				yes	no

<sup>\*</sup> See text.

Syntax Element Description:

Syntax	Description
Element	
MOVE SUBSTRING	
	Without the SUBSTRING option, the whole content of a field is moved.
	The SUBSTRING option allows you to move only a certain part of an alphanumeric/ Unicode or a binary field. After the field name (operand1) in the SUBSTRING clause, you specify first the starting position (operand3) and then the length (operand4) of the field portion to be moved.

Syntax Element	Description
Liement	If the underlying field format of operand1 is
	alphanumeric/Unicode (A) or binary (B), then the values supplied with <code>operand3</code> or <code>operand4</code> are considered as byte numbers;
	■ Unicode (U), then the values supplied with <i>operand3</i> or <i>operand4</i> are considered as number of Unicode code units; that is, as double-bytes.
	For example, to move the 5th to 12th position inclusive of the value in a field $\#A$ into a field $\#B$ , you would specify:
	MOVE SUBSTRING(#A,5,8) TO #B
	If <code>operand1</code> is a dynamic variable, the specified field portion to be moved must be within its current length; otherwise, a runtime error will occur.
	Also, you can move a value of an alphanumeric/Unicode or binary field into a certain part of the target field. After the field name (operand2) in the SUBSTRING clause you specify first the starting position (operand5) and then the length (operand6) of the field portion into which the value is to be moved.
	If the underlying field format of operand2 is
	alphanumeric/Unicode (A/U) or binary (B), then the values supplied with <code>operand5</code> or <code>operand6</code> are considered as byte numbers;
	■ Unicode (U), then the values supplied with <i>operand3</i> or <i>operand4</i> are considered as number of Unicode code units; that is, as double-bytes.
	For example, to move the value of a field $\#A$ into the 3rd to 6th position inclusive of a field $\#B$ , you would specify:
	MOVE #A TO SUBSTRING(#B,3,4)
	If <i>operand2</i> is a dynamic variable, the specified starting position ( <i>operand5</i> ) must not be greater than the variable's current length plus 1; a greater starting position will lead to a runtime error, because it would cause an undefined gap within the content of <i>operand2</i> .
	If operand3/operand5 or operand4/operand6 is a binary variable, it may be used only with a length of less than or equal to 4.
	If you omit <code>operand3/operand5</code> , the starting position is assumed to be 1. If you omit <code>operand4/operand6</code> , the length is assumed to range from the starting position to the end of the field.
	If <i>operand2</i> is a dynamic variable and the specified starting position ( <i>operand5</i> ) is the variable's current length plus 1, which means that the MOVE operation is used to increase the length of the variable, <i>operand6</i> must be specified in order to determine the new length of the variable.

Syntax	Description
Element	
	<b>Note:</b> MOVE with the SUBSTRING option is a byte-by-byte move (that is, the rules described
	under Rules for Arithmetic Assignment in the Programming Guide do not apply).
parameter	Parameter Option:
	See parameter in Syntax 1.

# **Syntax 3 - MOVE BY NAME / POSITION**

MOVE BY	{	[NAME] POSITION	}	operand1TO operand2
---------	---	-----------------	---	---------------------

# Operand Definition Table:

Operand	Pos	ssibl	le Structur	9	P	Possible Formats						ats	Referencing Permitted	Dynamic Definition		
operand1			G										yes	no		
operand2			G										yes	no		

# Syntax Element Description:

Syntax Element	Description
MOVE BY NAME	MOVE BY NAME Option:
operand1 TO operand2	This option is used to move individual fields contained in a data structure to another data structure, independent of their position in the structure.
	A field is moved only if its name appears in both structures (this includes REDEFINEd fields as well as fields resulting from a redefinition). The individual fields may be of any format. The operands can also be views.
	<b>Note:</b> The sequence of the individual moves is determined by the sequence of the fields in <i>operand1</i> .
	See also Example 2 - MOVE BY NAME Statement.
	MOVE BY NAME with Arrays:
	If the data structures contain arrays, these will internally be assigned the index (*) when moved; this may lead to an error if the arrays do not comply with the rules for assignment operations with arrays; see the section <i>Processing of Arrays</i> in the <i>Programming Guide</i> .
	See also Example 3 - MOVE BY NAME with Arrays.

Syntax Element	Description
•	MOVE BY POSITION Option:  This option allows you to move the contents of fields in a group to another group, regardless of the field names.  The values are moved field by field from one group to the other in the order in which the fields are defined (this does not include fields resulting from a redefinition).  The individual fields may be of any format. The number of fields in each group must be the same; also, the level structure and array dimensions of the fields must match. Format conversion is done according to the rules for arithmetic assignment; see the section <i>Rules for Arithmetic Assignments</i> in the <i>Programming Guide</i> . The operands can also be views.
	See also Example 4 - MOVE BY POSITION.

# Syntax 4 - MOVE EDITED (Edit Mask Specified with operand2)

# Operand Definition Table:

Operand	Ро	ssib	ure			P	oss	sik	ole	Fo	rm	ats			Referencing Permitted	Dynamic Definition			
operand1	C	S	A			A	U					В						yes	no
operand2		S	A			A	U	N	Р	Ι	F	В	D	Т	L			yes	yes

### Syntax Element Description:

Syntax Element	Description
MOVE EDITED	MOVE EDITED Option:
	If an edit mask is specified for <i>operand2</i> , the value of <i>operand1</i> will be placed into <i>operand2</i> using this edit mask.
	The edit mask can be considered as an <i>input</i> edit mask for <i>operand2</i> , that is used to specify at which positions in the alphanumeric/Unicode contents of <i>operand1</i> the significant input data for <i>operand2</i> can be found.
	If the edit mask refers more characters or digits than existent in <code>operand2</code> , it is truncated accordingly. The length of <code>operand1</code> may not be smaller than the length of the input value represented by the edit mask. If <code>operand1</code> is longer than the edit mask length, all the overhanging data is ignored.

Syntax Element	Description
	Under the pre-condition not to have an <code>operand1</code> length larger than the edit mask length, you may regard a
	MOVE EDITED operand1 TO operand2 (EM=value)
	operation like the execution of
	STACK TOP DATA operand1 INPUT operand2 (EM=value)
	See also Example 1 - Various Samples of MOVE Statement Usage.
EM	Edit Mask:
	For details on edit masks, see the session parameter EM in the <i>Parameter Reference</i> .
EMU	Unicode Edit Mask:
	For details on Unicode edit masks, see the session parameter EMU in the <i>Parameter Reference</i> .

# Syntax 5 - MOVE EDITED (Edit Mask Specified with operand1)

# Operand Definition Table:

Operand	Ро	ssib	le St	ructu	re		Possible Formats											Referencing Permitted	Dynamic Definition
operand1	C	S	A	I	N	Α	U	N	Р	PIFBDTL					L			yes	no
operand2		S	A			A U B								yes	yes				

# Syntax Element Description:

Syntax E	lement	Description
MOVE E	DITED	MOVE EDITED Option:
		If an edit mask is specified for <code>operand1</code> , the edit mask will be applied to <code>operand1</code> and the result will be moved to <code>operand2</code> .
		The edit mask can be considered as an <i>output</i> edit mask for <i>operand1</i> , that is used to create an alphanumeric/Unicode string with the layout and length described by the edit mask. Besides data characters or digits originating from <i>operand1</i> , you may include additional decoration characters into the output string.

Syntax Element	Description
	If the edit mask refers more characters or digits than existent in <code>operand1</code> , it is truncated accordingly. The length of the created output string (resulting from <code>operand1</code> value after the edit mask has been applied) must not exceed the length of <code>operand2</code> .
	the cult mask has been applied) must not exceed the length of operandz.
	Under the pre-condition not to have an operand2 length smaller than the edit mask length, you may regard a
	MOVE EDITED operand1 (EM=value) TO operand2
	operation like a
	WRITE operand1 (EM=value)
	that does not write the output to the screen, but fills it into variable operand2.
	See also Example 1 - Various Samples of MOVE Statement Usage.
EM	Edit Mask:
	For details on edit masks, see the session parameter EM in the <i>Parameter Reference</i> .
EMU	Unicode Edit Mask:
	For details on Unicode edit masks, see the session parameter EMU in the <i>Parameter Reference</i> .

# Syntax 6 - MOVE LEFT / RIGHT JUSTIFIED



# Operand Definition Table:

Operand	Possible Structure				Possible Formats	Referencing Permitted	Dynamic Definition
operand1	C	S	A	N	AUNPIFBDTL	yes	no
operand2		S	A		A U	yes	yes

Syntax Element Description:

Syntax Element	Description
	MOVE LEFT / RIGHT JUSTIFIED Options:
JUSTIFIED	This option is used to cause the values to be moved to be left- or right-justified in operand2.
	MOVE LEFT/RIGHT JUSTIFIED cannot be used if operand2 is a dynamic variable.
MOVE LEFT	MOVE LEFT Option:
JUSTIFIED	With MOVE LEFT JUSTIFIED, any leading blanks in <i>operand1</i> are removed (blanks and binary zeros are removed) before the value is placed left-justified into <i>operand2</i> . The remainder of <i>operand2</i> will then be filled with blanks. If the value is longer than <i>operand2</i> , the value will be truncated on the right-hand side.
MOVE RIGHT	RIGHT JUSTIFIED Option:
JUSTIFIED	With MOVE RIGHT JUSTIFIED, any trailing blanks in <code>operand1</code> are truncated (blanks and binary zeros are removed) before the value is placed right-justified into <code>operand2</code> . The remainder of <code>operand2</code> will then be filled with blanks. If the value is longer than <code>operand2</code> , the value will be truncated on the left-hand side.
	See also Example 1 - Various Samples of MOVE Statement Usage.
parameter	Parameter:
	When you use MOVE LEFT/RIGHT JUSTIFIED in conjunction with PM=I, the move is performed in the following steps:
	1. If <i>operand1</i> is not of alphanumeric/Unicode format, the value is converted to alphanumeric/Unicode format.
	2. Any trailing blanks in <i>operand1</i> are removed (blanks and binary zeros are removed).
	3. In the case of LEFT JUSTIFIED, any leading blanks in <i>operand1</i> are also removed (blanks and binary zeros are removed).
	4. The value is reversed, and then moved to operand2.
	5. If applicable, the remainder of <i>operand2</i> is filled with blanks, or the value is truncated (see above).

# **Syntax 7 - MOVE NORMALIZED**

The MOVE NORMALIZED statement converts a Unicode string into the "Unicode Normalization Form C" (NFC). The resulting Unicode string does no longer contain combining sequences for characters which are available as pre-composed characters.

If the format of the target operand is not Unicode itself, an implicit conversion from Unicode into the target operand takes place - during this conversion the default code page (see system variable \*CODEPAGE) will be used.

For further information on the MOVE NORMALIZED statement, see the section *Statements* in the *Unicode* and *Code Page Support* documentation.

### Syntax Diagram:

MOVE NORMALIZED operand1 TO operand2

### Operand Definition Table:

Operand	Po	ssib	le St	ructı	ure		Po	SS	ibl	e F	orr	nat	S	Referencing Permitted	Dynamic Definition	
operand1	С	S	A				U	U						yes	no	
operand2		S	A			Α	. U							yes	yes	

### Syntax Element Description:

Syntax Element	Description
MOVE NORMALIZED	MOVE NORMALIZED Option:
	This option is used to convert Unicode fields with potentially unnormalized content into the "Unicode Normalization Form C" (NFC). This composite form of a Unicode string does not contain combining sequences for characters which are available as pre-composed characters. See also: <a href="http://www.unicode.org/reports/tr15/#Canonical_Composition_Examples">http://www.unicode.org/reports/tr15/#Canonical_Composition_Examples</a> ("Normalization Forms D and C Examples").  Example:
	MOVE NORMALIZED #SCR TO #TGT
operand1	Source Operand:
	operand1 contains the Unicode string to be converted.
operand2	Target Operand:
	operand2 receives the converted Unicode string.

### Example:

Some code points have different representations in Unicode. For example, the German letter 'Ä': the decomposed representation in Unicode is U+0041 followed by U+0308 and uses a combining character (U+0308); another representation is the pre-composed character U+0004. The MOVE

NORMALIZED statement converts the Unicode representation with combining characters into a normalized Unicode representation using pre-composed characters, where possible.

# Syntax 8 - MOVE ENCODED

This section explains the syntax of the MOVE ENCODED statement. For information on the purpose of this statement, see the section *Statements* in the *Unicode and Code Page Support* documentation.

#### Syntax Diagram:

```
MOVE ENCODED

operand1 [[IN] CODEPAGE operand2] TO

operand3 [[IN] CODEPAGE operand4]

[GIVING operand5]
```

### Operand Definition Table:

Operand	Po	ssib	le St		P	os	sib	le F	<b>-</b> 0	rm	Referencing Permitted	Dynamic Definition			
operand1	C	S	A		A	U	В							yes	no
operand2		S			A	U								yes	no
operand3		S			A	U	В							yes	yes
operand4		S	A		A	U								yes	no
operand5		S						I4						yes	yes

### Syntax Element Description:

Syntax Element	Description
MOVE ENCODED	MOVE ENCODED Option:
	This option converts a character string, encoded in one code page, into the equivalent character string of another code page.
	<b>Note:</b> Natural uses the International Components for Unicode (ICU) library for
	Unicode conversion. For more information, see the ICU User Guide at <a href="http://userguide.icu-project.org/">http://userguide.icu-project.org/</a> .
operand1	Source Operand:
	operand1 contains the string to be converted.
CODEPAGE operand2	Code Page of Source Operand:
	As operand2, you specify the code page of operand1.

Syntax Element	Description
	Can only be supplied if operand1 is of format A or B. See Note 1 and 3.
TO operand3	Target Operand:
	operand3 receives the converted string.
	If the conversion result does not fit into the target field, the result is padded or truncated, respectively, and as padding character the blank of the resulting code page is used.
	If the target field is defined as a dynamic variable, no padding or truncation is needed, since the length of the dynamic variable is automatically adjusted to the length of the conversion result.
CODEPAGE operand4	Code Page of Target Operand:
	As operand4, you specify the code page of operand3.
	Can only be supplied if operand3 is of format A or B. See Note 1 and 3.
GIVING operand5	GIVING Clause:
	If you omit this clause, a Natural error message is returned if an error occurs.
	If you specify the keyword GIVING, <i>operand5</i> returns 0 or the Natural error code instead of the Natural error message.
	If the target gets truncated, no Natural error message is given, but when the keyword GIVING is used, <i>operand5</i> will contain an appropriate error code to indicate truncation.

#### Notes:

- 1. If a code page operand is not supplied, then the default code page (value of the system variable \*CODEPAGE) is used.
- 2. If the session parameter CPCVERR in the statement SET GLOBALS or in the system command GLOBALS is set to ON, an error is output if at least one character of the source field could not be converted properly into the destination code page, but was replaced in the target field by a substitution character.
- 3. Only code page names defined with the macro NTCPAGE in the source module NATCONFG can be used. Other code page names are rejected with a corresponding runtime error.

### **Examples of MOVE ENCODED:**

#### MOVE ENCODED A-FIELD1 TO A-FIELD2

Invalid: This results in a syntax error, since the code page names are taken by default and are the same for <code>operand1</code> and <code>operand3</code>.

```
MOVE ENCODED A-FIELD1 CODEPAGE 'IBM01140' TO A-FIELD2 CODEPAGE 'IBM01140'
```

Invalid: This results in an error, since the coded code page names are the same for *operand1* and *operand3*.

```
MOVE ENCODED A-FIELD1 CODEPAGE 'IBM01140' TO A-FIELD2 CODEPAGE 'IBM037'
```

Valid: The string in A-FIELD1 which is coded in IBM01140 is converted into A-FIELD2 which is coded in IBM037.

```
MOVE ENCODED U-FIELD TO U-FIELD
```

Invalid: This results in an error, since at least one operand must be of format A or B.

```
MOVE ENCODED U-FIELD TO A-FIELD
```

Valid: The Unicode string in U-FIELD which, considered to be encoded in UTF-16, is converted into the alphanumeric A-FIELD in the default code page (\*CODEPAGE).

```
MOVE ENCODED A-FIELD TO U-FIELD
```

Valid: The string in A-FIELD which, considered to be encoded in the default code page (\*CODEPAGE), is converted into the Unicode field U-FIELD.

```
MOVE ENCODED A100-FIELD CODEPAGE 'IBM1140' TO A50-FIELD CODEPAGE 'IBM037'
```

Valid: Conversion is done from A100-FIELD (format/length: A100) to A50-FIELD (format/length: A50), using the relevant code pages. The target is truncated. No Natural error message is returned.

```
MOVE ENCODED A100-FIELD CODEPAGE 'IBM1140' TO A50-FIELD CODEPAGE 'IBM037' GIVING RC-FIELD
```

Valid: Conversion is done from A100-FIELD (format/length: A100) to A50-FIELD (format/length: A50), using the relevant code pages. The target is truncated. Since a GIVING clause is supplied, the RC-FIELD receives an error code, indicating that a value truncation has taken place.

# Syntax 9 - MOVE ALL

The MOVE ALL statement enables you to move repeatedly the content of operand1 to operand2 until the complete target field is full or the UNTIL value (operand7) is reached.

Using a SUBSTRING Clause, you may limit the MOVE ALL operation to just segments of the source and target field.

### Syntax Diagram:

```
 \begin{array}{c} \text{MOVE ALL} \left\{ \begin{array}{c} \textit{operand1} \\ \text{SUBSTRING} \textit{(operand1,operand3,operand4)} \end{array} \right\} \\ \text{TO} \left\{ \begin{array}{c} \textit{operand2} \\ \text{SUBSTRING} \textit{(operand2,operand5,operand6)} \end{array} \right\} \\ \text{[UNTIL operand7]} \end{array}
```

### Operand Definition Table:

Operand	Po	ssib	le St	ructı	ıre			Pos	sik	ole	Forn	nat	S		Referencing Permitted	Dynamic Definition
operand1	C	S	A			A	U	$N^1$			В				yes	no
operand2		S	A			A	U				В				yes	yes
operand3	С	S						N	P	Ι	B <sup>2</sup>				yes	no
operand4	С	S						N	Р	Ι	B <sup>2</sup>				yes	no
operand5	С	S						N	Р	Ι	B <sup>2</sup>				yes	no
operand6	С	S						N	Р	Ι	B <sup>2</sup>				yes	no
operand7	С	S						N	Р	Ι					yes	no

 $<sup>^{1}</sup>$  A numeric format (N) for <code>operand1</code> is permitted only when used without the <code>SUBSTRING</code> clause.

Syntax Element Description:

 $<sup>^2</sup>$  If operand3/operand5 or operand4/operand6 is a binary variable, it may be used only with a length of less than or equal to 4.

Syntax Element	Description
operand1	Source Operand:
	The source operand contains the value to be moved.
	All digits of a numeric operand including leading zeros are moved.
T0	Target Operand:
operand2	The target operand is not reset before the execution of the MOVE ALL operation. This is of particular importance when using the UNTIL option since data previously in <i>operand2</i> is retained if not explicitly overlaid during the MOVE ALL operation.
UNTIL	UNTIL Option:
operand7	The UNTIL option can be used to limit the MOVE ALL operation to a given number of positions in <i>operand2</i> . <i>operand3</i> is used to specify the number of positions. The MOVE ALL operation is terminated when this value is reached.
	If operand7 is greater than the length of operand2, the MOVE ALL operation is terminated when operand2 is full.
	The UNTIL option may also be used to assign an initial value to a dynamic variable: if <code>operand2</code> is a dynamic variable, its length after the <code>MOVE ALL</code> operation will correspond to the value of <code>operand7</code> . The current length of a dynamic variable can be ascertained by using the system variable <code>*LENGTH</code> .
	For general information on dynamic variables, see <i>Usage of Dynamic Variables</i> .
	<b>Note:</b> The UNTIL option is not allowed when a SUBSTRING clause is used for the target operand.
SUBSTRING	SUBSTRING Clause:
	The SUBSTRING clause enables you to select a fixed segment of the source or target variable in a MOVE ALL statement - whereas, without the SUBSTRING clause, the whole content of the source or target variable is processed.
	operand3 and operand4 describe the start position and length of the operand1 segment used as source value. operand5 and operand6 describe the start position and length of the operand2 segment which is filled by the operation. If the start position (operand3 or operand5) is omitted, then position 1 is assumed by default. If the substring length (operand4 or operand6) is omitted, then the remaining length of the field is assumed.
	If SUBSTRING is used for the source field, the start value and length (operand3 and operand4) must describe a data segment which is completely inside operand1.
	If SUBSTRING is used for the target field the following rules apply:
	■ If <i>operand2</i> is a fixed length variable, the range described by the start-value and length ( <i>operand5</i> and <i>operand6</i> ) has completely to reside within the field extent.
	■ If operand2 is a dynamic length variable, the start value (operand5) can either point into or immediately behind the current field length (*LENGTH + 1). When the end of the

Syntax	Description
Element	
	SUBSTRING range is within the allocated field data, the operation is processed in the same way as for a fixed length field. When the SUBSTRING end exceeds the current field size, the dynamic variable is expanded to this extent.
	See also Examples of SUBSTRING Clause Usage below.

### **Examples of SUBSTRING Clause Usage**

```
DEFINE DATA LOCAL

1 ALFA (A10) INIT <'AAAAAAAAA'>

1 DYN (A) DYNAMIC INIT <'1234567890'>

1 #VAL (A4) INIT <'1234'>
END-DEFINE
```

Statement	Result	
	Before	After
MOVE ALL SUBSTRING (#VAL,1,2) TO ALFA	AAAAAAAA	1212121212
MOVE ALL '123' TO SUBSTRING (ALFA,3,5)	AAAAAAAA	AA12312AAA
MOVE ALL 'x' TO SUBSTRING (DYN,7,3)	1234567890 (*LENGTH=10)	123456xxx0 (*LENGTH=10)
MOVE ALL 'xyz' TO SUBSTRING (DYN,7,6)	1234567890 (*LENGTH=10)	123456xyzxyz (*LENGTH=12)
MOVE ALL 'xyz' TO SUBSTRING (DYN,11,4)	1234567890 (*LENGTH=10)	1234567890xyzx (*LENGTH=14)

# **Examples**

- Example 1 Various Samples of MOVE Statement Usage
- Example 2 MOVE BY NAME
- Example 3 MOVE BY NAME with Arrays
- Example 4 MOVE BY POSITION

### ■ Example 5 - MOVE ALL

### **Example 1 - Various Samples of MOVE Statement Usage**

```
** Example 'MOVEX1': MOVE
**************************
DEFINE DATA LOCAL
1 #A (N3)
1 #B (A5)
1 #C (A2)
1 #D (A7)
1 #E (N1.0)
1 #F (A5)
1 #G (N3.2)
1 #H (A6)
END-DEFINE
MOVE 5 TO #A
WRITE NOTITLE 'MOVE 5 TO #A' 30X '=' #A
MOVE 'ABCDE' TO #B #C #D
WRITE 'MOVE ABCDE TO #B #C #D'
                               20X '=' #B '=' #C '=' #D
MOVE -1 TO #E
WRITE 'MOVE -1 TO #E'
                               28X '=' #E
MOVE ROUNDED 1.995 TO #E
WRITE 'MOVE ROUNDED 1.995 TO #E' 18X '=' #E
MOVE RIGHT JUSTIFIED 'ABC' TO #F
WRITE 'MOVE RIGHT JUSTIFIED ''ABC'' TO #F'
                                            10X '=' #F
MOVE EDITED '003.45' TO #G (EM=999.99)
WRITE 'MOVE EDITED ''003.45'' TO #G (EM=999.99)' 4X '=' #G
MOVE EDITED 123.45 (EM=999.99) TO #H
WRITE 'MOVE EDITED 123.45 (EM=999.99) TO #H' 6X '=' #H
END
```

### **Output of Program MOVEX1:**

```
MOVE 5 TO #A #A: 5

MOVE ABCDE TO #B #C #D #B: ABCDE #C: AB #D: ABCDE

MOVE -1 TO #E #E: -1

MOVE ROUNDED 1.995 TO #E #E: 2

MOVE RIGHT JUSTIFIED 'ABC' TO #F #F: ABC

MOVE EDITED '003.45' TO #G (EM=999.99) #G: 3.45

MOVE EDITED 123.45 (EM=999.99) TO #H #H: 123.45
```

### **Example 2 - MOVE BY NAME**

```
** Example 'MOVEX2': MOVE BY NAME
************************
DEFINE DATA LOCAL
1 #SBLOCK
 2 #FIELDA (A10) INIT <'AAAAAAAAA'>
 2 #FIELDB (A10) INIT < BBBBBBBBBB'>
 2 #FIELDC (A10) INIT <'CCCCCCCCC'>
 2 #FIELDD (A10) INIT <'DDDDDDDDDD'>
1 #TBLOCK
 2 #FIELD1 (A15) INIT <' '>
 2 #FIELDA (A10) INIT <' '>
 2 #FIELD2 (A10) INIT <' '>
 2 #FIELDB (A10) INIT <' '>
 2 #FIELD3 (A20) INIT <' '>
 2 #FIELDC (A10) INIT <' '>
END-DEFINE
MOVE BY NAME #SBLOCK TO #TBLOCK
WRITE NOTITLE 'CONTENTS OF #TBLOCK AFTER MOVE BY NAME:'
      // '=' #TBLOCK.#FIELD1
       / '=' #TBLOCK.#FIELDA
       / '=' #TBLOCK.#FIELD2
       / '=' #TBLOCK.#FIELDB
       / '=' #TBLOCK.#FIELD3
       / '=' #TBLOCK.#FIELDC
END
```

### Contents of #TBLOCK after MOVE BY NAME Processing:

### **Example 3 - MOVE BY NAME with Arrays**

```
DEFINE DATA LOCAL

1 #GROUP1

2 #FIELD (A10/1:10)

1 #GROUP2

2 #FIELD (A10/1:10)

END-DEFINE

...

MOVE BY NAME #GROUP1 TO #GROUP2

...
```

In this example, the MOVE statement would internally be resolved as:

```
MOVE #GROUP1.#FIELD (*) TO #GROUP2.#FIELD (*)
```

If part of an indexed group is moved to another part of the same group, this may lead to unexpected results as shown in the example below.

```
DEFINE DATA LOCAL

1 #GROUP1 (1:5)

2 #FIELDA (N1) INIT <1,2,3,4,5>

2 REDEFINE #FIELDA

3 #FIELDB (N1)

END-DEFINE
...

MOVE BY NAME #GROUP1 (2:4) TO #GROUP1 (1:3)
...
```

In this example, the MOVE statement would internally be resolved as:

```
MOVE #FIELDA (2:4) TO #FIELDA (1:3)
MOVE #FIELDB (2:4) TO #FIELDB (1:3)
```

First, the contents of the occurrences 2 to 4 of #FIELDA are moved to the occurrences 1 to 3 of #FIELDA; that is, the occurrences receive the following values:

Occurrence:	1.	2.	3.	4.	5.
Value before:	1	2	3	4	5
Value after:	2	3	4	4	5

Then the contents of the occurrences 2 to 4 of #FIELDB are moved to the occurrences 1 to 3 of #FIELDB; that is, the occurrences receive the following values:

Occurrence:	1.	2.	3.	4.	5.
Value before:	2	3	4	4	5
Value after:	3	4	4	4	5

### **Example 4 - MOVE BY POSITION**

```
DEFINE DATA LOCAL

1 #GROUP1

2 #FIELD1A (N5)

2 #FIELD1B (A3/1:3)

2 REDEFINE #FIELD1B

3 #FIELD1BR (A9)

1 #GROUP2

2 #FIELD2A (N5)

2 #FIELD2B (A3/1:3)

2 REDEFINE #FIELD2B

3 #FIELD2BR (A9)

END-DEFINE

...

MOVE BY POSITION #GROUP1 TO #GROUP2

...
```

In this example, the content of #FIELD1A is moved to #FIELD2A, and the content of #FIELD1B to #FIELD2B; the fields #FIELD1BR and #FIELD2BR are not affected.

### **Example 5 - MOVE ALL**

```
** Example 'MOAEX1': MOVE ALL
************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 FIRST-NAME
 2 NAME
 2 CITY
1 VEH-VIEW VIEW OF VEHICLES
 2 PERSONNEL-ID
 2 MAKE
END-DEFINE
LIMIT 4
RD. READ EMPLOY-VIEW BY NAME
 SUSPEND IDENTICAL SUPPRESS
 FD. FIND VEH-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (RD.)
   IF NO RECORDS FOUND
     MOVE ALL '*' TO FIRST-NAME (RD.)
     MOVE ALL '*' TO CITY (RD.)
     MOVE ALL '*' TO MAKE (FD.)
   END-NOREC
   /*
   DISPLAY NOTITLE (ES=OFF IS=ON ZP=ON AL=15)
           NAME (RD.) FIRST-NAME (RD.)
           CITY (RD.)
           MAKE (FD.) (IS=OFF)
   /*
 END-FIND
END-READ
END
```

### **Output of Program MOAEX1:**

NAME	FIRST-NAME	CITY	MAKE
ABELLAN	*****	*****	*****
ACHIESON ADAM	ROBERT ********	DERBY *********	FORD *******
ADKINSON	JEFF	BROOKLYN	GENERAL MOTORS

# 93 MOVE INDEXED

The MOVE INDEXED statement is supported for compatibility reasons only.



**Caution:** In contrast to a MOVE statement with array operands, checks for out-of-bound index values are not possible when a MOVE INDEXED statement is executed. As a consequence, when executing an incorrect MOVE INDEXED statement, you may unintentionally destroy user data.

Therefore, Software AG strongly recommends that you replace MOVE INDEXED statements by MOVE statements.

See the statement MOVE.

# 94 MULTIPLY

Function	736
Syntax 1 - MULTIPLY Statement without GIVING Clause	736
Syntax 2 - MULTIPLY Statement with GIVING Clause	737
Example	738

Related Statements: ADD | COMPRESS | COMPUTE | DIVIDE | EXAMINE | MOVE | MOVE ALL | RESET | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

## **Function**

The MULTIPLY statement is used to multiply two operands. Depending on the syntax used, the result of the multiplication may be stored in *operand1* or *operand3*.

If a database field is used as the result field, the multiplication results in an update only to the internal value of the field as used within the program. The value for the field in the database remains unchanged.

For multiplications involving arrays, see also *Rules for Arithmetic Assignments, Arithmetic Operations* with Arrays (in the *Programming Guide*).

Two different structures are possible for this statement.

## Syntax 1 - MULTIPLY Statement without GIVING Clause

When Syntax 1 used, the result of the multiplication can be stored in operand1.

$$\begin{array}{ll} \texttt{MULTIPLY [ROUNDED]} \ \textit{operand1} \ \texttt{BY} & \left\{ \begin{array}{l} \textit{(arithmetic-expression)} \\ \textit{operand2} \end{array} \right\} \end{array}$$

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Operand Definition Table:

Operand	Po	ssib	le St	ructu	ure Possible Formats I				ats	Referencing Permitted	Dynamic Definition		
operand1		S	A	]	M	N	Р	I	F			yes	no
operand2	С	S	A	]	N	N	Р	Ι	F			yes	no

Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 BY operand2	Operands:  operand1 is the multiplicand, operand2 is the multiplier.
	The result is stored in <code>operand1</code> , hence the statement is equivalent to: <code>operand1 := operand1 * operand2</code>
ROUNDED	ROUNDED Option:  If you specify the keyword ROUNDED, the value will be rounded before it is assigned to <code>operand1</code> or <code>operand3</code> .
	For information on rounding, see <i>Rules for Arithmetic Assignment, Field Truncation and Field Rounding</i> in the <i>Programming Guide</i> .

# Syntax 2 - MULTIPLY Statement with GIVING Clause

When Syntax 2 is used, the result of the multiplication can be stored in operand3.

MULTIPLY	(arithmetic-expression)	) <sub>DV</sub> .	(arithmetic-expression)	GIVING
[ROUNDED]	operand1	) BT 1	operand2	operand3

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

#### Operand Definition Table:

0	perand	Po	ssib	le St	ruct	ure	Possible Formats				Referencing Permitted							
0	perand1	C	S	A		M			N	Р	Ι	F					yes	no
0	perand2	C	S	A		N			N	Р	Ι	F					yes	no
0	perand3		S	A		M	A	U	N	Р	Ι	F	B*	Т			yes	yes

<sup>\*</sup> Format B of operand3 may be used only with a length of less than or equal to 4.

Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 BY operand2 GIVING operand3	Operands:  operand1 is the multiplicand, operand2 is the multiplier. The result will be stored in operand3, hence the statement is equivalent to:
	operand3 := operand1 * operand2
ROUNDED	ROUNDED Option:  If you specify the keyword ROUNDED, the value will be rounded before it is assigned to operand1 or operand3.  For information on rounding, see Rules for Arithmetic Assignment, Field Truncation and Field Rounding in the Programming Guide.

## **Example**

```
** Example 'MULEX1': MULTIPLY
DEFINE DATA LOCAL
1 #A (N3) INIT <20>
1 #B
         (N5)
1 #C
         (N3.1)
1 #D
       (N2)
1 #ARRAY1 (N5/1:4,1:4) INIT (2,*) <5>
1 #ARRAY2 (N5/1:4,1:4) INIT (4,*) <10>
END-DEFINE
MULTIPLY #A BY 3
WRITE NOTITLE 'MULTIPLY #A BY 3' 25X '=' #A
MULTIPLY #A BY 3 GIVING #B
WRITE 'MULTIPLY #A BY 3 GIVING #B' 15X '=' #B
MULTIPLY ROUNDED 3 BY 3.5 GIVING #C
WRITE 'MULTIPLY ROUNDED 3 BY 3.5 GIVING #C' 6X '=' #C
MULTIPLY 3 BY -4 GIVING #D
WRITE 'MULTIPLY 3 BY -4 GIVING #D'
                                  14X '=' #D
MULTIPLY -3 BY -4 GIVING #D
WRITE 'MULTIPLY -3 BY -4 GIVING #D'
                                      14X '=' #D
MULTIPLY 3 BY 0 GIVING #D
WRITE 'MULTIPLY 3 BY O GIVING #D'
                                 14X '=' #D
```

```
WRITE / '=' #ARRAY1 (2,*) '=' #ARRAY2 (4,*)

MULTIPLY #ARRAY1 (2,*) BY #ARRAY2 (4,*)

WRITE / 'MULTIPLY #ARRAY1 (2,*) BY #ARRAY2 (4,*)'

/ '=' #ARRAY1 (2,*) '=' #ARRAY2 (4,*)

*
END
```

#### **Output of Program MULEX1:**

```
MULTIPLY #A BY 3
                                     #A:
                                          60
MULTIPLY #A BY 3 GIVING #B
                                     #B:
                                          180
MULTIPLY ROUNDED 3 BY 3.5 GIVING #C
                                     #C: 10.5
MULTIPLY 3 BY -4 GIVING #D
                                     #D: -12
MULTIPLY -3 BY -4 GIVING #D
                                     #D: 12
MULTIPLY 3 BY 0 GIVING #D
                                     #D: 0
#ARRAY1: 5 5 5 #ARRAY2:
                                             10
                                                   10
                                                          10
                                                                10
MULTIPLY #ARRAY1 (2,*) BY #ARRAY2 (4,*)
                                                   10
                                                          10
                                                                10
#ARRAY1:
           50
                  50
                        50
                              50 #ARRAY2:
                                             10
```

# 95 NEWPAGE

Function	74	12
Syntax Description		
Example	74	13



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The NEWPAGE statement is used to cause an advance to a new page. NEWPAGE also causes any AT END OF PAGE and WRITE TRAILER statements to be executed. A default title containing the date, time of day, and page number will appear on each new page unless a WRITE TITLE, WRITE NOTITLE, or DISPLAY NOTITLE statement is specified to define specific title processing.



#### Notes:

- 1. The advance to a new page is not performed at the time when the NEWPAGE statement is executed. It is performed only when a subsequent statement which produces output is executed.
- 2. If the NEWPAGE statement is not used, page advance is controlled automatically based on the Natural profile/session parameter PS (Page Size for Natural Reports).

## Syntax Description

Operand Definition Table:

Operand	Possible Structure					Possible Formats					ats	Referencing Permitted	Dynamic Definition	
operand1	C	S				N	ΡI					yes	no	

Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	The notation ( $rep$ ) may be used to specify the identification of the report for which the NEWPAGE statement is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If (rep) is not specified, the NEWPAGE statement will be applicable to the first report (Report 0).
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> (in the <i>Programming Guide</i> ).
EVEN IF TOP OF PAGE	EVEN IF TOP OF PAGE Option:
	This option is used to cause a new page (with corresponding AT TOP OF PAGE and page title processing) to be generated, even if a new page was initiated immediately before the NEWPAGE statement was encountered.
WHEN LESS THAN	WHEN LESS THAN LINES LEFT Option:
operand1 LINES LEFT	This option is used to cause a new page to be generated when there are less than <code>operand1</code> lines left on the current page (current line count compared with value for the Natural profile/session parameter <code>PS</code> ).
WITH TITLE	WITH TITLE Option:
title-definition	This option can be used to specify a title which is to be written to the new page generated.
	The <i>title-definition</i> is specified using the same syntax as described for the WRITE TITLE statement, except that the SKIP clause is not allowed in a NEWPAGE WITH TITLE <i>title-definition</i> statement.

# **Example**

```
** Example 'NWPEX1': NEWPAGE

*************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 CITY

2 NAME

2 SALARY (1)

2 CURR-CODE (1)

END-DEFINE

*

LIMIT 15

READ EMPLOY-VIEW BY CITY FROM 'DENVER'
```

```
DISPLAY CITY (IS=ON) NAME SALARY (1) CURR-CODE (1)
 AT BREAK OF CITY
  SKIP 1
  /*
  NEWPAGE WHEN LESS THAN 10 LINES LEFT
  WRITE '************
      'SUMMARY FOR ' OLD(CITY)
      'SUM OF SALARIES: 'SUM(SALARY(1))
      'AVG OF SALARIES: 'AVER(SALARY(1))
      NEWPAGE
  /*
 END-BREAK
END-READ
END
```

### **Output of Program NWPEX1 - Page 1:**

Page	1				05-01-18	10:01:45
	CITY	NAME	ANNUAL SALARY	CURRENC' CODE	( -	
DENVER		TANIMOTO MEYER	33000 50000			
*****	*****	*****				
SUMMARY						
		******				
		******				
	SALARIES:	83000				
	SALARIES:	41500				
*****	*****	******				

### **Output of Program NWPEX1 - Page 2:**

Page	2			05-01-18	10:01:45
	CITY	NAME	ANNUAL SALARY	CURRENCY CODE	
DERBY		DEAKIN	8750	UKL	
		GARFIELD	6750	UKL	
		MUNN	8800	UKL	
		MUNN	5650	UKL	
		GREBBY	9550	UKL	
		WHITT	8650	UKL	

	PONSONBY MAGUIRE HEYWOOD BRYDEN SMITH	5500 4150 3900 6750 39000	UKL UKL UKL						
	CONQUEST ACHIESON	45000 11300							
		11300	UNL						
**************************************									

## **Output of Program NWPEX1 - Page 3:**

DERBY	DEAKIN	8750	IIKI
DENBI	GARFIELD	6750	· · · · =
	MUNN	8800	UKL
	MUNN	5650	UKL
	GREBBY	9550	UKL
	WHITT	8650	UKL
	PONSONBY	5500	UKL
	MAGUIRE	4150	UKL
	HEYWOOD	3900	
	BRYDEN	6750	
	SMITH	39000	
	CONQUEST	45000	
	ACHIESON	11300	UKL
*****	******		
SUMMARY FOR DERBY	*****		
*****	******		
SUM OF SALARIES:	163750		
AVG OF SALARIES:	12596		
****	******		

# 96 OBTAIN

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Syntax Description	749
Examples	

OBTAIN operand1 ...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Reporting Mode Statements

### **Function**

The <code>OBTAIN</code> statement is used in reporting mode to cause one or more fields to be read from a file. The <code>OBTAIN</code> statement does not generate any executable code in the Natural object program. It is primarily used to read a range of values of a multiple-value field or a range of occurrences of a periodic group so that portions of these ranges may be subsequently referenced in the program.

An OBTAIN statement is *not* required for each database field to be referenced in the program since Natural automatically reads each database field referenced in a subsequent statement (for example, a DISPLAY or COMPUTE statement).

When multiple-value or periodic-group fields in the form of an array are referenced, the array must be defined with an <code>OBTAIN</code> statement to ensure that it is built for all occurrences of the fields. If individual multiple-value or periodic-group fields are referenced before the array is defined, the fields will not be placed within the array and will exist independent of the array. The fields will contain the same value as the corresponding occurrence within the array.

Individual occurrences of multiple-value or periodic-group fields or subarrays can be held within a previously defined array if the array dimensions of the second individual occurrence or array are contained within the initial array.

References to multiple-value or periodic-group fields with unique variable index cannot be contained in an array of values. If individual occurrences of an array are to be processed with a variable index, the index expression must be prefixed with the unique variable index to denote the individual array.

### Restriction

The OBTAIN statement is for reporting mode only.

## **Syntax Description**

#### Operand Definition Table:

Operand	Poss	sible	Stı	ruct	ure			Po	oss	ibl	le l	Foi	ma	ats		Referencing Permitted	Dynamic Definition
operand1	S	3 /	A	G		A	U	N	Р	I	F :	В	D	T [	L	yes	yes

#### Syntax Element Description:

Syntax Element	Description
operand1	Fields to be Read:
	With operand1 you specify the field(s) to be made available as a result of the <code>OBTAIN</code> statement.

#### **Examples:**

```
READ FINANCE OBTAIN CREDIT-CARD (1-10)
DISPLAY CREDIT-CARD (3-5) CREDIT-CARD (6-8)
SKIP 1 END
```

The above example results in the first 10 occurrences of the field CREDIT-CARD (which is contained in a periodic group) being read and occurrences 3-5 and 6-8 being displayed where the subsequent subarrays will reside in the initial array (1-10).

```
READ FINANCE
MOVE 'ONE' TO CREDIT-CARD (1)
DISPLAY CREDIT-CARD (1) CREDIT-CARD (1-5)
```

#### Output:

	CREDIT-CARD	CREDIT-CARD	
ONE		DINERS CLUB AMERICAN EXPRESS	
ONE		AVIS AMERICAN EXPRESS	

```
ONE HERTZ
AMERICAN EXPRESS

ONE UNITED AIR TRAVEL
```

The first reference to CREDIT-CARD (1) is not contained within the array. The array which is defined after the reference to the unique occurrence (1) cannot retroactively include a unique occurrence or an array which is shorter than the one being defined.

```
READ FINANCE
OBTAIN CREDIT-CARD (1-5)
MOVE 'ONE' TO CREDIT-CARD (1)
DISPLAY CREDIT-CARD (1) CREDIT-CARD (1-5)
```

#### Output:

CREDIT-CARD	CREDIT-CARD
ONE	ONE AMERICAN EXPRESS
ONE	ONE
ONL	AMERICAN EXPRESS
ONE	ONE AMERICAN EXPRESS
	AMENICAN EXPRESS
0.115	aug
ONE	ONE

The individual reference to CREDIT-CARD (1) is contained within the array defined in the OBTAIN statement.

```
MOVE (1) TO INDEX
READ FINANCE
DISPLAY CREDIT-CARD (1-5) CREDIT-CARD (INDEX)
```

#### Output:

```
CREDIT-CARD

DINERS CLUB

AMERICAN EXPRESS

AVIS

AMERICAN EXPRESS

HERTZ

AMERICAN EXPRESS

UNITED AIR TRAVEL UNITED AIR TRAVEL
```

The reference to CREDIT-CARD using the variable index notation is not contained within the array.

```
RESET A(A20) B(A20) C(A20)

MOVE 2 TO I (N3)

MOVE 3 TO J (N3)

READ FINANCE

OBTAIN CREDIT-CARD (1:3) CREDIT-CARD (I:I+2) CREDIT-CARD (J:J+2)

FOR K (N3) = 1 TO 3

MOVE CREDIT-CARD (1.K) TO A

MOVE CREDIT-CARD (I.K) TO B

MOVE CREDIT-CARD (J.K) TO C

DISPLAY A B C

LOOP /* FOR

LOOP / * READ

END
```

#### Output:

			Α		В	С
C	 A R D	01	C.A.	 ARD 02	CARI	03
C	ARD	02	CA	ARD 03	CARI	04
C	ARD	03	CA	ARD 04	CARI	05

The three arrays may be accessed individually by using the unique base index as qualifier for the index expression.

#### **Invalid Example 1**

```
READ FINANCE
OBTAIN CREDIT-CARD (1-10)
FOR I 1 10
MOVE CREDIT-CARD (I) TO A(A20)
WRITE A
END
```

The above example will produce error message NAT1006 (value for variable index = 0) because, at the time the record is read (READ), the index I still contains the value 0.

In any case, the above example would not have printed the first 10 occurrences of CREDIT-CARD because the individual occurrence with the variable index cannot be contained in the array and the variable index (I) is only evaluated when the next record is read.

The following is the correct method of performing the above:

```
READ FINANCE
OBTAIN CREDIT-CARD (1-10)
FOR I 1 10
MOVE CREDIT-CARD (1.I) TO A (A20)
WRITE A
END
```

#### **Invalid Example 2**

```
READ FINANCE
FOR I 1 10
WRITE CREDIT-CARD (I)
END
```

The following is the correct method of performing the above:

```
READ FINANCE
FOR I 1 10
GET SAME
WRITE CREDIT-CARD (0030/I)
END
```

The GET SAME statement is necessary to reread the record after the variable index has been updated in the FOR loop.

## **Examples**

- Example 1 OBTAIN Statement
- Example 2 OBTAIN Statement with Multiple Ranges

#### **Example 1 - OBTAIN Statement**

#### **Output of Program OBTEX1:**

```
05-02-08 13:37:48
Page
         1
NAME: SENKO
SALARIES (1:4):
                 31500
                              29900
                                        28100
                                                   26600
                31500
SALARY
      1
        2
SALARY
                29900
SALARY
        3
               28100
SALARY
       4
               26600
NAME: HAMMOND
```

SALARIES	(1:4):	22000	20200	18700	17500
SALARY	1	22000			
SALARY	2	20200			
SALARY	3	18700			
SALARY	4	17500			

#### **Example 2 - OBTAIN Statement with Multiple Ranges**

```
** Example 'OBTEX2': OBTAIN (with multiple ranges)
**********************
RESET #INDEX (I1) #K (I1)
#INDEX := 2
∦K
  := 3
LIMIT 2
READ EMPLOYEES BY CITY
 OBTAIN SALARY (1:5)
        SALARY (#INDEX:#INDEX+3)
 IF SALARY (5) GT 0 DO
   WRITE '=' NAME
   WRITE 'SALARIES (1-5):' SALARY (1:5) /
   WRITE 'SALARIES (2-5): SALARY (#INDEX:#INDEX+3)
   WRITE 'SALARIES (2-5): SALARY (#INDEX.1:4) /
   WRITE 'SALARY 3:' SALARY (3)
   WRITE 'SALARY 3:' SALARY (#K)
   WRITE 'SALARY 4:' SALARY (#INDEX.#K)
 DOEND
L00P
```

#### **Output of Program OBTEX2:**

Page 1					05-02-08	13:38:31
NAME: SENKO SALARIES (1-5):	31500	29900	28100	26600	25200	
					23200	
SALARIES (2-5): SALARIES (2-5):	29900 29900	28100 28100	26600 26600	25200 25200		
SALARY 3: 28	8100					
SALARY 3: 28	8100					
SALARY 4: 26	6600					

For further examples of using the OBTAIN statement, see *Referencing a Database Array* in the *Programming Guide*.

# 97 ON ERROR

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#### Structured Mode Syntax

```
ON ERROR

statement...
END-ERROR
```

#### **Reporting Mode Syntax**

```
 \begin{array}{c|c} \textbf{ON ERROR} & \left\{ \begin{array}{c} \textit{statement...} \\ \textbf{DO } \textit{statement...} \ \textbf{DOEND} \end{array} \right\} \\ \end{array}
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DECIDE FOR | DECIDE ON | IF | IF SELECTION

## **Function**

The ON ERROR statement is used to intercept execution time errors which would otherwise result in a Natural error message, followed by termination of Natural program execution, and a return to command input mode.

When the ON ERROR statement block is entered for execution, the normal flow of program execution has been interrupted and cannot be resumed except for Natural error 3145 (record requested in hold), in which case a RETRY statement will cause processing to be resumed exactly where it was suspended.

This statement is non-procedural (that is, its execution depends on an event, not on where in a program it is located).

### Restriction

Only one ON ERROR statement is permitted in a Natural object.

## **Syntax Description**

Syntax Element	Description
statement	Defining the ON ERROR Processing:
	To define the processing that shall take place when an ON ERROR condition has been encountered, you can specify one or multiple statements.
	Exiting from an ON ERROR Block:
	An ON ERROR block may be exited by using a FETCH, STOP, TERMINATE, RETRY, ESCAPE ROUTINE or ESCAPE MODULE statement. If the block is not exited using one of these statements, standard error message processing is performed and program execution is terminated.
END-ERROR	End of ON ERROR Statement Block:
statement DO statement DOENI	In structured mode, the Natural reserved word END-ERROR must be used to end an ON ERROR statement block.
	In reporting mode, use the DO DOEND statements to supply one or multiple statements, and to end the ON ERROR statement. If you specify only a single statement, you can omit the DO DOEND statements. With respect to good coding practice, this is not recommended.

# ON ERROR Processing within Objects on Different Levels

In an object call hierarchy created by means of CALLNAT, PERFORM or FETCH RETURN statements, each object may contain an ON ERROR statement.

When an error occurs, Natural will trace back the call hierarchy and select the first ON ERROR statement encountered in an object for execution.

For further information, see *Processing of Application Errors* in the *Programming Guide*.

## **System Variables**

The following Natural system variables can be used in conjunction with the ON ERROR statement (as shown in the **Example** below):

System Variable	Explanation
*ERROR-NR	Contains the number of the error detected by Natural.
*ERROR-LINE	Contains the line number of the statement which caused the error.
*PROGRAM	Contains the name of the Natural object that is currently being executed.

## **Example**

```
** Example 'ONEEX1': ON ERROR
**
**
CAUTION: Executing this example will modify the database records!
*************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 CITY
1 #NAME (A20)
1 #CITY (A20)
END-DEFINE
REPEAT
 INPUT 'ENTER NAME: ' #NAME
 IF #NAME = ' '
   STOP
 END-IF
  FIND EMPLOY-VIEW WITH NAME = #NAME
   INPUT (AD=M) 'ENTER NEW VALUES:' ///
                'NAME:' NAME /
                'CITY:' CITY
   UPDATE
   END TRANSACTION
   ON ERROR
     IF *ERROR-NR = 3009
       WRITE 'LAST TRANSACTION NOT SUCCESSFUL'
           / 'HIT ENTER TO RESTART PROGRAM'
       FETCH 'ONEEX1'
     END-IF
```

```
WRITE 'ERROR' *ERROR-NR 'OCCURRED IN PROGRAM' *PROGRAM

'AT LINE' *ERROR-LINE

FETCH 'MENU'

END-ERROR

/*

END-FIND

END-REPEAT

END
```

# 98 OPEN CONVERSATION

Function	762
Syntax Description	762
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OPEN CONVERSATION USING [SUBPROGRAMS] operand1 ...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CLOSE CONVERSATION | DEFINE DATA CONTEXT

Belongs to Function Group: Natural Remote Procedure Call

## **Function**

The statement OPEN CONVERSATION is used in conjunction with the Natural RPC (Remote Procedure Call). It allows the RPC Client to open a conversation and specify the remote subprograms to be included in the conversation.

When the OPEN CONVERSATION statement is executed, it assigns a unique ID identifying the conversation to the system variable \*CONVID.

## **Syntax Description**

#### Operand Definition Table:

Operand	Possible Structure					Possible Formats								S	Referencing Permitted	Dynamic Definition
operand1	C	S	A			A									yes	no

#### Syntax Element Description:

Syntax Element	Description
operand1	Subprogram Names:
	As <i>operand1</i> you specify the names of the remote subprograms to be included in the conversation.
	The name of a subprogram can be specified either as a constant of 1 to 8 characters, or as an alphanumeric variable of length 1 to 8.

# **Further Information and Examples**

See the following sections in the *Natural RPC (Remote Procedure Call)* documentation:

- Natural RPC Operation in Conversational Mode
- *Using a Conversational RPC*

# 99 OPTIONS

Function	70	66
Processing of Multiple OPTIONS Statements	7	66

OPTIONS parameter...

## **Function**

The OPTIONS statement can be used to specify compilation options as parameters for the current Natural object. These are the same options that can be specified

- statically with the NTCMPO macro;
- dynamically with the CMPO parameter;
- within a Natural session with the COMPOPT system command.

In addition, the OPTIONS statement can be used to specify options for the *Natural Optimizer Compiler*. These options are described in the *Natural Optimizer Compiler* documentation.

Natural Optimizer Compiler options specified with the MCG option are checked for validity even if the Natural Optimizer Compiler is not installed.

## **Processing of Multiple OPTIONS Statements**

If multiple <code>OPTIONS</code> statements are specified within the same Natural object, the option settings take effect immediately. However, this is not the case with the options <code>PSIGNF</code>, <code>TSENABL</code>, <code>GFID</code>, <code>DB2BIN</code> and <code>DB2PKYU</code>. For these options, the option value specified with the <code>last</code> <code>OPTIONS</code> statement applies.

# XII

■ 100 PARSE XML	769
■ 101 PASSW	779
■ 102 PERFORM	
■ 103 PERFORM BREAK PROCESSING	791
■ 104 PRINT	795
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■ 106 PROCESS COMMAND	809
■ 107 PROCESS PAGE	825
■ 108 PROCESS SQL (SQL)	839
■ 109 PROPERTY	843

# 100 PARSE XML

Function	7	70
Syntax Description	7	71
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```
PARSE XML operand1 [INTO [PATH operand2] [NAME operand3] [VALUE operand4]]

[[NORMALIZE] NAMESPACE operand5 PREFIX operand6]

statement...

END-PARSE (structured mode only)

LOOP (reporting mode only)
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statement: REQUEST DOCUMENT

Belongs to Function Group: Internet and XML

### **Function**

The PARSE XML statement allows you to parse XML documents from a Natural program. See also *Statements for Internet and XML Access* in the *Programming Guide*.

It is recommended that you use dynamic variables when using the PARSE statement, because it is impossible to determine the length of a static variable. Using static variables could in turn lead to the truncation of the value that is to be written into the variable.

For information on Unicode support, see PARSE XML in the *Unicode and Code Page Support* documentation.

#### Mark-Up

The following are markings used in path strings to represent the different data types in an XML document (on ASCII-based systems):

Marking	XML Data	Location in Path String
?	Processing instruction (except for XML? )	end
!	Comment	end
С	CDATA section	end
@	Attribute (on mainframes: § or @, depending on session code page and terminal emulation)	before the attribute name
/	Closing tag and/or parent name separator in a path	end or between parent names
\$	Parsed data - character data string	end

By using this additional markup in the path string, one can more easily identify the different elements of the XML document in the output document.

#### **Global Namespace**

To specify the global namespace, use a colon (:) as prefix and an empty URI.

#### Related System Variables

The following Natural system variables are automatically created for each PARSE XML statement issued:

- \*PARSE-TYPE
- \*PARSE-LEVEL
- \*PARSE-ROW
- \*PARSE-COL
- \*PARSE-NAMESPACE-URI

The notation (r) after \*PARSE-TYPE, \*PARSE-LEVEL, \*PARSE-ROW, \*PARSE-COL and \*PARSE-NAMESPACE-URI is used to indicate the label or statement number of the statement in which the PARSE was issued. If (r) is not specified, the corresponding system variable represents the system variable of the XML data currently being processed in the active PARSE processing loop.

For more information on these system variables, see the *System Variables* documentation.

# **Syntax Description**

Operand Definition Table:

Operand	Po	ssib	le St	ructui	re	Possible Formats					ats	Referencing Permitted	Dynamic Definition	
operand1	C	S			A	U	В						yes	no
operand2		S			A	U	В						yes	yes
operand3		S			A	U	В				П		yes	yes
operand4		S			A	U	В				П		yes	yes
operand5		S	A		A	U	В						yes	yes
operand6		S	A		A	U	В						yes	yes

Syntax Element Description:

Syntax Element	Description
operand1	XML Document: operand1 represents the XML document in question. The XML document may not be changed while it is being parsed. If you try to change the XML document during parsing (by writing into it, for example), an error message will be displayed.
operand2	Path:  operand2 represents the PATH of the data in the XML document.  The PATH contains the name of the identified XML part, the names of all parents, as well as the type of the XML part.  Note: The information given with PATH can be used to easily fill a tree view.  See also Example 1 - Using operand2.
operand3	Data Element Name:  operand3 represents the NAME of a data element in the XML document.  If NAME has no value, then the dynamic variable associated with it will be set to *length()=0, which is a static variable filled with a blank.  See also Example 2 - Using operand3.
operand4	Data Element Content:  operand4 represents the content (VALUE) of a data element in the XML document.  If there is no value, a given dynamic variable will be set to *length()=0, which is a static variable filled with a blank.  See also Example 3 - Using operand4.
operand5 and operand6 NORMALIZE NAMESPACE PREFIX	Namespace URI and Prefix:  The NAMESPACE URI or Uniform Resource Identifier (operand5) and the namespace PREFIX (operand6) are copied during runtime. Therefore, modifying the namespace mapping arrays inside the PARSE XML loop will not affect the parser.  operand5 and operand6 are one-dimensional arrays with an equal number of occurrences.  Namespace normalization is a feature of the PARSE statement. XML is capable of defining namespaces for the element names:
	The NAMESPACE definition consists of two parts:  a namespace PREFIX (which is, in this case, myns) and  a URI (myuri) to define the namespace.

Syntax Element	Description
	The namespace PREFIX is part of the element name. This means, that for the PARSE statement, and especially for <i>operand2</i> , the generated PATH strings depend on the namespace PREFIX. If the path inside a Natural program is used to indicate specific tags, then this will fail if an XML document uses the correct NAMESPACE (URI), but with a different PREFIX.
	With namespace normalization, all namespace PREFIXes can be set to defaults which have been defined in the NAMESPACE clause. The first entry will be the one used if a URI is specified more than once. If more than one PREFIX is used in the XML document, then only the first one will be taken into account for the output. The rest will be ignored.
	The NAMESPACE clause contains pairs of namespace URIs and prefixes. For example:
	<pre>uri(1) := 'http://namespaces.softwareag.com/natural/demo' pre(1) := 'nat:'</pre>
	If NAMESPACE is defined inside an XML document, the parser checks to see if that namespace (URI) exists in the normalization table. The prefix of the normalization table is used for all output data from the PARSE statement, instead of the namespace defined in the XML document.
	See also:
	■ Example 4 - Using operand5 and operand6
	Example 5 - Using operand5 and operand6 with Namespace Normalization
	Additional Information Concerning PREFIX:
	In addition, the following applies to the prefix definition:
	The prefix definition in the namespace normalization array always has to end in a colon (:), since this is the string that will be replaced.
	■ A PREFIX or a URI may only occur once in a namespace normalization array.
	■ If a PREFIX or the NAMESPACE URI contains trailing blanks (e.g. when using a static variable), the trailing blanks will be removed before the external parser is called.
	■ If the PREFIX definition at the namespace normalization only contains a colon (:), the NAMESPACE PREFIX will be reduced to a colon (:).
	■ If the PREFIX definition at the namespace normalization is empty, then the NAMESPACE PREFIX will be deleted.
END-PARSE	End of PARSE XML Statement:
LOOP	In structured mode, the Natural reserved keyword END-PARSE must be used to end the PARSE XML statement.
	In reporting mode, the Natural statement LOOP is used to end the PARSE XML statement.

# **Examples**

- Example 1 Using operand2
- Example 2 Using operand3
- Example 3 Using operand4
- Example 4 Using operand5 and operand6
- Example 5 Using operand5 and operand6 with Namespace Normalization

#### Example 1 - Using operand2

The following XML code

```
myxml := '<?xml version="1.0" ?>'-
    '<employee personnel-id="30016315" >'-
    '<full-name>'-
    '<!--this is just a comment-->'-
    '<first-name>RICHARD</first-name>'-
    '<name>FORDHAM</name>'-
    '</full-name>'-
    '</employee>'
```

processed by the following Natural code:

```
PARSE XML myxml INTO PATH mypath
PRINT mypath
END-PARSE
```

produces the following output:

```
employee
employee/@personnel-id
employee/full-name
employee/full-name/!
employee/full-name/first-name
employee/full-name/first-name/$
employee/full-name/first-name//
employee/full-name/name/
employee/full-name/name
employee/full-name/name/$
employee/full-name/name//
employee/full-name/name//
```

#### Example 2 - Using operand3

The following XML code

```
myxml := '<?xml version="1.0" ?>'-
    '<employee personnel-id="30016315" >'-
    '<full-name>'-
    '<!--this is just a comment-->'-
    '<first-name>RICHARD</first-name>'-
    '<name>FORDHAM</name>'-
    '</full-name>'-
    '</employee>'
```

processed by the following Natural code:

```
PARSE XML myxml INTO PATH mypath NAME myname
DISPLAY (AL=39) mypath myname
END-PARSE
```

**Note:** produces the following output:

```
MYPATH
                                                      MYNAME
employee
                                       employee
employee/@personnel-id
                                       personnel-id
employee/full-name
                                       full-name
employee/full-name/!
employee/full-name/first-name
                                       first-name
employee/full-name/first-name/$
employee/full-name/first-name//
                                       first-name
employee/full-name/name
                                       name
employee/full-name/name/$
employee/full-name/name//
                                       name
employee/full-name//
                                       full-name
employee//
                                       employee
```

#### Example 3 - Using operand4

The following XML code

#### processed by the following Natural code:

```
PARSE XML myxml INTO PATH mypath VALUE myvalue
DISPLAY (AL=39) mypath myvalue
END-PARSE
```

#### produces the following output:

```
MYPATH
                                                      MYVALUE
employee
employee/@personnel-id
                                      30016315
employee/full-name
employee/full-name/!
                                      this is just a comment
employee/full-name/first-name
employee/full-name/first-name/$
                                      RICHARD
employee/full-name/first-name//
employee/full-name/name
employee/full-name/name/$
                                      FORDHAM
employee/full-name/name//
employee/full-name//
employee//
```

#### Example 4 - Using operand5 and operand6

#### The following XML code

processed by the following Natural code:

```
PARSE XML myxml INTO PATH mypath
PRINT mypath
END-PARSE
```

#### produces the following output:

```
nat:employee
nat:employee/@nat:personnel-id
nat:employee/@xmlns:nat
nat:employee/nat:full-Name
nat:employee/nat:full-Name/nat:first-name
nat:employee/nat:full-Name/nat:first-name/$
nat:employee/nat:full-Name/nat:first-name//
nat:employee/nat:full-Name/nat:name
nat:employee/nat:full-Name/nat:name/$
nat:employee/nat:full-Name/nat:name//
nat:employee/nat:full-Name/nat:name//
nat:employee/nat:full-Name//
```

#### Example 5 - Using operand5 and operand6 with Namespace Normalization

Using NORMALIZE NAMESPACE, the same XML document as in Example 4 with a different NAMESPACE PREFIX would produce exactly the same output.

#### XML code:

#### Natural code:

```
uri(1) := 'http://namespaces.softwareag.com/natural/demo'
pre(1) := 'nat:'
*
PARSE XML myxml INTO PATH mypath NORMALIZE NAMESPACE uri(*) PREFIX pre(*)
    PRINT mypath
END-PARSE
```

#### Output of above program:

```
nat:employee
nat:employee/@nat:personnel-id
nat:employee/@xmlns:nat
nat:employee/nat:full-Name
nat:employee/nat:full-Name/nat:first-name
nat:employee/nat:full-Name/nat:first-name/$
nat:employee/nat:full-Name/nat:first-name//
nat:employee/nat:full-Name/nat:name
nat:employee/nat:full-Name/nat:name/$
nat:employee/nat:full-Name/nat:name//
nat:employee/nat:full-Name/nat:name//
nat:employee/nat:full-Name//
```

# 101 PASSW

Function	780
Restriction	781
Syntax Description	781
Example	

PASSW=operand1

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | HISTOGRAM | GET | GET SAME | GET TRANSACTION | LIMIT | PERFORM BREAK PROCESSING | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The PASSW statement is used to specify a default password for access to Adabas or VSAM files which have been password-protected.



**Note:** This password can be overwritten using the PASSWORD clause of the database access statements FIND, GET, HISTOGRAM, READ, STORE.

#### **Natural Security Considerations**

In the security profile of a library, you can specify a default Adabas password (as described in the *Natural Security* documentation); this password applies to all database access statements for which neither an individual password is specified nor a PASSW statement applies. It applies within the library in whose security profile it is specified, and also remains in effect in other libraries you subsequently log on to and in whose security profiles no password is specified.

#### **Password Display Protection**

If the password is specified as a constant, the PASSW statement should always be coded at the very beginning of a source-code line, and there should be no blank between the keyword PASSW and the equal sign; this ensures that the password is not visible/displayable in the source code of the program.

In TP mode:

You may enter the PASSW statement invisible by entering the terminal command %\* before you type in the PASSW statement.

```
In batch mode:

A password may be provided by specifying the following statements in the line editor:

EDT

PASSW='password'
END

.E
RUN

The password value will not appear in the printed output.
```

# Restriction

This statement is not valid for DL/I and DB2 databases.

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure					Possible Formats								Referencing Permitted	Dynamic Definition
operand1	C	S				A								yes	no

Syntax Element Description:

Syntax Element	Description
operand1	Password:
	The password (operand1) may be specified as an alphanumeric constant or the content of an alphanumeric variable. It may consist of up to 8 characters, and must not contain special characters or embedded blanks. If the password is specified as a constant, it must be enclosed in apostrophes.
	The password specified with the PASSW statement applies to all database access statements (FIND, GET, HISTOGRAM, READ, STORE) for which no individual password is specified. It remains in effect until another password is specified in the execution of a subsequent PASSW statement or the Natural session is terminated.
	A password specified with a specific database access statement applies only to that statement, not to any subsequent statement.

# **Example**

Example Program PWDEX1 with Password Display Protection (see above):

```
** Example 'PWDEX1': PASSW

*********************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

END-DEFINE

*

PASSW=

Password not visible

*

LIMIT 5

READ EMPLOY-VIEW

DISPLAY NOTITLE PERSONNEL-ID NAME

END-READ

*

END
```

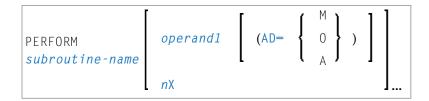
#### **Output of Program PWDEX1:**

```
PERSONNEL NAME
ID

50005800 ADAM
50005600 MORENO
50005500 BLOND
50005300 MAIZIERE
50004900 CAOUDAL
```

# 102 PERFORM

Function	784
Syntax Description	784
Examples	787



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CALL | CALL | FILE | CALL | LOOP | CALLNAT | DEFINE SUBROUTINE | ESCAPE | FETCH

Belongs to Function Group: Invoking Programs and Routines

# **Function**

The PERFORM statement is used to invoke a Natural subroutine.

#### **Nested PERFORM Statements**

The invoked subroutine may contain a PERFORM statement to invoke another subroutine (the number of nested levels is limited by the size of the required memory).

A subroutine may invoke itself (recursive subroutine). If database operations are contained within an external subroutine that is invoked recursively, Natural will ensure that the database operations are logically separated.

#### **Parameter Transfer with Dynamic Variables**

See the statement CALLNAT.

# **Syntax Description**

Operand Definition Table:

Operand	Pos	ssibl	le St	ruct	ure				Po	ssi	ble	F	orı	ma	ts				Referencing Permitted	Dynamic Definition
operand1	C	S	A	G		A	U	N	Р	I	7 I	B ]	D	T	L	C	G	Ο	yes	yes

Syntax Element Description:

Syntax Element	Description								
subroutine-name	Subroutine to be Invoked:								
	For a subroutine name (maximum 32 characters), the same naming conventions apply as for user-defined variables.								
	The subroutine name is independent of the name of the module in which the subroutine is defined (it may but need not be the same).								
	The subroutine to be invoked must be defined with a DEFINE SUBROUTINE statement. It may be an inline or external subroutine (see DEFINE SUBROUTINE statement).								
	Within one object, no more than 50 external subroutines may be referenced.								
	Data Available in a Subroutine								
	■ Inline Subroutines  No explicit parameters can be passed from the invoking object to an inline subroutine.  An inline subroutine has access to the currently established global data area as well as the local data area defined within the same object module.								
	■ External Subroutines  An external subroutine has access to the currently established global data area.  Moreover parameters can be passed with the PERFORM statement from the invoking object to the external subroutine (see <code>operand1</code> ); thus, you may reduce the size of the global data area.								
operand1	Parameters to be Passed:								
	When an external subroutine is invoked with the PERFORM statement, one or more parameters (operand1) can be passed with the PERFORM statement from the invoking object to the external subroutine. For an inline subroutine, operand1 cannot be specified.								
	If parameters are passed, the structure of the parameter list must be defined in a DEFINE DATA statement.								
	By default, the parameters are passed "by reference", that is, the data are transferred via address parameters, the parameter values themselves are not moved. However, it is also possible to pass parameters "by value", that is, pass the actual parameter values. To do so, you define these fields in the DEFINE DATA PARAMETER statement of the subroutine with the option BY VALUE or BY VALUE RESULT.								
	■ If parameters are passed "by reference" the following applies: The sequence, format and length of the parameters in the invoking object must match exactly the sequence, format and length of the DEFINE DATA PARAMETER structure of the invoked subroutine. The names of the variables in the invoking object and the subroutine may be different.								
	■ If parameters are passed "by value" the following applies: The sequence of the parameters in the invoking object must match exactly the sequence in the DEFINE DATA PARAMETER structure of the invoked subroutine. Formats and lengths of the								

Syntax Element	Description									
	have to be data transfer con and the subroutine may be in the subroutine are to be these fields with BY VALUE	bject and the subroutine may be different; however, they need to be a different. If parameter values that have been modified passed back to the invoking object, you have to define E RESULT. With BY VALUE (without RESULT) it is not parameter values back to the invoking object (regardless also below).								
	subroutine accesses this copy parameter values in the invol likewise created; however, af	<b>Note:</b> With BY VALUE, an internal copy of the parameter values is created. The subroutine accesses this copy and can modify it, but this will not affect the original parameter values in the invoking object. With BY VALUE RESULT, an internal copy is likewise created; however, after termination of the subroutine, the original parameter values are overwritten by the (modified) values of the copy.								
	For both ways of passing par	rameters, the following applies:								
	■ In the parameter data area of the invoked subroutine, a redefinition of groups is only permitted within a REDEFINE block.									
	<ul> <li>If an array is passed, its number of dimensions and occurrences in the subrouting parameter data area must be same as in the PERFORM parameter list.</li> <li>Note: If multiple occurrences of an array that is defined as part of an indexed ground are passed with the PERFORM statement, the corresponding fields in the subroutine parameter data area must not be redefined, as this would lead to the wrong address being passed.</li> </ul>									
AD=	Attributes:									
	If operand1 is a variable, you can mark it in one of the following ways:									
	AD=0	Non-modifiable, see session parameter AD=0.								
		<b>Note:</b> Internally, AD=0 is processed in the same way								
		as BY VALUE (see Note under operand1).								
	AD=M	Modifiable, see session parameter AD=M.								
		This is the default setting.								
	AD=A Input only, see session parameter AD=A.									
	If operand1 is a constant, AD cannot be explicitly specified. For constants, AD=0 always applies.									
nX	Parameters to be Skipped:									
	example, 1 x to skip the next	specify that the next $n$ parameters are to be skipped (for parameter, or $3 \times 10^{-5}$ to skip the next three parameters); this ameters no values are passed to the external subroutine.								

Syntax Element	Description
	A parameter that is to be skipped must be defined with the keyword OPTIONAL in the
	subroutine's DEFINE DATA PARAMETER statement. OPTIONAL means that a value can
	- but need not - be passed from the invoking object to such a parameter.

# **Examples**

- Example 1 PERFORM as Inline Subroutine
- Example 2 PERFORM as External Subroutine

#### Example 1 - PERFORM as Inline Subroutine

```
** Example 'PEREX1': PERFORM (as inline subroutine)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 ADDRESS-LINE (A20/2)
 2 PHONE
1 #ARRAY
          (A75/1:4)
1 REDEFINE #ARRAY
2 #ALINE (A25/1:4,1:3)
1 #X
      (N2) INIT <1>
1 #Y
          (N2) INIT <1>
END-DEFINE
LIMIT 5
FIND EMPLOY-VIEW WITH CITY = 'BALTIMORE'
 MOVE NAME
                     TO #ALINE (#X,#Y)
 MOVE ADDRESS-LINE(1) TO #ALINE (#X+1,#Y)
 MOVE ADDRESS-LINE(2) TO #ALINE (#X+2, #Y)
 MOVE PHONE
                     TO #ALINE (#X+3,#Y)
 IF \#Y = 3
   RESET INITIAL #Y
   PERFORM PRINT
   /*
  ELSE
   ADD 1 TO #Y
  END-IF
 AT END OF DATA
   PERFORM PRINT
 END-ENDDATA
END-FIND
```

```
*
DEFINE SUBROUTINE PRINT
WRITE NOTITLE (AD=OI) #ARRAY(*)
RESET #ARRAY(*)
SKIP 1
END-SUBROUTINE
*
END
```

#### Output of Program PEREX1:

_AWLER	FORREST
1588 CANDLEBERRY AVE	37 TENNYSON DRIVE
BALTIMORE	BALTIMORE
529-0403	881-3609
NEEDHAM	
12609 BUILDERS LANE	
BALTIMORE	
541-9789	
1 3 5 1 3	588 CANDLEBERRY AVE ALTIMORE 29-0403 EEDHAM 2609 BUILDERS LANE ALTIMORE

#### **Example 2 - PERFORM as External Subroutine**

Program containing PERFORM statement:

```
** Example 'PEREX2': PERFORM (as external subroutine)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 ADDRESS-LINE (A20/2)
 2 PHONE
1 #ALINE (A25/1:4,1:3)
      (N2) INIT <1> (N2) INIT <1>
1 #X
1 #Y
END-DEFINE
LIMIT 5
FIND EMPLOY-VIEW WITH CITY = 'BALTIMORE'
 MOVE NAME TO #ALINE (#X,#Y)
 MOVE ADDRESS-LINE(1) TO \#ALINE (\#X+1,\#Y)
 MOVE ADDRESS-LINE(2) TO \#ALINE (\#X+2,\#Y)
 MOVE PHONE TO \#ALINE (\#X+3,\#Y)
  IF \#Y = 3
   RESET INITIAL #Y
   PERFORM PEREX2E #ALINE(*,*)
   /*
  ELSE
```

```
ADD 1 TO #Y
END-IF
AT END OF DATA
/*
PERFORM PEREX2E #ALINE(*,*)
/*
END-ENDDATA
END-FIND
*
END
```

#### External subroutine PEREX3 with parameters called by program PEREX2:

#### Output of Program PEREX2:

JENSON 2120 HASSELL #206 998-5038	LAWLER 4588 CANDLEBERRY AVE BALTIMORE 629-0403	FORREST 37 TENNYSON DRIVE BALTIMORE 881-3609
ALEXANDER 409 SENECA DRIVE BALTIMORE 345-3690	NEEDHAM 12609 BUILDERS LANE BALTIMORE 641-9789	

# 103 PERFORM BREAK PROCESSING

Function	792
Syntax Description	
Example	

PERFORM BREAK [PROCESSING] [(r)]

AT BREAK statement ...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | READ | RETRY | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The PERFORM BREAK PROCESSING statement is used to establish break processing in loops created by FOR, REPEAT, CALL LOOP and CALL FILE statements where no automatic break processing is established, or whenever a user-initiated break processing is desired. Unlike automatic break processing which is executed immediately after the record is read, the PERFORM BREAK PROCESSING statement is executed when it is encountered in the normal flow of the program.

This statement causes a check for a break processing condition (based on the value of a control field) and also results in the evaluation of Natural system functions. This check and system function evaluation are performed each time the statement is encountered for execution. This statement may be executed depending on a condition specified in an IF statement.

# **Syntax Description**

Syntax Element	Description
(r)	Statement Reference Notation:
	By default, the final PERFORM BREAK condition is true at the end of execution of the program, subprogram or subroutine.
	The notation ( $r$ ) may be used to relate the final processing of a PERFORM BREAK to a specific loop. In this case the PERFORM BREAK is executed in the loop end handling of this loop; after the final automatic BREAK processing and before the AT END OF DATA statements are executed.
AT BREAK statement	See the syntax of the AT BREAK statement.

# **Example**

```
** Example 'PBPEX1S': PERFORM BREAK PROCESSING (structured mode)
*******************
DEFINE DATA LOCAL
1 #INDEX (N2)
1 #LINE (N2) INIT <1>
END-DEFINE
FOR #INDEX 1 TO 18
 PERFORM BREAK PROCESSING
 AT BREAK OF #INDEX /1/
   WRITE NOTITLE / 'PLEASE COMPLETE LINES 1-9 ABOVE' /
   RESET INITIAL #LINE
 END-BREAK
 /*
 WRITE NOTITLE '_' (64) '=' #LINE
 ADD 1 TO #LINE
END-FOR
END
```

#### **Output of Program PBPEX1S:**

```
#LINE:
       #LINE:
             _____ #LINE:
           #LINE:
           _____#LINE: 6
           ______ #LINE:
                        8
      #LINE:
                   _____#LINE:
PLEASE COMPLETE LINES 1-9 ABOVE
                 ______#LINE:
       #LINE:
            _____ #LINE: 3
         ______#LINE: 5
               _____#LINE: 6
           ______ #LINE:
       #LINE:
                        8
                 ____#LINE:
PLEASE COMPLETE LINES 1-9 ABOVE
```

Equivalent reporting-mode example: PBPEX1R.

# 104 PRINT

Function	79
Syntax Description	79
Example	80

For an explanation of the symbols used in the syntax diagram, see Syntax Symbols.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The PRINT statement is used to produce output in free format.

The PRINT statement differs from the WRITE statement in the following aspects:

- The output for each operand is written according to the value content rather than the length of the operand. Leading zeros for numeric values and trailing blanks for alphanumeric values are suppressed. The session parameter AD defines whether numeric values are printed left or right justified. With AD=L, the trailing blanks of a numeric value are suppressed. With AD=R, the leading blanks of a numeric value are printed.
- If the resulting output exceeds the current line size (LS parameter), the output is continued on the next line as follows: An alphanumeric constant or the content of an alphanumeric variable (without edit mask) is split at the rightmost blank or character which is neither a letter nor a numeric character contained on the current line. The first part of the split value is output to the current line, and the second part is written to the next line. Leading blanks in the second part are removed. As a consequence, empty lines are suppressed.

For all other operands, the entire value is written to the next line.

# **Syntax Description**

## Operand Definition Table:

Operand	Pos	ssib	le St	ruct	ure				208	si	ble	Fo	orm	nat	S				Referencing Permitted	Dynamic Definition
operand1		S	A	G	N	A	U	N	Р	Ι	F	3 I	O	Т	L	(	G	O	yes	no

# Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	The notation ( $rep$ ) may be used to specify the identification of the report for which the PRINT statement is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If $(rep)$ is not specified, the PRINT statement will apply to the first report (Report 0).
	If this printer file is defined to Natural as PC, the report will be downloaded to the PC, see <i>Example 2</i> .
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> (in the <i>Programming Guide</i> ).
NOTITLE	Default Page Title Suppression:
	Natural generates a single title line for each page resulting from a PRINT statement. This title contains the page number, the time of day, and the date. Time of day is set at the beginning of the session (TP mode) or at the beginning of the job (batch mode). This default title line may be overridden by using a WRITE TITLE statement, or it may be suppressed by specifying the NOTITLE clause in the PRINT statement. Examples:
	■ Default title will be produced:
	PRINT NAME
	■ User title will be produced:

Syntax Element	Description
	PRINT NAME WRITE TITLE 'user-title'
	■ No title will be produced:
	PRINT NOTITLE NAME
	If the NOTITLE option is used, it applies to all DISPLAY, PRINT and WRITE statements within the same object which write data to the same report.
NOHDR	Column Header Suppression:
	The PRINT statement itself does not produce any column headers. However, if you use the PRINT statement in conjunction with a DISPLAY statement, you can use the NOHDR option of the PRINT statement to suppress the column headers generated by the DISPLAY statement. The NOHDR option only takes effect if the execution of the PRINT statement causes a new page to be output.
	Without the NOHDR option, the column headers (if any) of the DISPLAY statement would be output on this new page; with NOHDR they will not.
statement-parameters	Parameter Definition at Statement Level:
	One or more parameters, enclosed within parentheses, may be specified at statement level, that is, immediately after the PRINT statement or an element being displayed.
	Each parameter specified in this manner will override any previous parameter specified in a <code>GLOBALS</code> command, <code>SET GLOBALS</code> (in Reporting Mode only) or <code>FORMAT</code> statement. If more than one parameter is specified, the parameters must be separated from one another by one or more blanks. A parameter entry must not be split between two statement lines.
	The parameter settings applied here will only be regarded for variable fields, but they have no effect on text-constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element, see <i>Parameter Definition at Element (Field) Level</i> .
	See also:
	■ List of Parameters
	Example of Parameter Usage at Statement and Element (Field) Level
nX, nT, /	Field Positioning, Text, Attribute Assignment:
	See Field Positioning, Text, Attribute Assignment below.

#### **List of Parameters**

Parameters that can be spe	cified with the PRINT statement	Specification (S = at statement level, E = at element level)
AD	Attribute Definition	SE
AL	Alphanumeric Length for Output	SE
CD	Color Definition	SE
CV	Control Variable	SE
DF	Date Format	SE
DL	Display Length for Output	SE
DY	Dynamic Attributes	SE
EM	Edit Mask	SE
EMU	Unicode Edit Mask	Е
FL	Floating Point Mantissa Length	SE
MC	Multiple-Value Field Count	S
MP	Maximum Number of Pages of a Report	S
NL	Numeric Length for Output	SE
PC	Periodic Group Count	S
PM	Print Mode	SE
SG	Sign Position	SE
ZP	Zero Printing	SE

The individual session parameters are described in the *Parameter Reference*.

#### Example of Parameter Usage at Statement and Element (Field) Level

```
DEFINE DATA LOCAL
                INIT <'1234'>
                                                 /*
1 VARI (A4)
                                                        Output
END-DEFINE
                                                 /*
                                                       Produced
                                                 /*
PRINT
                                  VARI
                                                 /*
                 'Text'
                                                       Text 1234
PRINT (PM=I)
                 'Text'
                                  VARI
                                                 /*
                                                       Text 4321
                 'Text' (PM=I)
PRINT
                                  VARI (PM=I)
                                                 /*
                                                       txeT 4321
                                                 /*
PRINT
                'Text' (PM=I)
                                  VARI
                                                       txeT 1234
END
```

# Field Positioning, Text, Attribute Assignment

```
 \left\{ \begin{array}{c} nX \\ nT \\ / \end{array} \right\} \dots \left\{ \begin{array}{c} 'text' \, [(attributes)] \\ 'c' \, (n) \, [(attributes)] \\ ['='] \, operand1 \, [(parameters)] \end{array} \right\} \dots
```

### **Field Positioning Notations**

Syntax Element	Description
nX	Column Spacing: This notation inserts <i>n</i> spaces between columns. <i>n</i> must not be zero.  PRINT NAME <b>5X</b> SALARY
nT	Tab Setting:
	The $n$ <sup><math>\top</math></sup> notation causes positioning (tabulation) to print position $n$ . Backward positioning results in a line advance.
	In the following example, NAME is printed beginning in position 25, and SALARY is printed beginning in position 50:
	PRINT 25T NAME 50T SALARY
/	Line Advance - Slash Notation:
	When placed between fields or text elements, a slash (/) causes positioning to the beginning of the next print line.
	PRINT NAME / SALARY

## **Text/Attribute Assignment**

Syntax Element	Description
'text'	Text Assignment:
	The character string enclosed by single quotes is displayed.

Syntax Element	Description
	PRINT 'EMPLOYEE' NAME 'MARITAL/STATUS' MAR-STAT
'c' (n)	Character Repetition:
	The character $c$ enclosed by single quotes is displayed $n$ times immediately before the field value.
	PRINT '*' (5) '=' NAME
'='	Field Content Positioned behind Field Heading:
	When placed before a field, the equal sign '=' results in the display of the field heading (as defined in the DEFINE DATA statement or in the DDM) followed by the field contents.
	PRINT '=' NAME
operand1	Field to be Printed:
	As operand1 you specify the field to be printed.
parameters	Parameter Definition at Element (Field) Level:
	One or more parameters (see table above), enclosed within parentheses, may be specified immediately after <code>operand1</code> .
	Each parameter specified in this manner will override any previous parameter specified at statement level or in a GLOBALS command, SET GLOBALS (in Reporting Mode only) or FORMAT statement.
	If more than one parameter is specified, one or more blanks must be placed between each entry. An entry must not be split between two statement lines.
	See also:
	■ Statement Parameters
	Example of Parameter Usage at Statement and Element (Field) Level

# **Output Attributes**

 ${\it attributes}$  indicates the output attributes to be used for text display. Attributes can be:

```
AD=ad-value...
BX=bx-value...
CD=cd-value
PM=pm-value...
...

ad-value
cd-value
```

#### Where:

ad-value, bx-value, cd-value and pm-value denote the possible values of the corresponding session parameters AD, BX, CD and PM described in the relevant sections of the *Parameter Reference* documentation.

The compiler actually accepts more than one attribute value for an output field. For example, you can specify: AD=BDI. In such a case, however, only the last value applies. In the given example, only the value I becomes effective and the output field is displayed intensified.

For an alphanumeric/Unicode constant (Natural data format A or U), you can specify <code>ad-value</code> and/or <code>cd-value</code> without preceding <code>CD=</code> or <code>AD=</code>, respectively. The single value entered is then checked against all possible <code>CD</code> values first. For example: a value of <code>IRE</code> will be interpreted as intensifed/red but not as intensified/right-justified/mandatory. You cannot combine a single <code>cd-value</code> or <code>ad-value</code> with a value preceded by <code>CD=</code> or <code>AD=</code>.

# **Example**

- Example 1 PRINT Statement
- Example 2 PRINT Statement with Report to be Downloaded to the PC

#### **Example 1 - PRINT Statement**

```
** Example 'PRTEX1': PRINT

************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME

2 FIRST-NAME

2 CITY

2 JOB-TITLE

2 ADDRESS-LINE (2)

END-DEFINE

*

LIMIT 1

READ EMPLOY-VIEW BY CITY

/*

WRITE NOTITLE 'EXAMPLE 1:'
```

```
// 'RESULT OF WRITE STATEMENT:'
 WRITE / NAME ',' FIRST-NAME ':' JOB-TITLE '*' (30)
 WRITE
            / 'RESULT OF PRINT STATEMENT:'
 PRINT
            / NAME ',' FIRST-NAME ':' JOB-TITLE '*' (30)
 /*
 WRITE
           // 'EXAMPLE 2:'
            // 'RESULT OF WRITE STATEMENT:'
 WRITE
           / NAME 60X ADDRESS-LINE (1:2)
            / 'RESULT OF PRINT STATEMENT:'
 WRITE
            / NAME 60X ADDRESS-LINE (1:2)
 PRINT
END-READ
END
```

#### **Output of Program PRTXEX1:**

```
EXAMPLE 1:
RESULT OF WRITE STATEMENT:
SENKO
                 , WILLIE
                                     : PROGRAMMER
*******
RESULT OF PRINT STATEMENT:
SENKO , WILLIE : PROGRAMMER ****************
EXAMPLE 2:
RESULT OF WRITE STATEMENT:
SENKO
2200 COLUMBIA PIKE #914
RESULT OF PRINT STATEMENT:
SENKO
                                                         2200 COLUMBIA
PIKE #914
```

## Example 2 - PRINT Statement with Report to be Downloaded to the PC

```
** Example 'PCPIEX1': PRINT to PC

**

** NOTE: Example requires that Natural Connection is installed.

****************

DEFINE DATA LOCAL

01 PERS VIEW OF EMPLOYEES

02 PERSONNEL-ID

02 NAME

02 CITY
```

# 105 PROCESS

Function	806
Restriction	
Syntax Description	

```
PROCESS view-name USING {operand1=operand2}, ...[GIVING operand3...]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Function**

The PROCESS statement is used in conjunction with Entire System Server. Entire System Server allows you to use various operating system facilities such as reading and writing files, VTOC and catalog management, JES queues, etc.

See the section *Getting Started* in the *Entire System Server User's Guide* for further information on the PROCESS statement and its individual clauses.

### Restriction

This statement is only available with Entire System Server.

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure					Possible Formats										Referencing Permitted	Dynamic Definition
operand1	C	S				A		N	Р		В					yes	no
operand2	С	S				A	U	N	Р		В				T	yes	no
operand3		S				A		N	Р		В				Ī	yes	no

Syntax Element Description:

Syntax Element	Description
view-name	View Name:
	Name of the view used by Entire System Server.
USING	USING Clause:
	The USING clause is used to pass parameters to the Entire System Server processor. This is done by assigning a value (operand2) to a field (operand1) in a view defined to Entire System Server. See the Entire System Server documentation for view description.

Syntax Element	Description
	<b>Note:</b> Multiple specifications of <i>operand1=operand2</i> must be separated either by the input
	delimiter character (as specified with the session parameter ID) or by a comma.
GIVING	GIVING Clause:
	The GIVING clause is used to specify the fields (operand3) for which values are to be returned by the Entire System Server processor. Each field must be defined in a view used by Entire System Server.

# 106 PROCESS COMMAND

Function	81	1
Syntax Description	81	2
Examples	82	2

## CHECK | EXEC | TEXT | HELP Syntax:

```
PROCESS COMMAND ACTION

USING PROCESSOR-NAME=operand1

COMMAND-LINE (index[:index])=operand2

GIVING RESULT-FIELD (index[:index]) (see Syntax Note)

RETURN-CODE

[NATURAL-ERROR]
```

#### **GET Syntax:**

```
PROCESS COMMAND ACTION

GET USING PROCESSOR-NAME=operand1

GETSET-FIELD-NAME=operand3

GIVING GETSET-FIELD-VALUE (see Syntax Note)

[NATURAL-ERROR]
```

## **SET Syntax:**

```
PROCESS COMMAND ACTION

SET USING PROCESSOR-NAME=operand1

GETSET-FIELD-NAME=operand3

GETSET-FIELD-VALUE=operand4

[GIVING NATURAL-ERROR] (see Syntax Note)
```

#### **CLOSE Syntax:**

```
PROCESS COMMAND ACTION

CLOSE [GIVING NATURAL-ERROR] (see Syntax Note)
```

#### **Syntax Note:**

The GIVING option is only required in the reporting mode and if no VIEW OF COMMAND has been defined in the DEFINE DATA statement.

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Invoking Programs and Routines

## **Function**

Once a Natural Command Processor has been created using the Natural utility SYSNCP, it can be invoked from a Natural program using the PROCESS COMMAND statement.

For details on how to create a Natural Command Processor, refer to the SYSNCP Utility documentation.

#### **DDM Used for Command Processing**



**Important:** The word COMMAND in the PROCESS COMMAND statement is in fact the name of a view. The name of the view that is used need not necessarily be COMMAND; however, we recommend the use of COMMAND because there exists a DDM (data definition module) that is also called COMMAND. This DDM must be referenced within the DEFINE DATA statement, for example COMMAND VIEW OF COMMAND.

The DDM COMMAND has been created specifically for use in conjunction with the PROCESS COMMAND statement:

DB:	1 F	ile: 1 - COMMAND				[	Default	Sequen	ce: ?	
TYL	DB	NAME	F	LENG	S	D	REMA	ARKS		
			-		-	-				-
1	AA	PROCESSOR-NAME	Α	8	Ν	D	DE	USING		
M 1	AB	COMMAND-LINE	Α	80	Ν	D	MU/DE	USING		
1	ΑF	GETSET-FIELD-NAME	Α	32	Ν	D	DE	USING		
1	ВА	NATURAL-ERROR	Ν	4.0	Ν			GIVING		
1	ВВ	RETURN-CODE	Α	4	Ν			GIVING		
M 1	ВС	RESULT-FIELD	Α	80	Ν		MU	GIVING		
1	BD	GETSET-FIELD-VALUE	Α	32	N	D		USING;	GIVING	
****	* DDI	M OUTPUT TERMINATED *****								

The fields contained in the DDM correspond to the fields used in the PROCESS COMMAND statement. They are explained in *Syntax Element Description*.



**Note:** To avoid possible compilation or runtime errors, make sure that the DDM named COMMAND is cataloged as type C (field DDM Type on the SYSDDM Menu) before you use it. (If you re-catalog the DDM, any DBID/FNR specification in the SYSDDM utility will be ignored.)

#### **Security Considerations**

With Natural Security, it is possible to restrict the usage of certain keywords and/or functions which are defined in a Command Processor. Keywords and/or functions can be allowed/disallowed for a specific user or group of users. See the *Natural Security* documentation for details.

# **Syntax Description**

## Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure	Possible Formats					Referencing Permitted	•			
operand1	С	S				A								no	no
operand2	С	S	A	G		A		N						no	no
operand3	С	S				A		N						no	no
operand4	С	S				A		N	Р	Ι				no	no

# Syntax Element Description:

Syntax Element	Description
CHECK	CHECK Action:  CHECK is used as a precautionary measure to determine if a command is executable with the statement PROCESS COMMAND EXEC. It works as follows: for the given Command Processor name, a runtime check is performed in two steps:
	■ It is checked whether the Command Processor exists in the current library or one of its steplibs;
	■ The content of the command line COMMAND-LINE (1) is analyzed to determine whether it is acceptable.
	In addition, the runtime action definitions R, M and 1-9 are written into RESULT-FIELD (1:9).
	If the field NATURAL-ERROR is specified in the view or in the GIVING option, it returns the error code. If this field is not available and the command analysis fails, a Natural system error occurs.
	<b>Note:</b> No CHECK is required if you want to perform an EXEC action. The CHECK is
	included in an EXEC operation.
EXEC	EXEC Action:
	EXEC works exactly the same as CHECK with the addition that the runtime actions are executed as specified in the runtime action editor.
	Only COMMAND-LINE (1) is needed. You can use up to 9 occurrences of RESULT-FIELD (however, for optimum performance, you should not use more occurrences than you really need).
	<b>Note:</b> EXEC is the only action which can be used to leave the currently active program. This is the case when the runtime action definition contains a FETCH or STOP statement.

Syntax Element	Description
	See also Example 1 - PROCESS COMMAND ACTION EXEC.
TEXT	TEXT Action:
	TEXT delivers general information about the Command Processor and text associated with a keyword or function.
	This text is the same as that entered in the keyword editor or action editor of the SYSNCP utility during Command Processor definition.
	For further information, see the following sections under <i>Input Values for TEXT Actions</i> :
	TEXT for General Information
	■ TEXT for Keyword Information
	■ TEXT for Function Information
	<b>Note:</b> To access texts for keywords and functions, you must have specified Y in the field Catalog user texts on the Processor Header Maintenance 3 screen of the SYSNCP utility, see the section <i>Miscellaneous Options - Header 3</i> .
HELP	HELP Action:
	HELP returns a list of all valid keywords, synonyms, and functions for the purpose of, for example, the creation of online help windows. This list is contained in the field(s) of RESULT-FIELD. The type of help returned is dependent on the content of the command lines.
	COMMAND-LINE (1) must contain the search criteria.
	■ COMMAND-LINE (2), if specified, must contain the start value or a search value.
	■ COMMAND-LINE (3), if specified, must contain a start value.
	For further information, see the following sections under <i>Input Values for HELP Actions</i> :
	■ HELP for Keywords
	■ HELP for Synonyms
	■ HELP for Global Functions
	■ HELP for Local Functions
	■ HELP for IKN
	■ HELP for IFN
	<b>Note:</b> For optimum performance, the number of occurrences of the field RESULT-FIELD should not exceed the number of lines to be displayed on the screen. At least one occurrence must be used.
GET	GET Action:

Syntax Element	Description
	GET reads internal Command Processor information and current Command Processor settings from the dynamically allocated NCPWORK buffer.
SET	SET Action:
	SET modifies internal Command Processor settings in the NCPWORK buffer.
CLOSE	CLOSE Action:  CLOSE terminates the use of the Command Processor and releases the Command Processor buffer.
	When the Command Processor is used during a session and is not released with CLOSE, then there exists a buffer named NCPWORK in your thread. The parameters of this buffer may be evaluated by using the system command BUS. The runtime part of the Command Processor requires this buffer; it can be released using the statement PROCESS COMMAND ACTION CLOSE.
	If any PROCESS COMMAND statement follows this statement, then the Command Processor buffer will be opened again.
	See also Example 2 - PROCESS COMMAND ACTION CLOSE.
GIVING	GIVING Option:
	This option is only required in reporting mode and if no VIEW OF COMMAND has been defined in the DEFINE DATA statement.
	The GIVING option is not available in structured mode, because there exists an implicit GIVING option made up of all fields specified in the DEFINE DATA statement, which are usually referenced in the GIVING option for the reporting mode.
	This means that in stuctured mode all field defined in the GIVING option must be defined in the DEFINE DATA statement.
	<b>Note:</b> Specified in the GIVING option are fields to be filled by the Command
	Processor as a result of the processing of any action.
PROCESSOR-NAME	The name of the Command Processor to be used for processing.
	The Command Processor specified must be cataloged.
COMMAND-LINE	The command line to be processed by a CHECK or an EXEC action, or the keyword/command for which user text or help text is to be returned to the program by a TEXT or HELP action. Note that this field can contain more than one occurrence.
RESULT-FIELD	Contains information resulting from the use of options that can be specified within a runtime action defined for a Command Processor function (see Runtime Actions in the Natural SYSNCP utility). Note that this field can contain more than one occurrence.
RETURN-CODE	The return code of an operation resulting from an EXEC or a CHECK action as specified within a Runtime Actions definition (see the Natural SYSNCP utility).

Syntax Element	Description
NATURAL - ERROR	The Natural error returned for a PROCESS COMMAND action.
	We recommend that you use this field in the DEFINE DATA statement as it returns
	the Natural error code for the Command Processor. When the field is absent,
	Natural runtime error processing is triggered if an error occurs.
GETSET-FIELD-NAME	The name of the constant or variable that is read when a GET action is performed
	or that is written with a SET action.
	For a list of possible values for GETSET-FIELD-NAME, see <i>Input Values for</i>
	GETSET-FIELD-NAME.
GETSET-FIELD-VALUE	The value of the constant or variable specified in the field GETSET-FIELD-NAME which is read when a GET action is performed or which written with a SET action.
	which is read when a GET action is performed of which written with a GET action.

This section covers the following topics:

- Input Values for GETSET-FIELD-NAME
- Input Values for TEXT Actions
- Input Values for HELP Actions

## Input Values for GETSET-FIELD-NAME

The following values can be used for the GETSET-FIELD-NAME field (A32):

Field Name	Format	G/S*	Content
NAME	A8	G	Name of current Command Processor.
LIBRARY	A8	G	Loaded from library.
FNR	N10	G	Loaded from file.
DBID	N10	G	Loaded from database.
TIMESTMP	A8	G	Time stamp of the current Command Processor.
COUNTER	N10	G	Access counter.
BUFFER-LENGTH	N10	G	Bytes allocated for NCPWORK.
C-DELIMITER	A1	G/S	Multiple command delimiter.
DATA-DELIMITER	A1	G	Delimiter to precede data.
PF-KEY	A1	G/S	PF key may be command (Y / N).
UPPER-CASE	A1	G	Keywords in upper case (Y / N).
UQ-KEYWORDS	A1	G	Keywords unique (Y/N).
IMPLICIT-KEYWORD	A1	G/S	Identifier for implicit keyword entry.
MIN-LEN	N10	G	Minimum length of keywords.
MAX-LEN	N10	G	Maximum length of keywords.
KEYWORD-SEQ	A8	G/S	Keyword sequence.
ALT-KEYWORD-SEQ	A8	G/S	Alternative keyword sequence.

Field Name	Format	G/S*	Content
USER-SEQUENCE	A1	G	User may override KEYWORD-SEQ (Y/N).
CURR-LOCATION	N10	G/S	Current location (IFN).
CURR-IKN1	N10	G/S	IKN1 of current location.
CURR-IKN2	N10	G/S	IKN2 of current location.
CURR-IKN3	N10	G/S	IKN3 of current location.
CHECK-LOCATION	N10	G	Last checked location (IFN).
CHECK-IKN1	N10	G	IKN1 of CHECK-LOCATION.
CHECK-IKN2	N10	G	IKN2 of CHECK-LOCATION.
CHECK-IKN3	N10	G	IKN3 of CHECK-LOCATION.
TOP-IKN1	N10	G	IKN1 of topmost keyword.
TOP-IKN2	N10	G	IKN2 of topmost keyword.
TOP-IKN3	N10	G	IKN3 of topmost keyword.
KEY1-TOTAL	N10	G	Number of keywords of type 1.
KEY2-TOTAL	N10	G	Number of keywords of type 2.
KEY3-TOTAL	N10	G	Number of keywords of type 3.
FUNCTIONS-TOTAL	N10	G	Number of cataloged functions.
LOCAL-GLOBAL-SEQ	A8	G/S	Local/global function validation.
ERROR-HANDLER	A8	G/S	General error program.
SECURITY	A1	G	Natural Security installed (Y/N).
SEC-PREFETCH	A1	G	Natural Security data are to be read $(Y / N)$ or have been read $(D = done)$ .
PREFIX1	A1	G	Corresponds to the field Prefix Character 1 on the Processor Header Maintenance 2 screen of the SYSNCP utility, see the section Keyword Editor Options - Header 2.
PREFIX2	A1	G	Corresponds to the field Prefix Character 2 on the Processor Header Maintenance 2 screen.
HEX1	A1	G	Corresponds to the field Hex. Replacement 1 on the Processor Header Maintenance 2 screen.
HEX2	A1	G	Corresponds to the field Hex. Replacement 2 on the Processor Header Maintenance 2 screen.
DYNAMIC	A32	G	Dynamic part (:n:) of last error message.
LAST	-	G	Last command placed on top of stack as data.
LAST-ALL	-	G	Last commands placed on top of stack as data.
LAST-COM	-	G	Last command moved to *COM.
MULTI	-	G	Places the last of multiple commands as data on top of the stack.
MULTI-COM	-	G	Places the last of multiple commands in the system variable *COM.

<sup>\*</sup>G = Field name can be used with the GET action.
\*S = Field name can be used with the SET action.

## Input Values for TEXT Actions

The following input values are provided to return different information from a TEXT action:

#### **TEXT for General Information**

For general information, COMMAND-LINE (\*); that is, all command lines, must be blank. Up to nine fields of RESULT-FIELD are returned containing the following information:

RESULT-FIELD	Format	Contents
1	Text (A40)	Header 1 for User Text
2	Text (A40)	Header 2 for User Text
3	Text (A16)	"First Entry used as" text
4	Text (A16)	"Second Entry used as" text
5	Text (A16)	"Third Entry used as" text
6	Numeric (N3)	Number of Entry 1 Keywords
7	Numeric (N3)	Number of Entry 2 Keywords
8	Numeric (N3)	Number of Entry 3 Keywords
9	Numeric (N7)	Number of Cataloged Functions

#### **TEXT for Keyword Information**

For keyword information, COMMAND-LINE (1) must contain the corresponding keyword; COMMAND-LINE (2) can optionally contain the keyword type (1, 2, 3 or P); COMMAND-LINE (3:6) must be empty.

RESULT-FIELD	Contents	Format
1	Keyword comment text	Text (A40)
2	Keyword in full length	Text (A16)
3	Keyword in unique short form	Text (A16)
4	"Keyword used as" entry	Text (A16)
5	Internal keyword number (IKN)	Numeric (N4)
6	Minimum length of keyword	Numeric (N2)
7	Maximum length of keyword	Numeric (N2)
8	Keyword type (1, 2, 3, 1S, 2S, 3S, P)	Text (A2)

#### **TEXT for Function Information**

For function information, COMMAND-LINE (1:3) must contain the keywords which specify the wanted location. COMMAND-LINE (4:6) contains the keywords which specify the wanted function. For example, if information about the global command ADD USER is to be returned, the command lines 1, 2, 3, and 6 must be blank; the command line 4 must contain the text string ADD, and the command line 5 must contain the text string USER.

RESULT-FIELD	Format	Contents
1	Text (A40)	Text as defined with the option T in runtime action definition.
2	Numeric (N10)	Internal function number (IFN) of the specified location.
3	Numeric (N10)	Internal function number (IFN) of the specified function.

## **Input Values for HELP Actions**

The following input values are provided to return different information from a HELP action:

## **HELP for Keywords**

This action returns an alphabetically sorted list of keywords and/or synonyms with their internal keyword numbers (IKN).

Command Line	Contents				
1	Must begin with indicator K.				
	The types of keywords to be returned:				
	*	Keywords of all types			
	1	Keywords with type 1			
	2	Keywords with type 2			
	3	Keywords with type 3			
	Р	Keywords with type P (parameter)			
	Options:				
	I	Return IKN in addition to keywords.			
	Т	Show keyword partially in upper case (to show possible abbreviation).			
	S	Return synonyms in addition to keywords.			
	Х	Return only synonyms of specified keywords.			
	A	Internal keywords are also returned.			
	+	Search does not include start value.			
2	Start value for the keyword search (optional).				
	1 -	begins with the start value. However, if you specify the plus (+) option, include the start value itself, but begins with the next higher value.			

The field RESULT-FIELD (1:n) returns the specified list.

## **Examples:**

Command Line 1:	K*X	Returns all synonyms of all keyword types.
Command Line 1:	K123S	Returns all keywords of type 1, 2 and 3 including $\leftrightarrow$
synonyms.		

## **HELP for Synonyms**

For a given IKN, this action returns the original keyword and all synonyms.

Command Line	Contents			
1	Must begin with the indicator S.			
	Option:			
		Shows keyword partially in upper case (to show possible abbreviation).		
2	Internal Keyword Number (IKN	N) of the keyword in format N4.		

The field RESULT-FIELD (1) returns the original keyword. The fields RESULT-FIELD (2:n) return associated synonyms for this keyword.

## Example:

Input:		Output:		
Command Line Command Line	1003	Result-Field Result-Field Result-Field	2:	Edit Maintain Modify

## **HELP for Global Functions**

This action returns a list of all global functions.

Command Line	Contents	
1	Must begin with the indicator G.	
	Options:	
	I	Internal Function Number (IFN) is also returned.
	Т	Shows keyword partially in upper case (to show possible abbreviation).
	S	The keywords returned in RESULT-FIELD will be aligned in columns.
	А	Internal keywords are also returned.
	1	Only functions containing the given keyword of type 1 are to be returned.

Command Line	Contents			
	2	Only functions containing the given keyword of type 2 are to be returned.		
	3	Only functions containing the given keyword of type 3 are to be returned.		
	+	Search does not include start value.		
2	Start value for global function search. Keywords must be given in sequence 123.			
	'	he start value. However, if you specify the plus (+) option, rt value itself, but begins with the next higher value.		
3	Must be blank.			
4	To search only for global functions	with a specific keyword, you specify the keyword here.		
	If you specify a keyword, you also above).	have to specify the keyword type (1, 2 or 3) as option (see		

The field RESULT-FIELD (1:n) returns the specified list.

## Example:

Input:		Output:		
Command Command		Result-Field Result-Field		CUSTOMER FILE
		Result-Field	ADD	USER

## **HELP for Local Functions**

This action returns a list of all local functions for a specified location.

Command Line	Contents	
1	Must begin with the in	ndicator L.
	Options:	
	I	Internal Function Number (IFN) is also returned.
	Т	Shows keyword partially in upper case (to show possible abbreviation).
	S	The keywords returned in RESULT-FIELD will be aligned in columns.
	A	Internal keywords are also returned.
	1	Only functions containing given keyword of type 1 are to be returned.
	2	Only functions containing given keyword of type 2 are to be returned.

Command	Contents			
Line				
	3	Only functions containing given keyword of type 3 are to be returned.		
	С	Only those functions are returned which are defined for the current location (command line 3 is ignored).		
	F	Invoke "recursive" listing of local functions; that is, all local commands that lead to the current/specified location will be returned.		
2	Start value for local function search (optional).			
	Keywords must be given in sec	juence 123.		
3	The location for which the list is to be returned.			
	Keywords must be given in sequence 123.			
	If no location is specified, the current location of the Command Processor will be used.			
4	Keyword restriction (optional):			
	If you specify a keyword, or an will be returned.	IKN with the format N4, only functions with this keyword		

The field RESULT-FIELD (1:n) returns the specified list.

## **HELP for IKN**

For any given internal keyword numbers (IKN), this action returns the original keyword.

Command Line	Contents					
1	Must start with IKN.  Options:					
	A The internal keyword will be shown.					
T Shows keyword partially in upper case (to sho abbreviation).		Shows keyword partially in upper case (to show possible abbreviation).				
2	The IKN to be translated, in format N4.					

The field RESULT-FIELD (1) returns the keyword.

Example:

Input:	Output:	
Command Line Command Line	Result-Field	1: CUSTOMER

#### **HELP for IFN**

For any given internal function numbers (IFN), this action returns the keywords of a function.

Command Line	Contents									
1	Must start with IF	N.								
	Option:									
	А	Functions with internal keywords will not be suppressed.								
2	The IFN to be tran	The IFN to be translated, in format N10.								
3	Further options:									
	S	Keywords belonging to the IFN will be returned in RESULT-FIELD (1:3).								
	Т	Shows keywords partially in upper case (to show possible abbreviations).								
	L IFN will be returned if IFN is used as a location.									
	С	IFN will be returned if IFN is used as a command.								

The field RESULT-FIELD(1) returns the function; if option S is used, the function is returned in RESULT-FIELD (1:3).

#### Example:

Input:		Output:			
Command Lin Command Lin	IFN 0001048578	Result-Field	1:	DISPLAY	INVOICE

# **Examples**

In addition to the example programs shown in this section, you can find example programs in the SYSNCP system library. These programs all begin with EXAM.

You can test all available PROCESS COMMAND actions by executing the EXAM program in SYSNCP. You can then choose an action from a menu.

■ Example 1 - PROCESS COMMAND ACTION EXEC

#### Example 2 - PROCESS COMMAND ACTION CLOSE

## **Example 1 - PROCESS COMMAND ACTION EXEC**

```
/* EXAM-EXS - Example for PROCESS COMMAND ACTION EXEC (Structured Mode)
/***********************
DEFINE DATA LOCAL
 01 COMMAND VIEW OF COMMAND
    02 PROCESSOR-NAME
    02 COMMAND-LINE (1)
    02 NATURAL-ERROR
    02 RETURN-CODE
    02 RESULT-FIELD (1)
 01 MSG (A65) INIT <'Please enter a command.'>
END-DEFINE
/*
RFPFAT
 INPUT (AD=MIT' ' IP=OFF) WITH TEXT MSG
    'Example for PROCESS COMMAND ACTION EXEC (Structured Mode)' (I)
 / 'Command \Longrightarrow' COMMAND-LINE (1) (AL=64)
  /*****
 PROCESS COMMAND ACTION EXEC
   USING
     PROCESSOR-NAME = 'DEMO'
     COMMAND-LINE (1) = COMMAND-LINE (1)
 COMPRESS 'NATURAL-ERROR =' NATURAL-ERROR TO MSG
END-REPEAT
FND
```

## **Example 2 - PROCESS COMMAND ACTION CLOSE**

```
/* EXAM-CLS - Example for PROCESS COMMAND ACTION CLOSE (Structured Mode)
/*****************
DEFINE DATA LOCAL
    01 COMMAND VIEW OF COMMAND
END-DEFINE
/*
PROCESS COMMAND ACTION CLOSE
/*
DEFINE WINDOW CLS
INPUT WINDOW = 'CLS'
    'NCPWORK has just been released.'
/*
END
```

# 107 PROCESS PAGE

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## **Function**

The PROCESS PAGE statement constitutes a general interface description to an external rendering engine, such as Natural for Ajax, thus linking the Natural internal data representation with an external data representation. Via this link, data and events, but no rendering information, are sent to and returned from an external, browser-based application.

For further information, refer to the *Natural for Ajax* documentation. The latest Natural for Ajax documentation is always available at *https://empower.softwareag.com/*.

## Syntax 1 - PROCESS PAGE

```
PROCESS PAGE [(parameter)] operand1

[WITH PARAMETERS

{[NAME] operand3 [VALUE] operand4 [(parameters)]} ...

END-PARAMETERS]

[GIVING operand11]
```

For an explanation of the symbols used in the syntax diagram, see Syntax Symbols.

Belongs to Function Group: Screen Generation for Interactive Processing

## Syntax Description - Syntax 1

Syntax 1 of the PROCESS PAGE statement is normally only used inside a Natural adapter. An adapter is a Natural object that forms the interface between Natural application code and web page. It is automatically created/updated by Natural for Ajax when the layout is saved.



Note:

#### Operand Definition Table:

Operand	Possible Structure								Pos	ssik	ole	Fo	rm	ats			Referencing Permitted	Dynamic Definition
operand1	С	S				A	U										yes	no
operand2		S	A													C	no	no
operand3	С	S				A	U										yes	no
operand4	С	S	A			A	U	N	Р	Ι	F	В	D	T	L		yes	yes
operand5		S	A													C	no	no

Operand	Pos	ssib	le St	ruct	ure	Possible Formats				Referencing Permitted								
operand11		S							I	4							yes	yes

## Syntax Element Description:

Syntax Element	Description											
parameter	Attribute Control Variable(s): The parameter CV, enclosed within parentheses, may be specified to reference one or more attribute control variables as specified in <i>operand2</i> :											
	(CV=operand2)											
	See also Logical Condition Criteria, MODIFIED Option - Check whether Field Content has been Modified in the Programming Guide.											
operand1		External Page Layout Name: operand1 contains the name of the external page layout.										
operand2	e Control Variable(s):											
	operand2 contains the name of the attribute control variable, must be of format C and must be either a scalar or a single array occurrence.											
operand3	* *	Name(s) of external Data Field(s): operand3 contains the name(s) of the external data field(s) operand4 will be transferred to/from.										
operand4	Name(s) of Natura operand4 contain	al Data Field(s): s the name(s) of the Natural data field(s) which will be transferred.										
parameters	Parameters: One or more para after operand4:	meters, enclosed within parentheses, may be specified immediately										
	EM or EMU	Edit mask used during data transfer.										
		For further information, see the session parameter EM in the <i>Parameter Reference</i> .										
		For details on Unicode edit masks, see the session parameter EMU in the <i>Parameter Reference</i> .										

Syntax Element	Description	
	CV	The parameter CV, enclosed within parentheses, may be specified immediately after <code>operand4</code> to reference one or more attribute control variables as specified in <code>operand5</code> :
		(CV=operand5)
		See also Logical Condition Criteria, MODIFIED Option - Check whether Field Content has been Modified in the Programming Guide.
operand5	Name of Attribute Co operand5 contains th format C.	ontrol Variable: e name of the attribute control variable. The variable must be of
	If operand4 is a scalar	r or a single array occurrence, operand5 must be
	a scalar	
	or a single array occ	currence.
	If operand4 is the full	range of an array of dimension 1, operand5 must be
	a scalar	
	or a single array occ	currence
	or the full range of a	an array of dimension 1 with the same size.
	If operand4 is the full	range of an array of dimension 2, operand5 must be
	a scalar	
	or a single array occ	currence
	or the full range of a	an array of dimension 2 with the same size in both dimensions
	or the full range of a dimension 1.	an array of dimension 1 with the same size that operand4 has in
	If operand4 is the full	range of an array of dimension 3, operand5 must be
	a scalar	
	or a single array occ	currence
	or the full range of a	an array of dimension 3 with the same size in all three dimensions
	or the full range of a dimension 1 and 2	an array of dimension 2 with the same size that operand4 has in
	or the full range of a dimension 1.	an array of dimension 1 with the same size that operand4 has in
GIVING	GIVING Clause:	
operand11	operand11 contains t	he Natural error if the request could not be performed.

Example of an adapter which has been created by Natural for Ajax:

```
* PAGE1: PROTOTYPE
                        --- CREATED BY Natural for Ajax ---
* PROCESS PAGE USING 'XXXXXXXX' WITH
* INFOPAGENAME RESULT YOURNAME
DEFINE DATA PARAMETER
1 INFOPAGENAME (U) DYNAMIC
1 RESULT (U) DYNAMIC
1 YOURNAME (U) DYNAMIC
END-DEFINE
PROCESS PAGE U'/njxdemos/helloworld' WITH
PARAMETERS
 NAME U'infopagename'
 VALUE INFOPAGENAME
 NAME U'result'
 VALUE RESULT
 NAME U'yourname'
 VALUE YOURNAME
END-PARAMETERS
 TODO: Copy to your calling program and implement.
/*/*( DEFINE EVENT HANDLER
* DECIDE ON FIRST *PAGE-EVENT
 VALUE U'nat:page.end'
  /* Page closed.
  IGNORF
  VALUE U'onHelloWorld'
  /* TODO: Implement event code.
  PROCESS PAGE UPDATE FULL
 NONE VALUE
   /* Unhandled events.
    PROCESS PAGE UPDATE
* END-DECIDE
/*/*) END-HANDLER
END
```

## Syntax 2 - PROCESS PAGE USING

```
PROCESS PAGE USING operand6

WITH {operand7} ...
NO PARAMETER

GIVING operand11]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Screen Generation for Interactive Processing

## Syntax Description - Syntax 2

This syntax is used to perform rich GUI input/output processing using an object of type adapter that has been generated from a page layout created with Natural for Ajax or a similar tool.

## Operand Definition Table:

Operand	Possible Structure							P	os	sib	le l	Foi	rma	ıts			Referencing Permitted	Dynamic Definition	
operand6	C	S				A												yes	no
operand7		S	A	G		A	U	N	Р	Ι	F	В	D	Т	L			yes	yes
operand11		S								<b>I4</b>								yes	yes

## Syntax Element Description:

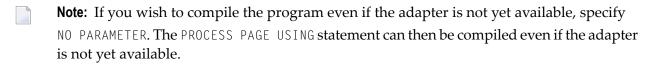
Syntax Element	Description								
USING	Adapter Name:								
operand6	Invokes an adapter definition which has been previously stored in a Natural system file. See also <i>Processing a Rich GUI Page - Adapter</i> in the <i>Programming Guide</i> .								
	The adapter name (operand6) may be a 1 to 8 character alphanumeric constant or user-defined variable. If a variable is used, it must have been defined previously.								
	The adapter name may contain an ampersand (&); at execution time, this character will be replaced by the current value of the Natural system variable *LANGUAGE. This feature is provided for historical reasons. If you need multi-lingual adapters, use the capability of the external rendering system (for example, Natural for Ajax).								
	<b>Note:</b> New applications do not need the ampersand feature to be multilingual. Pages								
	designed, for example, using Natural for Ajax, can hold multilingual information as part of the layout design. See <i>Multi Language Management</i> in the <i>Natural for Ajax</i> documentation.								
operand7	Field Specification:								
	A list of database fields and/or user-defined variables, all of which must have been defined previously. The fields must agree in number, sequence, format, length and (for arrays) number of occurrences with the fields in the referenced adapter; otherwise, an error occurs.								
	When the content of a database field is modified as a result of PROCESS PAGE processing, only the value as contained in the data area is modified. In order to change the content of the database, appropriate database UPDATE/STORE statements must be used.								
	See PROCESS PAGE USING Fields Defined in the Program.								
NO PARAMETER	NO PARAMETER Option:								

Syntax Element	Description
	See PROCESS PAGE USING without Parameter List.
GIVING	GIVING Clause:
operand11	operand11 contains the Natural error if the request could not be performed.
	<b>Note:</b> The GIVING clause interrupts the common Natural error handling, if an error
	occurs while the adapter object is being activated or executed. Instead of back-tracking
	the Natural modules in order to find an <code>ON ERROR</code> clause, the Natural error code is passed to this variable and execution is continued with the next statement.

#### PROCESS PAGE USING without Parameter List

The following requirements must be met when PROCESS PAGE USING is used without parameter list:

- The adapter name (operand6) must be specified as an alphanumeric constant (up to 8 characters).
- The adapter used in this manner must have been created prior to the compilation of the program which references the adapter.
- The names of the fields to be processed are taken dynamically from the adapter source definition at compilation time. The field names used in both program and adapter must be identical.
- All fields to be referenced in the PROCESS PAGE statement must be accessible at that point.
- In structured mode, fields must have been defined previously (database fields must be properly referenced to processing loops or views).
- When the page layout is changed, the programs using the adapter need not be recataloged. However, when array structures or names, formats/lengths of fields are changed, or fields are added/deleted in the adapter, the programs using the adapter must be recataloged.
- The adapter source must be available at program compilation; otherwise, the PROCESS PAGE USING statement cannot be compiled.



### PROCESS PAGE USING Fields Defined in the Program

By specifying the names of the fields to be processed within the program (*operand7*), it is possible to have the names of the fields in the program differ from the names of the fields in the adapter.

The sequence of fields in the program must match the sequence in the adapter. If you use Natural maps as adapter objects, note that the map editor sorts the fields as specified in the map in alphabetical order by field name. For more information, see the map editor description in your *Editors* documentation.

The program editor line command . I(adaptername) can be used to obtain a complete PROCESS PAGE USING statement with a parameter list derived from the fields defined in the specified adapter.

When the layout of the adapter is changed, the program using the adapter does not need to be recataloged. However, when field names, field formats/lengths, or array structures in the adapter are changed or fields are added or deleted in the adapter, the program must be recataloged.

A check is made at execution time to ensure that the format and length of the fields as specified in the program match the fields as specified in the adapter. If both layouts do not agree, an error message is produced.

## **Syntax 3 - PROCESS PAGE UPDATE**



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Screen Generation for Interactive Processing

## Syntax Description - Syntax 3

The PROCESS PAGE UPDATE statement is used to return to and re-execute a PROCESS PAGE statement. It is generally used to return from event processing, because the data input processing of the preceding PROCESS PAGE statement was incomplete.



**Note:** No INPUT, WRITE, PRINT or DISPLAY statements may be executed between a PROCESS PAGE statement and its corresponding PROCESS PAGE UPDATE statement.

The PROCESS PAGE UPDATE statement, when executed, repositions the program status regarding subroutine, special condition and loop processing as it existed when the PROCESS PAGE statement was executed (as long as the status of the PROCESS PAGE statement is still active). If the loop was initiated after the execution of the PROCESS PAGE statement and the PROCESS PAGE UPDATE statement is within this loop, the loop will be discontinued and then restarted after the PROCESS PAGE statement has been reprocessed as a consequence of the PROCESS PAGE UPDATE statement.

If a hierarchy of subroutines was invoked after the execution of the PROCESS PAGE statement, and the PROCESS PAGE UPDATE is performed within a subroutine, Natural will trace back all subroutines automatically and reposition the program status to that of the PROCESS PAGE statement.

It is not possible, however, to have a PROCESS PAGE statement positioned within a loop, a subroutine or a special condition block, and then execute the PROCESS PAGE UPDATE statement when the status

under which the PROCESS PAGE statement was executed has already been terminated. An error message will be produced and program execution terminated when this error condition is detected.

## Operand Definition Table:

Operand	Possib	le Structure	Possible Forr	nats	Referencing Permitted	Dynamic Definition
operand11	S				yes	yes

## Syntax Element Description:

Syntax Element	Description
FULL	FULL Option:
	If you specify the FULL option in a PROCESS PAGE UPDATE statement, the corresponding PROCESS PAGE statement will be re-executed fully:
	■ With an ordinary PROCESS PAGE UPDATE statement (without FULL option), the contents of variables that were changed between the PROCESS PAGE and PROCESS PAGE UPDATE statement will not be displayed; that is, all variables on the screen will show the contents they had when the PROCESS PAGE statement was originally executed.
	■ With a PROCESS PAGE UPDATE FULL statement, all changes that have been made after the initial execution of the PROCESS PAGE statement will be applied to the PROCESS PAGE statement when it is re-executed; that is, all variables on the screen contain the values they had when the PROCESS PAGE UPDATE statement was executed.
	A characteristic of the PROCESS PAGE UPDATE FULL statement is that the status of attribute control variables is reset to NOT MODIFIED. This is not done with the ordinary PROCESS PAGE UPDATE statement. To check if an attribute control variable has been assigned the status MODIFIED, use the MODIFIED option.
DATA	DATA Option:
	The DATA option behaves like the FULL option, with the exception that the MODIFIED status of the control variables is <i>not</i> reset.
event-option	EVENT Option:
	See EVENT Option below.
GIVING	GIVING Clause:
(operand11)	operand11 contains the Natural error if the request could not be performed.

Example User Program Fragment:

```
PROCESS PAGE USING "HELLOW-A"

*

/*( DEFINE EVENT HANDLER

DECIDE ON FIRST *PAGE-EVENT

VALUE U'nat:page.end'

/* Page closed.

IGNORE

VALUE U'onHelloWorld'

COMPRESS "HELLO WORLD" YOURNAME INTO RESULT

PROCESS PAGE UPDATE FULL

NONE VALUE

/* Unhandled events.

PROCESS PAGE UPDATE

END-DECIDE

/*) END-HANDLER
```

## **EVENT Option**

```
AND SEND EVENT operand8

[WITH PARAMETERS

{[NAME] operand9 [VALUE] operand10 [ { (EMU=value) } (EM=value) } ]}...

END-PARAMETERS]
```

With this option, you can advise the external I/O system to run specific functions. These functions are part of the external I/O system or implement special functions regarding the output processing as setting of focus, displaying message boxes, etc.

#### Operand Definition Table:

Operand	Possible Structure				Possible Formats											Referencing Permitted	Dynamic Definition		
operand8	C	S				A	U											yes	no
operand9	С	S				A	U											yes	no
operand10	С	S	A			A	U	N	Р	Ι	F	В	D	T	L			yes	yes

#### Syntax Element Description:

Syntax Element	Description
AND SEND EVENT operand8	Event Requested from the External I/O System:
	Depending on the implementation of the external I/O system, events are available, refer to <i>Sending Events to the User Interface</i> in the <i>Natural for Ajax</i> documentation.
WITH PARAMETERS	WITH PARAMETERS Clause:

Syntax Element	Description							
	With this clause, you can specify the following:							
NAME operand9	External Data Field Name:							
	operand9 contains the external name of the data fields operand10 will be transferred to/from.							
VALUE operand10	Natural Data Fields:							
	operand10 contains the Natural data fields which will be transferred.							
EMU=	Edit Mask:							
EM=	Edit mask used during data transfer.							
	For details on edit masks, see the session parameter EM in the <i>Parameter Reference</i> .							
	For details on Unicode edit masks, see the session parameter EMU in the <i>Parameter Reference</i> .							
END-PARAMETERS	End of WITH PARAMETERS Clause:							
	The Natural reserved word END-PARAMETERS must be used to end the WITH PARAMETERS clause.							

# Syntax 4 - PROCESS PAGE MODAL

PROCESS PAGE MODAL
statement...
END-PROCESS

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: PROCESS PAGE

Belongs to Function Group:

■ Screen Generation for Interactive Processing

## Syntax Description - Syntax 4

The PROCESS PAGE MODAL statement is used to initiate a processing block and to control the lifetime of a modal rich GUI window.

Entering the PROCESS PAGE MODAL statement block causes the following actions to be performed:

- Data from Report 0, which is not displayed yet, will be displayed first;
- the system variable \*PAGE-LEVEL is incremented;
- the opening of a modal page is prepared. The physical opening of the modal page will be performed with the next PROCESS PAGE USING operand6 WITH statement, where operand6 is the name of the adapter to be used.

Leaving the PROCESS PAGE MODAL statement block causes the following actions to be performed:

- If a modal page has been opened for this level, the closing of the modal page is prepared. The physical closing of the modal page will be performed with the next PROCESS PAGE UPDATE [FULL] statement;
- the system variable \*PAGE-LEVEL is decremented, and the system variable \*PAGE-EVENT is set back to the value it had before the statement block was entered;
- a nat:page.default event will be raised in the program that opened the modal page.
- Note: No PRINT, WRITE, INPUT or DISPLAY statements referring to Report 0 may be executed between a PROCESS PAGE MODAL statement and its corresponding END-PROCESS statement.

The PROCESS PAGE MODAL statement is not valid in batch mode.

Syntax Element Description:

Syntax Element	Description
statement	Statement(s) to be Executed:
	In place of <code>statement</code> , you must supply one or several suitable statements, depending on the situation. If you do not want to supply a specific statement, you may insert the <code>IGNORE</code> statement.
END-PROCESS	End of PROCESS PAGE MODAL Statement:
	The Natural reserved word END-PROCESS must be used to end the PROCESS PAGE MODAL statement.

Example:

```
* Name: First Demo/Open modal!
PROCESS PAGE USING "EMPTY-A"
/*( DEFINE EVENT HANDLER
DECIDE ON FIRST *PAGE-EVENT
 VALUE U'nat:page.end', U'onClose'
    /* Page closed.
    IGNORE
  VALUE U'onNextLevel'
    PROCESS PAGE MODAL
      FETCH RETURN "EMPTY-P"
    END-PROCESS
    PROCESS PAGE UPDATE
 NONE VALUE
    PROCESS PAGE UPDATE
END-DECIDE
/*) END-HANDLER
END
```

# **Examples**

Further examples of using the PROCESS PAGE statement are contained in library SYSEXNJX.

# 108 PROCESS SQL (SQL)

Function	84
Syntax Description	
Examples	

```
PROCESS SQL ddm-name << statement-string>>
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

See also *PROCESS SQL* in the *Natural for DB2* part of the *Database Management System Interfaces* documentation:

## **Function**

The PROCESS SQL statement is used to issue SQL statements to the underlying database.

# **Syntax Description**

Syntax Element	Description
ddm-name	DDM Name:
	The name of a data definition module (DDM) must be specified to provide the "address" of the database which executes the stored procedure. For more information, see <code>ddm-name</code> .
statement-string	Statement String:
	The statements which can be specified in the <code>statement-string</code> are the same statements which can be issued with the SQL statement <code>EXECUTE</code> ; see also <code>Flexible SQL</code> .
	<b>Caution:</b> To avoid transaction synchronization problems between the Natural
	environment and the underlying database, the COMMIT and ROLLBACK statements must not be used within PROCESS SQL.
	The statement string can cover several statement lines without any continuation character to be specified. Comments at the end of a line as well as entire comment lines are possible.
	The statement string can also include parameters; see <i>Parameters in Statement String</i> below.

## **Parameters in Statement String**

```
:U :host-variable[INDICATOR:host-variable][LINIDICATOR:host-variable]
```

Unlike with the *Parameters* described in the section *Basic Syntactical Items*, the *host-variables* used in this context must be prefixed by a colon (:). In addition, they can be preceded by a further qualifier (: U or : G).

See further details on *host-variable*.

Syntax Element Description:

Syntax Element	Description
:U:host-variable	"USING" Variable:
	The prefix : U qualifies the host variable as a so-called "USING" variable. Such a variable indicates that its value is to be <i>passed to</i> the database.
	:∪ is the default specification.
:G:host-variable	"GIVING" Variable:
	The prefix : 6 qualifies the host variable as a so-called "GIVING" variable. Such a variable indicates that it is to <i>receive</i> a value <i>from</i> the database.

# **Examples**

## Example 1 for DB2 (under z/OS):

```
PROCESS SQL DB2_DDM << CONNECT TO :LOCATION >>
```

## Example 2 for DB2 (under z/OS):

```
PROCESS SQL DB2_DDM << SET :G:LOCATION = CURRENT SERVER >>
```

# 109 PROPERTY

Function	844
Syntax Description	844
Example	845

```
PROPERTY property-name

OF [INTERFACE] interface-name

IS operand

END-PROPERTY
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CREATE OBJECT | DEFINE CLASS | INTERFACE | METHOD | SEND METHOD

Belongs to Function Group: Component Based Programming

#### **Function**

The PROPERTY statement assigns an object data variable operand as the implementation to a property, outside an interface definition.

It is used if the interface definition in question is included from a copycode and is to be implemented in a class-specific way.

It may only be used within the DEFINE CLASS statement and after the interface definitions.

The interface and property names specified must be defined in the INTERFACE clause of the DEFINE CLASS statement.

### **Syntax Description**

Syntax Element	Description
property-name	Property Name:
	This is the name assigned to the property.
OF interface-name	Interface Name:
	This is the name assigned to the interface.
IS operand	IS Clause:
	The <i>operand</i> in the IS clause assigns an object data variable as the place to store the property value.
END-PROPERTY	End of PROPERTY Statement:
	The Natural reserved word END-PROPERTY must be used to end the PROPERTY statement.

## **Example**

The **example** contained in the documentation of the METHOD statement shows how the same interface is implemented differently in two classes, and how the PROPERTY statement and the METHOD statement are used to achieve this.

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# 110 READ

Function	850
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System Variables Available with READ	862
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For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | GET TRANSACTION DATA | DELETE | END TRANSACTION | FIND | HISTOGRAM | GET | GET SAME | LIMIT | PASSW | PERFORM BREAK PROCESSING | READLOB | RETRY | STORE | UPDATE | UPDATE | DELETE | UPDATE | UPDAT

Belongs to Function Group: Database Access and Update

#### **Function**

The READ statement is used to read records from a database. The records can be retrieved in physical sequence, in Adabas ISN sequence, or in the value sequence of a descriptor (key) field. The READ statement causes a processing loop to be initiated.

See also the following sections in the *Programming Guide*:

- READ Statement
- Loop Processing
- Referencing of Database Fields Using (r) Notation

## **Syntax Description**

#### Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure		F	os	sil	ble	For	Referencing Permitted	Dynamic Definition		
operand1	C	S					N	1 I	) ]	[	В*			yes	no
operand2	С	S				A								yes	no
operand3	С	S					N	1						yes	no
operand4	С	S					N	1 I	) ]	[	B *			yes	no

 $<sup>^{*}</sup>$  Format B of <code>operand1</code> and <code>operand4</code> may be used with a length of less than or equal to 4.

#### Syntax Element Description:

Syntax Element	Description
operand1	Number of Records to be Read:
	The number of records to be read may be limited by specifying operand1 (enclosed in parentheses, immediately after the keyword READ) - either as a numeric constant (in the range from 0 to 4294967295) or as the name of a numeric variable.
	Example:
	READ (5) IN EMPLOYEES
	MOVE 10 TO CNT(N2) READ (CNT) EMPLOYEES
	For this statement, the specified limit has priority over a limit set with a LIMIT statement.
	If a smaller limit is set with the profile or session parameter $LT$ , the $LT$ limit applies.
	Note:
	1. If you wish to read a 4-digit number of records, specify it with a leading zero: (0 nnnn); because Natural interprets every 4-digit number enclosed in parentheses as a line-number reference to a statement.
	2. <i>operand1</i> is evaluated when the READ loop is entered. If the value of <i>operand1</i> is modified within the READ loop, this does not affect the number of records read.

Syntax Element	Description
ALL	ALL Option:
	To emphasize that <i>all</i> records are to be read, you can optionally specify the keyword ALL.
	The ALL option is used by default if <code>operand1</code> and <code>ALL</code> are omitted.
MULTI-FETCH-clause	MULTI-FETCH Clause:
	See MULTI-FETCH Clause below.
view-name	View Name:
	As <i>view-name</i> , you specify the name of a view, which must have been defined either within a DEFINE DATA statement or outside the program in a global or local data area.
	In reporting mode, <i>view-name</i> is the name of a DDM if no DEFINE DATA LOCAL statement is used.
PASSWORD=operand2	PASSWORD and CIPHER Clauses:
CIPHER=operand3	These clauses are applicable only to Adabas or VSAM databases. They cannot be used with Entire System Server.
	The PASSWORD clause is used to provide a password when retrieving data from a file which is password-protected.
	The CIPHER clause is used to provide a cipher key when retrieving data from a file which is enciphered.
	See the statements FIND and PASSW for further information.
WITH REPOSITION	WITH REPOSITION Option:
	This option is used to make the READ statement sensitive for repositioning events. See <i>WITH REPOSITION Option</i> .
sequence/range-specification	Sequence/Range Specification:
	This option specifies the sequence and/or the range of retrieval. See <i>Sequence/Range Specification</i> .
STARTING WITH ISN=operand4	STARTING WITH ISN Clause:
	This clause applies only to Adabas and VSAM databases.
	Access to Adabas
	This clause can be used in conjunction with a READ statement in physical or in logical (ascending/descending) sequence. The value supplied (operand4, range from 0 to 4294967295) represents an Adabas ISN (internal sequence number) and is used to specify a definite record where to start the READ loop.

Syntax Element	Description
	■ Logical Sequence Even if documented with an equal character (=), the READ statement does not return only those records with exactly the start value in the corresponding descriptor field, but starts a logical browse in ascending or descending order, beginning with the start value supplied. If some records have the same contents in the descriptor field, they will be returned in an ISN-sorted sequence.
	The STARTING WITH ISN clause is some kind of a "second level" selection criterion that applies only if the start value matches the descriptor value for the first record. All records with a descriptor value that is the same as the start value and an ISN that is "less equal" ("greater equal" for a descending READ) than the start ISN are ignored by Adabas. The first record returned in the READ loop is either
	the first record with descriptor = start value and an ISN "greater" ("less" for a descending READ) than the start ISN,
	or if such a record does not exist, the first record with a descriptor "greater" ("less" for a descending READ) than the start value.
	■ Physical Sequence The records are returned in the order in which they are physically stored. If a STARTING WITH ISN clause is specified, Adabas ignores all records until the record with the ISN that is the same as the start ISN is reached. The first record returned is the next record following the ISN=start ISN record.
	Access to VSAM
	This clause can only be used in physical sequence. The value supplied (operand4) represents a VSAM RBA (relative byte address of ESDS) or RRN (relative record number of RRDS), which is to be used as a start value for the read operation.
	Examples
	This clause may be used for repositioning within a READ loop whose processing has been interrupted, to easily determine the next record with which processing is to continue. This is particularly useful if the next record cannot be identified uniquely by any of its descriptor values. It can also be useful in a distributed client/server application where the reading of the records is performed by a server program while further processing of the records is performed by a client program, and the records are not processed all in one go, but in batches.
	For an example, see the program REASISND below.
[[IN] SHARED HOLD [MODE=option]]	SHARED HOLD Clause:

Syntax Element	Description										
	<b>Note:</b> This clause can	be used only for acces	s to Adabas.								
	This clause can be used to place records being read in a "shared he state. A record can be put in shared hold by many users at the stime. As long as a record is in a shared hold state, it is protected for being updated, because it cannot be set into an exclusive hold by parallel users. This ensures data consistency for the record data, no one can update the record while it is being processed.										
	read different MU/PE over a LOB field in a J	multiple statements to Estatement) or to browse EADLOB statement), the y over this transaction									
	Although such a hold state is an efficient way to protect reassequences, it is a basic and important matter when to release record again from this "soft lock". Since this question deper individual application aspects, different options can be select the MODE subclause.										
	MODE Option	Hold Period	Explanation								
	C	Only at the moment of reading the record.	Ensures only that the record version being read has been committed by the last user who updated the record. This option does not really set a lock in hold state, but checks only that the record is not in exclusive hold by another user at time of read.								
	Q	Until the next record in a sequence is read.	Releases the record from shared hold when  the next record is read in the loop sequence or  the loop is terminated or  an END TRANSACTION or BACKOUT TRANSACTION is executed.								

Syntax Element	Description										
	S	Until the logical transaction is terminated.	Releases the record from shared hold when a logical transaction is terminated with an END TRANSACTION or BACKOUT TRANSACTION statement.								
	MODE=Q and MODE=S ensure that the record being read ca updated concurrently by other users until it has been rele hold again.  If the MODE subclause is not specified, MODE=C is the defar See also <i>Example 8 - SHARED HOLD Clause</i> below.										
SKIP RECORDS IN HOLD	SKIP RECORDS Cla		e celo								
SKIT KESSKES IN HOLD		be used only for acces	ss to Adabas.								
	NAT3145 (Adabas resin hold by another us requested and the recis requested and the relative reduction of the recis requested and the relative reduction of the results of t	er at this time. This occord is in exclusive hold record is in either exclusive	at happen if the record is curs if a shared hold is d or if an exclusive hold asive or shared hold. eaction to assure a "clean								
	could be skipped. If it	t is alright that such a rop processing should c	ecord will not be								
	If the SKIP RECORDS record with hold.	clause is applied, Nati	ural first tries to read the								
	If the record is already occur,	y in hold and the Natur	al error NAT3145 would								
	no error processing	; is initiated;									
		y in hold by another us not processed in terms	er) is instantly re-fetched of the program logic;								
	the record which conhold and the process		oped record is read with								
	See also <i>Example 9 - 9</i>	SKIP RECORDS Claus	<i>5e</i> .								
WHERE logical-condition	WHERE Clause:										
		y be used to specify an ondition) which is ev	additional selection valuated <i>after</i> a value has								

Syntax Element	Description
	been read and <i>before</i> any processing is performed on the value (including the AT BREAK evaluation).
	The syntax for a <code>logical-condition</code> is described in the section <code>Logical Condition Criteria</code> in the <code>Programming Guide</code> .
	If a LIMIT statement or a processing limit is specified in a READ statement containing a WHERE clause, records which are rejected as a result of the WHERE clause are not counted against the limit.
END-READ	End of READ Statement:
LOOP	In structured mode, the Natural reserved keyword END-READ must be used to end the READ statement.
	In reporting mode, the Natural statement LOOP is used to end the READ statement.

#### **MULTI-FETCH Clause**



**Note**: This clause can only be used for Adabas or DB2 databases.

For more information, see the section MULTI-FETCH Clause (Adabas) in the Programming Guide or Multiple Row Processing (SQL) in the Natural for DB2 part of the Database Management System Interfaces documentation.

#### **WITH REPOSITION Option**



**Note:** This option can only be applied if the underlying database is Adabas, VSAM or DL/I.

With a WITH REPOSITION option, you can make a READ statement sensitive for repositioning events. This allows you to reposition to another start value within an active READ loop. Processing of the READ statement then continues with the new start value.

A repositioning event is triggered by one of two ways when you use a READ statement with the WITH REPOSITION option:

1. When an ESCAPE TOP REPOSITION statement is executed. At execution of an ESCAPE TOP REPOSITION statement, Natural makes an instant branch to the loop begin and performs a restart; that is, the database repositions to a new record in the file according to the current content of the search value variable. At the same time, the loop-counter \*COUNTER is reset to zero.

2. When a READ loop tries to fetch the next record from the database and the value of the system variable \*COUNTER is 0.



**Note:** If \*COUNTER is set to 0 within the active READ loop, processing of the current record is continued; no instant branch to the loop begin is performed.

#### **Functional Considerations**

- If the READ statement has a loop-limit (e.g. READ (10) EMPLOYEES WITH REPOSITION ..) and a restart event was triggered, the loop gets another 10 new records, no matter how many records where already processed until the repositioning takes place.
- If an ESCAPE TOP REPOSITION statement is executed, but the innermost loop is not capable of repositioning (since the WITH REPOSITION keyword is not set in the READ statement or the posted loop statement is anything else but a READ), a corresponding runtime error is issued.
- Since the ESCAPE TOP statement does not allow a reference, you can only initiate a reposition event if the innermost processing loop is a READ ...WITH REPOSITION statement.
- A reposition event does not trigger the execution of the AT START OF DATA section, nor does it trigger the re-evaluation of the loop-limit operand (if it is a variable).
- If the search value was not altered, the loop repositions to the same record like at initial loop start.

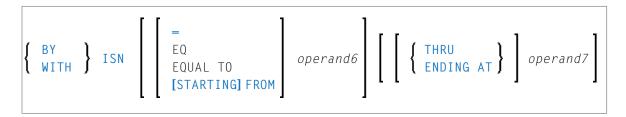
#### Sequence/Range Specification

Three syntax options are available to specify the sequence and/or the range of retrieval.

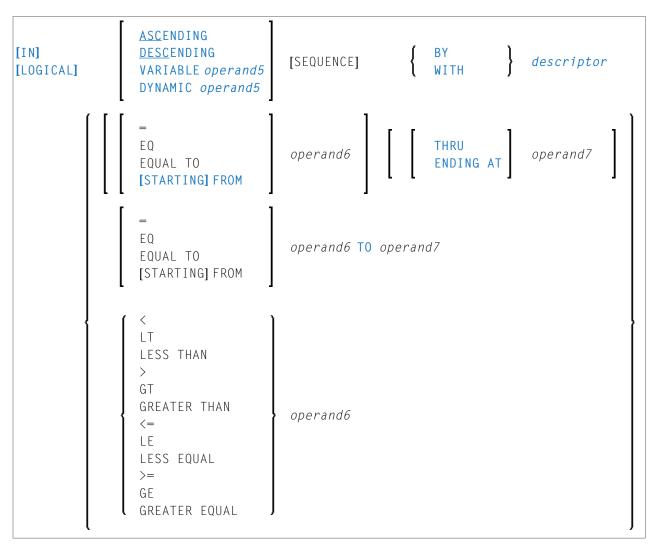
#### Syntax Option 1:



#### Syntax Option 2:



Syntax Option 3:



#### Notes:

- 1. The syntax options [2] and [3] are not available with Entire System Server.
- 2. If the comparators of Diagram 3 are used, the options ENDING AT, THRU and TO may not be used. These comparators are also valid for the HISTOGRAM statement.

#### Operand Definition Table:

Operand	Ро	ssib	Possible Formats												Referencing Permitted	Dynamic Definition		
operand5		S			A												yes	no
operand6	С	S			Α	]	N	Р	Ι	F	В*	D	Т	L			yes	no
operand7	C	S			Ā	]	N	P	Ī	F	В*	D	T	L			yes	no

<sup>\*</sup> Format B of operand6 and operand7 may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description		
READ IN	Read in Physical Sequence:		
PHYSICAL SEQUENCE	This option is used to read records in the order in which they are physically stored in a database.		
	<b>Note:</b> For VSAM databases: READ PHYSICAL can only be applied to ESDS and RRDS.		
	PHYSICAL is the default sequence.		
READ BY ISN	Read by ISN:		
	This option is used to read records in the order of Adabas ISNs (internal sequence numbers) or VSAM RBAs (relative byte addresses of ESDS) or RRNs (relative record numbers of RRDS) respectively. Instead of using the keyword BY, you may specify the keyword WITH, which has the same effect.		
	For READ BY ISN, operand6 and operand7 must be provided as a numeric constant or user-defined variable in the range from 0 to 4294967295.		
	READ BY ISN can only be used for Adabas and VSAM databases; for VSAM databases, it is only valid for ESDS and RRDS.		
	<b>Note:</b> For XML databases: READ BY ISN is used to read XML objects according to the order of Tamino object IDs.		
READ IN	Read in Logical Sequence:		
LOGICAL			
SEQUENCE	This option is used to read records in the order of the values of a descriptor (key) field.		
	If you specify a descriptor, the records will be read in the value sequence of the descriptor. A descriptor, subdescriptor, superdescriptor or hyperdescriptor may be used for sequence control. A phonetic descriptor, a descriptor within a periodic group, or a superdescriptor which contains a periodic-group field cannot be used.		
	If you do not specify a descriptor, the default descriptor as specified in the DDM (field Default Sequence) will be used.		
	Note:		
	1. For DL/I databases: The descriptor used must be either the sequence field of a root segment, or a secondary index field. If a secondary index field is specified, it must also be specified in the PROCSEQ parameter of a PCB. Natural uses this PCB and the corresponding hierarchical structure to process the database. As HDAM databases use a randomizing routine to locate root segments, no sensible results will be returned when using READ LOGICAL for HDAM databases; therefore you should use READ PHYSICAL for HDAM databases.		
	2. For VSAM databases: LOGICAL is only valid for KSDS with primary and alternate keys defined and for ESDS with alternate keys defined.		

Syntax Element	Description	
	If the descriptor used for sequence control is defined with null-value suppression (Adabas only), any record which contains a null value for the descriptor will not be read.	
	If the descriptor is a multiple-value field (Adabas only), the same record will be read multiple times depending on the number of values present.	
	<b>Note:</b> READ IN LOGICAL SEQUENCE is also discussed in the <i>Programming Guide</i> ; see	
	Statements for Database Access, READ Statement.	
ASCENDING	Ascending/Descending Order:	
DESCENDING   VARIABLE   DYNAMIC	This clause only applies to Adabas, XML databases, VSAM and SQL databases. In a READ PHYSICAL statement, it can only be applied to VSAM and DB2 databases.	
SEQUENCE	With this clause, you can determine whether the records are to be read in ascending sequence or in descending sequence.	
	■ The default sequence is ascending (which may, but need not, be explicitly specified by using the keyword ASCENDING).	
	■ If the records are to be read in descending sequence, you specify the keyword DESCENDING.	
	■ If, instead of determining it in advance, you want to have the option of determining at runtime whether the records are to be read in ascending or descending sequence, you either specify the keyword VARIABLE or DYNAMIC, followed by a variable (operand5). operand5 has to be of format/length A1 and can contain the value A (for "ascending") or D (for "descending").	
	■ If keyword VARIABLE is used, the reading direction (value of operand5) is evaluated at start of the READ processing loop and remains the same until the loop is terminated, regardless if the operand5 field is altered in the READ loop or not.	
	■ If keyword DYNAMIC is used, the reading direction (value of operand5) is evaluated before every record fetch in the READ processing loop and may be changed from record to record. This allows to change the scroll sequence from ascending to descending (and vice versa) at any place in the READ loop.	
	STARTING FROM/ENDING AT Clauses:	
ENDING AT/TO	The STARTING FROM and ENDING AT clauses are used to limit reading to a set of records based on a user-specified range of values.	
	The STARTING FROM clause (= or EQ or EQUAL TO or [STARTING] FROM) determines the starting value for the read operation. If a starting value is specified, reading will begin with the value specified. If the starting value does not exist in the file, the next higher (or lower for a DESCENDING read) value will be used. If no higher (or lower for DESCENDING) value exists, the loop will not be entered.	
	In order to limit the records to an end-value, you may specify an ENDING AT clause with the terms THRU, ENDING AT or T0, that imply an inclusive range. Whenever the read descriptor field exceeds the end-value specified, an automatic loop termination is	

Syntax Element	Description	
	performed. Although the basic functionality of the TO, THRU and ENDING AT keywords looks quite similar, internally they differ in how they work.	
THRU/ENDING AT	THRU/ENDING AT Option:	
	If THRU or ENDING AT is used, only the start-value is supplied to the database, but the end-value check is performed by the Natural runtime system, after the record is returned by the database. If the read direction is ASCENDING, you have to supply the lower value as the start-value and the higher-value as the end-value, since the start-value represents the value (and record) returned first in the READ loop. However, if you invoke a backwards read (DESCENDING), the higher value has to appear in the start-value and the lower-value in the end-value.	
	Internally, to determine the end of the range to be read, Natural reads one record beyond the end-value. If you have left the READ loop because the end-value has been reached, be aware that this last record is in fact not the last record within the demanded range, but the first record beyond that range (except if the file does not contain a further record after the last result record).	
	The THRU and ENDING AT clauses can be used for all databases which support the READ or HISTOGRAM statements.	
ТО	TO Option:	
	If the keyword T0 is used, both the start-value and the end-value are sent to the database, and Natural does not perform checks for value ranges. If the end-value is exceeded, the database reacts the same as when "end-of-file" is reached, and the database loop is exited. Since the complete range checking is done by the database, the lower-value (of the range) is always supplied in the start-value and the higher-value filled into the end-value, regardless if you are browsing in ASCENDING or DESCENDING order.	

#### Notes on Functional Differences between THRU/ENDING AT and TO

The following list describes the functional differences between the usage of the <code>THRU/ENDING</code> AT and  $\top 0$  options.

THRU/ENDING AT	то
When the READ loop terminates because the end-value has been reached, the view contains the first record "out-of-range".	When the READ loop terminates because the end-value has been reached, the view contains the last record of the specified range.
If a end-value variable is modified during the READ loop, the new value will be used for end-value check on next record being read.	
An incorrect range (for example, READ = 'B' THRU 'A') does not cause a database error, but just returns no record.	
If a READ DESCENDING is used with start- and end-value, the start value is used to position in the file,	Since both values are passed to the database, they have to appear in ascending order. In other words,

THRU/ENDING AT	ТО
whereas the end-value is used by Natural to check for "end-of-range". Therefore the start-value is higher than (or equal to) the end-value.	the start-value is lower than (or equal to) the end-value, no matter if you are reading in ascending or descending order.
In order to check for range overflow, the descriptor value has to appear in the underlying database view; that is, it must be returned in the record buffer.	The descriptor is not required in the record fields returned.
The end-value check for an Adabas multi-value field (MU-field) or a sub-/super-/hyper-descriptor is not possible and leads to syntax error NAT0160 at program compilation.	You may specify an end-value for MU-fields and sub-/super-/hyper-descriptors.
Can be used for all databases.	Can be used for all databases.



**Note:** The result of READ/HISTOGRAM THRU/ENDING AT might differ from the result of READ/HISTOGRAM TO if Natural and the accessed database reside on different platforms with different collating sequences.

## System Variables Available with READ

The Natural system variables \*ISN and \*COUNTER are available with the READ statement.

The format/length of these system variables is P10. This format/length cannot be changed.

The usage of the system variables is illustrated below.

System Variable	Explanation		
*ISN	The system variable *ISN contains the Adabas ISN of the record currently being processed		
	Note:		
	1. For VSAM databases, *ISN contains either the RRN (for RRDS) or the RBA (for ESDS) of the current record.		
	2. For Tamino, *ISN contains the XML object ID.		
	3. For DL/I and SQL databases and with Entire System Server, *ISN is not available.		
*COUNTER	The system variable *COUNTER contains the number of times the processing loop has been entered.		

#### **Examples**

- Example 1 READ Statement
- Example 2 READ WITH REPOSITION
- Example 3 Combining READ and FIND Statements
- Example 4 DESCENDING Option
- Example 5 VARIABLE Option
- Example 6 DYNAMIC Option
- Example 7 STARTING WITH ISN Clause
- Example 8 SHARED HOLD Clause
- Example 9 SKIP RECORDS Clause

#### **Example 1 - READ Statement**

```
** Example 'REAEX1S': READ (structured mode)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 PERSONNEL-ID
  2 NAME
1 VEHIC-VIEW VIEW OF VEHICLES
  2 PERSONNEL-ID
  2 MAKE
END-DEFINE
LIMIT 3
WRITE 'READ IN PHYSICAL SEQUENCE'
READ EMPLOY-VIEW IN PHYSICAL SEQUENCE
 DISPLAY NOTITLE PERSONNEL-ID NAME *ISN *COUNTER
END-READ
WRITE / 'READ IN ISN SEQUENCE'
READ EMPLOY-VIEW BY ISN STARTING FROM 1 ENDING AT 3
 DISPLAY
                  PERSONNEL-ID NAME *ISN *COUNTER
END-READ
WRITE / 'READ IN NAME SEQUENCE'
READ EMPLOY-VIEW BY NAME
 DISPLAY
                  PERSONNEL-ID NAME *ISN *COUNTER
END-READ
WRITE / 'READ IN NAME SEQUENCE STARTING FROM ''M'''
READ EMPLOY-VIEW BY NAME STARTING FROM 'M'
 DISPLAY
                  PERSONNEL-ID NAME *ISN *COUNTER
END-READ
```

\* END

#### **Output of Program REAEX1S:**

PERSONNEL ID	NAME	ISN	CNT	
READ IN P	HYSICAL SEQUENCE			
50005800	ADAM	1	1	
50005600		2	2	
50005500	BLOND	3	3	
READ IN I	SN SEQUENCE			
50005800	ADAM	1	1	
50005600	MORENO	2	2	
50005500	BLOND	3	3	
DEAD IN N	AME SEQUENCE			
60008339		478	1	
30000231		878	2	
50005800		1	3	
READ IN N	AME SEQUENCE STARTING FR	'M' MC		
30008125	MACDONALD	923	1	
20028700	MACKARNESS	765	2	
40000045	MADSEN	508	3	

Equivalent reporting-mode example: **REAEX1R**.

#### **Example 2 - READ WITH REPOSITION**

```
DEFINE DATA LOCAL
1 MYVIEW VIEW OF ...
 2 NAME
1 #STARTVAL (A20) INIT <'A'>
1 #ATTR
          (C)
END-DEFINE
. . .
SET KEY PF3
READ MYVIEW WITH REPOSITION BY NAME = #STARTVAL
INPUT (IP=OFF AD=0) 'NAME:' NAME /
    'Enter new start value for repositioning:' #STARTVAL (AD=MT CV=#ATTR) /
    'Press PF3 to stop'
  IF *PF-KEY = 'PF3'
   THEN STOP
  END-IF
  IF #ATTR MODIFIED
   THEN ESCAPE TOP REPOSITION
```

```
END-IF
END-READ
...
```

```
DEFINE DATA LOCAL
1 MYVIEW VIEW OF ...
2 NAME
1 #STARTVAL (A20) INIT <'A'>
1 #ATTR
        (C)
END-DEFINE
. . .
SET KEY PF3
READ MYVIEW WITH REPOSITION BY NAME = #STARTVAL
  INPUT (IP=OFF AD=O) 'NAME:' NAME /
    'Enter new start value for repositioning:' #STARTVAL (AD=MT CV=#ATTR) /
    'Press PF3 to stop'
  IF *PF-KEY = 'PF3'
   THEN STOP
  END-IF
  IF #ATTR MODIFIED
   THEN RESET *COUNTER
  END-IF
END-READ
. . .
```

#### **Example 3 - Combining READ and FIND Statements**

The following program reads records from the EMPLOYEES file in logical sequential order based on the values of the descriptor NAME. A FIND statement is then issued to the VEHICLES file using the personnel number from the EMPLOYEES file as search criterion. The resulting report shows the name (read from the EMPLOYEES file) of each person read and the model of automobile (read from the VEHICLES file) owned by this person. Multiple lines with the same name are produced if the person owns more than one automobile.

```
** Example 'REAEX2': READ and FIND combination

*************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 FIRST-NAME

2 NAME

2 CITY

1 VEH-VIEW VIEW OF VEHICLES

2 PERSONNEL-ID

2 MAKE

END-DEFINE

*

LIMIT 10
```

```
RD. READ EMPLOY-VIEW BY NAME STARTING FROM 'JONES'
SUSPEND IDENTICAL SUPPRESS
FD. FIND VEH-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (RD.)

IF NO RECORDS FOUND
ENTER
END-NOREC
DISPLAY NOTITLE (ES=OFF IS=ON ZP=ON AL=15)
PERSONNEL-ID (RD.)
FIRST-NAME (RD.)
MAKE (FD.) (IS=OFF)

END-FIND
END-READ
END
```

#### **Output of Program REAEX2:**

PERSONNEL ID	FIRST-NAME	MAKE
20007500	VIRGINIA	CHRYSLER
20008400	MARSHA	CHRYSLER
		CHRYSLER
20021100	ROBERT	GENERAL MOTORS
20000800	LILLY	FORD
		MG
20001100	EDWARD	GENERAL MOTORS
20002000	MARTHA	GENERAL MOTORS
20003400	LAUREL	GENERAL MOTORS
30034045	KEVIN	DATSUN
30034233	GREGORY	FORD
11400319	MANFRED	

#### **Example 4 - DESCENDING Option**

#### **Example 5 - VARIABLE Option**

```
** Example 'REAVSEQ': READ (with VARIABLE SEQUENCE)
************************
DEFINE DATA LOCAL
1 EMPL VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 BIRTH
1 #DIR
           (A1)
1 #STARTVALUE (A20)
END-DEFINE
SET KEY PF7 PF8
INPUT 'Select READ direction'
                                         21T 'to read backward'
  // 'Press' 08T 'PF7' (I)
            O8T 'PF8' (I) 'or' 'ENTER' (I) 21T 'to read forward'
IF *PF-KEY = 'PF7'
 MOVE 'D' TO #DIR
 MOVE 'ZZZ' TO #STARTVALUE
ELSE
 MOVE 'A' TO #DIR
 MOVE 'A' TO #STARTVALUE
END-IF
READ (10) EMPL IN VARIABLE #DIR SEQUENCE
              BY NAME FROM #STARTVALUE
 DISPLAY *ISN NAME FIRST-NAME BIRTH (EM=YYYY-MM-DD)
END-READ
END
```

#### **Example 6 - DYNAMIC Option**

```
DEFINE DATA LOCAL

1 #DIRECTION (A1) INIT <'A'> /* 'A' = ASCENDING

1 #EMPVIEW VIEW OF EMPLOYEES

2 NAME
...

END-DEFINE
...

READ #EMPVIEW IN DYNAMIC #DIRECTION SEQUENCE BY NAME = 'SMITH'

INPUT (AD=0) NAME

/ 'Press PF7 to scroll in DESCENDING sequence'

/ 'Press PF8 to scroll in ASCENDING sequence'
...

IF *PF-KEY = 'PF7' THEN MOVE 'D' TO #DIRECTION END-IF

IF *PF-KEY = 'PF8' THEN MOVE 'A' TO #DIRECTION END-IF
```

```
END-READ
```

#### **Example 7 - STARTING WITH ISN Clause**

```
** Example 'REASISND': READ (with STARTING WITH ISN)
**************************
DEFINE DATA LOCAL
1 EMPL VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 BIRTH
1 #DIR
         (A1)
1 #STARTVAL (A20)
1 #STARTISN (N8)
END-DEFINE
SET KEY PF3 PF7 PF8
MOVE 'ADKINSON' TO #STARTVAL
READ (9) EMPL BY NAME = #STARTVAL
 WRITE *ISN NAME FIRST-NAME BIRTH (EM=YYYY-MM-DD) *COUNTER
 IF *COUNTER = 5 THEN
   MOVE NAME TO #STARTVAL
   MOVE *ISN TO #STARTISN
 END-IF
END-READ
#DIR := 'A'
REPEAT
 READ EMPL IN VARIABLE #DIR BY NAME = #STARTVAL
           STARTING WITH ISN = #STARTISN
   MOVE NAME TO #STARTVAL
   MOVE *ISN TO #STARTISN
   INPUT NO ERASE (IP=OFF AD=O)
        15/01 *ISN NAME FIRST-NAME BIRTH (EM=YYYY-MM-DD)
          // 'Direction:' #DIR
          // 'Press PF3 to stop'
                    PF7 to go step back'
          /
                     PF8 to go step forward'
                    ENTER to continue in that direction'
   IF *PF-KEY = 'PF7' AND #DIR = 'A'
     MOVE 'D' TO #DIR
     ESCAPE BOTTOM
   END-IF
   IF *PF-KEY = 'PF8' AND #DIR = 'D'
     MOVE 'A' TO #DIR
```

```
ESCAPE BOTTOM

END-IF

IF *PF-KEY = 'PF3'

STOP

END-IF

END-READ

/*

IF *COUNTER(0290) = 0

STOP

END-IF

END-REPEAT

END-REPEAT

END
```

#### **Example 8 - SHARED HOLD Clause**

```
READ EMPL-VIEW WITH NAME = ...

IN SHARED HOLD MODE=Q /* Record in shared hold until next record is read.

...

GET EMPL-VIEW *ISN /* The record remains unchanged!

...

END-READ
```

#### **Example 9 - SKIP RECORDS Clause**

```
READ EMPL-VIEW WITH NAME = ... /* Records found are put in hold while reading.

SKIP RECORDS IN HOLD /* Records already held by other users are skipped /* to prevent error NAT3145.

UPDATE
END TRANSACTION
END-READ
```

# 111 READ RESULT SET (SQL)

Function	872
■ Restriction	873
Syntax Description	873
■ Example	

#### Common Set Syntax:

#### Extended Set Syntax:

```
VIEW view-name
READ [(1imit)] RESULT SET
                                               parameter[,
                                                                               FROM ddm-name
result-set INTO
                                               parameter]...
  [WITH INSENSITIVE SCROLL [:] scroll-hv]
 [GIVING [:] sq1-code]
                                               [:] row_hv
[WITH ROWSET POSITIONING]
                                                                               ROWS]
F0R
                                               integer
END-RESULT
                            (structured mode only)
L00P
                            (reporting mode only)
```

For an explanation of the symbols used in the syntax diagram, see Syntax Symbols.

Belongs to Function Group: Database Access and Update

See also *READ RESULT SET - SQL* in the *Natural for DB2* part of the *Database Management System Interfaces* documentation.

#### **Function**

The SQL statement READ RESULT SET can only be used in conjunction with a CALLDBPROC statement. It is used to read a result set which was created by a stored procedure that was invoked by a previous CALLDBPROC statement.

## Restriction

This statement is available only with Natural for DB2.

## **Syntax Description**

Syntax Element	Description
7 i m i t	Limit Option:
	You can limit the number of rows to be read. You can specify the limit either as a numeric constant (0 - 4294967295) or as a variable of format N, P or I.
result-set	Result Set:
	As result-set you specify a result-set locator variable filled by a preceding CALLDBPROC statement. result-set has to be a variable of format/length I4.
	<b>Note:</b> If a syncpoint operation takes place between the CALLDBPROC statement and
	the READ RESULT SET statement, the result sets can no longer be accessed by the READ RESULT SET statement.
INTO	INTO Clause:
	The INTO clause is used to specify the target fields in the program which are to be filled with the result set.
	The INTO clause can specify either single parameters or one or more views as defined in the DEFINE DATA statement.
VIEW view-name	VIEW Clause:
	<i>view-name</i> specifies a view whose fields receive the columns of the result set created by the stored procedure invoked via the CALLDBPROC statement.
	The number of columns of the result set must correspond to the number of fields defined in the view (not counting group fields, redefining fields and indicator fields).
parameter Parameter:	
	Each parameter specifies a field which receives a column of the result set created by the stored procedure invoked via the CALLDBPROC statement.
FROM ddm-name	DDM Name:
	As ddm-name you specify the name of the data definition module (DDM) which is used to "address" the database executing the stored procedure.
	For further information, see <i>ddm-name</i> .

Syntax Element	Description
	WITH INSENSITIVE SCROLL Clause:
SCROLL[:] scroll_hv	This clause belongs to the <b>SQL Extended Set</b> . It is available only with Natural for DB2.
	Using this clause causes the application to use an insensitive scrollable cursor to access the result set created by the previously invoked stored procedure. In order to use this clause, the stored procedure must have created the result set with a scrollable cursor. <code>scroll_hv</code> has to be an alphanumeric Natural variable which contains the scrolling direction. <code>scroll_hv</code> will be evaluated each time the READ RESULT SET processing loop is executed.
	If the GIVING <i>sqlcode</i> option is specified as well, the processing loop will stay open, even if an <i>sqlcode</i> +100 (row not found) is returned from the RDBMS.
	The processing will be terminated, if the application issues an ESCAPE statement or if the SQLCODE $+100$ (row not found) is encountered five times successively without a terminal I/O.
	If the GIVING <i>sqlcode</i> option is not specified, the processing loop will be closed, if any SQLCODE other than 0 (success) is returned from the RDBMS.
GIVING sqlcode	GIVING sq1code Clause:
	This clause may be used to obtain the SQLCODE of the SQL "fetch" operation used to process the result set.
	If this clause is specified and the SQLCODE of the SQL operation is not 0, no Natural error message will be issued. In this case, the action to be taken in reaction to the SQLCODE value has to be coded in the invoking Natural object.
	The sqlcode field has to be a variable of format/length I4.
	If the GIVING <i>sqlcode</i> clause is omitted, a Natural error message will be issued if the SQLCODE is not 0.
WITH ROWSET	WITH ROWSET POSITIONING FOR ROWS Clause:
POSITIONING FOR ROWS	This clause belongs to the SQL Extended Set. It is available only with Natural for DB2.
	Using this clause causes the application to read multiple rows of data from the result set by the previously invoked stored procedure. The <code>integer</code> or <code>:row_hv</code> variable determines the number of rows fetched.
	If the GIVING sqlcode option is specified as well, the processing loop will stay open, even if an SQLCODE +100 (row not found) is returned from the RDBMS.
	The processing will be terminated, if the application issues an ESCAPE statement or if the SQLCODE $\pm 100$ (row not found) is encountered five times successively without a terminal I/O.
	If the GIVING <i>sqlcode</i> clause is not specified, the processing loop will be closed if any SQLCODE other than 0 (success) is returned from the RDBMS.

Syntax Element	Description
END-RESULT	End of READ RESULT SET Statement:
LOOP	In structured mode, the Natural reserved keyword END-RESULT must be used to end the READ RESULT SET statement.
	In reporting mode, the Natural statement LOOP must be used to end the READ RESULT SET statement.

## **Example**

See *Example of CALLDBPROC/READ RESULT SET* in the section *CALLDBPROC - SQL* of the *Natural for DB2* documentation.

# 112 READ WORK FILE

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Related Statements: CLOSE WORK FILE | DEFINE WORK FILE | WRITE WORK FILE

Belongs to Function Group: Control of Work Files / PC Files

#### **Function**

The READ WORK FILE statement is used to read data from a non-Adabas physical sequential work file. The data is read sequentially from the work file. How it is read is independent of how it was written to the work file.

This statement can only be used within a program to be executed under Com-plete, CICS, TSO or TIAM, or in batch mode. Appropriate JCL or system commands must be executed to allocate the work file. For further information, see the *Operations* documentation. For information on work file assignments, see profile parameter WORK in the *Parameter Reference*.

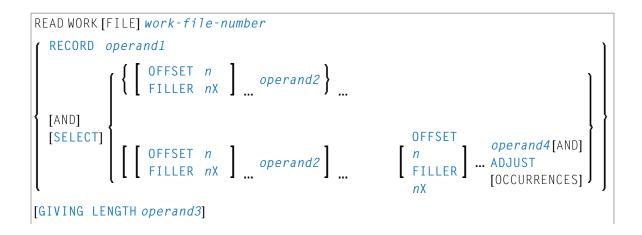
READ WORK FILE initiates and executes a processing loop for reading of all records on the work file. Automatic break processing may be performed within a READ WORK FILE loop.



#### Notes:

- 1. When an end-of-file condition occurs during the execution of a READ WORK FILE statement, Natural automatically closes the work file.
- 2. For Entire Connection: If an Entire Connection work file is read, no I/O statement may be placed within the READ WORK FILE processing loop.
- 3. For Unicode and code page support, see *Work Files and Print Files on Mainframe Platforms* in the *Unicode and Code Page Support* documentation.

## Syntax 1 - READ WORK FILE with Processing Loop



```
statement...

END-WORK (structured mode only)

LOOP (reporting mode only)
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

# Syntax 2 - READ WORK FILE without Processing Loop

```
READ WORK [FILE] work-file-number ONCE

RECORD operand1

\[
\begin{bmatrix}
OFFSET \\
INX \\
```

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

# **Syntax Description**

Operand Definition Table:

Operand	Po	Possible Structure						P	os	si	ble	F	_	Dynamic Definition					
operand1		S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C		yes	yes
operand2		S	A	G		A	U	N	Р	Ι	F	В	D	Т	L	C		yes	yes
operand3		S								I								yes	yes
operand4			A			A	U	N	Р	Ι	F	В	D	Т	L	C		no	no

Format C is not valid for Natural Connection.

See also *Field Lengths*.

# Syntax Element Description:

Syntax Element	Description						
work-file-number	Work File Number:						
	The number of the work file (as defined to Natural) to be read.						
ONCE	ONCE Option:						
	ONCE is used to indicate that only one record is to be read. No processing loop is initiated (and therefore the loop-closing keyword END-WORK or LOOP must not be specified). If ONCE is specified, the AT END OF FILE clause should also be used.						
	If a READ WORK FILE statement specified with the ONCE option is controlled by a user-initiated processing loop, an end-of-file condition may be detected on the work file before the loop ends. All fields read from the work file still contain the values from the last record read. The work file is then repositioned to the first record which will be read upon the next execution of READ WORK FILE ONCE.						
RECORD operand1	RECORD Option:						
FILLER nX	In reporting mode, an operand list ( <i>operand1</i> ) corresponding to the layout of the record must be provided. Specify FILLER <i>n</i> X if the total length of the operands is less that the work file record length.						
	In structured mode, or if the record to be used is defined using a DEFINE DATA statement, only one field (or group) may be specified, and FILLER is not permitted. The field (or group) must be long enough to receive the entire work file record.						
	No checking and no conversion is performed by Natural on the data contained in the record. It is the user's responsibility to describe the record layout correctly in order to avoid program abends caused by non-numeric data in numeric fields. Because no checking is performed by Natural, this option is the fastest way to process records from a sequential file. The record area defined by <code>operand1</code> is filled with blanks before the record is read. Thus, an end-of-file condition will return a cleared area. Short records will have blanks appended.						
	The RECORD option cannot be used:						
	■ If an Entire Connection work file is read.						
	■ If any dynamic variables are used.						
SELECT	SELECT Option (Default):						
	If SELECT is specified, only the fields specified in the operand list ( operand2) will be made available. The position of the field in the input record may be indicated with an OFFSET and/or FILLER specification.						

Syntax Element	Description								
	OFFSET n	OFFSET 0 indicates the first byte of the record. OFFSET cannot be specified for work files defined as TYPE UNFORMATTED.							
	FILLER nX	Indicates that $n$ bytes are to be skipped in the input record.							
	Natural will assign the selected values to the individual fields and check that numeric fields as selected from the record actually contain valid numeric data according to their definition. Because checking of selected fields is performed by Natural, this option results in more overhead for the processing of a sequential file.								
	If a record does not fill all fields specifie	ed in the SELECT option, the following applies:							
	For a field which is only partially filled, the section which has not been filled is reset to blanks or zeros.								
	Fields which are not filled at all still	l have the contents they had before.							
operand4 AND ADJUST	ADJUST Clause:								
OCCURRENCES	Specify a one-dimensional X-array with complete range (*). The X-array is expanded or reduced to the number of occurrences needed to receive all data read. See <i>Handling of X-Arrays</i> below.								
	<b>Note:</b> This feature is not supported by	Entire Connection.							
GIVING LENGTH	GIVING LENGTH Clause								
operand3	This clause can be used to retrieve the length (number of bytes) is returned in	actual length of the record being read. The n operand3.							
	operand3 must be defined with forma	at/length I4.							
	If the work file is defined as TYPE UNFORMATTED, the length returned indicates number of bytes read from the byte-stream, including bytes skipped using the FI operand.								
AT END OF FILE	AT END OF FILE Clause								
		ction with the ONCE option. If the ONCE option cate the action to be taken when an end-of-file							
	If the ONCE option is not used, an end-processing loop termination.	of-file condition is handled like a normal							
END-WORK	End of READ WORK FILE Statemen	t:							
	In structured mode with processing loo be used to end the READ WORK FILE s	op, the Natural reserved word END-WORK must statement.							
LOOP	End of READ WORK FILE Statemen	t:							

Syntax Element	Description
	In reporting mode with processing loop, the Natural statement LOOP must be used to end the READ WORK FILE statement.
	to end the READ WORK FILE statement.

# **Field Lengths**

The field lengths in the *Operand Definition Table* are determined as follows:

Format	Length
A, B, I, F	The number of bytes in the input record is the same as the internal length definition.
N	The number of bytes in the input record is the sum of internal positions before and after the decimal point. The decimal point and sign do not occupy a byte position in the input record.
P, D, T	The number of bytes in the input record is the sum of positions before and after the decimal point plus 1 for the sign, divided by 2 rounded upwards.
L	1 byte is used. For C format fields, 2 bytes are used.

# **Examples of Field Lengths:**

Field Defin	Field Definition									
#FIELD1	(A10)	10 bytes								
#FIELD2	(B15)	15 bytes								
#FIELD3	(N1.3)	4 bytes								
#FIELD4	(NO.7)	7 bytes								
#FIELD5	(P1.2)	2 bytes								
#FIELD6	(P6.0)	4 bytes								

See also Format and Length of User-Defined Variables in the Programming Guide.

# Variable Index Range

When reading an array from a work file, you can specify a variable index range for the array. For example:

# **Handling of Dynamic Variables**

Work File Type	Handling
UNFORMATTED	Reading a dynamic variable from an UNFORMATTED work file puts the complete rest of the file into the variable (from the current position). If the file exceeds 1073741824 bytes, then a maximum of 1073741824 bytes is placed into the variable.
FORMATTED	Reading a dynamic variable from a FORMATTED work file puts the rest of the work file record into the variable. Thus, for work files with variable record length, the dynamic variable is resized in each execution of the READ WORK FILE statement to match the exact length of the record being read.

# **Handling of X-Arrays**

When the ADJUST clause is *not* used, X-arrays are treated the same as regular arrays; that is, their existing occurrences are filled.

When the ADJUST clause is used, a one-dimensional X-array specified with complete range (\*) is expanded to receive all data from the rest of the record for a work file of type FORMATTED, or to received all data from the rest of the file for a work file of type UNFORMATTED.

# **Examples**

- Example 1 READ WORK FILE
- Example 2 READ WORK FILE Formatted with Dynamic Variable
- Example 3 READ WORK FILE Unformatted with Dynamic Variable
- Example 4 READ WORK FILE Formatted with X-array and ADJUST its Occurrences

■ Example 5 - READ WORK FILE Unformatted with X-array and ADJUST its Occurrences

## **Example 1 - READ WORK FILE**

```
** Example 'RWFEX1': READ WORK FILE
*********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
1 #RECORD
 2 #PERS-ID (A8)
 2 ∦NAME
          (A20)
END-DEFINE
FIND EMPLOY-VIEW WITH CITY = 'STUTTGART'
 WRITE WORK FILE 1
       PERSONNEL-ID NAME
END-FIND
 . . .
READ WORK FILE 1 RECORD #RECORD
 DISPLAY NOTITLE #PERS-ID #NAME
END-WORK
END
```

#### **Output of Program RWFEX1:**

```
#PERS-ID #NAME
------
11100328 BERGHAUS
11100329 BARTHEL
11300313 AECKERLE
11300316 KANTE
11500304 KLUGE
11500308 DIETRICH
11500318 GASSNER
11500343 ROEHM
11600303 BERGER
11600320 BLAETTEL
11500336 JASPER
11100330 BUSH
11500328 EGGERT
```

#### Example 2 - READ WORK FILE Formatted with Dynamic Variable

```
** Example 'RWFEX2': READ WORK FILE - Formatted with dynamic variable

**********************

DEFINE DATA LOCAL

1 #DYNA (A) DYNAMIC

END-DEFINE

*

DEFINE WORK FILE 1 TYPE 'FORMATTED'

*

WRITE WORK FILE 1 VARIABLE 'text1 text2 text3 '

WRITE WORK FILE 1 VARIABLE 'text4 text5'

*

READ WORK FILE 1 AND SELECT #DYNA

DISPLAY *LENGTH(#DYNA) #DYNA (AL=40)

/*

/* Length: 18 Dyn.Var: 'text1 text2 text3'

/* Length: 11 Dyn.Var: 'text4 text5'

END-WORK

*

END
```

#### **Output of Program RWFEX2:**

```
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LENGTH #DYNA

18 text1 text2 text3
11 text4 text5
```

## **Example 3 - READ WORK FILE Unformatted with Dynamic Variable**

```
** Example 'RWFEX3': READ WORK FILE - Unformatted with dynamic variable

*************************

DEFINE DATA LOCAL

1 #DYNA (A) DYNAMIC

END-DEFINE

*

DEFINE WORK FILE 1 TYPE 'FORMATTED'

*

WRITE WORK FILE 1 VARIABLE 'text1 text2 text3 '

WRITE WORK FILE 1 VARIABLE 'text4 text5'

*

DEFINE WORK FILE 1 TYPE 'UNFORMATTED'

*

READ WORK FILE 1 AND SELECT #DYNA

DISPLAY *LENGTH(#DYNA) #DYNA (AL=40)

/*
```

```
/* Length: 29 Dyn.Var: 'text1 text2 text3 text4 text5'
END-WORK
*
END
```

## **Output of Program RWFEX3:**

```
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LENGTH #DYNA

29 text1 text2 text3 text4 text5
```

## Example 4 - READ WORK FILE Formatted with X-array and ADJUST its Occurrences

```
** Example 'RWFEX4': READ WORK FILE - Formatted with X-array
**
                                  and ADJUST its occurrences
**********************
DEFINE DATA LOCAL
 1 #ARR (A6/1:*)
 1 #0CC (I4)
END-DEFINE
DEFINE WORK FILE 1 TYPE 'FORMATTED'
WRITE WORK FILE 1 VARIABLE 'text1 text2 text3 '
WRITE WORK FILE 1 VARIABLE 'text4 text5'
READ WORK FILE 1 AND SELECT #ARR(*) AND ADJUST OCCURRENCES
 #OCC := *OCCURRENCE(#ARR)
 DISPLAY #OCC #ARR(1:#OCC)
 /*
 /* Occurrences: 3 Array(*): 'text1', 'text2', 'text3'
 /* Occurrences: 2 Array(*): 'text4', 'text5'
END-WORK
END
```

#### **Output of Program RWFEX4:**

```
2 text4
text5
```

## Example 5 - READ WORK FILE Unformatted with X-array and ADJUST its Occurrences

```
** Example 'RWFEX5': READ WORK FILE - Unformatted with X-array
                                   and ADJUST its occurrences
************************
DEFINE DATA LOCAL
 1 #ARR (A6/1:*)
 1 #0CC (I4)
END-DEFINE
DEFINE WORK FILE 1 TYPE 'FORMATTED'
WRITE WORK FILE 1 VARIABLE 'text1 text2 text3 '
WRITE WORK FILE 1 VARIABLE 'text4 text5'
DEFINE WORK FILE 1 TYPE 'UNFORMATTED'
READ WORK FILE 1 AND SELECT #ARR(*) AND ADJUST OCCURRENCES
 #OCC := *OCCURRENCE(#ARR)
 DISPLAY #OCC #ARR(1:#OCC)
 /*Occurrences: 5 Array(*): 'text1', 'text2', 'text3', 'text4', 'text5'
END-WORK
END
```

## **Output of Program RWFEX5:**

```
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#OCC #ARR

5 text1
    text2
    text3
    text4
    text5
```

# 113 READLOB

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	ctions	
	k Description	
•		
,	n Variables Available with READLOB	
	onal Considerations	
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```
READLOB

ALL
(operand1)

[IN] [FILE] view-name

[PASSWORD=operand2]

[CIPHER=operand3]

[[WITH] ISN [=] operand4]

[[STARTING] [AT] OFFSET [=] operand5]

statement ...

END-READLOB (structured mode only)

LOOP (reporting mode only)
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: READ | FIND | GET | UPDATELOB

Belongs to Function Group: Database Access and Update

# **Function**

The READLOB statement is used on a single record, where the defined LOB field (Large OBject field) is read in fixed length segments during the loop processing. It is only applicable to read this LOB field.

At loop beginning, the offset inside the LOB field is set from where to get the first data. On the next loop iteration, the segment following the last segment is returned. If the LOB data end is reached, the loop terminates.

This statement causes a processing loop to be initiated. See also *Loop Processing* in the *Programming Guide*.

## Restrictions

The READLOB statement can only be used for access to Adabas databases.

# **Syntax Description**

# Operand Definition Table:

Operand	Possible Structure					Po	OSS	sib	le Fo	rm	Referencing Permitted	•			
operand1	С	S					N	Р	Ι	В*				yes	no
operand2	С	S				A								yes	no
operand3	С	S					N							yes	no
operand4	С	S					N	Р	Ι	В*				yes	no
operand5	С	S					N	P	Ι	В*				yes	no

<sup>\*</sup> Format B of operand1, operand4 and operand5 may be used with a length of less than or equal to 4.

# Syntax Element Description:

Syntax Element	Description									
operand1	Number of LOB Segments to Be Read:									
	The number of loop executions to be performed may be limited by specifying operand1 (enclosed in parentheses, immediately after the keyword READLOB) - either as a numeric constant (0 - 4294967295) or as the name of a numeric variable.									
	Example:									
	READLOB (5) IN FILE VIEW01									
	#CNT := 10 READLOB (#CNT) IN FILE VIEW01									
	For this statement, the specified limit has priority over a limit set with a LIMIT statement. If a smaller limit is set with the profile or session parameter LT, the LT limit applies.									
	<b>Note:</b> operand1 is evaluated when the READLOB is started. If the value of operand1									
	is modified within the READLOB loop, this does not affect the number of loop iterations.									
ALL	ALL Option:									
	To emphasize that the LOB data is to be read until its end, you can optionally specify the keyword ALL.									
	The ALL option is used by default if operand1 and ALL are omitted.									

Syntax Element	Description							
view-name	View Name:							
	As <i>view-name</i> , you specify the name of a view, which must have been defined either within a DEFINE DATA statement or outside the program in a global or local data area.							
	■ The view has to contain just a single-valued LOB field, additional fields are not allowed.							
	■ If the LOB is a MU or PE field, a unique occurrence must be specified; a range notation is not allowed.							
	■ The LOB field must be defined in the DDM with a fixed (non-dynamic) length (which represents the segment length of the LOB field).							
· '	PASSWORD and CIPHER Clauses:							
CIPHER=operand3	The PASSWORD clause is used to provide a password when retrieving data from a file which is password-protected.							
	The CIPHER clause is used to provide a cipher key when retrieving data from a fi which is enciphered.							
	See the statements FIND and PASSW for further information.							
WITH ISN=operand4	WITH ISN Option:							
	This option is used to specify the ISN of the record which is accessed by the READLOB statement. During the complete loop execution, only this record is fetched.							
	operand4 must be provided either in the form of a numeric constant or as a user-defined variable, or via the Natural system variable *ISN. The field is not modified by the READLOB execution.							
	<b>Note:</b> <i>operand4</i> is evaluated when the READLOB is started. If the value of <i>operand4</i>							
	is modified within the READLOB loop, this does not affect the record being fetched.							
	If this option is omitted, the *ISN field of the last active database statement is used by default.							
STARTING AT	STARTING AT OFFSET Clause:							
OFFSET=operand5	Provides the start offset within the LOB field, where the first segment read begins. The first byte of the LOB field is offset zero (0).							
	operand5 must be provided either in the form of a numeric constant or as a user-defined variable, without precision digits. The field is not modified by the READLOB execution.							
	If this clause is omitted, start offset (0) is assumed, which causes the LOB field to be read from the beginning.							

Syntax Element	Description
	See also *NUMBER during the processing described in <i>System Variables Available with READLOB</i> below.
END-READLOB	End of READLOB Statement:
LOOP	In structured mode, the Natural reserved keyword END-READLOB must be used to end the READLOB statement.
	In reporting mode, the Natural statement LOOP is used to end the READLOB statement.

# **System Variables Available with READLOB**

 $The \ Natural \ system \ variables \ {\tt *ISN, *COUNTER} \ and \ {\tt *NUMBER} \ are \ provided \ with \ the \ {\tt READLOB} \ statement.$ 

The format/length of these system variables is P10. This format/length cannot be changed.

The purpose of the Natural system variables, when used with the READLOB statement, is explained below:

System Variable	Explanation								
*ISN		ontains the Adabas ISN of the record currently being processed. Since a READLOB statement ways makes access to the same record, the *ISN value returned is the same over all loop erations.							
*COUNTER	Contains the number of times the pr	ocessing loop has been passed through.							
*NUMBER	Before the call:	It specifies the byte offset in the LOB field from which the segment is to be read. Value zero (0) represents the leftmost byte in the LOB field.  This does not apply for the first loop iteration. In this case the read offset is determined by the STARTING AT OFFSET clause.							
	After the call:	If data was found (that is, the offset was less than the LOB field length), it receives the offset plus the segment length. This may lead to a *NUMBER value which is higher than the length of the entire LOB field.  If no data was found (that is, the offset was higher or equal to the LOB field length), the value of *NUMBER remains unchanged.							
	d is requested, the *NUMBER value must not be modified ne offset to exactly continue with the next segment in the if a continuation at another place within the LOB field is ge the *NUMBER value to this offset. If *NUMBER is reset, this								

System Variable	Explanation
	leads to the next segment coming from the LOB start. If $*NUMBER$ is incremented by $(n)$ , this number of bytes will be skipped in the LOB field processing.

## **Functional Considerations**

- The READLOB statement always reads the record without hold. In order to guarantee stability on the LOB data (that is, to prevent an update by other users) while the READLOB browses over the LOB field, the record can be set into hold with the database statement providing the ISN; either
  - into an *exclusive hold*, due to an UPDATE or DELETE referring to an outer READ or FIND statement or
  - into a *shared hold* with an explicit IN SHARED HOLD option applied in a READ or FIND statement. If the additional subparameter MODE=Q is used, the record is automatically released from hold if the next record is fetched in the read sequence.
- Since the READLOB statement always reads the record without hold, an UPDATE, DELETE or GET SAME statement must not refer to a READLOB statement.

# **Examples**

- Example 1 Get Record Number from READ Loop
- Example 2 Get Record Number by User-defined Value
- Example 3 Get Record Number from READ Loop (with Exclusive Hold)

#### Example 1 - Get Record Number from READ Loop

```
DEFINE DATA LOCAL
1 VIEWO1 VIEW OF ..
  2 NAME
  2 L@LOBFIELD
1 VIEW02 VIEW OF ..
                                   /* LOB field defined in DDM with (A1000).
  2 LOBFIELD_SEGMENT
FND-DFFINE
READ VIEW01 BY NAME = 'SMITH'
                                    /* Outer statement reads all demanded record
                                    /* fields, except the LOB field.
     IN SHARED HOLD MODE=Q
                                    /* Set record into shared hold to enforce LOB
                                    /* data stability during READLOB.
  DISPLAY NAME 'Total-length LOB-field' L@LOBFIELD
                                    /* Record number used from active record of
  READLOB VIEW02
                                    /* READ statement.
```

```
/* LOB is read in segments with length 1000.

STARTING AT OFFSET = 2000 /* Start to read the LOB field at byte 2000.

WRITE 'Loop counter:' *COUNTER 10X ' Next offset:' *NUMBER PRINT VIEW02.LOBFIELD_SEGMENT END-READLOB

END-READLOB

END-READLOB
```

## **Example 2 - Get Record Number by User-defined Value**

```
DEFINE DATA LOCAL
1 #ISN (I4)
1 #CNT (I4)
1 #0FF (I4)
1 VIEWO2 VIEW OF ...
                      /* LOB field defined in DDM with (A1000).
 2 LOBFIELD_SEGMENT
END-DEFINE
INPUT (AD=T)
 / ' Read record (ISN): ' #ISN
  / 'Number of segments:' #CNT
 / ' Start at offset:' #OFF
READLOB (#CNT) VIEW02
                              /* Read max. (#CNT) segments with length 1000.
   WITH ISN = #ISN
                              /* Record number provided by user.
                              /* Record is not in hold.
   STARTING AT OFFSET = #OFF /* Start to read the LOB field at byte (#OFF).
 WRITE 'Loop counter:' *COUNTER 10X ' Next offset:' *NUMBER
 PRINT VIEWO2.LOBFIELD_SEGMENT
END-READLOB
END
```

## Example 3 - Get Record Number from READ Loop (with Exclusive Hold)

```
DEFINE DATA LOCAL
1 VIEWO1 VIEW OF ..
 2 NAME
1 VIEWO2 VIEW OF ..
                      /* LOB field defined in DDM with (A1000).
 2 LOBFIELD_SEGMENT
END-DEFINE
R1. READ VIEW01 BY NAME = 'SMITH'/* Outer statement reads all demanded
                                /* record fields, except the LOB field.
 DISPLAY NAME
                           /* Record number from active record of READ.
 READLOB VIEW02
                           /* LOB is read in segments with length 1000.
      STARTING AT OFFSET = 2000 /* Start to read LOB field at byte 2000.
   WRITE 'Loop counter:' *COUNTER 10X ' Next offset:' *NUMBER
   PRINT VIEWO2.LOBFIELD_SEGMENT
  END-READLOB
```

```
UPDATE (R1.) /* Set record into exclusive hold that /* enforces LOB data stability during READLOB.

END OF TRANSACTION
END-READ
END
```

# 114 REDEFINE

Function	. 898
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Syntax Description	. 898
Examples	

REDEFINE 
$$\left\{\begin{array}{c} operand1 \ \left\{\begin{array}{c} nX \\ operand2 \end{array}\right\} \dots \end{array}\right\} \right\}$$

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Reporting Mode Statements

# **Function**

The REDEFINE statement is used to redefine a field. The resulting definition may consist of one or more user-defined variables.

With one REDEFINE statement, several fields may be redefined.

# Restriction

The REDEFINE statement is only valid in reporting mode. To redefine a field in structured mode, use the REDEFINE clause of the DEFINE DATA statement.

# **Syntax Description**

Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure			P	os	sik	ole	F	Formats				Referencing Permitted	Dynamic Definition
operand1		S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C	yes	no
operand2		S	A	G		A		N	Р	Ι	F	В	D	T	L	C	yes	yes

Syntax Element Description:

Syntax Element	Description
REDEFINE	Method of Redefinition:
operand1 operand2	The byte positions of <i>operand1</i> are redefined from left to right regardless of format.
	The format of <code>operand2</code> can be different from the format of <code>operand1</code> . However, the data at the byte positions of <code>operand2</code> should match the format specification of <code>operand2</code> to avoid strange results in the output report. For example, if an alphanumeric field is redefined as numeric and does not contain numeric data

Syntax Element	Description							
	according to the format specification, an abnormal termination may result when it is used.							
	Further Redefinition:							
	Fields defined using a REDEFINE statement may be subsequently redefined with another REDEFINE statement.							
nX	Filler Notation:							
	The $nX$ notation is used to denote filler bytes within the field/variable being redefined. Any trailing $nX$ notation is optional.							

# **Examples**

- Example 1
- Example 2
- Example 3
- Example 4

## Example 1

The user-defined variable #A (format/length A10) contains the value 123ABCDEFG.

REDEFINE #A (#A1(N3) #A2(A7))

The value in #A1 is 123. The value in #A2 is ABCDEFG.

## Example 2

The user-defined variable #B (format/length A10) contains the value (shown in hexadecimal format) 12345001020304050607.

REDEFINE #B (#B1(P4) #B2(A7))

The value in #B1 is 123450 (in hexadecimal format).

The value in #B2 is C1C2C3C4C5C6C7 (in hexadecimal format).

REDEFINE #B (#BB1(B2)8X)) or REDEFINE #B(#BB1(B2))

The value in #BB1 is 1234 (in hexadecimal format).



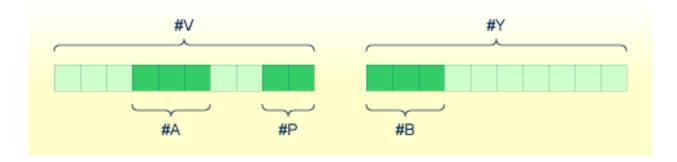
**Note**: For packed data (Format P), the number of decimal positions required must be specified. The following formula can be used to determine the number of bytes that the packed number occupies:

Number of bytes = (number of decimal positions + 1) / 2, rounded upwards to full bytes.

#### Example 3

```
COMPUTE \#V (N8.2) = \#Y (N10) = ...

REDEFINE \#V (3X \#A(N3) 2X \#P (N2)) \#Y (\#B(N3) 7X)
```



#### Example 4

This example redefines the value of the system variable \*DATN, which is in the form YYYYMMDD, and displays the result as three separate fields in the order day/month/year:

```
MOVE *DATN TO #DATINT (N8)
REDEFINE #DATINT (#YEAR (N4) #MONTH (N2) #DAY (N2))
DISPLAY NOTITLE #DATINT #DAY #MONTH #YEAR
END
```

#### **Output:**

# 115 REDUCE

Function	90	)2
Syntax Description	90	)2

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related statements: EXPAND | RESIZE

Belongs to Function Group: Memory Management Control for Dynamic Variables or X-Arrays.

# **Function**

The REDUCE statement is used to reduce:

- the allocated length of a dynamic variable (dynamic-clause), or
- the number of occurrences of X-arrays (array-clause).

For further information, see also the following sections in the *Programming Guide*:

- Using Dynamic Variables
- Allocating/Freeing Memory Space for a Dynamic Variable
- *X-Arrays*
- Storage Management of X-Group Arrays

# **Syntax Description**

Operand Definition Table:

Operand	Pos	ssib	le St	ruct	ure	Possible Formats							Referencing Permitted	Dynamic Definition						
operand1		S	A			A	U					В							no	no
operand2	C	S								Ι									no	no
operand3			A	G		A	U	N	Р	Ι	F	В	D	Т	L	C	G	O	yes	no
operand4	С	S						N	Р	Ι									no	no
operand5		S								I4									no	yes

Syntax Element Description:

Syntax Element	Description
dynamic-clause	Dynamic Clause:
	The REDUCE DYNAMIC VARIABLE statement reduces the allocated length of a dynamic variable (operand1) to the length specified (operand2).
	For further information, see <i>Dynamic Clause</i> below.
operand1	Dynamic Variable:
	operand1 is the dynamic variable for which the length is to be reduced.
operand2	Target Length of Dynamic Variable:
	operand2 is used to specify the length to which the dynamic variable is to be reduced.
	The value specified must be a non-negative integer constant or a variable of type Integer 4 (I4).
array-clause	Array Clause:
	The REDUCE ARRAY statement reduces the number of occurrences of the X-array (operand3) to the upper and lower bound specified with (dim[,dim[,dim]]).
	For further information, see <i>Array Clause</i> below.
operand3	X-Array:
	operand3 is the X-array. The occurrences of the X-array can be reduced.
	The index notation of the array is optional. As index notation only the complete range notation * is allowed for each dimension.
dim <i>operand4</i>	Dimension:
	The lower and upper bound notation ( <i>operand4</i> or asterisk) to which the X-array should be reduced is specified here. If the current value of the upper or lower bound should be used, an asterisk (*) must be specified instead of <i>operand4</i> .
	For further information, see <i>Dimension</i> below.
GIVING operand5	GIVING Clause:
	If the GIVING clause is not specified, Natural runtime error processing is triggered if an error occurs.
	If the GIVING clause is specified, <i>operand5</i> contains the Natural message number if an error occurred, or zero upon success.

### **Dynamic Clause**

```
[SIZE OF] DYNAMIC [VARIABLE] operand1 TO operand2
```

The REDUCE DYNAMIC VARIABLE statement reduces the allocated length of a dynamic variable (operand1) to the length specified (operand2). The allocated memory of the dynamic variable which is beyond the given length is released immediately, i.e., when the statement is executed.

If the currently allocated length (\*LENGTH) of the dynamic variable is greater than the given length, \*LENGTH is set to the given length and the content of the variable is truncated (but not modified). If the given length is larger than the currently allocated length of the dynamic variable, the statement will be ignored.

## **Array Clause**

```
[OCCURRENCES OF] ARRAY operand3 TO \{ \( \text{oim[,dim[,dim]]} \) \}
```

If REDUCE TO 0 (zero) is specified, all occurrences of the X-array are released. In other words, the whole array is reduced.

The REDUCE ARRAY statement reduces the number of occurrences of the X-array (*operand3*) to the upper and lower bound specified with TO (*dim*[, *dim*[, *dim*]]).

An upper or lower bound used in a REDUCE statement must be exactly the same as the corresponding upper or lower bound defined for the array.

#### **Example:**

```
DEFINE DATA LOCAL

1 #a(14/1:*)

1 #g(1:*)

2 #ga(14/1:*)

1 #i(i4)

END-DEFINE

...

*/ reducing #a (1:10)

REDUCE ARRAY #a TO (1:10) /* #a is reduced

REDUCE ARRAY #a TO (*:10) /* to 10 occurrences.

*/ reducing #ga (1:10,1:20)
```

For further information, see

- Storage Management of X-Arrays
- Storage Management of X-Group Arrays

#### **Dimension**

Each of the dimensions (dim) specified in the *Array Clause* is defined using the following syntax:

The lower and upper bound notation (*operand4* or asterisk) to which the X-array should be reduced is specified here. If the current value of the upper or lower bound should be used, an asterisk (\*) may be specified in place of *operand4*. In place of \*:\*, you may also specify a single asterisk.

The number of dimensions (*dim*) must exactly match the defined number of dimensions of the X-array (1, 2 or 3).

When using the REDUCE statement, it is only possible to decrease the number of occurrences. If the requested number is larger than the currently allocated number of occurrences, it will simply be ignored.

# 116 REINPUT

Function	9(	30
Syntax Description		
Examples		

```
REINPUT [FULL] [(statement-parameters)] \left\{\begin{array}{c} USING \ HELP \\ WITH-TEXT-option \end{array}\right\}
[MARK-option]
[ALARM-option]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DEFINE WINDOW | INPUT | SET WINDOW

Belongs to Function Group: Screen Generation for Interactive Processing

# **Function**

The REINPUT statement is used to return to and re-execute an INPUT statement. It is generally used to display a message indicating that the data input as a result of the previous INPUT statement were invalid. See *Example 1*.

No WRITE or DISPLAY statements may be executed between an INPUT statement and its corresponding REINPUT statement. The REINPUT statement is not valid in batch mode.

The REINPUT statement, when executed, repositions the program status regarding subroutine, special condition and loop processing as it existed when the INPUT statement was executed (as long as the status of the INPUT statement is still active). If the loop was initiated after the execution of the INPUT statement and the REINPUT statement is within this loop, the loop will be discontinued and then restarted after the INPUT statement has been reprocessed as a result of REINPUT.

If a hierarchy of subroutines was invoked after the execution of the INPUT statement, and the REINPUT is performed within a subroutine, Natural will trace back all subroutines automatically and reposition the program status to that of the INPUT statement.

It is not possible, however, to have an INPUT statement positioned within a loop, a subroutine or a special condition block, and then execute the REINPUT statement when the status under which the INPUT statement was executed has already been terminated. An error message will be produced and program execution terminated when this error condition is detected.

See also Dialog Design, Statements REINPUT/REINPUT FULL (in the Programming Guide).

#### Note:

When an input/output field (option (AD=M)) is displayed by an INPUT statement, the data visible on screen is only moved back into the variable if the field is regarded as "modified". A field gets the status MODIFIED when any of the following conditions applies:

■ The field content was changed (that is, *different* data was entered into the field).

- The key EEOF (erase to end of field) is pressed on an empty field.
- Blanks are entered in an empty field or behind the last non-blank character in the field.
- The profile parameter CVMIN has been set to ON, and the field data is manipulated by edit operations which lastly result in the restoration of its content (for example, by overwriting the first character with the same character).

The content of a field that lastly remains unmodified is not transferred from the screen field into the variable.

The execution of a REINPUT statement (without FULL option) does not affect the MODIFIED state of an input/output field. A field continues to be considered *non-modified* unless it is manipulated via the INPUT statement by using any of the operations listed above. Conversely speaking, a field is treated as *modified* if at least one of the aforementioned operations was performed, irrespective of how often the INPUT statement was re-posted by REINPUT statements (without FULL option).

In other words, a field value displayed using an INPUT statement, which was triggered by a REINPUT statement (without FULL option), is only transferred into the variable if the field was modified in terms of the aforementioned field manipulations.

The MODIFIED status can be checked in the program code if an attribute control variable (option CV) was assigned to the field which is checked with the MODIFIED option, for example, of the IF statement after the INPUT statement.

# **Syntax Description**

Syntax Element	Description
REINPUT FULL	FULL Option:
	If you specify the FULL option in a REINPUT statement, the corresponding INPUT statement will be re-executed fully:
	■ With an ordinary REINPUT statement (without FULL option), the contents of variables that were changed between the INPUT and REINPUT statement will not be displayed; that is, all variables on the screen will show the contents they had when the INPUT statement was originally executed.
	■ With a REINPUT FULL statement, all changes that have been made after the initial execution of the INPUT statement will be applied to the INPUT statement when it is re-executed; that is, all variables on the screen contain the values they had when the REINPUT statement was executed.
	<b>Note:</b> The contents of input-only fields (AD=A) will be deleted again by REINPUT FULL.

Syntax Element	Description							
	Another characteristic of the REINPUT FULL statement is that the status of attribute control variables is reset to NOT MODIFIED. This is not done with the ordinary REINPUT statement. To check if an attribute control variable has been assigned the status MODIFIED, use the <i>MODIFIED option</i> .							
	See also Example 3 - REINPUT FULL WITH MARK POSITION.							
statement-parameters	Parameters:							
	Parameters specified in a REINPUT statement will be applied to all fields specified in the statement.							
	Any parameter specified at element (field any corresponding parameter at statem							
	Parameters that can be specified with the REINPUT statement:	Specification (S = at statement level, E = at element level)						
	AD - Attribute Definition *	SE						
	CD - Color Definition	S						
	* If AD=P is specified at statement level, a option - are protected.	all fields - except those used in the MARK						
	The individual session parameters are o	described in the <i>Parameter Reference</i> .						
USING HELP	USING HELP Option:							
	This option causes the helproutine defin	ned for the INPUT map to be invoked.						
	USING HELP used in combination with defined for the first field specified in the helproutine is defined for that field, the l	e MARK option to be invoked. If no						
	Example:							
	REINPUT USING HELP MARK 3							
	As a result, the helproutine defined for invoked.	the third field in the ${ t INPUT}$ map will be						
WITH-TEXT-option	WITH TEXT Option:							
	The WITH TEXT option is used to provi message line.	de text which is to be displayed in the						
	See WITH TEXT Option below.							
MARK-option	MARK Option							
	With the MARK option, you can mark a swhich the cursor is to be placed when the MARK Option below.							
ALARM-option	ALARM Option:							

Syntax Element	Description						
	This option causes the sound alarm feature of the terminal to be activated when the REINPUT statement is executed.						
	See ALARM Option below.						

# **WITH TEXT Option**

WITH TEXT is used to provide text which is to be displayed in the message line. This is usually a message indicating what action should be taken to process the screen or to correct an error.

[WITH] [TEXT] 
$$\left\{ \begin{array}{c} *operand1 \\ operand2 \end{array} \right\}$$
 [(attributes)] [,operand3]...7

# Operand Definition Table:

Operand	Pos	ssibl	le St	ructure Possible Formats	Referencing Dynamic Permitted Definition		
operand1	C	S		NPI B*	yes	no	
operand2	C	S		A U	yes	no	
operand3	С	S		AUNPIFB DTL	yes	no	

<sup>\*</sup> Format B of operand1 may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description							
operand1	Message Text from Natural Message File:							
	operand1 represents the number of a message text that is to be retrieved from a Natural message file.							
	You can retrieve either user-defined messages or Natural system messages:							
	■ If you specify a positive value of up to four digits (for example: 954), you will retrieve user-defined messages.							
	■ If you specify a negative value of up to four digits (for example: -954), you will retrieve Natural system messages.							
	See also <i>Example 4 - WITH TEXT Options</i> .  Natural message files are created and maintained with the SYSERR utility as described in the relevant documentation.							
operand2	Message Text:							
	operand2 represents the message to be placed in the message line.							

Syntax Element	Description					
	See also Example 4 - WITH TEXT Options.					
attributes	Output Attributes:					
	It is possible to assign various output attributes for <code>operand1/operand2</code> . These attributes and the syntax that may be used are described in the section <code>Output Attributes</code> below.					
operand3	Dynamic Replacement of Message Text:					
	operand3 represents a numeric or text constant or the name of a variable.					
	The values provided are used to replace parts of a message text that are either specified with <i>operand1</i> or <i>operand2</i> .					
	The notation : $n$ : is used within the message text as a reference to $operand3$ contents, where $n$ represents the occurrence (1 - 7) of $operand3$ .					
	See also Example 4 - WITH TEXT Options.					
	<b>Note:</b> Multiple specifications of <i>operand3</i> must be separated from each other by a comma.					
	If the comma is used as a decimal character (as defined with the session parameter DC) and numeric constants are specified as <code>operand3</code> , put blanks before and after the comma so that it cannot be misinterpreted as a decimal character. Alternatively, multiple specifications of <code>operand3</code> can be separated by the input delimiter character (as defined with the session parameter ID); however, this is not possible in the case of ID=/ (slash).					
	Leading zeros or trailing blanks will be removed from the field value before it is displayed in a message.					

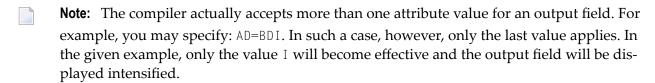
## **Output Attributes**

attributes indicates the output attributes to be used for text display. Attributes may be:

```
AD=ad-value...
CD=cd-value...
CV=variable
```

For the possible session parameter values, refer to the corresponding sections in the *Parameter Reference* documentation:

- *AD Attribute Definition*, section *Field Representation*
- CD Color Definition
- CV Attribute Control Variable



# **MARK Option**

With the MARK option, you can mark a specific field, that is, specify a field in which the cursor is to be placed when the REINPUT statement is executed. You can also mark a specific position within a field. Moreover, you can make fields input-protected, and change their display and color attributes.

```
MARK [POSITION operand4 [IN]] [FIELD] \left\{ \left\{ \begin{array}{c} \textit{operand5} \\ \textit{*fieldname} \end{array} \right\} \right. [(attributes)] \left. \right\} ...
```

# Operand Definition Table:

Operand	Possible Structure														Referencing Permitted	Dynamic Definition
operand4	С	S					N	Р	I						yes	no
operand5	С	S	A				N	Р	Ι						yes	no

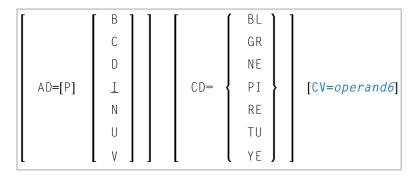
## Syntax Element Description:

Syntax Element	Description					
operand5 *fieldname	Field to be Marked:					
TTETUTAME	All AD=A or AD=M (that is, non-protected) fields specified in an INPUT statement are sequentially numbered (beginning with 1) by Natural. operand5 represents the number of the field in which the cursor is to be positioned.					
	The *fieldname notation is used to position to a field (as used in the INPUT statements using the name of the field as a reference.					
	If the corresponding INPUT field is an array, a unique index or an index range may be used to reference one or more occurrences of the array.					
	INPUT #ARRAY (A1/1:5)					
	REINPUT (AD=P) 'TEXT' MARK *#ARRAY (2:3)					
	If <i>operand5</i> is also an array, the values in <i>operand5</i> are used as field numbers for the INPUT array.					

Syntax Element	Description							
	RESET #X(N2/1:2) INPUT #ARRAY							
	REINPUT (AD=P) 'TEXT' MARK #X (1:2)							
MARK POSITION	MARK POSITION Option:							
	With this option, you can have the cursor placed at a specific position - as specified with operand4 - within a field.							
	See also Example 3 - REINPUT FULL WITH MARK POSITION.							
operand4	Cursor Position:							
	operand4 specifies the cursor position.							
	operand4 must not contain decimal digits.							
attributes	Attribute Assignments:							
	See Attribute Assignments below.							

## **Attribute Assignments**

With explicit attributes, you can define the display presentation and color of the WITH TEXT message and also the layout of the MARK field (which is positioned by the REINPUT statement).



Operand Definition Table:

Operand	Possib	le Structure	Possible	Format	3	Referencing Permitted	Dynamic Definition
operand6	S				C	no	no

With the attribute AD=P, you can make an input field (AD=A or AD=M) input-protected.

**Note:** You cannot use an attribute to make output-only fields (AD=0) available for input.

For information on the attributes AD, CD and CV, refer to the *Parameter Reference*.

The attributes for the WITH TEXT and MARK fields need not be specified in a fixed manner, but can also be assigned dynamically by means of a control variable, which is referenced in a (CV=operand6) clause. See *Example 5 - REINPUT with Attribute Assignment Using a Control Variable*.

If both an AD and a CV option are specified for the same field, the attributes from the AD option are completely ignored, except (AD=P) which remains in effect.

If a CD and a CV option are specified for the same field, the color from the CV option is used. If the CV variable contains no color specification, the color from the CD option is applied to that field.

If AD=P is specified at statement level, all fields except those specified in the MARK option are input-protected. See also *Example 2 - REINPUT with Attribute Assignment*.

#### **ALARM Option**

```
[AND] [SOUND] ALARM
```

This option causes the sound alarm feature of the terminal to be activated when the REINPUT statement is executed. The appropriate hardware must be available to be able to use this feature.

# **Examples**

- Example 1 REINPUT Statement
- Example 2 REINPUT with Attribute Assignment
- Example 3 REINPUT FULL with MARK POSITION
- Example 4 WITH TEXT Options
- Example 5 REINPUT with Attribute Assignment Using a Control Variable

#### Example 1 - REINPUT Statement

```
** Example 'REIEX1': REINPUT

*******************************

DEFINE DATA LOCAL

1 #FUNCTION (A1)

1 #PARM (A1)

END-DEFINE

*

INPUT #FUNCTION #PARM

*

DECIDE FOR FIRST CONDITION

WHEN #FUNCTION = 'A' AND #PARM = 'X'

REINPUT 'Function A with parameter X selected.'

MARK *#PARM

WHEN #FUNCTION = 'C' THRU 'D'

REINPUT 'Function C or D selected.'
```

```
WHEN #FUNCTION = 'X'
STOP
WHEN NONE
REINPUT 'Please enter a valid function.'
MARK *#FUNCTION
END-DECIDE
*
END
```

#### **Output of Program REIEX1:**

#FUNCTION A #PARM Y

#### And after pressing ENTER:

```
PLEASE ENTER A VALID FUNCTION
#FUNCTION A #PARM Y
```

#### **Example 2 - REINPUT with Attribute Assignment**

```
** Example 'REIEX2': REINPUT (with attributes)

***************************

DEFINE DATA LOCAL

1 #A (A20)

1 #B (N7.2)

1 #C (A5)

1 #D (N3)

END-DEFINE

*

INPUT (AD=A) #A #B #C #D

*

IF #A = ' ' OR #B = 0

REINPUT (AD=P) 'RETYPE VALUES'

MARK *#A (AD=I CD=RE) /* put cursor on first field

*#B (AD=U CD=PI) /* and change colors

END-IF

*

END
```

#### **Example 3 - REINPUT FULL with MARK POSITION**

```
** Example 'REIEX3': REINPUT (with FULL and POSITION option)
******************
DEFINE DATA LOCAL
1 #A (A20)
1 #B (N7.2)
1 #C (A5)
1 #D (N3)
END-DEFINE
INPUT (AD=M) #A #B #C #D
IF #A = ' '
 COMPUTE \#B = \#B + \#D
 RESET #D
END-IF
IF \#A = SCAN 'TEST' OR = ' '
REINPUT FULL 'RETYPE VALUES' MARK POSITION 5 IN *#A
END-IF
END
```

#### **Output of Program REIEX3:**

```
RETYPE VALUES
#A #B 0.00 #C #D 0
```

#### **Example 4 - WITH TEXT Options**

```
** Example 'REIEX4': REINPUT (with TEXT option)
***********************
DEFINE DATA LOCAL
01 #NAME
        (A8)
01 #TEXT (A20)
END-DEFINE
INPUT WITH TEXT 'Enter a program name.' 'Program name:' #NAME
IF #NAME = ' '
 REINPUT WITH TEXT 'Input missing. Enter a name.'
END-IF
IF #NAME NE MASK (A)
 MOVE 'Invalid input.' TO #TEXT
 REINPUT WITH TEXT ':1: Name must start with a letter.',#TEXT
ELSE
 /* Using Natural error message 7600 for demonstration
```

```
COMPRESS *INIT-USER 'on' *DAT4I INTO #TEXT INPUT WITH TEXT *-7600, #NAME, #TEXT 'Input accepted.' END-IF END
```

## **Example 5 - REINPUT with Attribute Assignment Using a Control Variable**

```
DEFINE DATA LOCAL

1 #HELLO (A5) INIT <'HELO'>

1 #VAR (A20) INIT <'Enter "HELLO"'>

1 #CV (C)

END-DEFINE

*

INPUT (IP=OFF) #HELLO (AD=M)

*

IF #HELLO NE 'HELLO' THEN

MOVE (AD=U CD=RE) TO #CV

REINPUT FULL WITH TEXT #VAR (CD=YE)

MARK *#HELLO (CV=#CV)

END-IF
END
```

# 117 REJECT

For more information about this statement, see the statement ACCEPT/REJECT.

# 118 RELEASE

Function	922
Syntax Description	
Example	

```
RELEASE { STACK | SETS[set-name...] } VARIABLES
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: STACK | FIND with RETAIN option | DEFINE DATA GLOBAL

## **Function**

The RELEASE statement is used to:

- delete the entire contents of the Natural stack;
- release sets of ISNs retained via a FIND statement that contained a RETAIN clause (applicable to Adabas databases only);
- reset global and application-independent variables.

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure						059	sik	ole	Fo	rm	ats	5	Referencing Permitted	<b>Dynamic Definition</b>	
set-name	C	S				A								no	no	

Syntax Element Description:

Syntax Element	Description
RELEASE STACK	RELEASE STACK Option:
	Causes all data/commands currently in the Natural stack to be deleted.
RELEASE SETS	RELEASE SETS Option:
	Is applicable to Adabas databases only.
	If only RELEASE SETS, without a set-name, is specified, all ISN sets retained with a FIND statement with a RETAIN clause will be released.
RELEASE SETS set-name	Causes a specific single ISN set to be released.

Syntax Element	Description
	RELEASE SET 'CITY-SET'
	MOVE 'CITY-SET' TO #SET(A32)
	RELEASE SET #SET
RELEASE VARIABLES	RELEASE VARIABLES Option:
	Causes all variables defined in the current global data area (GDA) to be reset to their initial values. Also, it eliminates all application-independent variables (AIVs), thus making them no longer available.
	The RELEASE VARIABLES statement does not perform the reset/eliminate operations directly after execution. Instead, a signal is set first which triggers
	these operations when all Natural objects currently running have finished processing.

# **Example**

```
** Example 'RELEX1': FIND (with RETAIN clause and RELEASE statement)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 CITY
 2 BIRTH
 2 NAME
1 #BIRTH (D)
END-DEFINE
MOVE EDITED '19400101' TO #BIRTH (EM=YYYYMMDD)
FIND NUMBER EMPLOY-VIEW WITH BIRTH GT #BIRTH
    RETAIN AS 'AGESET1'
IF *NUMBER = 0
 ST0P
END-IF
FIND EMPLOY-VIEW WITH 'AGESET1' AND CITY = 'NEW YORK'
 DISPLAY NOTITLE NAME CITY BIRTH (EM=YYYY-MM-DD)
END-FIND
RELEASE SET 'AGESET1'
END
```

# **Output of Program RELEX1:**

NAME	CITY	DATE
		0 F
		BIRTH
RUBIN	NEW YORK	1945-10-27
WALLACE	NEW YORK	1945-08-04

# REPEAT

Function	926
Syntax Description	
Examples	

Related Statements: FOR | ESCAPE

Belongs to Function Group: Loop Execution

## **Function**

The REPEAT statement is used to initiate a processing loop.

See also *Loop Processing* in the *Programming Guide*.

# **Syntax Description**

Two different structures are possible for this statement.

- Syntax 1 Statements are executed one or more times
- Syntax 2 Statements are executed zero or more times

The placement of the logical condition (either at the beginning or at the end of the loop) determines when it is to be evaluated.

For further information on logical conditions, see the section *Logical Condition Criteria* in the *Programming Guide*.

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

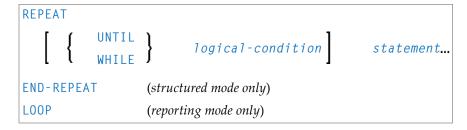
#### Syntax 1:

```
REPEAT

statement ... [ { UNTIL } logical-condition ] END-REPEAT (structured mode only)

LOOP (reporting mode only)
```

Syntax 2:



Syntax Element Description:

Syntax Element	Description
UNTIL	UNTIL Option:
	The processing loop will be continued until the logical condition becomes true.
WHILE	WHILE Option:
	The processing loop will be continued as long as the logical condition is true.
logical-condition	Logical Condition:
	If a logical condition is specified, the condition determines when the execution of the loop is to be terminated.
	If no logical condition is specified, the loop must be exited by an ESCAPE, STOP or TERMINATE statement specified within the loop.
	The syntax for a logical condition is described in the section <i>Logical Condition Criteria</i> in the Programming Guide.
END-REPEAT	End of REPEAT Statement:
LOOP	In structured mode, the Natural reserved word END-REPEAT must be used to end the REPEAT statement.
	In reporting mode, the Natural statement LOOP is used to end the REPEAT statement.

# **Examples**

■ Example 1 - REPEAT

■ Example 2 - Using WHILE and UNTIL Options

## **Example 1 - REPEAT**

```
** Example 'RPTEX1S': REPEAT (structured mode)
**********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
1 #PERS-NR (A8)
END-DEFINE
REPEAT
 INPUT 'ENTER A PERSONNEL NUMBER: ' #PERS-NR
 IF #PERS-NR = ' '
   ESCAPE BOTTOM
 END-IF
 /*
 FIND EMPLOY-VIEW WITH PERSONNEL-ID = #PERS-NR
   IF NO RECORD FOUND
     REINPUT 'NO RECORD FOUND'
   END-NOREC
   DISPLAY NOTITLE NAME
 END-FIND
END-REPEAT
END
```

#### **Output of Program RPTEX1S:**

ENTER A PERSONNEL NUMBER: 11500304

#### After entering and confirming personnel number:

```
NAME
-----
KLUGE
```

Equivalent reporting-mode example: RPTEX1R.

### **Example 2 - Using WHILE and UNTIL Options**

```
** Example 'RPTEX2S': REPEAT (with WHILE and UNTIL option)
*************************
DEFINE DATA LOCAL
1 #X (I1) INIT <0>
1 #Y (I1) INIT <0>
END-DEFINE
REPEAT WHILE #X <= 5
 ADD 1 TO #X
 WRITE NOTITLE '=' #X
END-REPEAT
SKIP 3
REPEAT
 ADD 1 TO #Y
 WRITE '=' #Y
 UNTIL \#Y = 6
END-REPEAT
END
```

#### **Output of Program RPTEX2S:**

```
#X:
       1
#X:
       2
#X:
       3
#X:
       4
#X:
       5
#X∶
#Y:
       1
#Υ:
       2
#Y:
       3
#Y:
       4
#Υ:
       5
#Y:
       6
```

Equivalent reporting-mode example: RPTEX2R.

# 120 REQUEST DOCUMENT

Function	932
Syntax Description	
Automatically Generated Headers	
JRL Encoding for Special Characters	
HTTP/HTTPS Responses Redirected and Denied	
Examples	942

```
REQUEST DOCUMENT FROM url

WITH [with-clause]

RETURN [return-clause]

RESPONSE http-response-code

[GIVING natural-error-number]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statement: PARSE XML

Belongs to Function Group: Internet and XML

## **Function**

The REQUEST DOCUMENT statement is used to retrieve and upload documents on the internet as described in *REQUEST DOCUMENT* in *Statements for Internet and XML Access* in the *Programming Guide*.

For information on Unicode support, see *REQUEST DOCUMENT* in the *Unicode and Code Page Support* documentation.

#### **Restrictions for Protocol Types**

For technical reasons, HTTPS is supported under z/OS only.

#### No Support for Cookies

Cookies are not supported and are ignored.

# **Syntax Description**

Operand Definition Table:

Operand	Po	ssib	le St	ructu	ıre	F	Possi	ble F	orm	ats	Referencing Permitted	Dynamic Definition
url	C	S				A					yes	no
http-response-code		S						I4			yes	yes
natural-error-number		S						I4			yes	no

# Syntax Element Description:

Syntax Element	Description
url	Location of Document:
	url is the URL to access a document.
	If <i>ur1</i> is an Internet Protocol Version 6 (IPv6) address in hexadecimal notation, you need to enclose the address in square brackets ([]). See also <i>Example 7 - GET Request for an IPv6 Address on Port Number 8080</i> .
	You cannot embed an Internet Protocol Version 4 (IPv4) address into an IPv6 address.
with-clause	WITH Clause:
	See with-clause.
return-clause	RETURN Clause:
	See return-clause.
http-response-code	RESPONSE:
	http-response-code is the HTTP/HTTPS response status code returned for the request, for example: 200 (request completed).
	See also HTTP/HTTPS Responses Redirected and Denied.
	For a list of possible HTTP/HTTPS status codes, refer to the RFC 2616 memorandum published by the World Wide Web Consortium (W3C).
natural-error-number	GIVING Option:  natural-error-number contains the 4-digit Natural error number if the request could not be performed.

#### with-clause

The with-clause is used to specify optional user/password, header and data details for the request.

An empty with-clause (that is, no value specified after WITH) is ignored.

#### Operand Definition Table:

Operand	Po	ssibl			Po	SS	ibl	le I	For	Referencing Permitted	Dynamic Definition						
user-id	С	S			A											yes	no
user-password	С	S			A											yes	no
header-name-out	С	S			A											yes	no
header-value-out	С	S			A		N	Р	Ι	F		D	T	L		yes	no
outbound-document	С	S			A	U	N	Р	Ι	F	В	D	T	L		yes	no
code-page-out	С	S			A											yes	no
variable-name-out	С	S			A											yes	no
variable-value-out	С	S			A		N	Р	Ι	F		D	T	L		yes	no

#### Syntax Element Description:

Syntax Element	Description
user-id	USER:
	<i>user-id</i> is the ID of the user that will be used for the request.
user-password	PASSWORD:
	<i>user-password</i> is the password of the user that will be used for the request.
header-name-out	HEADER NAME/VALUE Option:
header-value-out	header-name-out and header-value-out can only be used in conjunction with each other:
	■ <i>header-name-out</i> is the name of a header variable sent with this request.
	■ header-value-out is the value of a header variable sent with this request.
	header-name-out:

Syntax Element	Description
	Header names must not contain a carriage return (CR), a line feed (LF) or a colon (:). This will not be checked by the REQUEST DOCUMENT statement. For valid header names, see the HTTP specifications. For compatibility with the web interface, header names can be written with underscore (_) instead of a dash (-). (Internally, the underscore is replaced by a dash).
	header-value-out:
	Header values are not allowed to contain CR/LF. This will not be checked by the REQUEST DOCUMENT statement. For valid header values and formats, see the HTTP specifications.
	See also Automatically Generated Headers.
outbound-document	DATA ALL Option:
	outbound-document is a complete document that is to be sent. This value is needed for the HTTP REQUEST-METHOD PUT (see <i>Automatically Generated Headers</i> ).
code-page-out	DATA ALL ENCODED Option:
	Data transfer with the REQUEST DOCUMENT statement normally does not involve any code page conversion. If you want to encode outgoing data in a specific code page, use the CODEPAGE option:
	outbound-document will be encoded from the default code page (value of the system variable *CODEPAGE) to the code page given in code-page-out.  Encoding and Charset Attributes:
	If the outbound document contains an encoding (XML) or a charset (HTML) attribute, we recommend that the value of the ENCODED option maps the attribute value of the document.
	Example: If an outbound XML document contains the attribute encoding = "UTF-8", code the REQUEST DOCUMENT statement with the option DATA ALL #DOCUMENT ENCODED CODEPAGE 'UTF-8'.
variable-name-out	DATA NAME/VALUE Option:
variable-value-out	<pre>variable-name-out and variable-value-out request only specific DATA variable information instead of the complete document. They can only be used in conjunction with each other:</pre>
	■ variable-name-out is the name of a DATA variable to be sent with this request.
	■ <i>variable-value-out</i> is the value of a DATA variable to be sent with this request. This value is needed for the HTTP REQUEST-METHOD POST (URL encoding necessary, especially ampersand (&), equal sign (=), percent sign (%) characters).
	Restriction:

Syntax Element	Description
	If variable-name-out and variable-value-out are given and the
	communication is http://orhttps://, by default, the REQUEST-METHOD POST
	(see Automatically Generated Headers) with content type
	application/x-www-form-urlencoded is used. During the request,
	variable-name-out and variable-value-out will be separated by equal sign
	(=) and ampersand (&) characters. Therefore, the operands are not allowed to
	contain equal sign (=), ampersand (&) and, because of URL encoding, percent sign
	(%) characters. These characters are considered reserved and need to be encoded
	as indicated in <i>Reserved Characters</i> .

#### return-clause

```
[HEADER [ALL header-all-in] [[NAME] header-name-in [VALUE] header-value-in...]]
[PAGE inbound-document [ENCODED [[FOR TYPES mime-type...] [IN] CODEPAGE code-page-in]]]]
```

### Operand Definition Table:

Operand	perand Possible Structure										e F	or	Referencing Permitted	Dynamic Definition			
header-all-in		S				A										yes	yes
header-name-in	С	S				A										yes	no
header-value-in		S	A *			A		N	Р	Ι	F	В	D	Т	L	yes	yes
inbound-document		S				A	U					В				yes	yes
mime-type	С	S				A										yes	no
code-page-in	С	S				A										yes	no

This clause can be used to specify return information for the headers and/or the document.

### Syntax Element Description:

Syntax Element	Description
header-all-in	HEADER ALL Option:
	header-all-in contains all header data delivered with the HTTP response.
	The first line contains the status information and all following lines contain the headers as pairs of name and value. The names always end in a colon (:) and the values end in a line feed (LF). Internally, all carriage returns/line feeds (CR/LF) are transformed into line feeds (LF).
header-name-in	HEADER NAME/VALUE Option:
header-value-in	header-name-in and header-value-in return only specific header information. They can only be used in conjunction with each other:

Syntax Element	Description
	header-name-in is the name for the header information returned by the HTTP request.
	For compatibility with the web interface, header names can be written with underscore (_) instead of dash (-) characters.
	Internally, the underscore is replaced by a dash. If <code>header-name-in</code> is a blank string, the status information is returned, for example:
	HTTP/1.0 200 OK
	■ <i>header-value-in</i> is the scalar or array value required to receive the header data returned by the HTTP request.
	An array definition is required if more than one occurrence of the same header is expected, for example, multiple Set-Cookie headers.
	Only one dimension of a multi-dimensional array may contain an index range (see <i>Example 9</i> ).
	An X-array must be materialized before you can use it.
	If the number of array occurrences exceeds the number of headers, the unused occurrences are reset. If the number of headers exceeds the number of array occurrences, the remaining header values are ignored.
	For an example of an array definition, see <i>Example 9 - RETURN HEADER NAME VALUE with Array Definition</i> .
inbound-document	PAGE Option:
	<i>inbound-document</i> is the document returned for this request. No encoding at all of the returned page will be done; that is, the page will remain encoded as delivered from the HTTP server.
code-page-in	PAGE ENCODED Option:
	Data transfer with the REQUEST DOCUMENT statement normally does not involve any code page conversion. If you want to encode incoming data in a specific code page, use the ENCODED option:
	If necessary, <code>inbound-document</code> will be encoded in the default code page (value of system variable *CODEPAGE) of the Natural session.
	If the value of <code>code-page-in</code> is blank, then <code>inbound-document</code> will be encoded from the code page defined with the keyword subparameter <code>RDCP</code> to the default code page (A/B) or (U). The keyword subparameter <code>RDCP</code> of the profile parameter <code>XML</code> is used to specify the name of the default HTML/XML code page.

Syntax Element	Description
	Note: "Returned MIME type contains an encoding" means that the HTTP server
	returns a content-type header with a charset= clause, for example: charset=ISO-8859-1.
	For examples of using the RETURN PAGE ENCODED clause, see <i>Example 8 - RETURN PAGE ENCODED Clause</i> .
mime-type	PAGE ENCODED FOR TYPES Option:
	As a response of an HTTP/HTTPS request, incoming data may contain binary data (for example, image/gif) or character data (for example, text/html). Together with the response, the REQUEST DOCUMENT statement receives a parameter which specifies the type of content of the requested document (MIME type, also known as internet media type). This parameter may contain information about the code page in which the document is encoded. <i>mime-type</i> is the list of MIME types for which an encoding of the returned document in <i>inbound-document</i> will be performed.  If the returned MIME type contains an encoding, <i>inbound-document</i> will be encoded
	from this code page to the default code page (A/B) or (U).  If the returned MIME type does not contain an encoding, then <code>inbound-document</code> will be encoded from the code page defined with <code>code-page-in</code> to the default code
	page (value of the system variable *CODEPAGE) (A/B) or (U).  If the returned MIME type does not contain an encoding, then an additional check is performed if the returned MIME type matches one of the types given with <code>mime-type</code> . If a match is found, <code>inbound-document</code> will be encoded from the code page defined with <code>code-page-in</code> to the default code page (A/B) or (U).

# **Automatically Generated Headers**

For an HTTP request, some headers are required, for example: REQUEST-METHOD or content type. These headers will be automatically generated depending on the parameters given with the REQUEST DOCUMENT statement.



**Note:** It is possible to overwrite the automatically generated headers. Natural will not check them for errors. Unexpected errors may occur.

■ HTTP REQUEST-METHOD

Content Type

#### HTTP REQUEST-METHOD

The REQUEST DOCUMENT statement supports the following HTTP REQUEST-METHODS: HEAD, POST, GET and PUT.

The following table shows the HTTP REQUEST-METHOD generated depending on the given operands:

	WITH	HEADER	WITH DAT	ΓΑ	RETURN	HEADER	RETURN	PAGE
HEAD		0	-		,	ζ.	-	
POST		0	х		(	)	х	
GET		О	-		(	)	х	
PUT		0	DATA ALI	*	(	)	0	

In addition to the standard REQUEST-METHODS mentioned above, the methods DELETE, PATCH, OPTIONS and TRACE can be specified in a REQUEST-METHOD header.

#### **Explanation:**

- o Optional. Operand can be optionally specified.
- Operand cannot be specified.
- x Operand is always specified.
- \* Only applies to DATA ALL and not DATA NAME VALUE.

#### **Content Type**

The REQUEST-METHOD POST requires a content-type header for the HTTP request. If no content type is explicitly specified, Natural inserts the following default content-type header into the request:

application/x-www-form-urlencoded

# **URL Encoding for Special Characters**

When sending POST data with the content type application/x-www-form-urlencoded, certain characters must be represented by means of URL encoding, which means substituting the character with <code>%hexadecimal-character-code</code>. Some basic details are given here:

- Non-ASCII Characters
- Unsafe Characters

#### Reserved Characters

For full details of when and why URL encoding is necessary, refer to the memorandums RFC 1630, RFC 1738 and RFC 1808 published by the World Wide Web Consortium (W3C).

#### **Non-ASCII Characters**

All non-ASCII characters (that is, valid ISO 8859/1 characters that are not also ASCII characters) must be URL encoded, for example, the file köln.html would appear in an URL as k%F6ln.html.

#### **Unsafe Characters**

URL encode the following unsafe characters when you request web pages to avoid server failures:

Unsafe Character	URL Encoding
the tab character	%09
the space character	%20
[	%5B
\	%5C
]	%5D
^	%5E
`	%60
{	%7B
	%7C
}	%7D
~	%7E

#### **Reserved Characters**

Some characters have special meanings in URLs, such as the colon (:) that separates the URL scheme from the rest of the URL, the double slash (//) that indicates that the URL conforms to the Common Internet Scheme syntax and the percent sign (%). Generally, when these characters appear as parts of file names, they must be URL encoded to distinguish them from their special meaning in URLs (this is a simplification, refer to the RFCs mentioned earlier for full details).

Reserved characters are:

Reserved Character	URL Encoding
"	%22
#	%23
%	%25
&	%26
+	%2B
,	%2C
/	%2F
:	%3A
<	%3C
=	%3D
>	%3E
?	%3F
@	%40

# HTTP/HTTPS Responses Redirected and Denied

For a list of HTTP/HTTPS status codes, refer to the RFC 2616 memorandum published by the World Wide Web Consortium (W3C).

The following special considerations apply to the HTTP responses for redirected and denied requests:

- Response 301 303 (Redirected)
- Response 401 (Denied/Unauthorized)

#### Response 301 - 303 (Redirected)

The HTTP response codes 301, 302 and 303 mean that the URL where the requested document resides has changed and that the request was therefore redirected to another URL. As a response, the return header with the name LOCATION will be displayed. This header contains the URL where the requested page has moved to. A new REQUEST DOCUMENT request can be used to retrieve the page moved.

HTTP browsers redirect automatically to the new URL, but the REQUEST DOCUMENT statement does not handle redirection automatically.

#### Response 401 (Denied/Unauthorized)

The HTTP response code 401 means that the requested page can only be accessed if a valid user ID and password are provided with the request. As a response, the return header with the name <code>WWW-AUTHENTICATE</code> will be delivered with the REALM needed for this request.

HTTP browsers normally display a dialog with user ID and password, but with the REQUEST DOCUMENT statement, no dialog is displayed.

# **Examples**

- Example 1 General Request
- Example 2 Simple GET Request (no data)
- Example 3 Simple HEAD Request (no return page)
- Example 4 Simple POST Request (default REQUEST-METHOD)
- Example 5 Simple PUT Request (with DATA ALL)
- Example 6 REQUEST DOCUMENT with Proxy Authorization
- Example 7 GET Request for an IPv6 Address on Port Number 8080
- Example 8 RETURN PAGE ENCODED Clause
- Example 9 RETURN HEADER NAME VALUE with Array Definition



Note: There is an example dialog V5-RDOC for this statement in the example library SYSEXV.

#### **Example 1 - General Request**

```
REQUEST DOCUMENT FROM "http://bolsap1:5555/invoke/sap.demo/handle_RFC_XML_POST"
WITH
USER #User PASSWORD #Password
DATA
NAME 'XMLData' VALUE #Queryxml
NAME 'repServerName' VALUE 'NT2'
RETURN
PAGE #Resultxml
RESPONSE #rc
```

#### Example 2 - Simple GET Request (no data)

```
REQUEST DOCUMENT FROM "http://pcnatweb:8080"

RETURN

PAGE #Resultxml

RESPONSE #rc
```

#### **Example 3 - Simple HEAD Request (no return page)**

```
REQUEST DOCUMENT FROM "http://pcnatweb"
RESPONSE #rc
```

#### **Example 4 - Simple POST Request (default REQUEST-METHOD)**

```
REQUEST DOCUMENT FROM "http://pcnatweb/cgi-bin/nwwcgi.exe/sysweb/nat-env"
WITH
DATA
NAME 'XMLData' VALUE #Queryxml
NAME 'repServerName' VALUE 'NT2'
RETURN
PAGE #Resultxml
RESPONSE #rc
```

#### Example 5 - Simple PUT Request (with DATA ALL)

```
REQUEST DOCUMENT FROM "http://pcnatweb/test.txt"

WITH

DATA ALL #document

RETURN

PAGE #Resultxml

RESPONSE #rc
```

#### **Example 6 - REQUEST DOCUMENT with Proxy Authorization**

```
DEFINE DATA
LOCAL
1 #URL
                   (A) DYNAMIC
1 #PAGE
                   (A) DYNAMIC
1 #HTTPSTAT
                   (I4)
1 #PATH
                   (A) DYNAMIC
1 #NAME
                  (A) DYNAMIC
1 #VALUE
                  (A) DYNAMIC
1 #USERID
                  (A8)
1 #PASSWORD
                 (A8)
1 #AUTHHDR
                   (A) DYNAMIC
1 #CREDENTIALS
                   (A) DYNAMIC
                   (A2/0:2) INIT <' ','==','='>
1 #PADDCHAR
1 #LENGTH
                   (I4)
```

```
1 #FACTOR
                (14)
1 #REMAINDER
                (I4)
/*
/* #USR4210
1 PARM-FUNCTION (A2) INIT <'BA'>
1 PARM-RC
        (I4)
1 PARM-ERRTXT (A72)
1 PARM-A
             (A) DYNAMIC
1 PARM-B
            (B) DYNAMIC
1 PARM-RFC
            (B1)
END-DEFINE
**
ASSIGN #URL = 'http://www.softwareag.com/corporate/default.asp'
REQUEST DOCUMENT FROM #URL
 RETURN PAGE #PAGE ENCODED CODEPAGE ' '
 RESPONSE #HTTPSTAT
******************
** HTTP response 407 means that the proxy server requires **
** the client to identify itself!
********************
IF \#HTTPSTAT = 407
 INPUT
              'Please enter userid and password' (AD=I) /
 'Userid : ' #USERID / 'Password: ' #PASSWORD
 ASSIGN #AUTHHDR = 'Proxy-Authorization'
 COMPRESS #USERID ':' #PASSWORD INTO PARM-B LEAVING NO
*****************
** Convert credentials to ASCII
********************
 MOVE ENCODED PARM-B TO PARM-B
  CODEPAGE 'ASCII'
*****************
** ENCODE CREDENTIALS WITH BASE64
*******************
** BASE64 demands that the length of the encoded string is **
** a multiple of 3. If encoding length does not match this **
** the encoded string has to be padded with '=' characters.**
** Since USR4210 does not support padding of the base64 **
** string with trailing '=' characters, we have to do this **
******************
 CALLNAT 'USR4210N' PARM-FUNCTION PARM-RC PARM-ERRTXT PARM-B PARM-A
   PARM-RFC
 #LENGTH := *LENGTH(PARM-A)
 WRITE PARM-A (AL=40) #LENGTH EJECT
 DIVIDE 3 INTO #LENGTH GIVING #FACTOR REMAINDER #REMAINDER
 COMPRESS PARM-A #PADDCHAR(#REMAINDER)
   INTO #CREDENTIALS LEAVING NO
*********************
** Build Proxy-Authorization HTTP header
********************
 COMPRESS 'Basic ' #CREDENTIALS
```

#### Example 7 - GET Request for an IPv6 Address on Port Number 8080

```
REQUEST DOCUMENT FROM "http://[2BFC:5022:4081:0000::C:41]:8080"

RETURN

PAGE #Resultxml

RESPONSE #rc
```

#### **Example 8 - RETURN PAGE ENCODED Clause**

1. Server returns a header 'Content-type: text/html; charset=UTF-8'

#### Program Code Example 1:

```
RETURN PAGE inbound-document
```

#### Resulting Processing:

inbound-document remains UTF-8 encoded.

#### Program Code Example 2:

```
...
RETURN PAGE inbound-document ENCODED [...]
```

#### Resulting Processing:

*inbound-document* is converted from UTF-8 to the default code page regardless of whether *code-page-in* and *mime-type* are specified: When a valid encoding is returned in the content-type header, *mime-type* and *code-page-in* are ignored.

2. Server returns a header 'Content-type: text/xml'

#### Program Code Example 1:

```
RETURN PAGE inbound-document ENCODED
```

#### Resulting Processing:

*inbound-document* remains unconverted since the content-type header does not contain a valid encoding.

#### Program Code Example 2:

```
...
RETURN PAGE inbound-document ENCODED FOR TYPES 'text/xml' IN CODEPAGE 'USASCII'
```

#### Resulting Processing:

*inbound-document* is converted from USASCII code page to the default code page. In this case, conversion is done according to the programmers assumption about the encoding of the received page.

#### Program Code Example 3:

```
...
RETURN PAGE inbound-document ENCODED FOR TYPES 'text/html'
IN CODEPAGE ' '
```

#### Resulting Processing:

*inbound-document* remains unconverted since the MIME type 'text/html', specified in *mime-type*, does not match the MIME type 'text/xml', returned in the content-type header.

#### Program Code Example 4:

```
...
RETURN PAGE inbound-document ENCODED IN CODEPAGE ' '
```

#### Resulting Processing:

*inbound-document* is converted from the default code page, specified with subparameter RDCP of profile parameter XML, to the default code page.



**Note:** The default value for the RDCP subparameter, which applies if nothing has been explicitly specified, is ISO-8859-1. See also XML - Activate PARSE XML and REQUEST DOCUMENT Statements in the Parameter Reference.

#### **Example 9 - RETURN HEADER NAME VALUE with Array Definition**

```
DEFINE DATA
LOCAL
1 #FROM
            (A) DYNAMIC
1 #HEADER (A) DYNAMIC
1 #PAGE
           (A) DYNAMIC
1 #COOKIES (A20/1:3,1:4,2:5)
1 #RC
        (I4)
END-DEFINE
ASSIGN #FROM = 'http://www.myserver.com'
REQUEST DOCUMENT FROM #FROM
  RETURN
       HEADER NAME 'Set-Cookie' VALUE #COOKIES(1,2:3,3)
       PAGE #PAGE
       RESPONSE #RC
PRINT #COOKIES(*,*,*)
END
```

In the example program above, invalid array definitions (with multiple dimensions) would be:

```
RETURN HEADER NAME 'Set-Cookie' VALUE #COOKIES(1:3,2:3,3)
RETURN HEADER NAME 'Set-Cookie' VALUE #COOKIES(*,2,*)
```

# 121 RESET

Function	950
Syntax Description	
Example	

RESET [INITIAL] operand1...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ADD | COMPRESS | COMPUTE | DIVIDE | EXAMINE | MOVE | MOVE ALL | MULTIPLY | SEPARATE | SUBTRACT

Belongs to Function Group: Arithmetic and Data Movement Operations

### **Function**

The RESET statement is used to reset the value of a field:

- RESET (without INITIAL) sets the content of each specified field to its **default initial value** depending on its format.
- RESET INITIAL sets each specified field to the initial value as defined for the field in the DEFINE DATA statement. For a field declared without INIT clause in the DEFINE DATA statement, RESET INITIAL has the same effect as RESET (without INITIAL).



#### Notes:

- 1. A field declared with a CONSTANT clause in the DEFINE DATA statement may not be referenced in a RESET statement, since its content cannot be changed.
- 2. In reporting mode, the RESET statement may also be used to define a variable, provided that the program contains no DEFINE DATA LOCAL statement.

# **Syntax Description**

Operand Definition Table:

Оре	erand	Pos	ssib		Possible Formats											encing mitted	Dynamic Defin	ition			
op	erand1		S	A	G	M	A	U	N	Р	I ]	FE	3 E	T	L	C	GO	у	res	yes	

Syntax Element Description:

Syntax Element	Description							
RESET operand1	Reset to Null Value:							
	RESET (without INITIAL) sets the content of each specified field (operand1) to its default initial value.							
	If operand1 is a dynamic variable, it will be reset to a null value with the length the variable currently has at the time the RESET statement is executed. The current length of a dynamic variable can be ascertained by using the system variable *LENGTH.							
	For general information on dynamic variables, see the section <i>Using Dynamic and Large Variables</i> .							
RESET INITIAL	Reset to Initial Value:							
operand1	RESET INITIAL sets each specified field (operand1) to the initial value as defined for the field in the DEFINE DATA statement.							
	■ If you specify no INIT value in the DEFINE DATA statement, a field will be initialized with a <b>default initial value</b> depending on its format.							
	■ If a dynamic variable is used, *LENGTH is set to zero if no initial value is defined.							
	■ If you apply RESET INITIAL to an array, it must be applied to the entire array (as defined in the DEFINE DATA statement); a RESET INITIAL of individual array occurrences is not possible.							
	■ RESET INITIAL of fields resulting from a redefinition is not possible either.							
	RESET INITIAL is applied to a dynamic variable.							
	■ RESET INITIAL cannot be applied to database fields.							

## **Example**

```
** Example 'RSTEX1': RESET (with/without INITIAL)

*******************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME

1 #BINARY (B4) INIT <1>
1 #INTEGER (I4) INIT <5>
1 #NUMERIC (N2) INIT <25>

END-DEFINE

*

LIMIT 1

READ EMPLOY-VIEW

/*

WRITE NOTITLE 'VALUES BEFORE RESET STATEMENT:'

WRITE / '=' NAME '=' #BINARY '=' #INTEGER '=' #NUMERIC

/*
```

```
RESET NAME #BINARY #INTEGER #NUMERIC

/*

WRITE /// 'VALUES AFTER RESET STATEMENT:'

WRITE / '=' NAME '=' #BINARY '=' #INTEGER '=' #NUMERIC

/*

RESET INITIAL #BINARY #INTEGER #NUMERIC

/*

WRITE /// 'VALUES AFTER RESET INITIAL STATEMENT:'

WRITE / '=' NAME '=' #BINARY '=' #INTEGER '=' #NUMERIC

/*

END-READ

END
```

## **Output of Program RSTEX1:**

```
VALUES BEFORE RESET STATEMENT:

NAME: ADAM  #BINARY: 00000001 #INTEGER: 5 #NUMERIC:

25

VALUES AFTER RESET STATEMENT:

NAME: #BINARY: 00000000 #INTEGER: 0 #NUMERIC:

0

VALUES AFTER RESET INITIAL STATEMENT:

NAME: #BINARY: 00000001 #INTEGER: 5 #NUMERIC:

25
```

## 122 RESIZE

Function	954
Syntax Description	954

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: EXPAND | REDUCE

Belongs to Function Group: Memory Management Control for Dynamic Variables or X-Arrays.

## **Function**

The RESIZE statement is used to adjust:

- the size of a dynamic variable (dynamic-clause), or
- the number of occurrences of X-arrays (array-clause).

For further information, see also the following sections in the *Programming Guide*:

- Using Dynamic Variables
- Allocating/Freeing Memory Space for a Dynamic Variable
- X-Arrays
- Storage Management of X-Group Arrays

## **Syntax Description**

Operand Definition Table:

Operand	Po	ossible Structure				Possible Formats										Referencing Permitted	Dynamic Definition			
operand1		S	A			A	U					В							no	no
operand2	C	S								Ι									no	no
operand3			A	G		A	U	N	Р	Ι	F	В	D	Т	L	C	G	О	yes	no
operand4	C	S						N	Р	Ι									no	no
operand5		S								I4									no	yes

Syntax Element Description:

Syntax Element	Description
dynamic-clause	DYNAMIC Clause:
	The RESIZE DYNAMIC statement adjusts the allocated length of the currently allocated storage of a dynamic variable ( <i>operand1</i> ) to the value specified with <i>operand2</i> . For more information, see <i>Dynamic Clause</i> below.
operand1	Dynamic Variable to be Adjusted:
	operand1 is the dynamic variable for which the length is to be adjusted.
operand2	New Length Specification:
	operand2 is used to specify the new length of the dynamic variable. The value specified must be a non-negative numeric integer constant or a variable of type Integer 4 (I4).
array-clause	ARRAY Clause:
	The RESIZE ARRAY statement adjusts the number of occurrences of the X-array (operand3) to the upper and lower bound specified with (dim[,dim[,dim]]). For more information, see <i>Array Clause</i> below.
operand3	Name of X-array:
	operand3 is the X-array. The occurrences of the X-array can be expanded or reduced. The index notation of the array is optional. As index notation only the complete range notation * is allowed for each dimension.
dim	X-array Lower and Upper Bound:
operand4	The lower and upper bound notation ( <i>operand4</i> or asterisk) to which the X-array should be expanded is specified here. If the current value of the upper or lower bound should be used, an asterisk (*) must be specified in place of <i>operand4</i> . For further information, see <i>Dimension</i> below.
GIVING operand5	GIVING Clause:
	If the GIVING clause is not specified, Natural runtime error processing is triggered if an error occurs.
	If the GIVING clause is specified, <i>operand5</i> contains the Natural message number if an error occurred, or zero upon success.

## **Dynamic Clause**

```
[SIZE OF] DYNAMIC [VARIABLE] operand1 TO operand2
```

The RESIZE DYNAMIC statement adjusts the allocated length of a dynamic variable (*operand1*) to the value specified with *operand2*.

When the RESIZE statement is used, the currently allocated storage size will be adjusted to the requested values, regardless whether it must be increased or decreased.

## **Array Clause**

```
[AND RESET] [OCCURRENCES OF] ARRAY operand3 TO (dim[,dim[,dim]])
```

The RESIZE ARRAY statement adjusts the number of occurrences of the X-array (operand3) to the upper and lower bound specified with (dim[,dim[,dim]]).

The RESET option resets all occurrences of the resized X-array to its default zero value. By default (no RESET option), the actual values are kept and the resized (new) occurrences are reset.

An upper or lower bound used in an RESIZE statement must be exactly the same as the corresponding upper or lower bound defined for the array.

#### Example:

```
DEFINE DATA LOCAL
1 #a(I4/1:*)
1 #q(1:*)
  2 #ga(I4/1:*)
1 #i(i4)
END-DEFINE
*/ resizing #a (1:10)
RESIZE ARRAY #a TO (1:10)
                             /* #a is resized to
RESIZE ARRAY #a TO (*:10)
                              /* 10 occurrences.
/* resizing \#ga (1:10,1:20)
RESIZE ARRAY \#g TO (1:10) /* 1st dimension is set to (1:10)
RESIZE ARRAY #ga TO (*:*,1:20) /* 1st dimension is dependent and
                                /* therefore kept with (*:*)
                                /* 2nd dimension is set to (1:20)
RESIZE ARRAY #a TO (5:10)
                                /* This is rejected because the lower index
                                /* must be 1 or *
RESIZE ARRAY #a TO (#i:10)
                                /* This is rejected because the lower index
```

```
/* must be 1 or * RESIZE ARRAY \#ga TO (1:10,1:20) /* (1:10) for the 1st dimension is rejected /* because the dimension is dependent and /* must be specified with (*:*).
```

For further information, see the following sections in the *Programming Guide*:

- Storage Management of X-Arrays
- Storage Management of X-Group Arrays

## **Dimension**

Each of the dimensions (dim) specified in the *Array Clause* is defined using the following syntax:

$$\left\{egin{matrix} \star \\ \star \\ operand4 \end{matrix}\right\} : \left\{egin{matrix} \star \\ operand4 \end{matrix}\right\}$$

The lower and upper bound notation (*operand4* or asterisk) to which the X-array should be expanded is specified here. If the current value of the upper or lower bound should be used, an asterisk (\*) may be specified in place of *operand4*. In place of \*:\*, you may also specify a single asterisk.

The number of dimensions (*dim*) must exactly match the defined number of dimensions of the X-array (1, 2 or 3).

# 123 ROLLBACK (SQL)

Function	960
Consideration for Non-Natural Programs	
Example	

ROLLBACK

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

See also ROLLBACK - SQL in the Natural for DB2 part of the Database Management System Interfaces documentation:

## **Function**

The SQL statement ROLLBACK corresponds to the Natural statement BACKOUT TRANSACTION. It undoes all database modifications made since the beginning of the last recovery unit. A recovery unit may start either after the beginning of a session or after the last SYNCPOINT, COMMIT, END TRANSACTION or BACKOUT TRANSACTION statement. This statement also releases all records held during the transaction.

If a program tries to backout updates which have already been committed by a terminal I/O, a corresponding Natural error message (NAT3711) is returned.



**Caution:** As all cursors are closed when a logical unit of work ends, a ROLLBACK statement must not be placed within a database modification loop; instead, it has to be placed outside such a loop or after the outermost loop of nested loops.

## **Consideration for Non-Natural Programs**

If an external program written in another standard programming language is called from a Natural program, this external program should not contain its own ROLLBACK statement if the Natural program issues database calls, too. The calling Natural program should issue the ROLLBACK statement on behalf of the external program.

## Example

```
...
DELETE FROM SQL-PERSONNEL WHERE NAME = 'SMITH'
ROLLBACK
...
```

## RETRY

Function	964
Restriction	964
Example	964

RETRY

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | STORE | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The RETRY statement is used within an ON ERROR statement block (see ON ERROR statement). It is used to reattempt to obtain a record which is in hold status for another user.

When a record to be held is already in hold status for another user, Natural issues Error Message 3145. See also the session parameter WH (Wait for Record in Hold Status).

The RETRY statement must be placed in the object that causes the Error 3145.

For details on record hold logic, see the section Record Hold Logic in the Programming Guide.

## Restriction

This statement can only be used to access Adabas databases.

## **Example**

```
** Example 'RTYEX1': RETRY

**

** CAUTION: Executing this example will modify the database records!

******************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES
    2 NAME

*

1 #RETRY (A1) INIT <' '>
END-DEFINE

*

FIND EMPLOY-VIEW WITH NAME = 'ALDEN'
    /*
    DELETE
    END TRANSACTION
```

```
/*
 ON ERROR
   IF *ERROR-NR = 3145
     INPUT NO ERASE 10/1
            'RECORD IS IN HOLD' /
            'DO YOU WISH TO RETRY?' /
           #RETRY '(Y)ES OR (N)O?'
     IF #RETRY = 'Y'
       RETRY
     ELSE
       STOP
     END-IF
   END-IF
 END-ERROR
 /*
 AT END OF DATA
   WRITE NOTITLE *NUMBER 'RECORDS DELETED'
 END-ENDDATA
END-FIND
END
```

## 125 RUN

Function	968
Syntax Description	
Dynamic Source Text Creation/Execution	
Example	

```
RUN [REPEAT] operand1 [operand2 [(parameter)]] ... 40
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Invoking Programs and Routines

## **Function**

The RUN statement is used to read a Natural source program from the Natural system file and then execute it.

For Natural RPC: See *Notes on Natural Statements on the Server* in the *Natural RPC (Remote Procedure Call)* documentation.

## **Syntax Description**

## Operand Definition Table:

Operand	Possible Structure				Possible Formats	Reference Permitt	cing Dynamic Definition ed
operand1	C	S			A	yes	no
operand2	C	S	A	G	AUNPIFBDTL	G yes	no

### Syntax Element Description:

Syntax Elemen	t Description
REPEAT	REPEAT Option:
	RUN REPEAT causes the program not to prompt the user for input until the program has finished executing even if multiple output screens (produced by INPUT statements) are produced.
	This feature may be used if the program is to display multiple screens of information without having the user respond to each screen.
operand1	Program Name:
	As <i>operand1</i> the name of the program can be specified as an alphanumeric constant or as the content of an alphanumeric variable. If a variable is used, it must be 8 characters in length.
	The program may be stored in the current library or in a concatenated library (default steplib is SYSTEM). If the program is not found, an error message is issued.

Syntax Elemen	t Description
	The program is read into the source program work area and overlays any current source program.
operand2	Parameters:
	The RUN statement may also be used to pass parameters to the program to be run. A parameter may be defined with any format. The parameters are converted to a format suitable for a corresponding INPUT field. All parameters are placed on the top of the Natural stack.
	The parameters can be read using an INPUT statement. The first INPUT statement issued will result in the insertion of all parameters into the fields specified in the INPUT statement. The INPUT statement must have the sign specification (session parameter \$G=0N) for parameter fields defined with numeric format.
	If more parameters are passed than are read by the next INPUT statement, the extra parameters are ignored. The number of parameters may be obtained with the system variable *DATA.
	<b>Note:</b> If <i>operand2</i> is a time variable (format T), only the time component of the variable
	content is passed, but not the date component.
parameter	Date Format:
	If operand2 is a date variable, you can specify the session parameter DF (described in the <i>Parameter Reference</i> ) as parameter for this variable.

## **Dynamic Source Text Creation/Execution**

The RUN statement may be used to dynamically compile and execute a program for which the source or parts thereof are created dynamically.

Dynamic source text creation is performed by placing source text into global variables and then referring to these variables by using an ampersand (&) instead of a plus sign (+) as the first character of the variable name in the source text. The content of the global variable will be interpreted as source text when the program is invoked using the RUN statement.

A global variable with index must not be used within a program that is invoked via a RUN statement.

It is not allowed to place a comment or an INCLUDE statement in a global variable.

## **Example**

### **Program containing RUN statement:**

```
** Example 'RUNEX1': RUN (with dynamic source program creation)
           *******************
DEFINE DATA
GLOBAL
 USING RUNEXGDA
LOCAL
1 #NAME (A20)
1 #CITY (A20)
END-DEFINE
INPUT 'Please specify the search values:' //
     'Name:' #NAME /
     'City:' #CITY
RESET +CRITERIA
                 /* defined in GDA 'RUNEXGDA'
IF \#NAME = ' ' AND <math>\#CITY = ' '
 REINPUT 'Enter at least 1 value'
END-IF
IF #NAME NE ' '
 COMPRESS 'NAME' ' =''' #NAME '''' INTO +CRITERIA LEAVING NO
END-IF
IF #CITY NE ' '
 IF +CRITERIA NE ' '
   COMPRESS +CRITERIA 'AND' INTO +CRITERIA
 COMPRESS +CRITERIA ' CITY =''' #CITY '''' INTO +CRITERIA LEAVING NO
END-IF
RUN 'RUNEXFND'
END
```

#### Program RUNEXFND executed by RUN statement:

```
** Example 'RUNEXFND': RUN (program executed with RUN in RUNEX1)

************************

DEFINE DATA

GLOBAL

USING RUNEXGDA

LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 NAME

2 CITY
```

## Global Data Area RUNEXGDA:

Global	RUNEXGDA	Library	SYSEXSYN				DBID 1	10	FNR	32
Command										> +
I T L Na	me			F	Length		Miscellaneous			
All				-						>
1 +C	RITERIA			Α		80				

## XIV

126 SELECT (SQL)	975
127 SEND METHOD	
128 SEPARATE	1007
129 SET CONTROL	
130 SET GLOBALS	1025
131 SET KEY	1029
132 SET TIME	1041
133 SET WINDOW	1045
134 SKIP	1047
135 SORT	1051
136 STACK	1063
137 STOP	1069

# 126 SELECT (SQL)

■ Function	976
Syntax 1 - Cursor-Oriented Selection	976
Syntax 2 - Non-Cursor Selection	
Syntax Element Description	
Join Queries	

For explanations of the symbols used in the syntax diagrams, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

## **Function**

The SELECT statement supports both the cursor-oriented selection that is used to retrieve an arbitrary number of rows and the non-cursor selection (singleton SELECT) that retrieves at most one single row. With the SELECT ... END-SELECT construction, Natural uses the same database loop processing as with the FIND statement.

Two different structures are possible.

## Syntax 1 - Cursor-Oriented Selection

Like the Natural FIND statement, the cursor-oriented SELECT statement is used to select a set of rows (records) from one or more DB2 tables, based on a search criterion. Since a database loop is initiated, the loop must be closed by a LOOP (reporting mode) or END-SELECT statement. With this construction, Natural uses the same loop processing as with the FIND statement.

In addition, no cursor management is required from the application program; it is automatically handled by Natural.

- Syntax 1 Common Set
- Syntax 1 Extended Set

## Syntax 1 - Common Set

```
SELECT selection into-clause table-expression

[ UNION EXCEPT INTERSECT ] [ DISTINCT | table-expression | SELECT selection | table-expression | modes | modes
```

## Syntax 1 - Extended Set

```
[WITH_CTE common-table-expression,...]
SELECT selection into-clause table-expression
                                                     (SELECT selection
          UNION
                                                     table-expression)
                                    DISTINCT
           EXCEPT
                                                    SELECT selection
                                    ALL
                                                     table-expression
[ORDER BY criteria]
                                    ROW
   OPTIMIZE FOR integer
                                    ROWS
[WITH isolation-level]
[SKIP LOCKED DATA]
[QUERYNO integer]
[FETCH FIRST row-limit]
[WITH HOLD]
[WITH RETURN]
[WITH scroll-mode]
[WITH ROWSET POSITIONING FOR max-rowsets]
[IF NO RECORDS FOUND instruction]
statement...
   END-SELECT
   L<sub>00</sub>P
```

## **Syntax 2 - Non-Cursor Selection**

The SELECT SINGLE statement supports the functionality of a non-cursor selection (singleton SELECT); that is, a **select expression** that retrieves at most one row without using a cursor. It cannot be referenced by a **positioned UPDATE** or a **positioned DELETE** statement.

■ Syntax 2 - Common Set

Syntax 2 - Extended Set

## Syntax 2 - Common Set

```
SELECT SINGLE

selection into-clause table-expression

[IF NO RECORDS FOUND instruction]

statement...

{
END-SELECT }
LOOP
```

## Syntax 2 - Extended Set

```
SELECT SINGLE

selection into-clause table-expression

[WITH isolation-level]

[FETCH FIRST row-limit]

[IF NO RECORDS FOUND instruction]

statement...

{

END-SELECT LOOP
}
```

## **Syntax Element Description**

This section alphabetically lists and explains the syntax items contained in the syntax diagrams of *Syntax 1 - Cursor-Oriented Selection* and *Syntax 2 - Non-Cursor Selection*:

- END-SELECT | LOOP
- FETCH FIRST row-limit
- IF NO RECORDS FOUND instruction
- into-clause
- OPTIMIZE FOR integer ROWS
- ORDER BY criteria
- QUERYNO Clause
- selection
- SKIP LOCKED DATA
- statement
- table-expression
- UNION | EXCEPT | INTERSECT Clause
- WITH\_CTE common-table-expression

- WITH HOLD Clause
- WITH isolation-level
- WITH RETURN Clause
- WITH scroll-mode
- WITH ROWSET POSITIONING FOR max-rowsets

## **END-SELECT | LOOP**

In structured mode, the Natural reserved keyword END-SELECT must be used to end the SELECT statement.

In reporting mode, the LOOP statement must be used to end the SELECT statement.

### **FETCH FIRST row-limit**

```
FETCH FIRST \left[\begin{array}{c} 1\\integer\end{array}\right]\left\{\begin{array}{c} {\sf ROW}\\ {\sf ROWS}\end{array}\right\} ONLY
```

The FETCH FIRST clause limits the number of rows to be fetched. It improves the performance of queries with potentially large result sets if only a limited number of rows is needed.

#### IF NO RECORDS FOUND instruction



**Note:** This clause actually does not belong to Natural SQL; it represents Natural functionality which has been made available to SQL loop processing.

### Structured Mode Syntax

## **Reporting Mode Syntax**

```
IF NO [RECORDS] [FOUND]

{
    ENTER
    statement
    DO statement... DOEND
}
```

The IF NO RECORDS FOUND clause is used to initiate a processing loop if no records meet the selection criteria specified in the preceding SELECT statement.

If no records meet the specified selection criteria, the IF NO RECORDS FOUND clause causes the processing loop to be executed once with an "empty" record. If this is not desired, specify the statement ESCAPE BOTTOM within the IF NO RECORDS FOUND clause.

If one or more statements are specified with the IF NO RECORDS FOUND clause, the statements are executed immediately before the processing loop is entered. If no statements are to be executed before entering the loop, the keyword ENTER must be used.



**Note:** If the result set of the SELECT statement consists of a single row of NULL values, the IF NO RECORDS FOUND clause is not executed. This could occur if the selection list consists solely of one of the aggregate functions SUM, AVG, MIN or MAX on columns, and the set on which these aggregate functions operate is empty. When you use these aggregate functions in the above-mentioned way, you should therefore check the values of the corresponding null-indicator fields instead of using an IF NO RECORDS FOUND clause.

#### **Database Values**

Unless other value assignments are made in the statements accompanying an IF NO RECORDS FOUND clause, Natural resets to empty all database fields which reference the file specified in the current loop.

#### **Evaluation of System Functions**

Natural system functions are evaluated once for the empty record that is created for processing as a result of the IF NO RECORDS FOUND clause.

#### into-clause

```
INTO { parameter,...
VIEW {view-name[correlation-name]},... }
```

The INTO keyword introduces an INTO clause. This clause is used to specify the target fields in the program which are to be filled with the result of the selection.

The INTO clause can specify either single parameters or one or more views as defined in the DEFINE DATA statement.

All target field values can come either from a single table or from more than one table as a result of a join operation (see also *Join Queries*).



**Note:** In standard SQL syntax, an INTO clause is only used in non-cursor select operations (singleton SELECT) and can be specified only if a single row is to be selected. In Natural, however, the INTO clause is used for both cursor-oriented and non-cursor select operations.

The *selection* can also merely consist of an asterisk (\*). In a standard **select expression**, this is a shorthand for a list of all column names in the table(s) specified in the FROM clause. In the Natural SELECT statement, however, the same syntactical item SELECT \* has a different semantic meaning:

all the items listed in the INTO clause are also used in the selection. Their names must correspond to names of existing database columns.

Syntax Element Description:

Syntax Element	Description
parameter	If single parameters are specified as target fields, their number and formats must correspond to the number and formats of the <code>columns</code> and/or <code>scalar-expressions</code> specified in the corresponding selection as described above (for details, see <code>Scalar Expressions</code> ). See <code>Example 5</code> .
view-name	The name a Natural view as defined in the DEFINE DATA statement.  If one or more views are referenced in the INTO clause, the number of items specified in the selection must correspond to the number of fields defined in the view(s) (not counting group fields, redefining fields and indicator fields).  Note: Both the Natural target fields and the table columns must be defined in a Natural DDM. Their names, however, can be different, since assignment is made according to their sequence.  See Example 5.
correlation-name	If the VIEW clause is used within a SELECT * construction where multiple tables are to be joined, <code>correlation-names</code> are required if the specified view contains fields that reference columns which exist in more than one of these tables. In order to know which column to select, all these columns are qualified by the specified <code>correlation-name</code> at generation of the selection list. The <code>correlation-name</code> assigned to a view must correspond to one of the <code>correlation-names</code> used to qualify the tables to be joined. See also the section <code>Join Queries</code> and <code>Example 6</code> .

## **Examples**

## Example 1:

```
DEFINE DATA LOCAL

01 PERS VIEW OF SQL-PERSONNEL

02 NAME

02 AGE
END-DEFINE

...

SELECT *

INTO NAME, AGE
```

## Example 2:

```
SELECT *
INTO VIEW PERS
```

These examples are equivalent to the following ones:

## Example 3:

```
...
SELECT NAME, AGE
INTO NAME, AGE
```

## Example 4:

```
...
SELECT NAME, AGE
INTO VIEW PERS
```

### Example 5:

```
DEFINE DATA LOCAL

01 PERS VIEW OF SQL-PERSONNEL

02 NAME

02 AGE

END-DEFINE

...

SELECT FIRSTNAME, AGE

INTO VIEW PERS

FROM SQL-PERSONNEL

...
```

The target fields NAME and AGE, which are part of a Natural view, receive the contents of the table columns FIRSTNAME and AGE.

### Example 6:

```
DEFINE DATA LOCAL

01 PERS VIEW OF SQL-PERSONNEL

02 NAME

02 FIRST-NAME

02 AGE
END-DEFINE

...

SELECT *

INTO VIEW PERS A

FROM SQL-PERSONNEL A, SQL-PERSONNEL B

...
```

## OPTIMIZE FOR integer ROWS

```
OPTIMIZE FOR integer ROWS
```

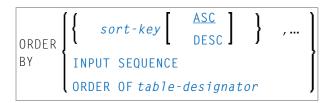
The OPTIMIZE FOR *integer* ROWS clause is used to inform DB2 in advance of the number (*integer*) of rows to be retrieved from the result table. Without this clause, DB2 assumes that all rows of the result table are to be retrieved and optimizes accordingly.

This optional clause is useful if you know how many rows are likely to be selected, because optimizing for *integer* rows can improve performance if the number of rows actually selected does not exceed the *integer* value (which can be in the range from 0 to 2147483647).

## Example

```
SELECT name INTO
#name FROM table WHERE AGE = 2 OPTIMIZE FOR 100 ROWS
```

#### **ORDER BY criteria**



The ORDER BY clause arranges the result set of a SELECT statement in a particular sequence.

The result set can be ordered by sort-key, by INPUT SEQUENCE or BY ORDER OF table-designator.

Syntax Element Description:

Syntax Element	Description
sort-key	You have the following options to specify a sort key:
	■ Specify an integer number <i>n</i> .
	Specify that the ordering is done by ordering the values of the nth column of the result set, or by giving a column name, specifying the ordering is done by ordering the values of the given column.
	Specify a scalar expression, where specifying the ordering is done by ordering the values of the expression.
	The expression may consist of columns of the result set host variables and constants.
	If multiple sort keys exist, the rows are ordered by the first sort key; duplicate first sort keys are ordered by the second sort key, and so on.

Syntax Element	Description
	If a column name is specified in the sort key of a fullselect including a set operator (UNION, EXCEPT, INTERSECTION), it has to be unqualified.
ASC   DESC	Specifies the sort order for the sort key: ascending (ASC) or descending (DESC). ASC is the default. See <i>Example 2</i> .
INPUT-SEQUENCE	Indicates the result table reflects the input order of the rows specified in the VALUES clause of an INSERT statement.
ORDER OF table-designator	Specifies the result table rows should be ordered in the same way as the table designated by the table-designator.
	table-designator must also be specified in the FROM clause.

## Examples

## Example 1:

```
DEFINE DATA LOCAL

1 #NAME (A20)

1 #YEARS-TO-WORK (I2)

END-DEFINE
...

SELECT NAME , 65 - AGE
  INTO #NAME, #YEARS-TO-WORK
  FROM SQL-PERSONNEL
  ORDER BY 2
...
```

## Example 2:

```
DEFINE DATA LOCAL

1 PERS VIEW OF SQL-PERSONNEL

1 NAME

1 AGE

1 ADDRESS (1:6)
END-DEFINE
...

SELECT NAME, AGE, ADDRESS
INTO VIEW PERS
FROM SQL-PERSONNEL
WHERE AGE = 55
ORDER BY NAME DESC
...
```

#### **QUERYNO Clause**

```
QUERYNO integer
```

The QUERYNO clause specifies the number to be used for this SQL statement in EXPLAIN output and trace records. The number is used as QUERYNO column in the PLAN\_TABLE for the rows that contain information on this statement.

#### selection

See *Selection* in *Select Expressions*.

#### SKIP LOCKED DATA

```
SKIP LOCKED DATA
```

The SKIP LOCKED DATA clause specifies that rows are skipped when incompatible locks are held on the row by other transactions.

#### statement

The Natural statement(s) to be executed in the processing loop.

### table-expression

See table-expression in Select Expressions.

## UNION | EXCEPT | INTERSECT Clause

```
      UNION

      EXCEPT

      INTERSECT

      INTERSECT

(SELECT selection table-expression)
...
```

UNION, EXCEPT and INTERSECT introduce a query that involves set operations.

Set operations combine the results of two or more *select-expressions*. The columns specified in the individual *select-expressions* must match in number, type and format.

The INTO clause must be specified with the first select-expression only.

Syntax Element Description:

Syntax Element	Description
UNION	Combines the results of two or more <i>select-expressions</i> .
EXCEPT	Specifies the difference set of the result sets of two select-expressions.
INTERSECT	Specifies the intersection of two result sets.
DISTINCT	Specifies that the result set does not contain redundant (duplicate) rows. <code>DISTINCT</code> is the default setting.
ALL	Specifies that the result set contains redundant (duplicate) rows. Redundant duplicate rows are eliminated from the result of a set operation unless the set operation explicitly includes the ALL qualifier.

## Example

```
DEFINE DATA LOCAL
01 PERS VIEW OF SQL-PERSONNEL
 02 NAME
 02 AGE
 02 ADDRESS (1:6)
END-DEFINE
SELECT NAME, AGE, ADDRESS
 INTO VIEW PERS
  FROM SQL-PERSONNEL
 WHERE AGE > 55
UNION ALL
SELECT NAME, AGE, ADDRESS
  FROM SQL-EMPLOYEES
  WHERE PERSNR < 100
ORDER BY NAME
. . .
END-SELECT
```

## WITH\_CTE common-table-expression

```
WITH_CTE common-table-expression-name[(column-name,...)] AS (fullselect)
```

This clause allows you to define a result table which can be referenced in any FROM clause of the SELECT statement that follows.

Syntax Element Description:

Syntax Element	Description
WITH_CTE	The Natural specific keyword WITH_CTE corresponds to the SQL keyword WITH. WITH_CTE will be translated into the SQL keyword WITH by the Natural compiler.
common-table-expression-name	Has to be an unqualified SQL identifier and must be different from any other common-table-expression-name specified in the same statement.
	Multiple common-table-expression can be specified following the single WITH_CTE keyword.
	Each common-table-expression-name can be specified in the FROM clause of any common-table-expression-name following or in the FROM clause of the SELECT statement following.
column-name	Has to be an unqualified SQL identifier and must be unique within one <code>common-table-expression-name</code> .
AS (fullselect)	The number of <i>column-names</i> must match the number of columns of the fullselect.

A common-table-expression can be used

- in place of a view to avoid creating the view;
- when the same result table needs to be shared in a fullselect;
- when the result needs to be derived using recursion.

Queries using recursion are useful in applications such as bills of materials.

## Example

```
WITH_CTE

RPL (PART,SUBPART,QUANTITY) AS

(SELECT ROOT.PART,ROOT.SUBPART,ROOT.QUANTITY

FROM HGK-PARTLIST ROOT

WHERE ROOT.PART ='01'

UNION ALL

SELECT CHILD.PART,CHILD.SUBPART,CHILD.QUANTITY

FROM RPL PARENT, HGK-PARTLIST CHILD

WHERE PARENT.SUBPART = CHILD.PART

)

SELECT DISTINCT PART,SUBPART,QUANTITY

INTO VIEW V1

FROM RPL

ORDER BY PART,SUBPART,QUANTITY

END-SELECT
```

## **WITH HOLD Clause**

```
WITH HOLD
```

The WITH HOLD clause is used to prevent cursors from being closed by a commit operation within database loops. If WITH HOLD is specified, a commit operation commits all the modifications of the current logical unit of work, but releases only locks that are not required to maintain the cursor. This optional clause is mainly useful in batch mode; it is ignored in CICS pseudo-conversational mode and in IMS message-driven programs.

## Example

```
SELECT name INTO #name FROM table
WHERE AGE = 2 WITH HOLD
```

#### WITH isolation-level

```
WITH { CS RR RR KEEP UPDATE LOCK RS RS KEEP UPDATE LOCKS UR
```

This clause allows you to specify an explicit isolation level with which the statement is to be executed.

The following options are provided:

Option	Meaning
CS	Cursor Stability
RR	Repeatable Read
RR KEEP UPDATE LOCKS	Only applies to <i>Syntax 1 - Extended Set</i> and only if a <b>positioned UPDATE</b> or a <b>positioned DELETE</b> statement is processed with the SELECT statement.
	Repeatable Read and retaining update locks.
RS	Read Stability
RS KEEP UPDATE LOCKS	Only applies to <i>Syntax 1 - Extended Set</i> and only if a <b>positioned UPDATE</b> or a <b>positioned DELETE</b> statement is processed with the SELECT statement.
	Read Stability and retaining update locks.
UR	Uncommitted Read
	UR can only be specified within a SELECT statement and when the table is read-only. The default isolation level is determined by the isolation of the package

Option	Meaning
	or plan into which the statement is bound. The default isolation level also depends on whether the result table is read-only or not. To find out the default isolation level, refer to the IBM literature.

#### WITH RETURN Clause

```
WITH RETURN
```

The WITH RETURN clause is used to create result sets. Therefore, this clause only applies to programs which operate as Natural stored procedure. If the WITH RETURN clause is specified in a SELECT statement, the underlying cursor remains open when the associated processing loop is left, except when the processing loop had read all rows of the result set itself. During first execution of the processing loop, only the cursor is opened. The first row is not yet fetched. This allows the Natural program to return a full result set to the caller of the stored procedure. It is up to you to decide how many rows are processed by the Natural stored procedure and how many unprocessed rows of the result set are returned to the caller of the stored procedure. If you want to process rows of the select operation in the Natural stored procedure, you must define

```
IF *counter =1 ESCAPE TOP END-IF
```

in order to avoid processing of the first "empty row" in the processing loop. If you decide to terminate the processing of rows, you must define the following statement in the processing loop:

```
IF condition ESCAPE BOTTOM END-IF
```

If the program reads all rows of the result set, the cursor is closed and no result set is returned for this SELECT WITH RETURN to the caller of the stored procedure.

The following programs are examples for retrieving full result sets (*Example 1*) and partial result sets (*Example 2*).

#### **Examples**

### Example 1:

```
DEFINE DATA LOCAL
...
END DEFINE

*

* Return all rows of the result set

*

SELECT * INTO VIEW V2

FROM SYSIBM-SYSROUTINES

WHERE RESULT_SETS > 0

WITH RETURN

ESCAPE BOTTOM
```

```
END-SELECT END
```

## Example 2:

```
DEFINE DATA LOCAL

. . .

END DEFINE

*

* Read the first two rows and return the rest as result set

*

* SELECT * INTO VIEW V2

FROM SYSIBM-SYSROUTINES

WHERE RESULT_SETS > 0

WITH RETURN

WRITE PROCEDURE *COUNTER

IF *COUNTER = 1 ESCAPE TOP END-IF

IF *COUNTER = 3 ESCAPE BOTTOM END-IF

END-SELECT

END
```

#### WITH scroll-mode

```
WITH 

ASENSITIVE SCROLL
INSENSITIVE SCROLL
SENSITIVE STATIC SCROLL
SENSITIVE DYNAMIC SCROLL

SENSITIVE DYNAMIC SCROLL
```

Natural for DB2 supports DB2 scrollable cursors by using the clauses WITH ASENSITIVE SCROLL, WITH SENSITIVE STATIC SCROLL and SENSITIVE DYNAMIC SCROLL. Scrollable cursors allow Natural for DB2 applications to position randomly any row in a result set. With non-scrollable cursors, the data can only be read sequentially, from top to bottom.

DB2 scrollable cursors are enabled with this clause. Scrollable cursors can be ASENSITIVE, INSENSITIVE, SENSITIVE STATIC or SENSITIVE DYNAMIC.

Scrollable cursors allow the application to position any row in the cursor at any time as long as the cursor is open.

The positioning is performed depending on the content of the  $scroll_hv$ . The content is evaluated each time a FETCH against DB2 is executed.

Syntax Element Description:

Syntax Element	Description
ASENSITIVE SCROLL	Specifies that the cursor is either INSENSITIVE or SENSITIVE DYNAMIC.
	This is determined by DB2 at open time of the cursor, depending on the read-only property of the cursor: If the cursor is read-only, the cursor will become INSENSITIVE. If the cursor is not read-only, the cursor will become SENSITIVE DYNAMIC.
INSENSITIVE SCROLL	Specifies that the cursor is insensitive for updates, deletes and inserts executed against the base table, after the cursor has been updated. INSENSITIVE SCROLL refers to a cursor that cannot be used in <b>Positioned UPDATE</b> or <b>Positioned DELETE</b> operations. In addition, once opened, an INSENSITIVE SCROLL cursor does not reflect UPDATE, DELETE or INSERT operations against the base table after the cursor was opened.
	See also Note.
SENSITIVE STATIC SCROLL	Specifies that the cursor is sensitive for updates and deletes against the base table, but not against inserts, after the cursor has been opened. SENSITIVE STATIC SCROLL refers to a cursor that can be used for Positioned UPDATE or Positioned DELETE operations. In addition, a SENSITIVE STATIC SCROLL cursor reflects UPDATE and DELETE operations of base table rows. The cursor does not reflect INSERT operations.
	See also Note.
SENSITIVE DYNAMIC	SENSITIVE DYNAMIC specifies that the cursor is sensitive for updates, deletes and inserts against the base table, after the cursor has been opened.
	SENSITIVE DYNAMIC scrollable cursors reflect UPDATE, DELETE and INSERT operations against the base table while the cursor is open.

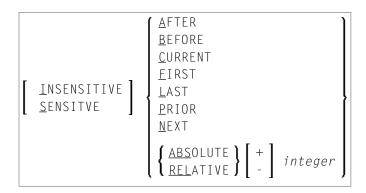


**Note:** INSENSITIVE and SENSITIVE STATIC scrollable cursors use temporary result tables and require a TEMP database in DB2 (see the relevant DB2 literature by IBM).

#### scroll\_hv

The variable *scroll\_hv* must be alphanumeric.

The variable  $scroll_hv$  specifies which row of the result table will be fetched during one execution of the database processing loop. Additionally, it specifies the sensitivity of UPDATES or DELETES against the base table row during a FETCH operation. The contents of  $scroll_hv$  is evaluated each time the database processing loop cycle is executed.



## scroll\_hv Sensitivity Specification

The specification of the sensitivity INSENSITIVE or SENSITIVE is optional.

- If it is omitted from a FETCH against an INSENSITIVE SCROLL cursor, the default will be INSENSITIVE.
- If it is omitted from a FETCH against a SENSITIVE STATIC/DYNAMIC SCROLL cursor, the default will be SENSITIVE.

The sensitivity specifies whether or not the rows in the base table are checked when performing a FETCH operation for a scrollable cursor.

- If the corresponding base table column qualifies for the WHERE clause and has not been deleted, a SENSITIVE FETCH will return the row of the base table.
- If the corresponding base table column does not qualify for the WHERE clause or has not been deleted, a SENSITIVE FETCH will return an UPDATE hole or a DELETE hole state (SQLCODE +222).

An INSENSITIVE FETCH will not check the corresponding base table column.

#### scroll\_hv Options

Below is an explanation of the options available to determine the row(s) to fetch, the position from where to start the fetch and/or the direction in which to scroll:

Option	Explanation						
AFTER	Positions after the last row. No row is fetched.						
BEFORE	Positions before the first. No row is fetched.						
CURRENT	Fetches the current row (again).						
FIRST	Fetches the first row.						
LAST	Fetches the last row.						
NEXT	Fetches the row after the current one. This is the default value.						
PRIOR	Fetch the row before the current one.						
+ -integer	Only applies in connection with ABSOLUTE or RELATIVE.						
	Specifies the position of the row to be fetched ABSOLUTE or RELATIVE.						

Option	Explanation
	Enter a plus (+) or minus (-) sign followed by an integer.
	The default value is a plus (+).
ABS0LUTE	Only applies in connection with +   - integer.
	Uses <i>integer</i> as the absolute position within the result set from where the row is fetched.
	See the DB2 SQL reference by IBM about further details regarding positive and negative position numbers.
RELATIVE	Only applies in connection with +   - integer.
	Uses <i>integer</i> as the relative position to the current position within the result set from where the row is fetched.
	See the DB2 SQL reference by IBM about further details regarding positive and negative position numbers.

### GIVING [:] sqlcode

The specification of GIVING [:] sqlcode is optional. If specified, the Natural variable [:] sqlcode must be of format I4. The values for this variable are returned from the DB2 SQLCODE of the underlying FETCH operation. This allows the application to react to different statuses encountered while the scrollable cursor is open. The most important status codes indicated by SQLCODE are listed in the following table:

SQLCODE	Explanation
0	FETCH operation successful, data returned except for FETCH with option BEFORE or AFTER.
+100	Row not found, cursor still open, no data returned.
+222	UPDATE or DELETE hole, cursor still open, no data returned. The corresponding row of the base table has been updated or deleted, so that the row no longer qualifies for the WHERE clause.
+231	Fetch operation with the option CURRENT, but cursor not positioned on any row, no data returned. This occurs if the previous FETCH returned SQLCODE +100.

If you specify GIVING [:] *sqlcode*, the application must react to the different statuses. If an SQLCODE +100 is entered five times successively and without terminal I/O, the Natural for DB2 runtime will issue Natural error NAT3296 in order to avoid application looping. The application can terminate the processing loop by executing an ESCAPE statement.

If you do not specify GIVING [:] *sqlcode*, except for SQLCODE 0 and SQLCODE +100, each SQLCODE will generate Natural error NAT3700 and the processing loop will be terminated. SQLCODE +100 (row not found) will terminate the processing loop.

See also the example program DEM2SCRL supplied in the Natural system library SYSDB2.

### WITH ROWSET POSITIONING FOR max-rowsets

This clause enables DB2 rowset processing, which corresponds to Natural native DML multi-fetch processing. [:] row\_hv (I4) or integer determines the maximum number of rows returned from DB2 to Natural. The number determines either the size of the Natural multi-fetch buffer used for standard multiple row processing or the maximum number of rows returned from DB2 into the Natural program for advanced multiple row processing.

## **ROWS\_RETURNED** [:] *ret\_row* **Clause**:

This clause specifies an I4 variable which will receive the number of rows returned by DB2 on behalf of the last executed DB2 fetch operation for advanced multiple row processing.

## **Join Queries**

A join is a query in which data is retrieved from more than one table. All the tables involved must be specified in the FROM clause.

A join always forms the Cartesian product of the tables listed in the FROM clause and later eliminates from this Cartesian product table all the rows that do not satisfy the join condition specified in the WHERE clause.

**Correlation names** can be used to save writing if table names are rather long. Correlation names must be used when a column specified in the selection list exists in more than one of the tables to be joined in order to know which of the identically named columns to select.

#### Example

```
DEFINE DATA LOCAL

1 #NAME (A20)

1 #MONEY (I4)

END-DEFINE
...

SELECT NAME, ACCOUNT
INTO #NAME, #MONEY
FROM SQL-PERSONNEL P, SQL-FINANCE F
WHERE P.PERSNR = F.PERSNR
AND F.ACCOUNT > 10000
...
```

# 127 SEND METHOD

Function	996
Syntax Description	
Example	

SEND [METHOD] operand1 TO [OBJECT] operand2 
$$\left[ \begin{array}{c} operand3 \\ nX \end{array} \right] \left[ \begin{array}{c} M \\ 0 \\ A \end{array} \right] \right]$$
 | WITH 
$$\left[ \begin{array}{c} operand3 \\ nX \end{array} \right] \left[ \begin{array}{c} AD = \left\{ \begin{array}{c} M \\ 0 \\ A \end{array} \right\} \right]$$
 | [RETURN operand4] [GIVING operand5]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CREATE OBJECT | DEFINE CLASS | INTERFACE | METHOD | PROPERTY

Belongs to Function Group: Component Based Programming

## **Function**

The SEND METHOD statement is used to invoke a particular method of an object.

See the section *NaturalX* in the *Programming Guide* for information on component-based programming.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure					Possible Formats												Referencing Permitted	Dynamic Definition	
operand1	C	S				A													yes	no
operand2		S																O	no	no
operand3	С	S	A	G		A	U	N	Р	Ι	F	В	D	T	L	С	G	O	yes	no
operand4		S	A			A	U	N	Р	Ι	F	В	D	T	L	С	G	O	yes	no
operand5		S			N					Ι									yes	no

The formats C and G can only be passed to methods of local classes.

Syntax Element Description:

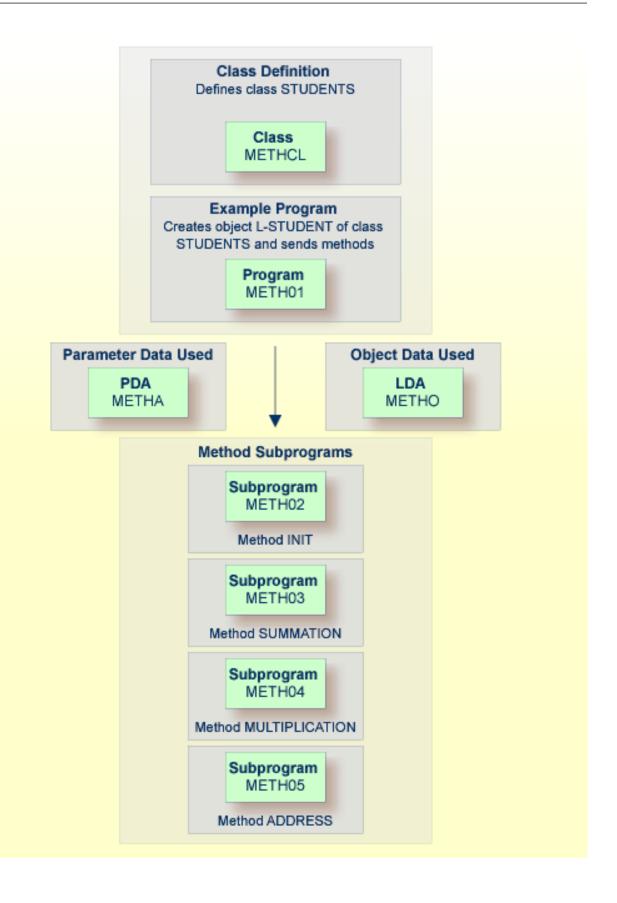
Syntax Element	Description
operand1	Method-Name:
	operand1 is the name of a method which is supported by the object specified in operand2.
	Since the method names can be identical in different interfaces of a class, the method name in <code>operand1</code> can also be qualified with the interface name to avoid ambiguity.
	In the following example, the object #03 has an interface Iterate with the method Start. The following statements apply:
	* Specifying only the method name. SEND 'Start' TO #03
	* Qualifying the method name with the interface name. SEND 'Iterate.Start' TO #03
	If no interface name is specified, Natural searches the method name in all the interfaces of the class. If the method name is found in more than one interface, a runtime error occurs.
operand2	Object Handle:
	The handle of the object to which the method call is to be sent.
	operand2 must be defined as an object handle (HANDLE OF OBJECT). The object must already exist.
	To invoke a method of the current object inside a method, use the system variable *THIS-OBJECT.
operand3	Parameter(s) Specific to the Method:
	As operand3 you can specify parameters specific to the method.
	In the following example, the object #03 has the method PositionTo with the parameter Pos. The method is called in the following way:
	SEND 'PositionTo' TO #03 WITH Pos
	Methods can have optional parameters. Optional parameters need not to be specified when the method is called. To omit an optional parameter, use the placeholder 1X. To omit $n$ optional parameters, use the placeholder $nX$ .
	In the following example, the method SetAddress of the object #04 has the parameters FirstName, MiddleInitial, LastName, Street and City, where MiddleInitial, Street and City are optional. The following statements apply:

Syntax Element	Description						
	* Specifying all parameters.  SEND 'SetAddress' TO #04 WITH FirstName MiddleInitial LastName Street City * Omitting one optional parameter.  SEND 'SetAddress' TO #04 WITH FirstName 1X LastName Street City * Omitting all optional parameters.  SEND 'SetAddress' TO #04 WITH FirstName 1X LastName 2X  Omitting a non-optional (mandatory) parameter results in a runtime error.						
AD=	Attribute Definition: If operand3 is a variable, you can mark it	in one of the following ways:					
	AD=0	Non-modifiable, see session parameter AD=0.					
	AD=M	Modifiable, see session parameter AD=M.					
		This is the default setting.					
	AD=A	Input only, see session parameter AD=A.					
	If operand3 is a constant, AD cannot be exapplies.	eplicitly specified. For constants AD=0 always					
nX	Parameter(s) to be Skipped:						
	With the notation <i>n</i> X you can specify that the next <i>n</i> parameters are to be skipped (for example 1X to skip the next parameter, or 3X to skip the next three parameters). This means that for the next n parameters no values are passed to the method.  For a method implemented in Natural, a parameter that is to be skipped must be defined with the keyword OPTIONAL in the dialog's DEFINE DATA PARAMETER statement. OPTIONAL means that a value can - but need not - be passed from the invoking object to such a parameter RETURN Clause:						
RETURN							
operand4							
	If the RETURN clause is specified, <code>operand4</code> contains the return value of the method. If the method execution fails, <code>operand4</code> is reset to its initial value.						
	<b>Note:</b> For classes written in Natural, the r	eturn value of a method is defined by entering					
	one additional parameter in the parameter data area of the method and by marking it with BY VALUE RESULT. For more information, see the PARAMETER clause in the INTERFACE statement description. Therefore the parameter data area of a method that is written in Natural and that has a return value always contains one additional field next to the method parameters. This is to be considered when you call a method of a Natural written class and want to use the parameter data area of the method in the SEND statement.						
GIVING	GIVING Clause:						
operand5	If the GIVING clause is not specified, the Natural run time error processing is triggered if a error occurs.						

Syntax Element	Description
	If the GIVING clause is specified, <code>operand5</code> contains the Natural message number if an error
	occurred, or zero on success.

## **Example**

The following diagram gives an overview of the Natural objects that are used in this example. The corresponding source code and the program output are shown below.



## Program METH01 - CREATE OBJECT and SEND METHOD Using a Class and Several Methods:

```
** Example 'METHO1': CREATE OBJECT and SEND METHOD
                   using a class and several methods (see METH*)
*************************
LOCAL
 USING METHA
LOCAL
1 L-STUDENT HANDLE OF OBJECT
1 #NAME (A20)
1 #STREET (A20)
1 #CITY (A20)
1 #SUM (I4)
         (I4)
1 #MULTI (I4)
END-DEFINE
CREATE OBJECT L-STUDENT OF CLASS 'STUDENTS' /* see METHCL for class
L-STUDENT.FULL-NAME := 'John Smith'
SEND METHOD 'INIT' TO L-STUDENT
                                      /* see METHCL
    WITH #VAR1 #VAR2 #VAR3 #VAR4
SEND METHOD 'SUMMATION' TO L-STUDENT
                                      /* see METHCL
    WITH #VAR1 #VAR2 #VAR3 #VAR4
SEND METHOD 'MULTIPLICATION' TO L-STUDENT /* see METHCL
    WITH #VAR1 #VAR2 #VAR3 #VAR4
#NAME := L-STUDENT.FULL-NAME
#SUM := L-STUDENT.SUM /* property calls method SUMMATION
#MULTI := L-STUDENT.MULTI  /* property calls method MULTIPLICATION
SEND METHOD 'ADDRESS' TO L-STUDENT /* see METHCL
#STREET := L-STUDENT.STREET
#CITY := L-STUDENT.CITY
WRITE 'Name : ' #NAME
WRITE 'Street:' #STREET
WRITE 'City :' #CITY
WRITE ' '
WRITE 'is' #SUM
WRITE 'The multiplication of' #VAR1 #VAR2 #VAR3 #VAR4
WRITE 'is' #MULTI
END
```

## **Class Definition METHCL Used by METH01:**

```
** Example 'METHCL': DEFINE CLASS (used by METHO1)
                           ***********
* Defining class STUDENTS for METH01
DEFINE CLASS STUDENTS
 OBJECT
                                /* Object data for class STUDENTS
   USING METHO
  /*
  INTERFACE STUDENT-ARITHMETICS
   PROPERTY FULL-NAME
     IS NAME
   END-PROPERTY
   PROPERTY SUM
    END-PROPERTY
   PROPERTY MULTI
   END-PROPERTY
   METHOD INIT
     IS METHO2
     PARAMETER USING METHA
    END-METHOD
   METHOD SUMMATION
     IS METH03
     PARAMETER USING METHA
   END-METHOD
   METHOD MULTIPLICATION
     IS METH04
     PARAMETER USING METHA
   END-METHOD
  END-INTERFACE
  INTERFACE STUDENT-ADDRESS
   PROPERTY STUDENT-NAME
     IS NAME
    END-PROPERTY
   PROPERTY STREET
    END-PROPERTY
    PROPERTY CITY
   END-PROPERTY
   METHOD ADDRESS
     IS METH05
   END-METHOD
 END-INTERFACE
END-CLASS
END
```

## Local Data Area METHO (object data) Used by Class METHCL and Subprograms METH02, METH03, METH04 and METH05:

Local	METH0	Library	SYSEXSYN			DBID	10 FNR	32
Comman	d							> +
ITL	Name			F Length		Miscellaneous		
A11								>
1	NAME			Α	20			
1	STREET			Α	30			
1	CITY			Α	20			
1	SUM			I	4			
1	MULTI			I	4			

## Parameter Data Area METHA Used by Program METH01, Class METHCL and Subprograms METH02, METH03 and METH04:

Parameter METHA Command	Library	SYSEXSYN			DBID	10 FNR	32 > +
I T L Name			F Length	Misce	llaneous		
All							>
1 #VAR1			Ι	4			
1 #VAR2			Ι	4			
1 ∦VAR3			I	4			
1 #VAR4			I	4			

## **Subprogram METH02 - Method INIT Used by Program METH01:**

```
** Example 'METHO2': Method INIT (used by METHO1)

**************************

DEFINE DATA

PARAMETER

USING METHA

OBJECT

USING METHO

END-DEFINE

*

* Method INIT of class STUDENTS

*

#VAR1 := 1

#VAR2 := 2

#VAR3 := 3

#VAR4 := 4

*

END
```

## Subprogram METH03 - Method SUMMATION Used by Program METH01:

```
** Example 'METH03': Method SUMMATION (used by METH01)

**************************

DEFINE DATA

PARAMETER

USING METHA

OBJECT

USING METHO

END-DEFINE

*

Method SUMMATION of class STUDENTS

*

COMPUTE SUM = #VAR1 + #VAR2 + #VAR3 + #VAR4

END
```

## Subprogram METH04 - Method MULTIPLICATION Used by Program METH01:

```
** Example 'METH04': Method MULTIPLICATION (used by METH01)

************************

DEFINE DATA

PARAMETER

USING METHA

OBJECT

USING METHO

END-DEFINE

*

* Method MULTIPLICATION of class STUDENTS

*

COMPUTE MULTI = #VAR1 * #VAR2 * #VAR3 * #VAR4

END
```

#### Subprogram METH05 - Method ADDRESS Used by Program METH01:

```
** Example 'METHO5': Method ADDRESS (used by METHO1)

**************************

DEFINE DATA

OBJECT USING METHO

END-DEFINE

*

Method ADDRESS of class STUDENTS

*

IF NAME = 'John Smith'

STREET := 'Oxford street'

CITY := 'London'

END-IF

END
```

## Output of Program METH01:

Page 1			05	-01-17 15:	59:04
Name : John Smith Street: Oxford street City : London					
The summation of is 10	1	2	3	4	
The multiplication of is 24	1	2	3	4	

## 128 SEPARATE

Function	1008
Syntax Description	
Rules and Operational Considerations	1012
Examples	1014

```
SEPARATE {
    SUBSTRING (operand1, operand2, operand3)

[[STARTING] FROM [POSITION] operand8]

[LEFT [JUSTIFIED]] INTO operand4...

[ IGNORE

    REMAINDER operand5

REMAINDER POSITION operand9

[[ANY] DELIMITERS

INPUT DELIMITERS

DELIMITERS operand6

[[GIVING] NUMBER [IN] operand7]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: COMPRESS | COMPUTE | EXAMINE | MOVE | MOVE ALL | RESET

Belongs to Function Group: Arithmetic and Data Movement Operations

## **Function**

The SEPARATE statement is used to separate the content of an alphanumeric or binary operand into two or more alphanumeric or binary operands (or into multiple occurrences of an alphanumeric or binary array).

## **Syntax Description**

Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure	Possible Formats					Referencing Permitted	Dynamic Definition			
operand1	С	S	A			A	U				В			yes	no
operand2	С	S						N	Р	Ι	B*			yes	no
operand3	С	S						N	Р	Ι	B*			yes	no
operand4		S	A	G		A	U				В			yes	yes
operand5		S				A	U				В			yes	yes
operand6	С	S				A	U				В			yes	no
operand7		S						N	Р	Ι				yes	yes

Operand	Po	ssib	le St	ruct	ure	Possible Formats				Referencing Permitted	Dynamic Definition			
operand8	С	S					N	Р	I				yes	no
operand9		S					N	Р	Ι				yes	yes

 $<sup>^{*}</sup>$  Format B of operand2 and operand3 may be used only with a length of less than or equal to 4.

## Syntax Element Description:

Syntax Element	Description
operand1	Source Operand:
	operand1 is the alphanumeric/binary constant or variable whose content is to be separated.
	Trailing blanks in <i>operand1</i> are removed before the value is processed (even if the blank is used as a delimiter character; see also the DELIMITERS option).
SUBSTRING	SUBSTRING Option:
	Normally, the whole content of a field is separated, starting from the beginning of the field.
	The SUBSTRING option allows you to separate only a certain part of the field. After the field name ( <i>operand1</i> ) in the SUBSTRING clause you specify first the starting position ( <i>operand2</i> ) and then the length ( <i>operand3</i> ) of the field portion to be separated. For example, if a field #A contained CONTRAPTION, SUBSTRING(#A,5,3) would contain RAP.
	<b>Note:</b> If you omit <i>operand2</i> , the starting position is assumed to be 1. If you omit
	operand3, the length is assumed to be from the starting position to the end of the field.
STARTING FROM	STARTING FROM POSITION Option:
POSITION operand8	This option determines the starting position for the source operand (operand1) to be separated.
	For details, see <i>Defining Ranges for STARTING POSITION</i> .
LEFT JUSTIFIED	LEFT JUSTIFIED Option:
	This option causes leading blanks which may occur between the delimiter character and the next non-blank character to be removed from the target operand.
operand4	Target Operand:
	operand4 represents the target operands. If an array is specified as target operand, it is filled occurrence by occurrence with the separated values.
	The number of target operands corresponds to the number of delimiter characters (including trailing delimiter characters) in <code>operand1</code> , plus 1.

Syntax Element	Description
	If <i>operand4</i> is a dynamic variable, its length may be modified by the SEPARATE operation. The current length of a dynamic variable can be ascertained by using the system variable *LENGTH.
	For general information on dynamic variables, see the section <i>Using Dynamic and Large Variables</i> .
IGNORE/	IGNORE / REMAINDER Options:
REMAINDER operand5	If you do not specify enough target fields for the source value to be separated into, you will receive an appropriate error message.
	To avoid this, you have two options:
	■ IGNORE Option:
	If you specify IGNORE, Natural will ignore it if there are not enough target operands to receive the source value.
	■ REMAINDER Option:
	If you specify REMAINDER <i>operand5</i> , that section of the source value which could not be placed into target operands will be placed into <i>operand5</i> . You may then use the content of <i>operand5</i> for further processing, for example in a subsequent SEPARATE statement.
	REMAINDER can only be used for single-value source operands. For array source operands, use the REMAINDER POSITION option.
	See also Rules and Operational Considerations and Example 3.
REMAINDER	REMAINDER POSITION Option:
POSITION operand9	The value returned by the REMAINDER POSITION clause corresponds to the position from which a REMAINDER data field is filled.
	For details, see Rules and Operational Considerations.
DELIMITERS	DELIMITERS Option:
	See DELIMITERS Option below.
RETAINED	RETAINED Option:
	Normally, the delimiter characters themselves are not moved into the target operands.
	When you specify RETAINED, however, each delimiter (that is, either default delimiters and blanks, or the delimiter specified with <code>operand6</code> ) will also be placed into a target operand.
	Example:
	The following SEPARATE statement would place 150 into $\#B$ , + into $\#C$ , and 30 into $\#D$ :

Syntax Element	Description
	MOVE '150+30' TO #A SEPARATE #A INTO #B #C #D WITH RETAINED DELIMITER '+'
	See also <i>Example 3</i> .
GIVING NUMBER operand7	GIVING NUMBER Option:  This option causes the number of filled target operands (including those filled with blanks) to be returned in <code>operand7</code> . The number actually obtained is the number of delimiters plus 1.
	If you use the <i>IGNORE Option</i> , the maximum possible number returned in <i>operand7</i> will be the number of target operands ( <i>operand4</i> ).
	If you use the <i>REMAINDER Option</i> , the maximum possible number returned in <i>operand7</i> will be the number of target operands ( <i>operand4</i> ) plus 1 (for <i>operand5</i> ).

## **DELIMITERS Option:**

Delimiter characters within *operand1* indicate the positions at which the value is to be separated.

Syntax Element Description:

Syntax Element	Description
WITH [ANY] DELIMITERS	If you omit the DELIMITERS option or specify WITH ANY DELIMITERS, a blank and any character which is neither a letter nor a numeric character will be treated as delimiter character.  The definition of delimiters may be modified using the SCTAB profile parameter.
WITH INPUT DELIMITERS	Indicates that the blank and the default input delimiter character (as specified with the session parameter ID) is to be used as delimiter character.
WITH DELIMITERS operand	Indicates that each of the characters specified in <code>operand6</code> is to be treated as delimiter character.  If <code>operand6</code> contains trailing blanks, these will be ignored.

## **Rules and Operational Considerations**

- Processing of Source and Target Operands
- Defining Ranges for STARTING FROM POSITION
- Values Returned by REMAINDER POSITION
- Overlapping Fields: REMAINDER and REMAINDER POSITION
- Delimiters in SEPARATE

## **Processing of Source and Target Operands**

Trailing blanks are ignored in source operands (in single values and array occurrences as well) when the separation process starts. Trailing blanks only count when the REMAINDER POSITION value is calculated: see also *Values Returned by REMAINDER POSITION*.

If the source operand (operand1) is an empty dynamic field (\*LENGTH=0) or an X-array that is not expanded, the SEPARATE statement stops executing after resetting the following fields:

- all target operands (operand4);
- the field (operand7) returning the number of filled target operands;
- the REMAINDER data field (operand5);
- the REMAINDER POSITION field (operand9)

The same applies if the source operand contains only blanks.

## **Defining Ranges for STARTING FROM POSITION**

The value range allowed for the STARTING FROM POSITION clause *operand8* is 1: *n* where *n* is the last byte of the source field.

If the source operand (operand1) is an array, all occurrences are counted, including trailing blanks. For a dynamic array, the length of each individual field is counted, up to the specified position.

Examples of operand8:

Position 63 in #A (A100)	is the 63rd char in #A.
Position 63 in #B (A20/1:10)	is the 3rd char in #B(4).
Position 63 in #C (A10/1:3,1:4)	is the 3rd char in $\#C(2,3)$ .
Position 63 in #D (1:5) DYNAMIC with *LENGTH(#D(*)) = (15,25,0,33,61)	is the 23rd char in $\#D(4)$ .

If you specify an invalid range (a negative or zero value, or a value greater than the actual field length), the return fields listed in *Processing of Source and Target Operands* are reset, but no

runtime error occurs. Since the STARTING FROM value denotes a position (and not an offset), operand8 requires a minimum value of 1 for the first execution.

## Values Returned by REMAINDER POSITION

The value returned by the REMAINDER POSITION clause corresponds to the position from which a REMAINDER data field is filled.

### Example:

```
...
SEPARATE 'AB CD' INTO #A REMAINDER #R
...
```

The above statement returns #A= 'AB' and #R= 'CD' as the REMAINDER starts after the separator character (here: a blank), right after AB. With the REMAINDER POSITION option used instead, a value of 4 would be returned.

Although trailing blanks are ignored during the separation process, they are taken into account for the calculation of the REMAINDER POSITION value in occurrences of a source array.

If all source segments are processed and the end of the source field is reached, REMAINDER POSITION returns a value of zero indicating "no more data".

See also Example 6 - Using a Source Array with STARTING FROM and REMAINDER POSITION.

#### Overlapping Fields: REMAINDER and REMAINDER POSITION

When the SEPARATE statement is executed, the source data (operand1) is usually copied and processed from a work field. Therefore, the REMAINDER result is independent of possibly overlapping source and result fields.

Such field backup copies are not produced if a REMAINDER POSITION clause is used. The complete separation process operates on the original source operand, regardless of whether you separate the source and target operands. Overlapping operands are neither rejected during compilation nor execution but can cause undesired results.

#### **Delimiters in SEPARATE**

When you separate a single-value field, the field border always delimits the last word. The same applies to each occurrence of an array field.

If the RETAINED DELIMITERS option is used, delimiters are also placed into the target field. This only applies to delimiter characters within an array occurrence, and not to consecutive array occurrences that are automatically delimited (without delimiter character) when an occurrence ends.

See also Example 4 - Using a Source Array of a Redefined String and Example 5 - Using a Source Array with RETAINED Delimiters.

## **Examples**

- Example 1 Various Samples
- Example 2 Using an Array
- Example 3 Using REMAINDER/RETAINED Options
- Example 4 Using a Source Array of a Redefined String
- Example 5 Using a Source Array with RETAINED Delimiters
- Example 6 Using a Source Array with STARTING FROM and REMAINDER POSITION

## **Example 1 - Various Samples**

```
** Example 'SEPEX1': SEPARATE
*************************
DEFINE DATA LOCAL
1 #TEXT1 (A6) INIT <'AAABBB'>
1 #TEXT2 (A7) INIT <'AAA BBB'>
1 #TEXT3 (A7) INIT <'AAA-BBB'>
1 #TEXT4 (A7) INIT <'A.B/C,D'>
1 #FIELD1A (A6)
1 #FIELD1B (A6)
1 #FIELD2A (A3)
1 #FIELD2B (A3)
1 #FIELD3A (A3)
1 #FIELD3B (A3)
1 #FIELD4A (A3)
1 #FIELD4B (A3)
1 #FIELD4C (A3)
1 #FIELD4D (A3)
1 #NBT
         (N1)
1 #DEL
          (A5)
END-DEFINE
WRITE NOTITLE 'EXAMPLE A (SOURCE HAS NO BLANKS)'
SEPARATE #TEXT1 INTO #FIELD1A #FIELD1B GIVING NUMBER #NBT
```

```
WRITE / '=' #TEXT1 5X '=' #FIELD1A 4X '=' #FIELD1B 4X '=' #NBT

*
WRITE NOTITLE /// 'EXAMPLE B (SOURCE HAS EMBEDDED BLANK)'
SEPARATE #TEXT2 INTO #FIELD2A #FIELD2B GIVING NUMBER #NBT
WRITE / '=' #TEXT2 4X '=' #FIELD2A 7X '=' #FIELD2B 7X '=' #NBT

*
WRITE NOTITLE /// 'EXAMPLE C (USING DELIMITER ''-'')'
SEPARATE #TEXT3 INTO #FIELD3A #FIELD3B WITH DELIMITER '-'
WRITE / '=' #TEXT3 4X '=' #FIELD3A 7X '=' #FIELD3B

*
MOVE ',/' TO #DEL
WRITE NOTITLE /// 'EXAMPLE D USING DELIMITER' '=' #DEL

*
SEPARATE #TEXT4 INTO #FIELD4A #FIELD4B
#FIELD4C #FIELD4D WITH DELIMITER #DEL
WRITE / '=' #TEXT4 4X '=' #FIELD4A 7X '=' #FIELD4B

# 19X '=' #FIELD4C 7X '=' #FIELD4D

*
END
```

## **Output of Program SEPEX1:**

```
EXAMPLE A (SOURCE HAS NO BLANKS)

#TEXT1: AAABBB  #FIELD1A: AAABBB  #FIELD1B: #NBT: 1

EXAMPLE B (SOURCE HAS EMBEDDED BLANK)

#TEXT2: AAA BBB  #FIELD2A: AAA  #FIELD2B: BBB  #NBT: 2

EXAMPLE C (USING DELIMITER '-')

#TEXT3: AAA-BBB  #FIELD3A: AAA  #FIELD3B: BBB

EXAMPLE D USING DELIMITER #DEL: ,/

#TEXT4: A.B/C,D  #FIELD4A: A.B  #FIELD4B: C
  #FIELD4C: D  #FIELD4D:
```

## Example 2 - Using an Array

```
** Example 'SEPEX2': SEPARATE (using array variable)
************************
DEFINE DATA LOCAL
1 #INPUT-LINE (A60) INIT <'VALUE1, VALUE2, VALUE3'>
1 #FIELD (A20/1:5)
1 #NUMBER
           (N2)
END-DEFINE
SEPARATE #INPUT-LINE LEFT JUSTIFIED INTO #FIELD (1:5)
                  GIVING NUMBER IN #NUMBER
WRITE NOTITLE #INPUT-LINE //
            #FIELD (1) /
            #FIELD (2) /
            #FIELD (3) /
            #FIELD (4) /
            #FIELD (5) /
            #NUMBER
FND
```

## **Output of Program SEPEX2:**

```
VALUE1, VALUE2, VALUE3

VALUE1
VALUE2
VALUE3
```

## **Example 3 - Using REMAINDER/RETAINED Options**

```
SEPARATE #INPUT-LINE INTO #FIELD (1:2)
         REMAINDER #REM WITH DELIMITERS '.'
WRITE #FIELD(1) 13T #FIELD(2) 25T #FIELD(3) 37T #FIELD(4) 49T #REM
RESET #FIELD(*) #REM
SEPARATE #INPUT-LINE INTO #FIELD (1:2)
         IGNORE WITH DELIMITERS '.'
WRITE #FIELD(1) 13T #FIELD(2) 25T #FIELD(3) 37T #FIELD(4) 49T #REM
RESET #FIELD(*) #REM
SEPARATE #INPUT-LINE INTO #FIELD (1:4) IGNORE
        WITH RETAINED DELIMITERS ','
WRITE #FIELD(1) 13T #FIELD(2) 25T #FIELD(3) 37T #FIELD(4) 49T #REM
RESET #FIELD(*) #REM
SEPARATE SUBSTRING(#INPUT-LINE,1,50) INTO #FIELD (1:4)
         IGNORE WITH DELIMITERS ','
WRITE #FIELD(1) 13T #FIELD(2) 25T #FIELD(3) 37T #FIELD(4) 49T #REM
END
```

#### **Output of Program SEPEX3:**

```
INP: VAL1, VAL2, VAL3, VAL4
#FIELD (1) #FIELD (2) #FIELD (3) #FIELD (4) REMAINDER

VAL1 VAL2 VAL3, VAL4
VAL1 VAL2
VAL1 , VAL2
VAL1 , VAL2
VAL1 VAL2 , VAL3 VAL4
```

#### Example 4 - Using a Source Array of a Redefined String

```
SEPARATE #TEXT INTO #WORD1(*)

/* Redefinition may split original words into two parts

SEPARATE #TEXTARRAY(*) INTO #WORD2(*)

*

DISPLAY #TEXT #WORD1(*) #TEXTARRAY(*) #WORD2(*)

END
```

### **Output of Program SEPEX4:**

```
#TEXT #WORD1 #TEXTARRAY #WORD2

VAL1 VAL2 VAL3 VAL4 VAL5 VAL1 VAL1 VAL2 VA VAL1

VAL2 L3 VAL4 VAL5 VAL2

VAL3

VAL4

VAL5

VAL5

VAL5
```

## **Example 5 - Using a Source Array with RETAINED Delimiters**

```
** Example 'SEPEX5': SEPARATE with and without RETAINED DELIMITERS
              *******************
* This example shows different results with a source array
* when using the option RETAINED DELIMITERS or not.
**************************
DEFINE DATA LOCAL
1 #TEXT(A20)
           INIT <'VAL1,VAL2,VAL3,VAL4'>
1 #TEXTARRAY(A10/3) INIT <'VAL1, VAL2',
                       'VAL3',
                       'VAL4'>
1 #WORD1(A5/7)
1 #WORD2(A5/7)
END-DEFINE
SEPARATE #TEXT INTO #WORD1(*)
SEPARATE #TEXTARRAY(*) INTO #WORD2(*)
DISPLAY #TEXT #WORD1(*) #TEXTARRAY(*) #WORD2(*)
SEPARATE #TEXT
                   INTO #WORD1(*) WITH RETAINED DELIMITERS
SEPARATE #TEXTARRAY(*) INTO #WORD2(*) WITH RETAINED DELIMITERS
DISPLAY #TEXT #WORD1(*) #TEXTARRAY(*) #WORD2(*)
END
```

## **Output of Program SEPEX5:**

```
#TEXT
                    #WORD1 #TEXTARRAY #WORD2
VAL1, VAL2, VAL3, VAL4 VAL1
                          VAL1, VAL2 VAL1
                    VAL2 VAL3 VAL2
                    VAL3 VAL4
                                     VAL3
                    VAL4
                                     VAL4
VAL1, VAL2, VAL3, VAL4 VAL1
                          VAL1, VAL2 VAL1
                          VAL3
                    VAL2
                         VAL4
                                     VAL2
                                     VAL3
                    VAL3
                                     VAL4
                    VAL4
```

## Example 6 - Using a Source Array with STARTING FROM and REMAINDER POSITION

```
** Example 'SEPEX6': SEPARATE with STARTING FROM and REMAINDER POSITION
*************************
* This example shows how the options STARTING FROM POSITION and
* REMAINDER POSITION work together in a processing loop when
* separating a source array.
*******************
DEFINE DATA LOCAL
1 #TEXT (A15/1:3) INIT <'VAL1 VAL2',
                   'VAL3',
                   'VAL4 VAL5 VAL6'>
1 #WORD (A5/1:4)
1 #POS (I1) INIT <1>
END-DEFINE
WRITE '#TEXT(A15/1:3): (1)
                            (2)
                                                (3)'
 / 16T #TEXT(*)
 / 16T '----+---4----+'
 // '#WORD (A5/1:4): (1) (2) (3) (4) : #POS'
    '(within #TEXT(*))'
REPEAT
 SEPARATE #TEXT(*) STARTING FROM POSITION #POS
    INTO #WORD(*) REMAINDER POSITION #POS
 WRITE 16T #WORD(*) 44T ': ' #POS
 UNTIL \#POS = 0
```

END-REPEAT END

## **Output of Program SEPEX6**

```
#TEXT(A15/1:3): (1) (2) (3)

VAL1 VAL2 VAL3 VAL4 VAL5 VAL6

----+----1----+ ----2---+----3 ----+----4----+

#WORD (A5/1:4): (1) (2) (3) (4) : #POS (within #TEXT(*))

VAL1 VAL2 VAL3 VAL4 : 36

VAL5 VAL6 : 0
```

# 129 SET CONTROL

Function	1022
Syntax Description	1022
Examples	1022

```
SET CONTROL operand1 ...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## **Function**

The SET CONTROL statement is used to perform terminal commands from within a program.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure					Possible Formats							ıts	Referencing Permitted	Dynamic Definition
operand1	C	S				A								yes	no

Syntax Element Description:

Syntax Element	Description
operand1	Terminal Commands to be Performed:
	The terminal commands are specified as <code>operand1</code> without the control character % (by default). They can be specified as a text constant or as the content of an alphanumeric variable.
	For further information on terminal commands, see the <i>Terminal Commands</i> documentation.

## **Examples**

■ Example 1 - Switching to Lower Case

■ Example 2 - Activating Hardcopy Output Destination

## **Example 1 - Switching to Lower Case**

```
...
SET CONTROL 'L'
...
```

Switches to lower case (equivalent to the terminal command %L).

## **Example 2 - Activating Hardcopy Output Destination**

```
...
SET CONTROL 'HDEST'...
```

Activates hardcopy output to destination DEST (equivalent to the terminal command %Hdestination).

# 130 SET GLOBALS

Function	1026
Syntax Description	1026
Parameters	1027
Example	1028

```
SET GLOBALS { parameter=value} ...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## **Function**

The SET GLOBALS statement is used to set values for session parameters.

The parameters are evaluated either when the program that contains the SET GLOBALS statement is compiled, or when it is executed; this depends on the individual parameters.

The parameter settings specified with SET GLOBALS remain in effect until the end of the Natural session, unless they are overridden with a subsequent SET GLOBALS statement or GLOBALS system command. The statement SET GLOBALS and the system command GLOBALS offer the same parameters for modification. They can both be used in the same Natural session. Parameter values specified with a GLOBALS command remain in effect until they are overridden by a new GLOBALS command or SET GLOBALS statement, the session is terminated, or you log on to another library.

### **Exception**

A SET GLOBALS statement in a subordinate program (that is, a subroutine, subprogram, or program invoked with FETCH RETURN) only applies until control is returned from the subordinate program to the invoking object; then the parameter values set for the invoking object apply again.

# **Syntax Description**

Syntax Element	Description
parameter=value	Parameter Specification(s):
	In place of <i>parameter</i> , specify the name of the parameter to be set. For a list of possible parameters, see <i>Parameters</i> below.
	If you specify multiple parameters, you have to separate them from one another by one or more blanks. The parameters can be specified in any order; see also <i>Example</i> .
	In place of <i>value</i> , specify a valid parameter value. For information on valid parameter values, see the descriptions of the individual parameters listed below.

# **Parameters**

Parameters that can be	e specified with the SET GLOBALS statement	Evaluation (R = at runtime, C = at compilation)
CC	Conditional Program Execution	R
CF	Character for Terminal Commands	R
CPCVERR	Code Page Conversion Error	R
DC	Character for Decimal Point Notation	R
DFOUT	Date Format for Output	R
DFSTACK	Date Format for Stack	R
DFTITLE	Date Format in Default Page Title	R
DO DO	Display Order of Output Data	R
DU	Dump Generation	R
EJ	Page Eject	R
FCDP	Filler Character for Dynamically Protected Fields	R
FS	Format Specification	R
IA	INPUT Assign Character	R
ID	INPUT Delimiter Character	R
IM	INPUT Mode	R
LE	Limit Error Processing	С
LS	Line Size	RC
LT	Limit of Records Read	R
MT	Maximum CPU Time	R
NC	Use of Natural System Commands	R
OPF	Overwriting of Protected Fields by Helproutines	R
PD	NATPAGE Page Data Set	R
PM	Print Mode	С
PS	Page Size	RC
REINP	Internal REINPUT for Invalid Data	R
SA	Sound Terminal Alarm	R
SF	Spacing Factor	С
TS	Translate Output from Programs in System Libraries	R
WH	Wait for Record in Hold Status	R
ZD	Zero Division Check	R
ZP	Zero Printing	RC
		L

The individual session parameters are described in the *Parameter Reference*.

# **Example**

In the example below, the SET GLOBALS statement is used to set the maximum number of characters permitted per line to 74 and to limit the number of database records that can be read in processing loops within a Natural program to 5000.

```
SET GLOBALS LS=74 LT=5000 ...
```

# SET KEY

■ Function	
Syntax Description	1030
Making Keys Program-Sensitive and Deactivating Keys	
Assigning Commands/Programs	
Assigning Input DATA	1033
■ COMMAND OFF/ON	1034
Assigning HELP	1034
■ DYNAMIC Option	1035
■ DISABLED Option	1035
SET KEY Statements on Different Program Levels	1036
Assigning Names	1038
■ Example	

## **Function**

The SET KEY statement is used to assign functions to the following types of keys:

- video terminal PA (program attention) keys,
- PF (program function) keys,
- CLEAR key.

When a SET KEY statement is executed, Natural receives control of the keys during program execution and uses the values assigned to the keys.

The Natural system variable \*PF-KEY identifies which key was pressed last.



**Note:** If a user presses a key to which no function is assigned, either a warning message will be issued prompting the user to press a valid key, or the value ENTR will be placed into the Natural system variable \*PF-KEY; that is, Natural will react as if the ENTER key had been pressed (this depends on the Natural profile parameter IKEY as set by the Natural administrator). Processing of PA and PF keys is also affected by the Natural profile parameter KEY as set by the Natural administrator.

See also *Processing Based on Function Keys* (in the *Programming Guide*).

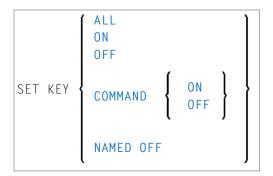
Application programming interface: USR4005N. See SYSEXT - Natural Application Programming Interfaces in the Utilities documentation.

# Syntax Description

Several structures are possible for this statement.

For an explanation of the symbols used in the syntax diagrams, see *Syntax Symbols*.

Syntax 1 - Affecting All Keys:



### Syntax 2 - Affecting Individual Keys:

```
 \left\{ \left\{ \begin{array}{c} \mathsf{PA} n \\ \mathsf{PF} n \\ \mathsf{CLR} \\ \mathsf{DYNAMIC} \ operand1 \end{array} \right\} \left[ \begin{array}{c} \mathsf{ON} \\ \mathsf{OFF} \\ \mathsf{DISABLED} \\ \mathsf{COMMAND} \end{array} \right\} \right\} \right\}
```

Syntax 3 - Affecting Individual Keys:

```
 \begin{cases} \left\{ \begin{array}{c} \mathsf{PA} n \\ \mathsf{PF} n \\ \mathsf{CLR} \\ \mathsf{DYNAMIC} \\ \mathit{operand1} \end{array} \right\} \left[ \begin{array}{c} \left\{ \begin{array}{c} \mathsf{PGM} \\ \mathsf{PROGRAM} \end{array} \right\} \\ \mathit{operand2} \\ \mathsf{HELP} \\ \mathsf{DATA} \ \mathit{operand3} \end{array} \right] \left[ \begin{array}{c} \mathsf{NAMED} \left\{ \begin{array}{c} \mathit{operand4} \\ \mathsf{OFF} \end{array} \right\} \right] \\ \mathsf{ENTR} \left[ \begin{array}{c} \mathsf{NAMED} \end{array} \right] \left[ \begin{array}{c} \mathsf{NAMED} \left\{ \begin{array}{c} \mathit{operand4} \\ \mathsf{OFF} \end{array} \right\} \right] \\ \ldots \end{cases}
```

Operand Definition Table:

Operand	Possible Structure				Possible Formats								Referencing Permitted	Dynamic Definition	
operand1		S			A									yes	no
operand2	С	S			A	U			П				П	yes	no
operand3	С	S			A	U								yes	no
operand4	С	S			A	U								yes	no

# Making Keys Program-Sensitive and Deactivating Keys

Making a key program-sensitive means that the key will be available for interrogation by the currently active program. If a key is made program-sensitive, pressing the key has the same effect as pressing ENTER. All data that have been entered on the screen are transferred to the program.

**Note:** PA keys and the CLEAR key, when made program-sensitive, do not cause any data to be transferred from the screen.

The program-sensitivity remains in effect only for the execution of the current program. See also the section *SET KEY Statements on Different Program Levels*.

### Examples:

SET	KEY	ALL	This statement causes all keys to be made program-sensitive. All function assignments to any keys are overwritten.
	KEY KEY	PF2 PF2=PGM	Each of these statements causes PF2 to be made program-sensitive.
SET	KEY	OFF	This statement de-activates all key settings. The Natural system variable *PF-KEY contains ENTR after SET KEY 0FF has been executed.
SET	KEY	ON	This statement re-activates the functions assigned to all keys that had an assignment and re-activates the program-sensitivity of keys that were made program-sensitive before they were de-activated.
SET	KEY	PF2=0FF	This statement de-activates PF2. After execution of SET KEY PF2=0FF, the Natural system variable *PF-KEY contains ENTR if it contained PF2 before.
SET	KEY	PF2=ON	This statement re-activates the function assigned to PF2 before it was de-activated or made program-sensitive. If no function had been assigned to PF2, it will be made program-sensitive again.

## Key Program-Sensitivity and Contents of \*PF-KEY

The following example shows the relation between the program-sensitivity of a key and the contents of the system variable \*PF-KEY.

Assume that PF2 has been made program-sensitive by means of SET KEY PF2=PGM and an INPUT statement is executed afterwards. The table below shows how user actions and executed Natural statements influence the contents of \*PF-KEY.

Seq	quence	Natural Statement Executed / User Action	Contents of *PF-KEY
	1	User presses PF2.	PF2
	2	SET KEY OFF	ENTR
	3	SET KEY ON	PF2
	4	SET KEY PF2=0FF	ENTR
	5	SET KEY PF2=0N	PF2
	6	SET KEY PF3=0FF	PF2

# **Assigning Commands/Programs**

You can assign a command or program name to a key, and you can delete such an assignment. When the key is pressed, the current program is terminated and the command/program assigned to the key is invoked via the Natural stack. When assigning a command/program, you can also pass parameters to the command/program (see third example below).

You can also assign a terminal command to a key. When the key is pressed, the terminal command assigned to the key is executed.

When operand2 is specified as a constant, it must be enclosed within apostrophes.

### Examples:

SET	KEY	PF4='SAVE'	The command SAVE is assigned to PF4.
SET	KEY	PF4=#XYX	The value contained in the variable $\#XYZ$ is assigned to PF4.
SET	KEY		The command LIST, including the LIST parameters MAP and *, is assigned to PF6.
SET	KEY	PF2='%%'	The terminal command %% is assigned to PF2.
SET	KEY	PF9=' '	The command and name previously assigned to PF9 are deleted.

The assignment remains in effect until it is overwritten by another SET KEY statement, until the user logs on to another application, or until the end of the Natural session. See also the section SET KEY Statements on Different Program Levels.



**Note:** Before a program invoked via a key is executed, Natural internally issues a BACKOUT TRANSACTION statement.

# **Assigning Input DATA**

You can assign a data string (*operand3*) to a key. When the key is pressed, the data string is placed into the input field in which the cursor is currently positioned, and the data are transferred to the executing program (as if ENTER had been pressed).

When *operand3* is specified as a constant, it must be enclosed within apostrophes.

#### Example:

#### SET KEY PF12=DATA 'YES'

For the validity of a DATA assignment, the same applies as for a command assignment, that is, it remains in effect until it is overwritten by another SET KEY statement, until the user logs on to another application, or until the end of the Natural session. See also the section *SET KEY Statements on Different Program Levels*.

### **COMMAND OFF/ON**

With COMMAND OFF, you can temporarily de-activate any function (command, program, or data) assigned to a key. If the key had been program-sensitive before the function was assigned, COMMAND OFF will make it program-sensitive again.

With a subsequent COMMAND ON, you can re-activate the assigned function again.

### **Examples:**

SET	KEY	PF4=COMMAND	0FF	The function that has been assigned to PF4 is temporarily de-activated; if PF4 had been program-sensitive before the function was assigned, it is now made program-sensitive again.
SET	KEY	PF4=COMMAND	ON	The function assigned to PF4 is re-activated again.
SET	KEY	COMMAND OFF		All functions assigned to all keys are temporarily de-activated; those keys which had been program-sensitive before functions were assigned to them, are now made program-sensitive again.
SET	KEY	COMMAND ON		All functions assigned to all keys are re-activated again.

With SET KEY PFnn='' you can delete the function assigned to a key and at the same time deactivate the program sensitivity of the key.

# **Assigning HELP**

You can assign HELP to a key. When the key is pressed, the helproutine assigned to the field in which the cursor is currently positioned will be invoked.

The effect is the same as when entering the help character in the field to invoke help. (The help character - default is a question mark (?) - is determined by the Natural profile parameter HI as set by the Natural administrator.)

#### Example:

```
SET KEY PF1=HELP
```

For the validity of a HELP assignment, the same applies as for program-sensitivity, that is, it remains in effect only for the execution of the current program. See also the section *SET KEY Statements on Different Program Levels*.

# **DYNAMIC Option**

Instead of specifying a specific key with the SET KEY statement, you can use the DYNAMIC option with a variable ( <code>operand1</code> ), and assign a value (PFn, PAn, CLR) to this variable in the program. This allows you to specify a function and make it dependent on the program logic which key this function is assigned to.



**Note:** SET KEY cannot be used if *operand1* is a dynamic variable.

### Example:

```
IF ...

MOVE 'PF4' TO #KEY

ELSE

MOVE 'PF7' TO #KEY

END-IF

...

SET KEY DYNAMIC #KEY = 'SAVE'

...
```

# **DISABLED Option**

Graphical user interface (GUI) elements, such as push buttons, menus, and bitmaps, are implemented as PF keys. With the <code>DISABLED</code> option, you can disable the use the of a GUI element assigned to a PF key. Push buttons and menu items will then be displayed grey.

To cancel the effect of SET\_KEY\_PF*nn*=DISABLED, you use SET\_KEY\_PF*nn*=ON.

Example:

SET KEY PF10=D	ISABLED <b>Disable</b>	es the use of the GUI element assigned to PF10.
----------------	------------------------	---

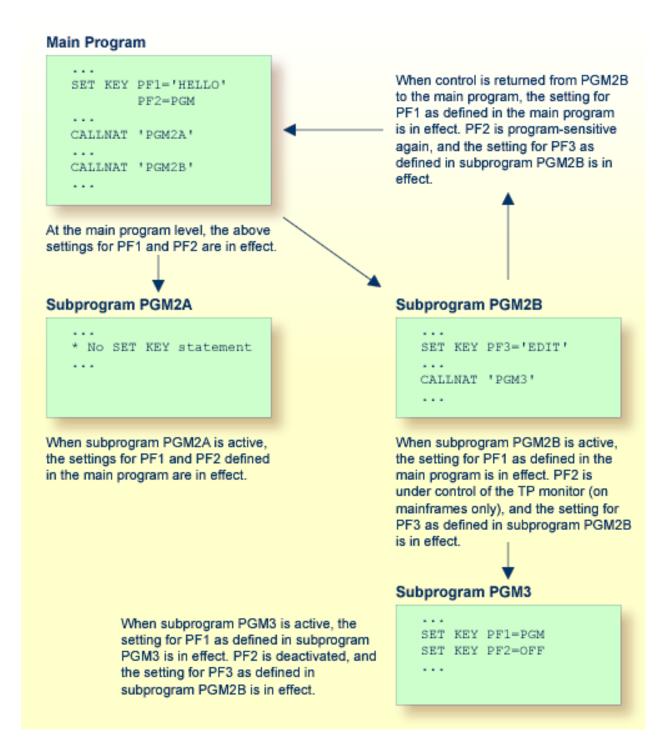
The DISABLED option can only be used within a processing rule.

# **SET KEY Statements on Different Program Levels**

When an application contains SET KEY statements at different levels, the following applies:

- When keys are made program-sensitive, the program-sensitivity also applies to all lower level (called) programs, unless these programs contain further SET KEY statements. When control is returned to a higher level program, the SET KEY assignments made at the higher level come into effect again.
- For keys which are defined as HELP keys, the same applies as for keys which are program-sensitive.
- When a function (program, command, terminal command, or data string) is assigned to a key, this assignment is valid at all higher and lower levels regardless of the level at what the assignment is made until another function is assigned to the key or it is made program-sensitive, or until the user logs on to another application or the Natural session is terminated.

### **Example of SET KEY Statements on Different Program Levels**



# **Assigning Names**

With the NAMED clause, you can assign a name ( <code>operand4</code> ) to a key. The name will then be displayed in the PF-key lines on the screen; this allows the users to identify the functions assigned to the keys:

```
? Help
. Exit

Code ..: ? Library ..: *____
Object ...: *____
DBID ....: 0__ FILENR ...: 0__

Command ===>
Enter-PF1--PF2--PF3--PF4--PF5--PF6--PF7--PF8--PF9--PF10--PF11--PF12--
Help Exit Last Flip Canc
```

The display of the PF-key lines is activated with the session parameter KD (see the *Parameter Reference*). You can control the way in which the PF-key lines are displayed by using the terminal command %Y (see the *Terminal Commands* documentation).

The maximum length of a name to be assigned to a key is 10 characters. In normal tabular PF-key line format (%YN), only the first 5 characters are displayed.

When *operand4* is specified as a constant, it must be enclosed within apostrophes (see examples below).

You cannot assign a name to a key without assigning a function to it or making it program-sensitive. To the ENTER key, however, you can only assign a name, but no function.

With NAMED OFF, you delete the name assigned to a program-sensitive key.

#### Examples:

SET KEY ENTR NAMED 'EXEC'	The name EXEC is assigned to the ENTER key.
SET KEY PF3 NAMED 'EXIT'	PF3 is made program-sensitive, and the name $EXIT$ is assigned to PF3.
SET KEY PF3 NAMED OFF	PF3 is made program-sensitive, and the name that has been assigned to PF3 is deleted.
SET KEY NAMED OFF	All names that have been assigned to any program-sensitive keys are deleted.
SET KEY PF4='AP1' NAMED 'APPL1'	The program AP1 and the name APPL1 are assigned to PF4.

When you use normal tabular PF-key line format (%YN), the following applies:

- If you omit the NAMED clause when assigning a command/program to a key, the command/program name will be displayed in the PF-key line; if the command/program name is longer than 5 characters, CMND will be displayed.
- If you omit the NAMED clause when assigning input data to a key, DATA will be displayed in the PF-key line.
- If you assign (with the NAMED clause) a name in Unicode format to a PF-key, the name might not be correctly positioned under the respective headers. This problem, however, may occur only when you are using the *Natural Web I/O Interface* and only for "wide" characters. In this case, the sequential PF-key line format (%YS or %YP) is recommended.

When you use sequential PF-key line format (%YS or %YP), only those keys to which names have been assigned will be displayed in the PF-key line; that is, if you omit the NAMED clause when assigning a command/program/data to a key, the key will not be displayed in the PF-key line.

See also Processing Based on Function Key Names in the Programming Guide.

# **Example**

```
** Example 'SKYEX1': SET KEY
**********************
DEFINE DATA LOCAL
1 #PF4 (A56)
END-DEFINE
MOVE 'LIST VIEW' TO #PF4
SET KEY PF1 PF2
SET KEY PF3 = 'MENU'
       PF4 = #PF4
       PF5 = 'LIST VIEW EMPLOYEES' NAMED 'Empl'
FORMAT KD=ON
INPUT ////
     10X 'The following function keys are assigned:' //
     10X 'PF1: Function for PF1 '/
     10X 'PF2: Function for PF2 ' /
     10X 'PF3: Return to MENU program' /
     10X 'PF4: LIST VIEW
     10X 'PF5: LIST VIEW EMPLOYEES ' ///
IF *PF-KFY = 'PF1'
 WRITE 'Function for PF1 executed.'
END-IF
IF *PF-KEY = 'PF2'
```

```
WRITE 'Function for PF2 executed.'
END-IF
*
END
```

## **Output of Program SKYEX1:**

```
The following function keys are assigned:

PF1: Function for PF1
PF2: Function for PF2
PF3: Return to MENU program
PF4: LIST VIEW
PF5: LIST VIEW EMPLOYEES
```

# 132 SET TIME

Function	1042
Example	1042

```
{ SET TIME }
SETTIME }
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## **Function**

The SET TIME (or SETTIME) statement is used in conjunction with the Natural system variable \*TIMD to measure the time it takes to execute a specific section of a program.

The SET TIME statement is placed at a specific position in the program, and \*TIMD will contain the amount of time elapsed since the execution of the SET TIME statement.

\*TIMD must always contain a reference to the SET TIME statement, either by using the source-code line number of the SET TIME statement or by assigning a label to the SET TIME statement, which can then be used as a reference.

# **Example**

# **Output of Program STIEX1:**

START TIME: 16:39:07.6 END TIME: 16:39:07.7

ELAPSED TIME TO READ 100 RECORDS (HH:MM:SS.T): 00:00:00.1

# 133 SET WINDOW

Function	1046
Syntax Description	
Example	1046

```
SET WINDOW { 'window-name' } OFF
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DEFINE WINDOW | INPUT WINDOW='window-name' | REINPUT

Belongs to Function Group: Screen Generation for Interactive Processing

## **Function**

The SET WINDOW statement is used to activate and de-activate a window.

Any SET WINDOW 'window-name' or INPUT WINDOW='window-name' statement de-activates the window which has currently been active and activates the window specified in the statement. This means that only one window can be active at a time.



**Note:** If you use SET WINDOW to activate a window which is defined with SIZE AUTO, the data on the screen *before* the window is activated determine the size of the window.

# **Syntax Description**

Syntax Element	Description						
	Activates the specified window, which means that all subsequent statements refer to that window until either the window is de-activated or another window is activated. The specified window must have been defined with a DEFINE WINDOW statement.						
SET WINDOW OFF	De-activates the currently active window.						

# **Example**

See DEFINE WINDOW statement.

# 134 SKIP

Function	1048
Syntax Description	1048
Example	1049

SKIP [(rep)] operand1 [LINES]

For an explanation of the symbols used in the syntax diagram, see Syntax Symbols.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The SKIP statement is used to generate one or more blank lines in an output report.

See also Page Titles, Page Breaks, Blank Lines in the Programming Guide.

### **Processing**

If the execution of a SKIP statement would cause the page size to be exceeded, exceeding lines will be ignored (except in an AT\_TOP\_OF\_PAGE statement).

A SKIP statement is only executed if something has already been output on the page (output from an AT\_TOP\_OF\_PAGE statement is not taken into account here).

# **Syntax Description**

Operand Definition Table:

Operand	Possible Structure					Po	ossib	le l	or	ma	ts	Referencing Permitted	Dynamic Definition
operand1	С	S				N	PI					yes	no

Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	The notation ( $rep$ ) may be used to specify the identification of the report for which the SKIP statement is applicable.
	A value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.

Syntax Element	Description
	If (rep) is not specified, the SKIP statement will apply to the first report (Report 0).
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .
operand1	Number of Lines to be Skipped:
	operand1 represents the number (1 - 250) of blank lines to be generated. This number may be specified as a numeric constant or as the content of a numerical variable.
	If operand1 exceeds the page size of the report, the SKIP statement will result in a newpage condition.

# **Example**

```
** Example 'SKPEX1': SKIP
************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 CITY
 2 COUNTRY
 2 NAME
END-DEFINE
LIMIT 7
READ EMPL-VIEW BY CITY STARTING FROM 'W'
 AT BREAK OF CITY
   SKIP 2
 END-BREAK
 DISPLAY NOTITLE CITY (IS=ON) COUNTRY (IS=ON) NAME
 /*
END-READ
END
```

## **Output of Program SKPEX1:**

CITY	COUNTRY	NAME
WASHINGTON	USA	REINSTEDT PERRY
WEITERSTADT	D	BUNGERT UNGER DECKER

WEST BRIDGFORD	UK	ENTWHISTLE
WEST MIFFLIN	USA	WATSON

# 135 SORT

■ Function	1050
■ Restrictions	
Syntax Description	1053
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■ Example	1057
■ Using External Sort Programs	1061

### Structured Mode Syntax

### **Reporting Mode Syntax**

```
SORT [ THEM RECORDS ] [BY] { operand1 [ ASCENDING DESCENDING ] } ... 10

[USING-clause] [GIVE-clause] statement ...

LOOP
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statement: FIND with SORTED BY option

Belongs to Function Group: Loop Execution

### **Function**

The SORT statement is used to perform a sort operation, sorting the records from all processing loops that are active when the SORT statement is executed.

For the sort operation, Natural's internal sort program is used. It is also possible to use another, external sort program.

<sup>\*</sup> If a statement label is specified, it must be placed *before* the keyword SORT, but *after* END-ALL (and AND).

# **Restrictions**

- The SORT statement must be contained in the same object as the processing loops whose records it sorts.
- Nested SORT statements are not allowed.
- The total length of a record to be sorted must not exceed 10240 bytes.
- The number of sort criteria must not exceed 10.

# **Syntax Description**

## Operand Definition Table:

Operand	Possible Structure				Possible Formats									Referencing Permitted	Dynamic Definition
operand1	S				Αl	N	PI	F	В	D	T			no	no

## Syntax Element Description:

Syntax Element	Description
END-ALL	Closing All Currently Active Loops:
	In structured mode, the SORT statement must be preceded by END-ALL, which serves to close all active processing loops. The SORT statement itself initiates a new processing loop, which must be closed with END-SORT.
	<b>Note:</b> For reporting mode: The SORT statement closes all active processing loops and initiates
	a new processing loop.
operand1	Sort Criteria:
	operand1 represents the fields/variables to be used as the sort criteria. 1 to 10 database fields (descriptors and non-descriptors) and/or user-defined variables may be specified. A multiple-value field or a field contained within a periodic group may be used. A group or an array is not permitted.
	<b>Note:</b> A field specified in the SORT criteria is used for both, to put a value into the SORT
	record in the selecting phase (1st phase), and to receive the sorted value in the processing phase (3rd phase). Be aware, this may cause addressing errors, when indexed array fields are used which carry a correct index value in the selecting (1st) phase, but with an out-of-range value in the processing (3rd) phase. Therefore, indexed array fields should be used with caution, and better be replaced with non-indexed fields (scalar).
ASCENDING	Sort Sequence:

Syntax Element	Description							
DESCENDING	The default sort sequence is ascending. If you wish the values to be sorted in descending sequence, specify <code>DESCENDING</code> .							
	ASCENDING/DESCENDING may be specified for each sort field.							
USING	USING Clause:							
	See <i>USING Clause</i> below.							
	<b>Note:</b> The note given under the description of <i>operand1</i> also applies to the USING clause.							
GIVE	GIVE Clause:							
	See GIVE Clause below.							
END-SORT	End of SORT Statement:							
LOOP	In structured mode, the Natural reserved word END-SORT must be used to end the SORT statement.							
	In reporting mode, the Natural statement LOOP is used to end the SORT statement.							

### **USING Clause**

The USING clause indicates the fields which are to be written to intermediate sort storage. It is required in structured mode and optional in reporting mode. However, it is strongly recommended to also use it in reporting mode so as to reduce memory requirements.

```
{ USING operand2... } USING KEYS
```

### Operand Definition Table:

Operand	Possible St		P	oss	ible	Forr	nats		Referencing Permitted	Dynamic Definition	
operand2	S A		A	N F	'I	F B	D	ΓL	C	no	no

### Syntax Element Description:

Syntax Element	Description
USING operand2	Additional Fields:
	You can specify additional fields that are to be written to the intermediate sort storage - in addition to the sort key fields (as specified with <code>operand1</code> ).
USING <u>KEY</u> S	Sort Key Fields Only:
	Only the sort key fields, as specified with <i>operand1</i> , will be written to intermediate sort storage.

*In Reporting Mode:* If you omit the USING clause, all database fields of processing loops initiated before the SORT statement, as well as all user-defined variables defined before the SORT statement, will be written to intermediate sort storage.

If, after sort execution, a reference is made to a field which was not written to the sort intermediate storage, the value for the field will be the last value of the field before the sort.

#### **GIVE Clause**

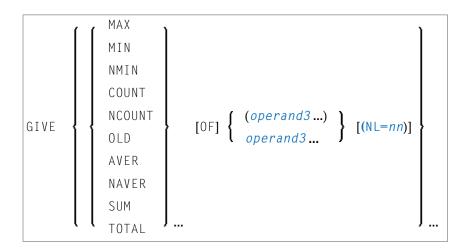
The GIVE clause is used to specify Natural system functions (such as MAX, MIN) that are to be evaluated in the first phase of the SORT statement. These system functions may be referenced in the third phase (see *SORT Statement Processing*).

A reference to a system function after the SORT statement must be preceded by an asterisk, for example, \*AVER(SALARY).



#### Notes:

- 1. In place of the keyword GIVE, the keyword GIVING may be used.
- 2. The GIVE clause is only allowed if at least one of the (inner) loops closed by the SORT statement derives from a FIND, READ, HISTOGRAM or READ WORK FILE statement.



Operand Definition Table:

Operand	Possible Structure			Possible Formats							ts	Referencing Permitted	Dynamic Definition		
operand3		S	A			*								yes	no

<sup>\*</sup> depends on function

Syntax Element Description:

Syntax Element	Description
MAX   MIN   NMIN   COUNT   NCOUNT   OLD   AVER   NAVER	System Functions:
SUM I TOTAL	For details on the individual system functions, see the <i>System Functions</i> documentation.
operand3	Field Name:
	operand3 is the field name.
(NL=nn.m)	Preventing Arithmetic Overflows:
	This option applies to the system functions AVER, NAVER, SUM and TOTAL only. It will be ignored for any other system function. See also session parameter NL in the <i>Parameter Reference</i> documentation.
	This option may be used to prevent an arithmetic overflow during the evaluation of system functions; it is described under <i>Format/Length Requirements for AVER, NAVER, SUM and TOTAL</i> in the <i>System Functions</i> documentation.

# **Three-Phase SORT Processing**

A program containing a SORT statement is executed in three phases.

### 1st Phase - Selecting the Records to be Sorted

The statements before the SORT statement are executed. Data as described in the USING clause will be written to intermediate sort storage.

In reporting mode, any variables to be used as accumulators following the sort must not be defined before the SORT statement. In structured mode, they must not be included in the USING clause. Fields written to intermediate sort storage cannot be used as accumulators because they are read back with each individual record during the 3rd processing phase. Consequently, the accumulation function would not produce the desired result because with each record the field would be overwritten with the value for that individual record.

The number of records written to intermediate storage is determined by the number of processing loops and the number of records processed per loop. One record on the internal intermediate storage is created each time the SORT statement is encountered in a processing loop. In the case of nested loops, a record is only written to intermediate storage if the inner loop is executed. If in the example below a record is to be written to intermediate storage even if no records are found for the inner (FIND) loop, the FIND statement must contain an IF NO RECORDS FOUND clause.

```
READ ...

FIND ...

END-ALL

SORT ...

DISPLAY ...

END-SORT
...
```

### 2nd Phase - Sorting the Records

The records are sorted.

### 3rd Phase - Processing the Sorted Records

The statements after the SORT statement are executed for all records on the intermediate storage in the specified sorting sequence. Database fields to be referenced after a SORT statement must be correctly referenced using the appropriate statement label or reference number.

# **Example**

- Example 1 SORT
- Example 2 SORT
- Example 3 SORT

### Example 1 - SORT

```
** Example 'SRTEX1S': SORT (structured mode)
************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 CITY
 2 SALARY (1:2)
 2 PERSONNEL-ID
 2 CURR-CODE (1:2)
1 #AVG
              (P11)
1 #TOTAL-TOTAL (P11)
1 #TOTAL-SALARY (P11)
1 #AVER-PERCENT (N3.2)
END-DEFINE
LIMIT 3
FIND EMPL-VIEW WITH CITY = 'BOSTON'
 COMPUTE \#TOTAL-SALARY = SALARY (1) + SALARY (2)
 ACCEPT IF #TOTAL-SALARY GT 0
```

```
/*
END-ALL
AND
SORT BY PERSONNEL-ID USING #TOTAL-SALARY SALARY(*) CURR-CODE(1)
     GIVE AVER(#TOTAL-SALARY)
  /*
  AT START OF DATA
    WRITE NOTITLE '*' (40)
         'AVG CUMULATIVE SALARY: ' *AVER (#TOTAL-SALARY) /
   MOVE *AVER (#TOTAL-SALARY) TO #AVG
  END-START
  COMPUTE ROUNDED #AVER-PERCENT = #TOTAL-SALARY / #AVG * 100
  ADD #TOTAL-SALARY TO #TOTAL-TOTAL
  /*
  DISPLAY NOTITLE PERSONNEL-ID SALARY (1) SALARY (2)
          #TOTAL-SALARY CURR-CODE (1)
          'PERCENT/OF/AVER' #AVER-PERCENT
  AT END OF DATA
    WRITE / '*' (40) 'TOTAL SALARIES PAID: ' #TOTAL-TOTAL
  END-ENDDATA
END-SORT
END
```

### **Output of Program SRTEX1S:**

PERSONNEL ID	ANNUAL SALARY	ANNUAL SALARY	#TOTAL-SALARY	CURRENCY CODE	PERCENT OF AVER	
*****	*****	******	****** AV(	G CUMULAT	IVE SALARY:	41900
20007000	16000	1520	31200	) USD	74.00	
20019200	18000	1710	00 35100	) USD	83.00	
20020000	30500	2890	59400	) USD	141.00	
******	*****	*****	****** TO	TAL SALAR	IES PAID:	125700

The previous example is executed as follows:

### **First Phase:**

- Records with CITY=BOSTON are selected from the EMPLOYEES file.
- The first 2 occurrences of SALARY are accumulated in the field #TOTAL-SALARY.
- Only records with #TOTAL-SALARY greater than 0 are accepted.
- The records are written to the sort intermediate storage. The database arrays SALARY (first 2 occurrences) and CURR-CODE (first occurrence), the database field PERSONNEL-ID, and the user-defined variable #TOTAL-SALARY are written to the intermediate storage.

■ The average of #TOTAL-SALARY is evaluated.

#### **Second Phase:**

■ The records are sorted.

#### Third Phase:

- The sorted intermediate storage is read.
- At the at-start-of-data condition, the average of #TOTAL-SALARY is displayed.
- #TOTAL-SALARY is added to #TOTAL-TOTAL and the fields PERSONNEL-ID, SALARY(1), SALARY(2), #AVER-PERCENT and #TOTAL-SALARY are displayed.
- At the end-of-data condition, the variable #TOTAL-TOTAL is written.

Equivalent reporting-mode example: SRTEX1R.

### Example 2 - SORT

```
** Example 'SRTEX2': SORT
************************
DEFINE DATA LOCAL
1 VEHIC-VIEW VIEW OF VEHICLES
 2 MAKE
 2 YEAR
END-DEFINE
LIMIT 10
READ VEHIC-VIEW
END-ALL
SORT BY MAKE YEAR USING KEY
 DISPLAY NOTITLE (AL=15) MAKE (IS=ON) YEAR
 AT BREAK OF MAKE
   WRITE '-' (20)
 END-BREAK
END-SORT
END
```

### **Output of Program SRTEX2S:**

```
MAKE YEAR
-----
FIAT 1980
1982
1984
-----
PEUGEOT 1980
```

### Example 3 - SORT

```
** Example 'SRTEX3': SORT values in an array
***********************
DEFINE DATA LOCAL
1 #I (I4)
1 #J
    (I4)
1 #X (I1)
1 \#TAB (I1/1:6) INIT <2,4,6,5,3,1>
END-DEFINE
WRITE
      'Array before SORT:' #TAB(*) /
FOR #I := 1 TO 6
 \#X := \#TAB(\#I)
 WRITE #X '<-- Put into SORT record'
END-ALL
SORT #X USING KEYS
 WRITE #X '<-- Get from SORT'
 ADD 1 TO #J
 #TAB(#J) := #X
END-SORT
WRITE / 'Array after SORT:' #TAB(*)
END
```

### **Output of Program SRTEX3:**

```
Array before SORT: 2 4 6 5 3 1

2 <-- Put into SORT record
4 <-- Put into SORT record
6 <-- Put into SORT record
5 <-- Put into SORT record
1 <-- Put into SORT record
1 <-- Get from SORT
2 <-- Get from SORT
4 <-- Get from SORT
5 <-- Get from SORT
6 <-- Get from SORT
```

Array after SORT: 1 2 3 4 5 6

## **Using External Sort Programs**

In Natural, sort operations are by default processed by Natural's internal sort program, as described above. However, an external sort program can be used. This external sort program then processes the sort operations instead of Natural's internal sort program.

See also External Sort Programs in the Operations documentation.

# 136 STACK

Function	1064
Syntax Description	1064
Example	1067

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: INPUT | RELEASE

## **Function**

The STACK statement is used to place any of the following into the Natural stack:

- the name of a Natural program or Natural system command to be executed;
- data to be used during the execution of an INPUT statement.

For further information on the stack, see *Further Programming Aspects, Stack Processing* in the *Programming Guide*.

## **Syntax Description**

Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure		Possible Formats								S	Referencing Permitted	Dynamic Definition	
operand1	С	S	A	G	N	A											yes	yes
operand2	С	S	A	G	N	A	U	N	Р	Ι	F	В	D	T	L	G	yes	yes

Syntax Element Description:

Syntax Element	Description
ТОР	TOP Option:
	If you specify TOP, the data/program/command will be placed at the top of the Natural stack. Otherwise, they are placed at the bottom of the stack.
	Example: The following statement causes the content of the variable #FIELDA to be placed as data on top of the stack:

Syntax Element	Description
	STACK TOP #FIELDA
DATA	DATA Option:
	This option, which is also the default, causes data to be placed in the stack which are to be used as input data for an INPUT statement.
	Delimiter characters or input assign characters contained within the data values will be processed as delimiters. For details on how data from the stack are processed by an INPUT statement, refer to <i>Processing Data from the Natural Stack</i> (in the description of the INPUT statement).
	Example: The following statements cause the contents of the variables #FIELD1 and #FIELD2 to be placed in the stack:
	MOVE 'ABC' TO #FIELD1 MOVE 'XYZ' TO #FIELD2 STACK #FIELD1 #FIELD2
	These variables will be passed as data to the next INPUT statement in the Natural program, using delimiter mode:
	INPUT #FIELD1 #FIELD2
	<b>Note:</b> If <i>operand2</i> is a time variable (Format T), only the time component of the variable
FORMATTED	content is placed in the stack, but not the date component.
TORMATTED	This option causes all data to be passed on a field-by-field basis to the next INPUT statement; no key assignments or delimiter characters will be interpreted.
	Examples:
	The following statements cause ABC, DEF to be placed in #FIELD1 and XYZ in #FIELD2:
	MOVE 'ABC, DEF' TO #FIELD1 MOVE 'XYZ' TO #FIELD2 STACK TOP DATA FORMATTED #FIELD1 #FIELD2
	INPUT #FIELD1 #FIELD2
	Assuming the input delimiter character to be the comma (profile/session parameter ID=,), the following statements - without the keyword FORMATTED - cause ABC to be placed in #FIELD1 and DEF in #FIELD2:

Syntax Element	Description						
	MOVE 'ABC, DEF' TO #FIELD1 STACK TOP DATA #FIELD1						
	INPUT #FIELD1 #FIELD2						
	<b>Note:</b> The FORMATTED option should be used if the data to be passed contains delimiter, control or DBCS characters to avoid unintentional interpretation of these characters.						
COMMAND	COMMAND Option:						
operand1	To place a command (or program name) in the stack, you specify the keyword COMMAND followed by the command specified in <code>operand1</code> . Natural will execute the command instead of displaying the <code>NEXT</code> prompt and prompting the user for input.						
	Example:						
	The following statement causes the command RUN to be placed at the top of the stack. Natural will execute this command at the point where the NEXT prompt would normally be issued.						
	STACK TOP COMMAND 'RUN'						
COMMAND	COMMAND with Data Option:						
operand1 operand2	Together with a command (operand1), you may also place data (operand2) in the stack. These data will then be processed by the next INPUT statement after the command has been executed.						
	Data stacked with a command are always stacked unformatted.						
	<b>Note:</b> If the data to be stacked include empty alphanumeric fields (that is, blanks), these						
	blanks will be interpreted as delimiters between values and thus not processed correctly by the corresponding INPUT statement. Therefore, if you wish to stack empty alphanumeric fields as data with a command, you have to use two STACK statements: one STACK DATA operand2 to stack the data, and one STACK COMMAND operand1 to stack the command.						
parameter	Date Format:						
	If <i>operand2</i> is a date variable, you can specify the session parameter DF as a parameter for this variable.						

## **Example**

```
** Example 'STKEX1': STACK
DEFINE DATA LOCAL
1 #CODE (A1)
END-DEFINE
INPUT //
 10X 'PLEASE SELECT COMMAND' //
 10X 'LIST VIEW
                  (V)'/
 10X 'LIST PROGRAM * (P)' /
 10X 'TECH INFO
                 (T)'/
 10X 'STOP
                     (.)'//
 20X 'CODE: ' #CODE
DECIDE ON FIRST #CODE
 VALUE 'V'
   STACK TOP DATA
                    'VIEW'
   STACK TOP COMMAND 'LIST'
 VALUE 'P'
   STACK TOP COMMAND 'LIST PROGRAM *'
 VALUE 'T'
   STACK TOP COMMAND 'LAST *'
   STACK TOP COMMAND 'TECH'
   STACK TOP COMMAND 'SYSPROD'
 VALUE '.'
   STOP
 NONE
   REINPUT 'PLEASE ENTER VALID CODE'
END-DECIDE
END
```

### **Output of Program STKEX1:**

```
PLEASE SELECT COMMAND

LIST VIEW (V)

LIST PROGRAM * (P)

TECH INFO (T)

STOP (.)

CODE:P
```

## After entering and confirming code:

16:4				MAND ****	2005-01-19				
User	HTR	- L	IST 0	bje	cts in a	Library -	Libra	ry SYSEXSYN	
Cmd	Name	Туре	S/C		Version	User ID	Date	Time	
	*	P	*	*	*	*	*	*	
	ACREX1	Program	S/C	S	4.1.03	RKE	2004-11-11	16:32:37	
	ACREX2	Program	S/C	S	4.1.03	RKE	2005-01-05	10:29:51	
	ADDEX1	Program	S/C	S	4.1.03	RKE	2004 - 11 - 11	16:36:49	
	AEDEX1R	Program	S/C	R	4.1.03	RKE	2004-11-11	16:40:34	
	AEDEX1S	Program	S/C	S	4.1.03	RKE	2004-11-11	16:39:57	
	AEPEX1R	Program	S/C	R	4.1.03	RKE	2004-11-11	16:41:57	
	AEPEX1S	Program	S/C	S	4.1.03	RKE	2004-11-11	16:42:31	
	AEPEX2	Program	S/C	S	4.1.03	RKE	2004-11-11	16:43:37	
	ASDEX1R	Program	S/C	R	4.1.03	RKE	2004-11-11	17:00:21	
	ASDEX1S	Program	S/C	S	4.1.03	RKE	2004-11-11	17:00:50	
	ASGEX1R	Program	S/C	R	4.1.03	RKE	2004-11-11	17:02:01	
	ASGEX1S	Program	S/C	S	4.1.03	RKE	2004-11-11	17:02:08	
	ATBEX1R	Program	S/C	R	4.1.03	RKE	2004-11-11	17:03:18	
	ATBEX1S	Program	S/C	S	4.1.03	RKE	2004-11-11	17:03:05	
							14 Obj	ects found	
	of List.								
	and ===>								
Ente		PF3PF4-	PF5		PF6PF7				
	Help Pri	nt Exit Sort				+ ++	>	Canc	

# 137 stop

Function	1070
Example	1070

ST0P

## **Function**

The STOP statement is used to terminate the execution of a program and return to the command input prompt.

One or more STOP statements may be inserted anywhere within a Natural program.

The STOP statement will terminate the execution of the program immediately. Independent of the positioning of a STOP statement in a subroutine, any end-page condition specified in the main program will be invoked for final end-page processing during execution of the STOP statement.

For Natural RPC: See Notes on Natural Statements on the Server in the Natural RPC (Remote Procedure Call) documentation.

## **Example**

```
** Example 'STPEX1': STOP
DEFINE DATA LOCAL
1 #CODE (A1)
END-DEFINE
INPUT //
  10X 'PLEASE SELECT COMMAND' //
  10X 'LIST VIEW (V)' /
  10X 'LIST PROGRAM * (P)' /
 10X 'TECH INFO (T)' /
  10X 'STOP
                      (.)' //
  20X 'CODE: ' #CODE
DECIDE ON FIRST #CODE
  VALUE 'V'
    STACK TOP DATA
                     'VIEW'
   STACK TOP COMMAND 'LIST'
  VALUE 'P'
    STACK TOP COMMAND 'LIST PROGRAM *'
  VALUE 'T'
    STACK TOP COMMAND 'LAST *'
    STACK TOP COMMAND 'TECH'
    STACK TOP COMMAND 'SYSPROD'
  VALUE '.'
    ST<sub>O</sub>P
```

```
NONE
REINPUT 'PLEASE ENTER VALID CODE'
END-DECIDE

*
END
```

## **Output of Program STPEX1:**

```
PLEASE SELECT COMMAND

LIST VIEW (V)

LIST PROGRAM * (P)

TECH INFO (T)

STOP (.)
```

## XV

■ 138 STORE	
■ 139 SUBTRACT	
■ 140 SUSPEND IDENTICAL SUPPRESS	
• 141 TERMINATE	
■ 142 UPDATE	
■ 143 UPDATE (SQL)	
■ 144 UPDATELOB	1111
■ 145 UPLOAD PC FILE	
■ 146 WRITE	
■ 147 WRITE TITLE	
■ 148 WRITE TRAILER	
■ 149 WRITE WORK FILE	1155

# 138 STORE

Function	1076
Database-Specific Considerations	
Syntax Description	
Example	

### **Structured Mode Syntax**

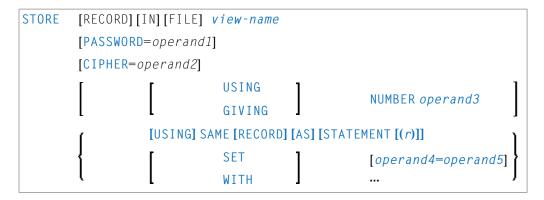
```
STORE [RECORD][IN][FILE] view-name

[PASSWORD=operand1]

[CIPHER=operand2]

[USING GIVING NUMBER operand3]
```

### **Reporting Mode Syntax**



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | READLOB | RETRY | UPDATE | | UPDATELOB

Belongs to Function Group: Database Access and Update

## **Function**

The STORE statement is used to add a record to a database.

## **Database-Specific Considerations**

Adabas	The Natural system variable *ISN contains the Adabas ISN assigned to the new record as a result of the STORE statement execution. A subsequent reference to *ISN must include the statement number of the related STORE statement.
DL/I	This statement may be used to add a segment occurrence.
	If the data set is defined with a primary key, a value for the primary key field must be provided. In the case of a GSAM database, records must be added at the end of the database (due to GSAM restrictions).
	The Natural system variable *ISN is not available.
SQL	This statement may be used to add a row to a table. The PASSWORD, CIPHER, and GIVING NUMBER clauses cannot be used. The STORE statement corresponds with the SQL statement INSERT.
	The Natural system variable *ISN is not available.
VSAM	If the data set is defined with a primary key, a value for the primary key field must be provided.
	The Natural system variable *ISN contains the VSAM RBA/RRN assigned to the new record as a result of the STORE statement execution. A subsequent reference to *ISN must include the statement number of the related STORE statement.
	For VSAM databases, the Natural system variable *ISN is available only for ESDS and RRDS files.

## **Syntax Description**

## Operand Definition Table:

Operand	Possible Structure							Po	SS	sibl	le Fo	Referencing Permitted	•				
operand1	C	S				A										yes	no
operand2	C	S					N									yes	no
operand3	С	S					N	P			В*					no	yes
operand4		S	A			A	N	P	I	F	В	D	T	L		no	no
operand5	С	S	A			A	N	P	Ι	F	В	D	T	L		yes	no

<sup>\*</sup> Format B of operand3 may be used only with a length of less than or equal to 4.

Syntax Element Description:

Syntax Element	Description
view-name	View Name:
	As <i>view-name</i> , you specify the name of a view, which must have been defined either in a DEFINE DATA statement or outside the program in a global or local data area.
	In reporting mode, <i>view-name</i> is the name of a DDM if no DEFINE DATA LOCAL statement is used.
PASSWORD= <i>operand1</i>	PASSWORD Clause:
	The PASSWORD clause is applicable only for an Adabas or VSAM database.
	This clause is used to provide a password ( <code>operand1</code> ) when updating data from a file which is password-protected. The password ( <code>operand1</code> ) may be specified as an alphanumeric constant or as an alphanumeric variable. It may consist of up to 8 characters, and must not contain special characters or embedded blanks. If the password is specified as a constant, it must be enclosed in apostrophes.
	For further information, see the statements FIND and PASSW.
CIPHER=operand2	CIPHER Clause:
	The CIPHER clause is applicable only for an Adabas or VSAM database.
	This clause is used to provide a cipher key (operand2) when updating data from a file which is enciphered. The cipher key (operand2) may be specified as an numeric constant with 8 digits or as a user-defined variable with format/length N8.
	For further information, see the statement FIND.
USING NUMBER	USING NUMBER Clause:
operand3	This clause can only be used for an Adabas or VSAM database. For VSAM databases, this clause is only valid for VSAM RRDS, in which case a user-supplied RRN (relative record number) corresponds to the ISN as described above.
GIVING NUMBER	GIVING NUMBER Clause:
operand3	This clause is used to store a record with a user-supplied Adabas ISN (range from 1 to 4294967295). If a record with the specified ISN already exists, an error message will be returned, and the execution of the program will be terminated unless 0N ERROR processing was specified.
SET/WITH	SET/WITH Clause:
operand4=operand5	SET/WITH can be used in reporting mode to specify the fields for which values are being provided. Any field defined in the file that is not specified in the SET clause will contain a null value in the new record.
	This clause is not permitted if a DEFINE DATA statement is used, because in that case the STORE statement always refers to the entire view as defined in the DEFINE DATA statement.

Syntax Element	Description
	DL/I-Specific Considerations:
	A segment of variable length is stored with the minimum length necessary to contain all fields as specified with the STORE statement. The segment length will never be less than the minimum size specified in the SEGM macro of the DBD. Values must be provided for the segment sequence field, and for all sequence fields of the ancestors. Only I/O (sensitive) fields may be provided. If a multiple-value field or a periodic group is defined as variable in length, at the end of the segment only the occurrences as specified in the STORE statement are written to the segment and define the segment length.
USING SAME (r)	USING SAME Clause:
	In reporting mode, this clause can be used to indicate that the same field values as read in the statement referenced by the STORE statement (FIND, GET, READ) are to be used to add a new record.
	The statement reference notation $(r)$ may be specified as a source-code line number or as a statement label.
	This clause is not permitted if a DEFINE DATA statement is used, because in that case the STORE statement would always refers to the entire view, as defined in the DEFINE DATA statement.

## **Example**

```
** Example 'STOEX1S': STORE (structured mode)
** CAUTION: Executing this example will modify the database records!
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 NAME
 2 FIRST-NAME
 2 MAR-STAT
 2 BIRTH
 2 CITY
 2 COUNTRY
1 #PERSONNEL-ID (A8)
1 #NAME
               (A20)
1 #FIRST-NAME
               (A15)
1 #BIRTH-D
               (D)
1 #MAR-STAT
                (A1)
1 #BIRTH
                (8A)
1 #CITY
                (A20)
1 #COUNTRY
                (A3)
```

```
1 #CONF
               (A1)
END-DEFINE
RFPFAT
  INPUT 'ENTER A PERSONNEL ID AND NAME (OR ''END'' TO END)' //
        'PERSONNEL-ID : ' #PERSONNEL-ID //
               : ' #NAME
        'NAMF
        'FIRST-NAME
                   : ' #FIRST-NAME
  /*
 /* VALIDATE ENTERED DATA
  IF #PERSONNEL-ID = 'END' OR #NAME = 'END'
   STOP
  END-IF
  IF #NAME = ' '
    REINPUT WITH TEXT 'ENTER A LAST-NAME' MARK 2 AND SOUND ALARM
  END-IF
  IF #FIRST-NAME = ' '
   REINPUT WITH TEXT 'ENTER A FIRST-NAME' MARK 3 AND SOUND ALARM
  END-IF
  /*
  /* ENSURE PERSON IS NOT ALREADY ON FILE
  FIND NUMBER EMPL-VIEW WITH PERSONNEL-ID = #PERSONNEL-ID
  IF *NUMBER > 0
   REINPUT 'PERSON WITH SAME PERSONNEL-ID ALREADY EXISTS'
            MARK 1 AND SOUND ALARM
  END-IF
 MOVE 'N' TO #CONF
  /*
  /* GET FURTHER INFORMATION
  /*
  INPUT
    'ADDITIONAL PERSONNEL DATA'
                                                      ////
                            :' #PERSONNEL-ID (AD=IO) /
    'PERSONNEL-ID
   'NAME
                              :' ♯NAME
                                              (AD=IO) /
    'FIRST-NAME
                              :' #FIRST-NAME
                                               (AD=IO) ///
    'MARITAL STATUS
                             :' #MAR-STAT
    'DATE OF BIRTH (YYYYMMDD) : #BIRTH
                             :' #CITY
    'CITY
    'COUNTRY (3 CHARACTERS) : #COUNTRY
                                                       //
    'ADD THIS RECORD (Y/N) :' #CONF
                                               (AD=M)
  /*
     ENSURE REQUIRED FIELDS CONTAIN VALID DATA
  /*
  IF NOT (\#MAR-STAT = 'S' OR = 'M' OR = 'D' OR = 'W')
   REINPUT TEXT 'ENTER VALID MARITAL STATUS S=SINGLE ' -
                'M=MARRIED D=DIVORCED W=WIDOWED' MARK 1
  IF NOT (#BIRTH = MASK(YYYYMMDD) AND #BIRTH = MASK(1582-2699))
   REINPUT TEXT 'ENTER CORRECT DATE' MARK 2
  END-IF
```

```
IF #CITY = ' '
   REINPUT TEXT 'ENTER A CITY NAME' MARK 3
 END-IF
 IF #COUNTRY = ' '
   REINPUT TEXT 'ENTER A COUNTRY CODE' MARK 4
 END-IF
 IF NOT (#CONF = 'N' OR= 'Y')
   REINPUT TEXT 'ENTER Y (YES) OR N (NO)' MARK 5
 END-IF
 IF #CONF = 'N'
   ESCAPE TOP
 END-IF
 /*
 /* ADD THE RECORD
 /*
 MOVE EDITED #BIRTH TO #BIRTH-D (EM=YYYYMMDD)
 EMPL-VIEW.PERSONNEL-ID := #PERSONNEL-ID
 EMPL-VIEW.NAME := #NAME
 EMPL-VIEW.FIRST-NAME := #FIRST-NAME
 EMPL-VIEW.MAR-STAT := #MAR-STAT
 EMPL-VIEW.BIRTH
                       := #BIRTH-D
 EMPL-VIEW.CITY
                       := #CITY
 EMPL-VIEW.COUNTRY := #COUNTRY
 STORE RECORD IN EMPL-VIEW
 END OF TRANSACTION
 WRITE NOTITLE 'RECORD HAS BEEN ADDED'
 /*
END-REPEAT
END
```

#### **Output of Program STOEX1S:**

```
ENTER A PERSONNEL ID AND NAME (OR 'END' TO END)

PERSONNEL-ID: 90001100

NAME: JONES
FIRST-NAME: EDWARD
```

After entering and confirming the personnel key data, additional personnel data fields are displayed for input:

```
PERSONNEL-ID : 90001100

NAME : JONES
FIRST-NAME : EDWARD

MARITAL STATUS :
DATE OF BIRTH (YYYYMMDD) :
CITY :
COUNTRY (3 CHARACTERS) :

ADD THIS RECORD (Y/N) : N
```

Equivalent reporting-mode example: STOEX1R.

# 139 SUBTRACT

Function	1084
Syntax 1 - SUBTRACT Statement without GIVING Clause	
Syntax 2 - SUBTRACT Statement with GIVING Clause	1085
Example	1086

Related Statements: ADD | COMPRESS | COMPUTE | DIVIDE | EXAMINE | MOVE | MOVE ALL | MULTIPLY | RESET | SEPARATE

Belongs to Function Group: Arithmetic and Data Movement Operations

## **Function**

The SUBTRACT statement is used to subtract one or more arithmetic expressions or operands from another operand.

## Syntax 1 - SUBTRACT Statement without GIVING Clause

### Operand Definition Table:

Operand	Pos	ssib	le St	ructu	re		Po	SS	ible	e F	orı	mat	ts	Referencing Permitted	Dynamic Definition
operand1	С	S	A	1	N	N	Р	I	F	I	D	Т		yes	no
operand2		S	A	N	M	N	P	I	F	I	D	T		yes	no

### Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
operand1 FROM operand2	Operands:
Their operanal	operand2 is the minuend, operand1 is the subtrahend, hence the statement is equivalent to:
	operand2 := operand2 - operand1
	As for the formats of the operands, see also Rules for Arithmetic Assignments, Performance Considerations for Mixed Formats in the Programming Guide.
ROUNDED	ROUNDED Option:
	If you specify the keyword ROUNDED, the result will be rounded.
	For information on rounding, see Rules for Arithmetic Assignment, Field Truncation and Field Rounding in the Programming Guide.

## Syntax 2 - SUBTRACT Statement with GIVING Clause

	FROM $\begin{cases} (arithmetic-expression) \\ operand2 \end{cases}$	GIVING operand3
--	--	--------------------

### Operand Definition Table:

Operand	Possible Structure					Possible Formats										Referencing Permitted	Dynamic Definition	
operand1	С	S	A		N			N	Р	Ι	F		D	Т			yes	no
operand2	С	S	A		N			N	Р	Ι	F		D	Т			yes	no
operand3		S	A		M	A	U	N	Р	Ι	F	B*	D	Т			yes	yes

<sup>\*</sup> Format B of operand3 may be used only with a length of less than or equal to 4.

### Syntax Element Description:

Syntax Element	Description
arithmetic-expression	See Arithmetic Expression in the COMPUTE statement.
GIVING	GIVING Clause:
	When the GIVING clause is used, <code>operand2</code> will not be modified, and the result will be stored in <code>operand3</code> .
operand1	Operands:
FROM operand2 GIVING operand3	operand2 is the minuend, operand1 is the subtrahend, operand3 is the result field, hence the statement is equivalent to:
	operand3 := operand2 - operand1
	As for the formats of the operands, see also the section <i>Performance Considerations for Mixed Formats</i> in the <i>Programming Guide</i> .
ROUNDED	ROUNDED Option:
	If you specify the keyword ROUNDED, the result will be rounded.
	For information on rounding, see <i>Rules for Arithmetic Assignment</i> , Field Truncation and Field Rounding in the <i>Programming Guide</i> .

## **Example**

```
** Example 'SUBEX1': SUBTRACT
************************
DEFINE DATA LOCAL
1 #A (P2) INIT <50>
1 #B (P2)
1 #C (P1.1) INIT <2.4>
END-DEFINE
SUBTRACT 6 FROM #A
WRITE NOTITLE 'SUBTRACT 6 FROM #A
                                   ' 10X '=' #A
SUBTRACT 6 FROM 11 GIVING #A
            'SUBTRACT 6 FROM 11 GIVING #A ' 10X '=' #A
WRITE
SUBTRACT 3 4 FROM #A GIVING #B
            'SUBTRACT 3 4 FROM #A GIVING #B ' 10X '=' #A '=' #B
WRITE
SUBTRACT -3 -4 FROM #A GIVING #B
            'SUBTRACT -3 -4 FROM #A GIVING #B' 10X '=' #A '=' #B
WRITE
SUBTRACT ROUNDED 2.06 FROM #C
            'SUBTRACT ROUNDED 2.06 FROM #C ' 10X '=' #C
WRITE
END
```

#### **Output of Program SUBEX1:**

```
      SUBTRACT 6 FROM #A
      #A: 44

      SUBTRACT 6 FROM 11 GIVING #A
      #A: 5

      SUBTRACT 3 4 FROM #A GIVING #B
      #A: 5 #B: -2

      SUBTRACT -3 -4 FROM #A GIVING #B
      #A: 5 #B: 12

      SUBTRACT ROUNDED 2.06 FROM #C
      #C: 0.3
```

# 140 SUSPEND IDENTICAL SUPPRESS

Function	1088
Syntax Description	
Examples	1088

SUSPEND IDENTICAL [SUPPRESS] [(rep)]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | WRITE | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The SUSPEND IDENTICAL SUPPRESS statement is used to suspend the Natural session parameter setting IS=0N (which suppresses the output of identical field values) for the processing of one record.

See also session parameter IS in the *Parameter Reference*.

## **Syntax Description**

Syntax Element	Description
(rep)	Report Specification:
	The notation ( rep) may be used to specify the identification of the report for which the SUSPEND IDENTICAL SUPPRESS statement is applicable.
	A value in the range $0$ - $31$ or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If ( $rep$ ) is not specified, the SUSPEND IDENTICAL SUPPRESS statement will be applicable to the first report (Report 0).
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> in the <i>Programming Guide</i> .

## **Examples**

Example 1 - Program with SUSPEND IDENTICAL SUPPRESS

■ Example 2 - Same as Previous Program, but without SUSPEND IDENTICAL SUPPRESS

### **Example 1 - Program with SUSPEND IDENTICAL SUPPRESS**

```
** Example 'SISEX1': SUSPEND IDENTICAL SUPPRESS
*************************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
 2 FIRST-NAME
 2 NAME
 2 CITY
1 VEH-VIEW VIEW OF VEHICLES
 2 PERSONNEL-ID
 2 MAKE
END-DEFINE
LIMIT 15
RD. READ EMPLOY-VIEW BY NAME STARTING FROM 'JONES'
 SUSPEND IDENTICAL SUPPRESS
 FD. FIND VEH-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (RD.)
   IF NO RECORDS FOUND
     MOVE '***NO CAR***' TO MAKE
   END-NOREC
   DISPLAY NOTITLE
           NAME (RD.) (IS=ON)
           FIRST-NAME (RD.) (IS=ON)
           MAKE (FD.)
 END-FIND
 /*
END-READ
END
```

### **Output of Program SISEX1:**

	NAME	FIRST-NAME	MAKE
JONES		VIRGINIA	CHRYSLER
JONES		MARSHA	CHRYSLER
			CHRYSLER
JONES		ROBERT	GENERAL MOTORS
JONES		LILLY	FORD
			MG
JONES		EDWARD	GENERAL MOTORS
JONES		MARTHA	GENERAL MOTORS

JONES	LAUREL	GENERAL MOTORS
JONES	KEVIN	DATSUN
JONES	GREGORY	FORD
JONES	EDWARD	***NO CAR***
JOPER	MANFRED	***NO CAR***
JOUSSELIN	DANIEL	RENAULT
JUBE	GABRIEL	***NO CAR***
JUNG	ERNST	***NO CAR***
JUNKIN	JEREMY	***NO CAR***

### Example 2 - Same as Previous Program, but without SUSPEND IDENTICAL SUPPRESS

```
** Example 'SISEX2': SUSPEND IDENTICAL SUPPRESS (compare with SISEX1)
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 PERSONNEL-ID
  2 FIRST-NAME
 2 NAME
 2 CITY
1 VEH-VIEW VIEW OF VEHICLES
  2 PERSONNEL-ID
  2 MAKE
END-DEFINE
LIMIT 15
RD. READ EMPLOY-VIEW BY NAME STARTING FROM 'JONES'
  /* SUSPEND IDENTICAL SUPPRESS /* statement removed
  /*
  FD. FIND VEH-VIEW WITH PERSONNEL-ID = PERSONNEL-ID (RD.)
   IF NO RECORDS FOUND
     MOVE '***NO CAR***' TO MAKE
   END-NOREC
   DISPLAY NOTITLE
            NAME (RD.) (IS=ON)
            FIRST-NAME (RD.) (IS=ON)
            MAKE (FD.)
  END-FIND
  /*
END-READ
END
```

## Output of Program SISEX2:

NAME	FIRST-NAME	MAKE
JONES	VIRGINIA	CHRYSLER
	MARSHA	CHRYSLER
		CHRYSLER
	ROBERT	GENERAL MOTORS
	LILLY	FORD
		MG
	EDWARD	GENERAL MOTORS
	MARTHA	GENERAL MOTORS
	LAUREL	GENERAL MOTORS
	KEVIN	DATSUN
	GREGORY	FORD
	EDWARD	***NO CAR***
JOPER	MANFRED	***NO CAR***
JOUSSELIN	DANIEL	RENAULT
JUBE	GABRIEL	***NO CAR***
JUNG	ERNST	***NO CAR***
JUNKIN	JEREMY	***NO CAR***

# 141 TERMINATE

Function	1094
Syntax Description	
Program Receiving Control after Termination	
Example	1095

TERMINATE [operand1 [operand2]]

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Function**

The TERMINATE statement is used to terminate a Natural session. A TERMINATE statement may be placed anywhere within a Natural program. When a TERMINATE statement is executed, no end-of-page or end-loop processing will be performed.

For Natural RPC: See Notes on Natural Statements on the Server in the Natural RPC (Remote Procedure Call) documentation.

## **Syntax Description**

### Operand Definition Table:

Operand	Operand Possible Structure							F	os	sil	ble	Fo	rm	ats			Referencing Permitted	Dynamic Definition	
operand1	С	S						N	Р	I								yes	no
operand2	С	S	Α			Α	U	N	Р	Ι	F	В	D	T	L	C		yes	yes

### Syntax Element Description:

Syntax Element	Description
	operand1 may be used to pass a return code to the program receiving control when Natural terminates. For example, a return code setting may be passed to the operating system via Register 15.  The value supplied for operand1 must be in the range 0 - 255.
	The value supplied for operation that be in the range of 200.
operand2	operand2 may be used to pass additional information to the program which receives control after the termination.

# **Program Receiving Control after Termination**

After the termination of the Natural session, the program whose name is specified with the profile parameter PROGRAM will receive control.

# **Example**

```
** Example 'TEREX1': TERMINATE
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 PERSONNEL-ID
  2 NAME
 2 SALARY (1)
1 #PNUM
        (A8)
1 #PASSWORD (A8)
END-DEFINE
INPUT 'ENTER PASSWORD: ' #PASSWORD
IF #PASSWORD NE 'USERPASS'
 /*
 TERMINATE
END-IF
INPUT 'ENTER PERSONNEL NUMBER: ' #PNUM
FIND EMPLOY-VIEW WITH PERSONNEL-ID = #PNUM
 DISPLAY NAME SALARY (1)
END-FIND
END
```

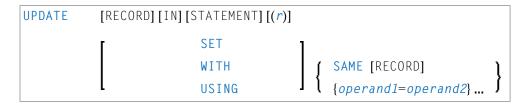
# 142 UPDATE

■ Function	1009
■ Restrictions	1099
Database-Specific Considerations	1099
Syntax Description	1100
■ Example	1101

### Structured Mode Syntax

```
UPDATE [RECORD] [IN] [STATEMENT] [(r)]
```

### **Reporting Mode Syntax**



For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: ACCEPT/REJECT | AT BREAK | AT START OF DATA | AT END OF DATA | BACKOUT TRANSACTION | BEFORE BREAK PROCESSING | DELETE | END TRANSACTION | FIND | GET | GET SAME | GET TRANSACTION DATA | HISTOGRAM | LIMIT | PASSW | PERFORM BREAK PROCESSING | READ | READLOB | RETRY | STORE | UPDATELOB

Belongs to Function Group: Database Access and Update

## **Function**

The UPDATE statement is used to update one or more fields of a record in a database. The record to be updated must have been previously selected with a FIND, GET or READ statement (or, for Adabas only, with a STORE statement).

#### **Hold Status**

The use of the UPDATE statement causes each record read for processing in the corresponding FIND or READ statement to be placed in exclusive hold.

For further information, see *Record Hold Logic* (in the *Programming Guide*).

# **Restrictions**

The UPDATE statement

- must not be entered on the same line as the statement used to select the record to be updated;
- cannot be applied to Entire System Server views.

# **Database-Specific Considerations**

DL/I	The UPDATE statement can be used to update a segment in a DL/I database. If necessary, the segment length is increased to accommodate all fields specified with the UPDATE statement.
	If a multiple-value field or a periodic group is defined as variable in length, only the occurrences as specified in the UPDATE statement are written to the segment.
	The DL/I AIX field name cannot be used in an UPDATE statement. AIX fields, however, may be updated by referring to the source field which comprises the AIX field.
	DL/I sequence fields cannot be updated because of DL/I restrictions.
	Due to GSAM restrictions, the UPDATE statement cannot be used for GSAM databases.
VSAM	VSAM primary keys cannot be updated because of VSAM restrictions.
	The DL/I AIX field name cannot be used in an UPDATE statement. AIX fields, however, may be updated by referring to the source field which comprises the AIX field.
SQL	The UPDATE statement can be used to update a row in a database table. It corresponds with the SQL statement UPDATE WHERE CURRENT OF CURSOR (Positioned UPDATE), which means that only the row which was read last can be updated.
	Only columns (fields) that have been modified within the program, as well as columns that might have been (but not necessarily actually have been) modified outside the program (for example, as input fields in maps), are updated. On all other platforms, all columns are updated.
	With most SQL databases, a row that was read with a FIND SORTED BY or with a READ LOGICAL statement cannot be updated.

# **Syntax Description**

## Operand Definition Table:

Operand	Possible Structure			ıre	Possible Formats										Referencing Permitted	Dynamic Definition	
operand1		S	A			A	N	I	P I	F	В	D	T	L		no	no
operand2	C	S	A			A	N	I	l	F	В	D	T	L		yes	no

# Syntax Element Description:

Syntax Element	Description
(r)	Statement Reference:
	The notation $(r)$ is used to indicate the statement in which the record to be modified was read. $r$ may be specified as a source-code line number or as a statement label.
	If no reference is specified, the UPDATE statement will reference the innermost active READ or FIND processing loop. If no READ or FIND loop is active, it will reference the last preceding GET (or STORE) statement.
	<b>Note:</b> The UPDATE statement must be placed within the READ or FIND loop it
	references.
USING SAME	USING SAME Clause:
	This clause is not permitted if a DEFINE DATA statement is used, because in that case the UPDATE statement always refers to the entire view as defined in the DEFINE DATA statement.
	The layout of the record buffer or format buffer may be declared using the OBTAIN statement.
	USING SAME can be used in reporting mode to indicate that the same fields as read in the statement referenced by the UPDATE statement are to be used for the update function. In this case, the most recent value assigned to each database field will be used to update the field. If no new value has been assigned, the old value will be used.
	If the field to be updated is an array range of a multiple-value field or periodic group and you use a variable index for this array range, the latest range will be updated. This means that if the index variable is modified after the record has been read and before the UPDATE USING SAME (reporting mode) or UPDATE (structured mode) statement respectively is executed, the range updated will not be the same as the range read.
SET/WITH	SET/WITH Clause:
operand1=operand2	

Syntax Element	Description
	This clause can be used in reporting mode to specify the fields to be updated and the values to be used.
	This clause is not permitted if a DEFINE DATA statement is used, because in that case the UPDATE statement always refers to the entire view as defined in the DEFINE DATA statement.
	<b>Note:</b> For DL/I databases: If the SET/WITH clause is used, only I/O (sensitive) fields can be provided. A segment sequence field cannot be updated (DELETE and STORE must be used instead).

# **Example**

```
** Example 'UPDEX1S': UPDATE (structured mode)
**
** CAUTION: Executing this example will modify the database records!
**********************
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 CITY
1 #NAME (A20)
END-DEFINE
INPUT 'ENTER A NAME: ' #NAME (AD=M)
IF #NAME = ' '
 STOP
END-IF
FIND EMPLOY-VIEW WITH NAME = #NAME
 IF NO RECORDS FOUND
   REINPUT WITH 'NO RECORDS FOUND' MARK 1
 END-NOREC
 INPUT 'NAME: ' NAME (AD=0) /
       'FIRST NAME: 'FIRST-NAME (AD=M) /
       'CITY:
                 ' CITY (AD=M)
 UPDATE
 END TRANSACTION
END-FIND
END
```

## **Output of Program SUBEX1S**

ENTER A NAME: BROWN

## After entering and confirming name:

NAME: BROWN

FIRST NAME: KENNETH

CITY: DERBY

Equivalent reporting-mode example: UPDEX1R.

# 143 UPDATE (SQL)

Function	1104
Syntax 1 - Searched UPDATE	
Syntax 2 - Positioned UPDATE	1107
Examples	1108

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Belongs to Function Group: Database Access and Update

See also *UPDATE - SQL* in the *Natural for DB2* part of the *Database Management System Interfaces* documentation:

### **Function**

The SQL UPDATE statement is used to perform an UPDATE operation on either rows in a table without using a cursor ("searched" UPDATE) or columns in a row to which a cursor is positioned ("positioned" UPDATE).

Two different syntax structures are possible.

# Syntax 1 - Searched UPDATE

The "Searched" UPDATE statement is a stand-alone statement not related to any SELECT statement. With a single statement you can update zero, one, multiple or all rows of a table. The rows to be updated are determined by a search-condition that is applied to the table. Optionally, view names and table names can be assigned a correlation-name.

**Note:** The number of rows that have actually been updated with a "searched" UPDATE can be ascertained by using the system variable \*ROWCOUNT.

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Syntax Element Description - Syntax 1:

Syntax Element	Description					
view-name	View Name:					
	Refers to the name of a Natural view as d further information, see <i>view-name</i> (in the function of the view of the	lefined in the DEFINE DATA statement. For the section <i>Basic Syntactical Items</i> ).				
period-clause	Period Clause:					
	Specifies that a period clause applies to the information, see <i>Period Clause</i> in the sect	e target of the update operation. For further tion <i>Basic Syntactical Items</i> .				
correlation-name	Correlation Name:					
	The item correlation-name represents	an alias name for a table-name.				
	For further information, see <i>correlatio Items</i> ).	on-name (in the section Basic Syntactical				
include-columns	Include Columns Clause:					
	1 -	ed, along with the columns of tables-name at, when it is nested in the FROM clause of a sare appended to the end of the list of				
	For further details, see <i>include-columns</i> .					
SET	SET Clause:					
	If a view has been specified for updating, an asterisk (*) has to be specified in the SET clause, because all columns of the view must be updated.					
	If a table has been specified for updating, the SET clause must contain either assignment-list or the name of the view which contains the columns to be					
assignment-list	Assignment List: See Assignment List below.					
WHERE	WHERE Clause:					
search-condition	This clause is used to specify the selection criteria for the rows to be updated.  If no WHERE clause is specified, the entire table is updated.					
WITH	WITH - Isolation Level Clause:					
	This clause allows the explicit specification of the isolation level used when the row to be updated.					
	For detailed information, see <i>WITH isolation-level</i> in the description of the SELEC statement.					
	CS	Cursor Stability				
	RR	Repeatable Read				
	RS	Read Stability				
SKIP LOCKED DATA	SKIP LOCKED DATA Clause:					

Syntax Element	Description
	Specifies that rows are skipped when incompatible locks are held on the row by other transactions.
QUERYNO integer	QUERYNO Clause:
	This clause allows you to explicitly specify the number to be used in EXPLAIN output and trace records for this statement. The number is used as QUERYNO column in the PLAN_TABLE for the rows that contain information on this statement.

### **Assignment List**

```
 \left\{ \begin{array}{c} \textit{column-name} = \left\{ \begin{array}{c} \textit{scalar-expression} \\ \textit{DEFAULT} \\ \textit{NULL} \end{array} \right\} \right\} \text{, ...}
```

In an assignment-list, you can assign values to one or more columns. A value can be a scalar-expression, DEFAULT or NULL. For further information, see *Scalar Expressions*.

If the value NULL has been assigned, it means that the addressed field is to contain no value (not even the value "0" or "blank").

#### Alternative:

### Syntax Element Description:

Syntax Element	Description
column-name	Column Name:
	Specifies the name of a column of the result table of the MERGE statement that is not the same name as another include column or a column in the target table.
DEFAULT	DEFAULT Option:
	Specifies that the default value is used based on how the corresponding column is defined in the table.
NULL	NULL Option:
	Specifies the null value as the new value of the column.
	If the value NULL has been assigned, it means that the addressed field is to contain no value (not even the value 0 or "blank").

Syntax Element	Description
row-fullselect	Row Full Select Option:
	Specifies a full select that returns a single row. The column values are assigned to the corresponding column-names.

# **Syntax 2 - Positioned UPDATE**

The "positioned" UPDATE statement always refers to a cursor within a database loop. Thus, the table or view referenced by a positioned UPDATE statement must be the same as the one referenced by the corresponding SELECT statement; otherwise an error message is returned. A positioned UPDATE cannot be used with a non-cursor selection.

### Common Set Syntax:

```
UPDATE \left\{ \begin{array}{c} \textit{view-name} & \text{SET *} \\ \textit{view-name} & \text{SET } \textit{assignment-list} \end{array} \right\} [WHERE CURRENT OF CURSOR (r)]
```

### Extended Set Syntax:

### Syntax Element Description - Syntax 2:

Syntax Element	Description
view-name	Natural View:
	Refers to the name of a Natural view as defined in the DEFINE DATA statement; see also <i>view-name</i> (in the section <i>Basic Syntactical Items</i> ).
SET *	SET Clause:
SET assignment-list	If a Natural view has been specified for updating, an asterisk (*) has to be specified in the SET clause, because all columns of the view must be updated.
	If a table has been specified for updating, the $SET$ clause must contain either an $assignment-list$ or the name of the view which contains the columns to be updated.
WHERE CURRENT OF	Statement Reference:
CURSOR (r)	The $(r)$ notation is used to reference the statement which was used to select the row to be updated. If no statement reference is specified, the <code>UPDATE</code> statement

Syntax Element	Description
	is related to the innermost active processing loop in which a database record was selected.
FOR ROW OF ROWSE	FOR ROW OF ROWSET Clause:  This clause belongs to the SQL Extended Set.
	The optional FOR ROW OF ROWSET clause for positioned SQL UPDATE statements specifies which row of the current rowset has to be updated. It should only be specified if the UPDATE statement is related to a SELECT statement, which uses rowset positioning and which has column arrays in the INTO clause (see <i>into-clause</i> ).
	If this clause is omitted, all rows of the current rowset are updated by the values in the <code>assignment-list</code> .
	This clause cannot be specified if <i>view-name</i> SET * is specified.

# **Examples**

- Example 1 Searched UPDATE
- Example 2 Searched UPDATE with assignment-list
- Example 3 Positioned UPDATE
- Example 4 Positioned UPDATE with assignment-list

## **Example 1 - Searched UPDATE**

```
DEFINE DATA LOCAL

1 PERS VIEW OF SQL-PERSONNEL

2 NAME

2 AGE
...
END-DEFINE
...
ASSIGN AGE = 45
ASSIGN NAME = 'SCHMIDT'
UPDATE PERS SET * WHERE NAME = 'SCHMIDT'
...
```

### Example 2 - Searched UPDATE with assignment-list

```
DEFINE DATA LOCAL

1 PERS VIEW OF SQL-PERSONNEL

2 NAME

2 AGE
...
END-DEFINE
...
UPDATE SQL-PERSONNEL SET AGE = AGE + 1 WHERE NAME = 'SCHMIDT'
...
```

### **Example 3 - Positioned UPDATE**

```
DEFINE DATA LOCAL

1 PERS VIEW OF SQL-PERSONNEL

2 NAME

2 AGE
...

END-DEFINE
...

SELECT * INTO PERS FROM SQL_PERSONNEL WHERE NAME = 'SCHMIDT'

COMPUTE AGE = AGE + 1

UPDATE PERS SET * WHERE CURRENT OF CURSOR

END-SELECT
...
```

### **Example 4 - Positioned UPDATE with assignment-list**

```
DEFINE DATA LOCAL

1 PERS VIEW OF SQL-PERSONNEL

2 NAME

2 AGE
...
END-DEFINE
...
SELECT * INTO PERS FROM SQL-PERSONNEL WHERE NAME = 'SCHMIDT'
UPDATE SQL-PERSONNEL SET AGE = AGE + 1 WHERE CURRENT OF CURSOR
END-SELECT
...
```

# 144 UPDATELOB

Function	1112
Restrictions	
Syntax Description	1113
System Variable Available with UPDATELOB	1114
Functional Considerations	1115
Examples	1115

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: READ | FIND | GET | READLOB | UPDATE

Belongs to Function Group: Database Access and Update

## **Function**

The UPDATELOB statement is used to update a data segment of a LOB field (Large OBject field) in a database record. The position of the value modification is freely selectable. The record to be updated must have been previously selected with a FIND, READ, GET statement or created with a STORE statement

#### **Hold Status**

The use of the UPDATELOB statement causes each record read for processing in the corresponding FIND, READ or GET statement to be placed in exclusive hold.

For further information, see *Record Hold Logic* in the *Programming Guide*.

## Restrictions

The UPDATELOB statement

- can only be used for access to Adabas databases;
- must not be entered on the same line as the statement used to select the record to be updated;
- is only applicable to update a single LOB field.

# **Syntax Description**

## Operand Definition Table:

Operand	Pos	ssib	le St	ruct	ure		P	059	sik	ole	Fori	ma	its		Referencing Permitted	Dynamic Definition
operand1	C	S				A									yes	no
operand2	C	S					N								yes	no
operand3	С	S					N	Р	I		В*				yes	no

<sup>\*</sup> Format B of operand3 may be used with a length of less than or equal to 4.

### Syntax Element Description:

Syntax Element	Description											
(r)	Statement Reference:											
	The notation ( $r$ ) is used to indicate the statement in which the record to be modified was read or created. $r$ may be specified as a source-code line number or as a statement label. You may reference a FIND, READ, GET or STORE statement.											
	If no reference is specified, the <code>UPDATELOB</code> statement will reference the innermost active <code>READ</code> or <code>FIND</code> processing loop. If no <code>READ</code> or <code>FIND</code> loop is active, it will reference the last preceding <code>GET</code> statement. To reference a <code>STORE</code> statement, you have always to provide the $(r)$ notation.											
	<b>Note:</b> The UPDATELOB statement must be placed within the READ or FIND loop it											
	references.											
view-name	View Name:											
	As <i>view-name</i> , you specify the name of a view, which must have been defined either within a DEFINE DATA statement or outside the program in a global or local data area.											
	■ The view has to contain just a single-valued LOB field, additional fields are not allowed.											
	■ If the LOB is a MU or PE field, a unique occurrence must be specified; a range notation is not allowed.											
	■ The LOB field must be defined in the view with a fixed (non-dynamic) length.											
'	PASSWORD and CIPHER Clauses:											
CIPHER=operand2	The PASSWORD clause is used to provide a password when retrieving data from a file which is password-protected.											

Syntax Element	Description
	The CIPHER clause is used to provide a cipher key when retrieving data from a file which is enciphered.
	See the statements FIND and PASSW for further information.
STARTING AT OFFSET=operand3	STARTING AT OFFSET Clause:
orraci operando	Provides the start offset within the LOB field, where the operation is executed. The leftmost byte of the LOB field is offset zero (0).
	operand3 must be provided either in the form of a numeric constant or as a user-defined variable, without precision digits. The field is not modified by the UPDATELOB execution. If the offset value is greater than the LOB length, the gap is filled with blanks. This means a LOB field can be updated at a position which is beyond its length.
	If this clause is omitted, start offset (0) is assumed.
TRUNCATE REMAINDER	TRUNCATE Clause:
or TRUNCATE AT OFFSET	If TRUNCATE REMAINDER is specified, the remaining LOB field data is truncated after the new segment has been written into the LOB field. This makes the end of the inserted segment to the end of the LOB field.
	If TRUNCATE AT OFFSET is specified, the data behind the specified starting offset is truncated. A segment insert into the LOB field is not performed. After this, the LOB length is equal to <code>operand3</code> .
	If this clause is omitted, the data behind the inserted segment is preserved.

# **System Variable Available with UPDATELOB**

The Natural system variable \*NUMBER is provided with the UPDATELOB statement.

The format/length of this system variable is P10. This format/length cannot be changed.

System Variable	e Explanation
*NUMBER	The system variable *NUMBER returns the sum of the start offset and the number of characters inserted. This value represents the starting offset for the next UPDATELOB, if a consecutive area of the LOB field is replaced with multiple calls.
	The number of inserted characters is either the byte length of the LOB segment defined in the view or zero (0) if the TRUNCATE AT OFFSET clause was specified.
	The *NUMBER field returned by the UPDATELOB statement must always be provided with a reference label or number (for example, *NUMBER(0430)) when used.

## **Functional Considerations**

- An UPDATELOB operates a record which was set into hold by an associated FIND, READ, GET or STORE statement. The link is either implicit via the current active reference or explicit with (*r*) notation.
- The view used by the associated statement and the view used by the UPDATELOB have to access the same database and file number. This is automatically assured if the views are derived from the same data definition module (DDM).
- If the insert position *operand3* is greater than the LOB length, the gap is filled with blanks. This means you may update a LOB field at a position which is beyond its length.
- You cannot replace *m* bytes with *n* bytes or in other words, it is not admissible to substitute a LOB part with a data segment of different length.
- The value returned with \*NUMBER is the high-water mark indicating the position inside the LOB where the last insert has ended. If a number of consecutive update operations is demanded, this value should always be retained as STARTING AT value for the next UPDATELOB execution.

# **Examples**

- Example 1 Store New Record and Fill LOB Segment
- Example 2 Add LOB Data to Existent Record, Piece by Piece
- Example 3 Truncate LOB Field
- Example 4 Read LOB Data to Existent Record and Update LOB Segment

### Example 1 - Store New Record and Fill LOB Segment

```
DEFINE DATA LOCAL

1 V1 VIEW OF ..

2 PERSONNEL-ID

2 NAME

1 V2 VIEW OF ..

2 LOBFIELD_SEGMENT /* LOB field defined in DDM with (A1024).

END-DEFINE

*

**

**

Store new record

**

V1. PERSONNEL-ID := '12345678'

V1. NAME := 'Smith'

LAB1.

STORE V1 /* Store new record with 2 fixed length fields.

*

MOVE ALL 'X' TO LOBFIELD_SEGMENT
```

```
**-----

** Update LOB field

**-----

UPDATELOB (LAB1.) IN FILE V2 /* INSERT 1 KB SEGMENT (LOBFIELD_SEGMENT)

/* IN LOB.

STARTING AT OFFSET = 2048

/* STORE DATA IN LOB RANGE 2049-3072.

/* FIRST 2 KBS ARE AUTO-FILLED WITH BLANKS BY THE DB.

END TRANSACTION
END
```

### Example 2 - Add LOB Data to Existent Record, Piece by Piece

```
DEFINE DATA LOCAL
1 V1 VIEW OF EMPLOYEES-V2009
 2 PERSONNEL-ID
 2 NAME
 2 L@PICTURE
1 V2 VIEW OF EMPLOYEES-V2009
 2 PICTURE_SEGMENT /* LOB field defined in DDM with (A1024).
 2 REDEFINE PICTURE
   3 PICTURE B (B1024)
1 #0FF (I4)
END-DEFINE
** Read record to be updated
LAB1.
READ (1) V1 BY PERSONNEL-ID = '60008339'
                     /* Read record and set into exclusive hold.
 RESET #OFF
                     /* Start to overwrite LOB field from the beginning.
 /* Read data from work file and put into LOB field
 READ WORK FILE 7 PICTURE_B
                      /* Start to read picture data (.jpg) from work file.
LAB2.
   UPDATELOB (LAB1.) IN FILE V2
            STARTING AT OFFSET #OFF
   #OFF := *NUMBER(LAB2.) /* Keep next position to append.
 END-WORK
FND-RFAD
**----
END TRANSACTION
END
```

### **Example 3 - Truncate LOB Field**

```
DEFINE DATA LOCAL
1 V1 VIEW OF EMPLOYEES-V2009
 2 PERSONNEL-ID
 2 NAME
 2 L@PICTURE
1 V2 VIEW OF EMPLOYEES-V2009
1 V3 VIEW OF EMPLOYEES-V2009
 2 PICTURE_SEGMENT /* LOB field defined in DDM with (A1024).
END-DEFINE
** Read record to be updated
LAB1.
READ V1 BY PERSONNEL-ID /* Read records.
 IF L@PICTURE > 10240 THEN /* Check if LOB length is too high.
LAB2.
   GET V2 RECORD *ISN(LAB1.) /* Set record to be updated into exclusive hold.
   UPDATELOB (LAB2.) IN FILE V3
             STARTING AT OFFSET 10240
             TRUNCATE AT OFFSET /* Truncate LOB data beyond 10KB.
   END TRANSACTION
 END-IF
END-READ
END
```

### Example 4 - Read LOB Data to Existent Record and Update LOB Segment

```
DEFINE DATA LOCAL
1 V1 VIEW OF ..
 2 NAME
1 V2 VIEW OF ..
 2 DOCUMENT_SEGMENT /* LOB field defined in DDM with (A100).
1 #ISN (I4)
1 #P0S
      (I4)
1 #LENGTH (I4) INIT <100>
END-DEFINE
** Read record to be updated
**-----
INPUT (AD=T)
/ ' Read record (ISN):' #ISN
G1.
GET V1 RECORD #ISN /* Get record with ISN and set into exclusive hold.
```

# 145 UPLOAD PC FILE

Function	1120
Syntax Description	
Example	1122

### Structured Mode Syntax

### **Reporting Mode Syntax**

```
{ UPLOAD READ } { PC WORK } [FILE] work-file-number [ONCE]

{ RECORD {operand1 [FILLER nX]} ... }

[AND] [SELECT] { [ OFFSET n FILLER nX] ... operand2 } ... }

[GIVING LENGTH operand3]

[ AT [END] [OF] [FILE] { statement DO statement ... DOEND }

statement ...

LOOP
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: CLOSE PC FILE | DOWNLOAD PC FILE | READ WORK FILE

Belongs to Function Group: Control of Work Files / PC Files

## **Function**

The UPLOAD PC FILE statement is used to transfer data from a PC to a mainframe platform.

See also:

- *Natural Connection* and Entire Connection documentation
- READ WORK FILE statement syntax description

# **Syntax Description**

## Operand Definition Table:

Operand	Operand Possible Structure							Po	ssi	bl	e F	or	ma	ts			Referencing Permitted	Dynamic Definition
operand1		S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C	yes	yes
operand2		S	A	G		A	U	N	Р	Ι	F	В	D	T	L	C	yes	yes
operand3		S								Ι							yes	yes

Format C is not valid for Natural Connection.

## Syntax Element Description:

Syntax Element	Description
work-file-number	Work File Number:
	The number of the work file to be used. This number must correspond to one of the work file numbers for the PC as defined to Natural.
operand1-2	Field Specification:
	With <i>operand1</i> and <i>operand2</i> you specify the fields to be uploaded from the PC. The fields may be database fields or user-defined variables.
statement	Statement(s) to be Executed:
	In place of <i>statement</i> , you must supply one or several suitable statements, depending on the situation.
	No I/O statement may be placed with the UPLOAD PC FILE processing.
ONCE, SELECT, GIVING LENGTH	Options:
RECORD	For a description of the ONCE, SELECT, GIVING LENGTH options, refer to the corresponding sections in the description of the READ WORK FILE statement.
	The RECORD option is not permitted for PC work files. It will be rejected at runtime.
	When uploading data: If you wish to define a filler, you must use a dummy variable instead of the standard filler notation.
END-WORK	End of UPLOAD PC FILE Statement:
LOOP	In structured mode, the Natural reserved keyword END-WORK must be used to end the UPLOAD PC FILE statement.

Syntax Element	Description
	In reporting mode, the Natural statement LOOP is used to end the UPLOAD PC FILE statement.

# **Example**

The following program demonstrates the use of the UPLOAD PC FILE statement. The data is first uploaded from the PC and then processed on the mainframe.

```
** Example 'PCUPEX1': UPLOAD PC FILE
** NOTE: Example requires that Natural Connection is installed.
** CAUTION: Executing this example will modify the database records!
**********************
DEFINE DATA LOCAL
01 EMPL VIEW OF EMPLOYEES
  02 PERSONNEL-ID
  02 INCOME
     03 SALARY (1)
01 #PID (A8)
                                          /* Personnel ID on PC
01 #NEW-INCREASE (N4)
                                          /* Increase for salary
END-DEFINE
UPLOAD PC FILE 7 #PID #NEW-INCREASE
                                         /* Data upload
 FIND EMPL WITH PERSONNEL-ID = #PID
                                    /* Data selection
   ADD #NEW-INCREASE TO SALARY (1)
                                         /* Data update on host
   UPDATE
   END TRANSACTION
   ESCAPE BOTTOM
 END-FIND
END-WORK
END
```

### **Output of Program PCUPEX1:**

When you run the program, a window appears in which you specify the name of the PC file from which the data is to be uploaded. The data is then uploaded from the PC.

# WRITE

Function	1124
Syntax 1 - Dynamic Formatting	
Syntax 2 - Using Predefined Form/Map	1132
Examples	1133

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE TITLE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The WRITE statement is used to produce output in free format.

The WRITE statement differs from the DISPLAY statement in the following respects:

- Line overflow is supported. If the line width is exceeded for a line, the next field (or text) is written on the next line. Fields or text elements are not split between lines.
- No default column headers are created. The length of the data determines the number of positions printed for each field.
- A range of values/occurrences for an array is output horizontally rather than vertically.

See also the following topics in the *Programming Guide*:

- Report Format and Control
- Statements DISPLAY and WRITE
- Index Notation for Multiple-Value Fields and Periodic Groups
- Example of DISPLAY VERT with WRITE Statement
- Layout of an Output Page

# Syntax 1 - Dynamic Formatting

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

## Operand Definition Table:

Operand	Pos	ssib	le St	ruct	ure			F	208	SSI	ble	e F	orr	na	ts			Referencing Permitted	Dynamic Definition
operand1		S	A	G	N	A	U	N	Р	Ι	F	В	D	T	L	G	О	yes	no

### Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	The notation ( $rep$ ) is used to specify the identification of the report if multiple reports are to be produced by the program.
	As report identification, a value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If ( rep) is not specified, the statement will apply to the first report (Report 0).
	If this printer file is defined to Natural as PC, the report will be downloaded to the PC, see <i>Example 6</i> .
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> (in the <i>Programming Guide</i> ).
NOTITLE	Default Page Title Suppression:
	Natural generates a single title line for each page resulting from a WRITE statement. This title contains the page number, the time of day, and the date. Time of day is set at the beginning of program execution. This default title line may be overridden by using a WRITE TITLE statement, or it may be suppressed by using the NOTITLE option in the WRITE statement.
	Examples:
	■ Default title will be produced:
	WRITE NAME
	■ User title will be produced:

Syntax Element	Description
	WRITE NAME WRITE TITLE 'user-title'
	■ No title will be produced:
	WRITE NOTITLE NAME
	Note:
	1. If the NOTITLE option is used, it applies to all DISPLAY, PRINT and WRITE statements within the same object which write data to the same report.
	2. Page overflow is checked <i>before</i> execution of a WRITE statement. No new page with title or trailer information is generated <i>during</i> the execution of a WRITE statement.
NOHDR	Column Header Suppression:
	The WRITE statement itself does not produce any column headers. However, if you use the WRITE statement in conjunction with a DISPLAY statement, you can use the NOHDR option of the WRITE statement to suppress the column headers generated by the DISPLAY statement. The NOHDR option only takes effect if the execution of the WRITE statement causes a new page to be output.
	Without the NOHDR option, the column headers (if any) of the DISPLAY statement would be output on this new page; with NOHDR they will not.
statement-parameters	Parameter Definition at Statement Level:
	One or more parameters, enclosed within parentheses, may be specified at statement level, that is, immediately after the WRITE statement.
	Each parameter specified will override the corresponding parameter previously specified in a GLOBALS command, SET GLOBALS (in Reporting Mode only) or FORMAT statement.
	If more than one parameter is specified, they must be separated by one or more blanks from one another. Each parameter specification must not be split between two statement lines.
	<b>Note:</b> The parameter settings applied here will only be regarded for variable
	fields, but they have no effect on text-constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element, see <i>Parameter Definition at Element (Field) Level</i> .
	See also:
	■ List of Parameters
	Example of Parameter Usage at Statement and Element (Field) Level

Syntax Element	Description
	Example 5 - WRITE Statement Using '=' and Parameters on Statement/Element (Field) Level
nX, $nT$ , $x/y$ ,	Field Positioning Notation:
T*field-name, P*field-name,'=',/	See Field Positioning Notations in the section Output Format Definitions.
'text','c'(n),	Text/Attribute Assignment:
attributes, operand1, parameters	See <i>Text/Attribute Assignment</i> in the section <i>Output Format Definitions</i> .

### **List of Parameters**

Parameters that c	an be specified with the WRITE statement	Specification (S = at statement level, E = at element level)
AD	Attribute Definition	SE
AL	Alphanumeric Length for Output	SE
ВХ	Box Definition	SE
CD	Color Definition	SE
CV	Control Variable	SE
DF	Date Format	SE
DL	Display Length for Output	SE
DY	Dynamic Attributes	SE
EM	Edit Mask	SE
EMU	Unicode Edit Mask	E
FL	Floating Point Mantissa Length	SE
IS	Identical Suppress	SE
LS	Line Size	S
MC	Multiple-Value Field Count	S
MP	Maximum Number of Pages of a Report	S
NL	Numeric Length for Output	SE
PC	Periodic Group Count	S
PM	Print Mode	SE
PS	Page Size *	S
SG	Sign Position	SE
UC	Underlining Character	S
ZP	Zero Printing	SE

 $<sup>^{*}</sup>$  If the number of occurrences of an array exceeds the PS value, a NAT0303 error will be output.

The individual session parameters are described in the *Parameter Reference*.

See also the following topics in the *Programming Guide*:

- Centering of Column Headers HC Parameter
- Width of Column Headers HW Parameter
- Filler Characters for Headers Parameters FC and GC
- Underlining Character for Titles and Headers UC Parameter

### Example of Parameter Usage at Statement and Element (Field) Level

```
DEFINE DATA LOCAL
1 VARI (A4) INIT <'1234'>
                                                        Output
END-DEFINE
                                                 /*
                                                       Produced
                'Text'
                                  VARI
WRITE
                                                       Text 1234
                'Text'
                                                 /*
WRITE (PM=I)
                                  VARI
                                                       Text 4321
                                                 /*
WRITE
                'Text' (PM=I)
                                  VARI (PM=I)
                                                       txeT 4321
                'Text' (PM=I)
                                                 /*
WRITE
                                  VARI
                                                       txeT 1234
END
```

See also Example 5 - WRITE Statement Using '=' and Parameters on Statement/Element (Field) Level.

### **Output Format Definitions**

```
 \left\{ \begin{bmatrix} nX \\ nT \\ x/y \\ T*field-name \\ P*field-name \\ / \end{bmatrix} \right\} \begin{bmatrix} 'text' [(attributes)] \\ 'c' (n) [(attributes)] \\ ['='] operand1 [(parameters)] \end{bmatrix} \right\} ...
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

### **Field Positioning Notations**

Syntax Element	Description
nX	Column Spacing:
	This notation inserts $n$ spaces between columns. $n$ must not be zero.
	Example:

Syntax Element	Description
	WRITE NAME <b>5X</b> SALARY
	See also:
	■ Example 2 - WRITE Statement Using nX, nT Notation (below)
	■ Column Spacing - SF Parameter and nX Notation in the Programming Guide
nТ	Tab Setting:
	The $n$ <sup><math>\top</math></sup> notation causes positioning (tabulation) to print position $n$ . Backward positioning is not permitted.
	In the following example, NAME is printed beginning in position 25, and SALARY is printed beginning in position 50:
	WRITE 25T NAME 50T SALARY
	See also:
	■ Example 2 - WRITE Statement Using nX, nT Notation (below)
	■ Tab Setting - nT Notation in the Programming Guide
x/y	x/y Positioning:
	The $x/y$ notation causes the next element to be placed $x$ lines below the output of the last statement, beginning in column $y$ . $y$ must not be zero. Backward positioning in the same line is not permitted.
	See also <i>Positioning Notation</i> $x/y$ (in the <i>Programming Guide</i> ).
T*field-name	Field Related Positioning:
	The notation $T^*$ is used to position to a <i>specific print position of a field</i> used in a previous DISPLAY statement. Backward positioning is not permitted.
	See also:
	■ Example 3 - WRITE Statement Using T* Notation (below)
	■ Tab Notation - T*field (in the Programming Guide)
P*field-name	Field and Line Related Positioning:
	The notation P* is used to position to a <i>specific print position and line of a field</i> used in a previous DISPLAY statement. It is most often used in conjunction with vertical printing mode. Backward positioning is not permitted.
	See also:
	■ Example 4 - WRITE Statement Using P* Notation (below)
	■ Tab Notation P*field (in the Programming Guide)

Syntax Element	Description
'='	Field Content Positioned behind Field Heading:
	When placed before a field, the equal sign '=' results in the display of the field heading (as defined in the DEFINE DATA statement or in the DDM) followed by the field contents.
	See also:
	■ Example 1 - WRITE Statement Using '=', 'text', '/'
	■ Example 5 - WRITE Statement Using '=' and Statement/Element Parameters
/	Line Advance - Slash Notation:
	When placed between fields or text elements, a slash (/) causes positioning to the beginning of the next print line.
	Example:
	WRITE NAME / SALARY
	Multiple slash (/) notations may be used to cause multiple line advances.
	See also:
	■ Example 1 - WRITE Statement Using '=', 'text', '/' (below)
	Line Advance - Slash Notation (in the Programming Guide)
	Example 2 - Line Advance in WRITE Statement (in the Programming Guide)

# Text/Attribute Assignments

Syntax Element	Description
'text'	Text Assignment:
	The character string enclosed by single quotes is displayed.
	Example:
	WRITE 'EMPLOYEE' NAME 'MARITAL/STATUS' MAR-STAT
	See also:
	■ Example 1 - WRITE Statement Using '=', 'text', '/' (below)
	■ Text Notation, Defining a Text to Be Used with a Statement in the Programming Guide
'c'(n)	Character Repetition:
	The character enclosed by single quotes is displayed $n$ times immediately before the field value.

Syntax Element	Description
	For example:
	WRITE '*' (5) '=' NAME
	results in
	**** SMITH
	See also $Text$ Notation, Defining a Character to Be Displayed $n$ Times before a Field Value (in the Programming Guide).
attributes	Field Representation and Color Attributes:
	It is possible to assign various attributes for text/field display. These attributes and the syntax that may be used are described in the section <i>Output Attributes</i> below.
	Examples:
	WRITE 'TEXT' (BGR)
	WRITE 'TEXT' (B) WRITE 'TEXT' (BBLC)
operand1	Field to be Written:
operanai	
	operand1 specifies the field whose content is to be written in this place.
	Arrays with ranges that allow to vary the number of occurrences at execution time may not be specified.
	<b>Note:</b> For DL/I databases: The DL/I AIX fields can be displayed only if a PCB is used with
	the AIX specified in the parameter PROCSEQ. If not, an error message is returned by Natural at runtime.
parameters	Parameter Definition at Element (Field) Level:
	One or more parameters, enclosed within parentheses, may be specified at element (field) level, that is, immediately after <code>operand1</code> . Each parameter specified in this manner will override the corresponding parameter previously specified at statement level or in a <code>GLOBALS</code> command, <code>SET GLOBALS</code> (in Reporting Mode only) or <code>FORMAT</code> statement.
	If more than one parameter is specified, one or more blanks must be placed between each entry. An entry may not be split between two statement lines.
	See also:
	■ List of Parameters
	Example of Parameter Usage at Statement and Element (Field) Level

#### **Output Attributes**

attributes indicates the output attributes to be used for text display. Attributes can be:

```
AD=ad-value...

BX=bx-value...

CD=cd-value

PM=pm-value...

ad-value

cd-value

...
```

#### Where:

ad-value, bx-value, cd-value and pm-value denote the possible values of the corresponding session parameters AD, BX, CD and PM described in the relevant sections of the *Parameter Reference* documentation.

The compiler actually accepts more than one attribute value for an output field. For example, you can specify: AD=BDI. In such a case, however, only the last value applies. In the given example, only the value I becomes effective and the output field is displayed intensified.

For an alphanumeric/Unicode constant (Natural data format A or U), you can specify ad-value and/or cd-value without preceding CD= or AD=, respectively. The single value entered is then checked against all possible CD values first. For example: a value of IRE will be interpreted as intensified/red but not as intensified/right-justified/mandatory. You cannot combine a single cd-value or ad-value with a value preceded by CD= or AD=.

## Syntax 2 - Using Predefined Form/Map

```
WRITE [(rep)] [NOTITLE] [NOHDR] [USING] \left\{\begin{array}{c} FORM \\ MAP \end{array}\right\} operand1 [operand2...]
```

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Operand Definition Table:

Operand	Possible Structure					Possible Formats												Referencing Permitted	Dynamic Definition
operand1	C	S				A												no	no
operand2		S	A	G	N	A	U	N	Р	Ι	F	В	D	Т	L			yes	no

Syntax Element Description:

Syntax Element	Description
[USING] FORM [USING] MAP	Use of Predefined Form/Map Layout:
	This option may be used to indicate that a form/map layout previously defined with the map editor is to be used.
	A map layout used in a WRITE statement does not automatically create a new page each time the map is output.
	For the line spacing, the LS parameter setting must be 1 byte greater than the LS setting defined in the map.
operand1	Form/Map Name:
	operand1 is the name of the form/map to be used.
operand2	Field to be Written:
	operand2 is the name(s) of the field(s) to be written.
	If <i>operand1</i> is a constant and <i>operand2</i> is omitted, the fields are taken from the map source at compilation time.
	The fields must agree in number, sequence, format, length and (for arrays) number of occurrences with the fields in the referenced form/map; otherwise, an error occurs.
NOTITLE/NOHDR	Title Line/Column Header Suppression:
	NOTITLE and NOHDR are described under <i>Syntax 1</i> of the WRITE statement.

# **Examples**

- Example 1 WRITE Statement Using '=', 'text', '/'
- Example 2 WRITE Statement Using nX, nT Notation
- Example 3 WRITE Statement Using T\* Notation
- Example 4 WRITE Statement Using P\* Notation
- Example 5 WRITE Statement Using '=' and Parameters on Statement/Element (Field) Level

Example 6 - Report Specification with Output File Defined to Natural as PC

#### Example 1 - WRITE Statement Using '=', 'text', '/'

```
** Example 'WRTEX1': WRITE (with '=', 'text', '/')
***************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 FULL-NAME
   3 FIRST-NAME
   3 MIDDLE-I
   3 NAME
 2 CITY
 2 COUNTRY
END-DEFINE
LIMIT 1
READ EMPL-VIEW BY NAME
 WRITE NOTITLE
       '=' NAME '=' FIRST-NAME '=' MIDDLE-I //
       'L O C A T I O N' /
       'CITY: 'CITY
       'COUNTRY:' COUNTRY //
 /*
END-READ
END
```

#### **Output of Program WRTEX1:**

```
NAME: ABELLAN FIRST-NAME: KEPA MIDDLE-I:

L O C A T I O N
CITY: MADRID
COUNTRY: E
```

#### **Example 2 - WRITE Statement Using nX, nT Notation**

```
** Example 'WRTEX2': WRITE (with nX, nT notation)

*******************

DEFINE DATA LOCAL

1 EMPL-VIEW VIEW OF EMPLOYEES

2 NAME

2 JOB-TITLE

END-DEFINE

*

LIMIT 4

READ EMPL-VIEW BY NAME

WRITE NOTITLE 5X NAME 50T JOB-TITLE
```

```
END-READ
END
```

#### **Output of WRTEX2:**

ABELLAN	MAQUINISTA
ACHIESON	DATA BASE ADMINISTRATOR
ADAM	CHEF DE SERVICE
ADKINSON	PROGRAMMER

#### **Example 3 - WRITE Statement Using T\* Notation**

```
** Example 'WRTEX3': WRITE (with T* notation)
**********************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 CITY
 2 SALARY (1)
END-DEFINE
LIMIT 5
READ EMPL-VIEW BY CITY STARTING FROM 'ALBU'
 DISPLAY NOTITLE CITY NAME SALARY (1)
 AT BREAK CITY
   /*
   WRITE / 'CITY AVERAGE:' T*SALARY (1) AVER(SALARY(1)) //
 END-BREAK
END-READ
END
```

#### **Output of Program WRTEX3:**

CITY	NAME	ANNUAL SALARY
ALBUQUERQUE	HAMMOND	22000
ALBUQUERQUE	ROLLING	34000
ALBUQUERQUE	FREEMAN	34000
ALBUQUERQUE	LINCOLN	41000
CITY AVERAGE:		32750
ALFRETON	GOLDBERG	4800
CITY AVERAGE:		4800

### Example 4 - WRITE Statement Using P\* Notation

```
** Example 'WRTEX4': WRITE (with P* notation)
************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 CITY
 2 BIRTH
 2 SALARY (1)
END-DEFINE
LIMIT 3
READ EMPL-VIEW BY CITY FROM 'N'
 DISPLAY NOTITLE NAME CITY
        VERT AS 'BIRTH/SALARY' BIRTH (EM=YYYY-MM-DD) SALARY (1)
 SKIP 1
 AT BREAK CITY
   WRITE / 'CITY AVERAGE' P*SALARY (1) AVER(SALARY (1)) //
 END-BREAK
END-READ
END
```

#### **Output of Program WRTEX4:**

NAME	CITY	BIRTH SALARY
WILCOX	NASHVILLE	1970-01-01 38000
MORRISON	NASHVILLE	1949-07-10 36000
CITY AVERAGE		37000
BOYER	NEMOURS	1955-11-23 195900
CITY AVERAGE		195900

#### Example 5 - WRITE Statement Using '=' and Parameters on Statement/Element (Field) Level

#### **Output of Program WRTEX5:**

```
PERSONNEL ID: 60008339 NAME: ABELLAN TELEPHONE: 435-6726
PERSONNEL ID: 30000231 NAME: ACHIESON TELEPHONE: 523-341
```

#### Example 6 - Report Specification with Output File Defined to Natural as PC

```
** Example 'PCDIEX1': DISPLAY and WRITE to PC
** NOTE: Example requires that Natural Connection is installed.
**************************
DEFINE DATA LOCAL
01 PERS VIEW OF EMPLOYEES
 02 PERSONNEL-ID
 02 NAME
 02 CITY
END-DEFINE
FIND PERS WITH CITY = 'NEW YORK'
                                           /* Data selection
 WRITE (7) TITLE LEFT 'List of employees in New York' /
 DISPLAY (7)
                     /* (7) designates the output file (here the PC).
   'Location'
              CITY
   'Surname'
              NAME
   'ID'
              PERSONNEL-ID
END-FIND
END
```

# 147 WRITE TITLE

	Function	1140
	Restrictions	1141
	Syntax Description	
	Example	
_	LAGITIPIG	1170

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TRAILER

Belongs to Function Group: Creation of Output Reports

## **Function**

The WRITE TITLE statement is used to override the default page title with a page title of your own. It is executed whenever a new page is initiated.

See also the following sections in the *Programming Guide*:

- Report Format and Control
- Report Specification (rep) Notation
- Layout of an Output Page
- Page Titles, Page Breaks, Blank Lines
- Define Your Own Page Title WRITE TITLE Statement
- Text Notation

#### **Processing**

This statement is non-procedural, that is, its execution depends on an event, not on where in a program it is located.

If a report is produced by statements in different objects, the WRITE TITLE statement is only executed if it is contained in the same object as the statement that causes a new page to be initiated.

## **Restrictions**

- WRITE TITLE may be specified only once per report.
- WRITE TITLE cannot be specified within a special condition statement block.
- WRITE TITLE cannot be specified within a subroutine.

# **Syntax Description**

#### Operand Definition Table:

Operand	Po	ssib	le St	ruct	ure				Po:	SS	ible	F	orr	nat	ts		Referencing Permitted	Dynamic Definition		
operand1		S	A	G	N	A	U	N	Р	Ι	F	В	D	T	L		G	Ο	yes	no
operand2	C	S						N	Р	Ι		В							yes	no

#### Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	If multiple reports are to be produced, the notation ( $rep$ ) may be used to specify the identification of the report for which the WRITE TITLE statement is applicable.
	As report identification, a value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If ( $rep$ ) is not specified, the WRITE TITLE statement applies to the first report (Report 0).
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> (in the <i>Programming Guide</i> ).
LEFT JUSTIFIED	Page Title Justification and/or Underlining:

Syntax Element	Description
UNDERLINED	By default, page titles are centered and not underlined. LEFT JUSTIFIED and UNDERLINED may be specified to override these defaults.
	If UNDERLINED is specified, the underlining character (system default or specified with the session parameter UC (Underlining Character) in a FORMAT statement) is printed underneath the title and runs the width of the line size (see session parameter LS).
	Natural first applies all spacing or tab specifications and creates the line before centering the whole line. For example, a notation of $10 \text{ T}$ as the first element would cause the centered header to be positioned five positions to the right.
statement-parameters	Parameter Definition at Statement Level:
	One or more parameters, enclosed within parentheses, may be specified at statement level, that is, immediately after the WRITE TITLE statement. Each parameter specified in this manner will override the corresponding parameter previously specified in a GLOBALS command, SET GLOBALS (in Reporting Mode only) or FORMAT statement.
	If more than one parameter is specified, one or more blanks must be present between each entry. An entry may not be split between two statement lines.
	<b>Note:</b> The parameter settings applied here will only be regarded for variable
	fields, but they have no effect on text-constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element, see <i>Parameter Definition at Element (Field) Level</i> .
	For information on which parameters may be used, see <i>List of Parameters</i> (in the WRITE statement documentation).
nX	Format Notation and Spacing Elements:
nT x/y T*field-name P*field-name	See Format Notation and Spacing Elements (below).
'text'	Text/Attribute Assignment:
'c' (n) attributes	See Text/Attribute Assignments (below).
operand1	Field to Be Displayed in Title:
	operand1 represents the field(s) to be displayed within the title.
	Arrays with ranges that allow to vary the number of occurrences at execution time may not be specified.
parameters	Parameter Definition at Element (Field) Level:
	One or more parameters, enclosed within parentheses, may be specified at element (field) level, that is, immediately after <code>operand1</code> . Each parameter

Syntax Element	Description
	specified in this manner will override the corresponding parameter previously specified at statement level or in a GLOBALS command, SET GLOBALS (in Reporting Mode only) or FORMAT statement.
	If more than one parameter is specified, one or more blanks must be present between each entry. An entry may not be split between two statement lines.
	For information on which parameters may be used, see <i>List of Parameters</i> (in the WRITE statement documentation).
SKIP operand2 LINES	Lines to Be Skipped:
	SKIP may be used to cause lines to be skipped immediately after the title line. The number of lines to be skipped may be specified in <i>operand2</i> as a numeric constant or as the content of a numeric variable.
	<b>Note:</b> SKIP after WRITE TITLE is always interpreted as the SKIP clause of the
	WRITE TITLE statement, and not as an independent statement. If you wish an independent SKIP statement after a WRITE TITLE statement, use a semicolon (;) to separate the two statements from one another.

## **Format Notation and Spacing Elements**

Syntax Element	Description
nX	Column Spacing:
	This notation inserts $n$ spaces between columns. $n$ must not be zero.
nТ	Tab Setting:
	The $n$ <sup><math>\top</math></sup> notation causes positioning (tabulation) to print position $n$ . Backward positioning is not permitted.
x/y	x/y Positioning:
	Causes the next element to be placed <i>x</i> lines below the output of the last statement, beginning in column <i>y</i> . <i>y</i> must not be zero. Backward positioning in the same line is not permitted.
T*field-name	Field-Related Positioning:
	The <i>T*</i> notation causes positioning to a <i>specific print position of a field</i> used in a previous DISPLAY statement. Backward positioning is not permitted.
P*field-name	Field- and Line-Related Positioning:
	The <i>P*</i> notation causes positioning to a <i>specific print position and line of a field</i> used in a previous DISPLAY statement. It is most often used in conjunction with vertical printing mode. Backward positioning is not permitted.
/	Line Advance - Slash Notation:

Syntax Element	Description
	When placed between fields or text elements, a slash (/) causes positioning to the beginning of the next print line.

#### **Text/Attribute Assignments**

Description							
Text Assignment:							
The character string enclosed by single quotes is displayed.							
Character Repetition:							
The character enclosed by single quotes is displayed $n$ times immediately before the field value.							
Field Representation and Color Attributes:							
It is possible to assign various attributes for text/field display. These attributes and the syntax that may be used are described in the section <i>Output Attributes</i> below.							
Examples:							
WRITE TITLE 'TEXT' (BGR) WRITE TITLE 'TEXT' (B) WRITE TITLE 'TEXT' (BBLC)							

#### **Output Attributes**

attributes indicates the output attributes to be used for text display. Attributes can be:

```
AD=ad-value...
BX=bx-value...
CD=cd-value
PM=pm-value...
...

ad-value
cd-value
...
```

#### Where:

ad-value, bx-value, cd-value and pm-value denote the possible values of the corresponding session parameters AD, BX, CD and PM described in the relevant sections of the *Parameter Reference* documentation.

The compiler actually accepts more than one attribute value for an output field. For example, you can specify: AD=BDI. In such a case, however, only the last value applies. In the given example, only the value I becomes effective and the output field is displayed intensified.

For an alphanumeric/Unicode constant (Natural data format A or U), you can specify ad-value and/or cd-value without preceding CD= or AD=, respectively. The single value entered is then checked against all possible CD values first. For example: a value of IRE will be interpreted as intensifed/red but not as intensified/right-justified/mandatory. You cannot combine a single cd-value or ad-value with a value preceded by CD= or AD=.

## **Example**

```
** Example 'WTIEX1': WRITE (with TITLE option)
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 CITY
 2 JOB-TITLE
END-DEFINE
FORMAT LS=70
WRITE TITLE LEFT JUSTIFIED UNDERLINED
      *TIME 3X 'PEOPLE LIVING IN NEW YORK CITY'
     11X 'PAGE:' *PAGE-NUMBER
SKIP 1
FIND EMPL-VIEW WITH CITY = 'NEW YORK'
 DISPLAY NAME FIRST-NAME 3X JOB-TITLE
END-FIND
END
```

#### **Output of Program WTIEX1:**

```
09:33:16.5 PEOPLE LIVING IN NEW YORK CITY PAGE: 1

NAME FIRST-NAME CURRENT
POSITION

RUBIN SYLVIA SECRETARY
WALLACE MARY ANALYST
```

# 148 WRITE TRAILER

Function	1148
Restrictions	
Syntax Description	1149
Example	1153

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: AT END OF PAGE | AT TOP OF PAGE | CLOSE PRINTER | DEFINE PRINTER | DISPLAY | EJECT | FORMAT | NEWPAGE | PRINT | SKIP | SUSPEND IDENTICAL SUPPRESS | WRITE | WRITE TITLE

Belongs to Function Group: Creation of Output Reports

## **Function**

The WRITE TRAILER statement is used to output text or the contents of variables at the bottom of a page.

See also the following sections (in the *Programming Guide*):

- Report Format and Control
- Report Specification (rep) Notation
- Layout of an Output Page
- Page Trailer WRITE TRAILER Statement
- Text Notation

#### **Processing**

This statement is non-procedural, that is, its execution depends on an event, not on where in a program it is located.

This statement is executed when an end-of-page or end-of-data condition is detected, or when a SKIP or NEWPAGE statement causes a page advance. It is not executed as a result of an EJECT statement.

The end-of-page condition is checked only after the processing of an entire DISPLAY/WRITE statement. If a DISPLAY/WRITE statement produces multiple lines of output, overflow of the physical page may occur before the end-of-page condition is reached.

If a report is produced by statements in different objects, the WRITE TRAILER statement is only executed if it is contained in the same object as the statement that causes the end-of-page condition.

#### **Logical Page Size**

The logical page size (specified with the session parameter PS) should be less than the physical page size to ensure that the trailer information appears at the bottom of the same page.

### Restrictions

- WRITE TRAILER may be specified only once per report.
- WRITE TRAILER cannot be specified within a special condition statement block.
- WRITE TRAILER cannot be specified within a subroutine.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure				Possible Formats											Referencing Permitted	Dynamic Definition			
operand1		S	A	G	N	A	U	N	Р	Ι	F I	3	D	T	L		G	0	yes	no
operand2	С	S						N	Р	Ι	]	3							yes	no

Syntax Element Description:

Syntax Element	Description
(rep)	Report Specification:
	If multiple reports are to be produced, the notation ( $rep$ ) may be used to specify the identification of the report for which the WRITE TRAILER statement is applicable.
	As report identification, a value in the range 0 - 31 or a logical name which has been assigned using the DEFINE PRINTER statement may be specified.
	If ( rep) is not specified, the WRITE TRAILER statement applies to the first report (Report 0).

Syntax Element	Description
	For information on how to control the format of an output report created with Natural, see <i>Report Format and Control</i> (in the <i>Programming Guide</i> ).
LEFT JUSTIFIED	Title Justification and/or Underlining:
UNDERLINED	By default, the trailer lines are centered and not underlined.
	LEFT JUSTIFIED and UNDERLINED may be specified to override these defaults.
	If UNDERLINED is specified, the underlining character (either default or specified with the session parameter $UC$ ) is printed underneath the trailer and runs the width of the line size (session parameter $LS$ ).
	Natural first applies all spacing or tab specifications and creates the line before centering the whole line. For example, a notation of $10 \text{ T}$ as the first element would cause the centered header to be positioned five positions to the right.
statement-parameters	Parameter Definition at Statement Level:
	One or more parameters, enclosed within parentheses, may be specified at statement level, that is, immediately after the WRITE TRAILER statement. Each parameter specified in this manner will override the corresponding parameter previously specified in a GLOBALS command, SET GLOBALS (in Reporting Mode only) or FORMAT statement.
	If more than one parameter is specified, one or more blanks must be present between each entry. An entry may not be split between two statement lines.
	<b>Note:</b> The parameter settings applied here will only be regarded for variable
	fields, but they have no effect on text-constants. If you would like to set field attributes for a text-constant, they have to be set explicitly for this element, see <i>Parameter Definition at Element (Field) Level</i> .
	For information on which parameters may be used, see <i>List of Parameters</i> (in the WRITE statement documentation).
nX	Format Notation and Spacing Elements:
nT x/y T*field-name P*field-name	See Format Notation and Spacing Elements (below).
'text'	Text/Attribute Assignments:
'c'(n)	
attributes	See Text/Attribute Assignments (below).
operand1	Trailer Information:
	operand1 represents the field/fields to be output as trailer information.
	Arrays with ranges that allow to vary the number of occurrences at execution time may not be specified.

Syntax Element	Description
parameters	Parameter Definition at Element (Field) Level:
	One or more parameters, enclosed within parentheses, may be specified at element (field) level, that is, immediately after <code>operand1</code> . Each parameter specified in this manner will override the corresponding parameter previously specified at statement level or in a <code>GLOBALS</code> command, <code>SET GLOBALS</code> (in Reporting Mode only) or <code>FORMAT</code> statement.
	If more than one parameter is specified, one or more blanks must be present between each entry. An entry may not be split between two statement lines.
	For information on which parameters may be used, see <i>List of Parameters</i> in the WRITE statement documentation.
SKIP operand2 LINES	Lines to Be Skipped:
	SKIP may be used to cause lines to be skipped immediately after the trailer line. The number of lines to be skipped ( <i>operand2</i> ) may be specified as a numeric constant or as the content of a numeric variable.
	<b>Note:</b> SKIP after WRITE TRAILER is always interpreted as the SKIP clause of
	the WRITE TRAILER statement, and not as an independent statement. If you wish an independent SKIP statement after a WRITE TRAILER statement, use a semicolon (;) to separate the two statements from one another.

## Format Notation and Spacing Elements

Syntax Element	Description
nX	Column Spacing:
	This notation inserts $n$ spaces between columns. $n$ must not be zero.
nΤ	Tab Setting:
	The $n$ <sup><math>\top</math></sup> notation causes positioning (tabulation) to print position $n$ . Backward positioning is not permitted.
x/y	x/y Positioning:
	Causes the next element to be placed <i>x</i> lines below the output of the last statement, beginning in column <i>y</i> . <i>y</i> must not be zero. Backward positioning in the same line is not permitted.
T*field-name	Field-Related Positioning:
	The <i>T*</i> notation causes positioning to a <i>specific print position of a field</i> used in a previous DISPLAY statement. Backward positioning is not permitted.
P*field-name	Field- and Line-Related Positioning:

Syntax Element	Description
	The P* notation causes positioning to a <i>specific print position and line of a field</i> used in a previous DISPLAY statement. It is most often used in conjunction with vertical printing mode. Backward positioning is not permitted.
/	Line Advance - Slash Notation:
	When placed between fields or text elements, a slash (/) causes positioning to the beginning of the next print line.

#### **Text/Attribute Assignments**

Syntax Element	Description							
'text'	Text Assignment:							
	The character string enclosed by single quotes is displayed.							
'c'(n)	Character Repetition:							
	The character enclosed by single quotes is displayed $n$ times immediately before the field value.							
attributes	Field Representation and Color Attributes:							
	It is possible to assign various attributes for text/field display. These attributes and the syntax that may be used are described in the section <i>Output Attributes</i> below.							
	Examples:							
	WRITE TRAILER 'TEXT' (BGR) WRITE TRAILER 'TEXT' (B) WRITE TRAILER 'TEXT' (BBLC)							

#### **Output Attributes**

attributes indicates the output attributes to be used for text display. Attributes can be:

```
AD=ad-value...

BX=bx-value...

CD=cd-value

PM=pm-value...

ad-value

cd-value

}...
```

#### Where:

ad-value, bx-value, cd-value and pm-value denote the possible values of the corresponding session parameters AD, BX, CD and PM described in the relevant sections of the *Parameter Reference* documentation.

The compiler actually accepts more than one attribute value for an output field. For example, you can specify: AD=BDI. In such a case, however, only the last value applies. In the given example, only the value I becomes effective and the output field is displayed intensified.

For an alphanumeric/Unicode constant (Natural data format A or U), you can specify ad-value and/or cd-value without preceding CD= or AD=, respectively. The single value entered is then checked against all possible CD values first. For example: a value of IRE will be interpreted as intensifed/red but not as intensified/right-justified/mandatory. You cannot combine a single cd-value or ad-value with a value preceded by CD= or AD=.

## **Example**

```
** Example 'WTLEX1': WRITE (with TRAILER option)
************************
DEFINE DATA LOCAL
1 EMPL-VIEW VIEW OF EMPLOYEES
 2 NAME
 2 FIRST-NAME
 2 CITY
 2 JOB-TITLE
END-DEFINE
FORMAT PS=15
WRITE TITLE LEFT JUSTIFIED UNDERLINED
     *TIME 3X 'PEOPLE LIVING IN BARCELONA'
     14X 'PAGE:' *PAGE-NUMBER
SKIP 1
WRITE TRAILER LEFT JUSTIFIED UNDERLINED
     / 'CITY OF BARCELONA REGISTER'
LIMIT 10
FIND EMPL-VIEW WITH CITY = 'BARCELONA'
 DISPLAY NAME FIRST-NAME 3X JOB-TITLE
END-FIND
END
```

#### **Output of Program WTLEX1 - Page 1:**

```
09:36:09.5 PEOPLE LIVING IN BARCELONA PAGE: 1

NAME FIRST-NAME CURRENT
POSITION

DEL CASTILLO ANGEL EJECUTIVO DE VENTAS
```

GARCIA	M. DE LAS MERCEDES	SECRETARIA
GARCIA	ENDIKA	DIRECTOR TECNICO
MARTIN	ASUNCION	SECRETARIA
MARTINEZ	TERESA	SECRETARIA
YNCLAN	FELIPE	ADMINISTRADOR
FERNANDEZ	ELOY	OFICINISTA
TORRES	ANTONI	OBRERA
CITY OF BARCELONA RE	GISTER	

## Output of Program WTLEX1 - Page 2:

09:37:26.0	PEOPLE LIVING IN BARCELONA	PAGE: 2
NAME	FIRST-NAME	CURRENT POSITION
RODRIGUEZ GARCIA	VICTORIA GERARDO	SECRETARIA INGENIERO DE PRODUCCION
CITY OF BARCE	LONA REGISTER	

# 149 WRITE WORK FILE

■ Function	1156
Syntax Description	
External Representation of Fields	
Handling of Large and Dynamic Variables	
■ Example	

WRITE WORK[FILE] work-file-number [VARIABLE] operand1 ...

For an explanation of the symbols used in the syntax diagram, see *Syntax Symbols*.

Related Statements: DEFINE WORK FILE | READ WORK FILE | CLOSE WORK FILE | DOWNLOAD PC FILE

Belongs to Function Group: Control of Work Files / PC Files

### **Function**

The WRITE WORK FILE statement is used to write records to a physical sequential work file.

This statement can only be used within a program to be executed under Com-plete, CICS, TSO or TIAM, or in batch mode. Appropriate JCL or system commands must be executed to allocate the work file. For further information, see the *Operations* documentation. For information on work file assignments, see profile parameter WORK in the *Parameter Reference*.

It is possible to create a work file in one program or processing loop and to read the same file in a subsequent independent processing loop or in a subsequent program using the READ WORK FILE statement.

**Note:** For Unicode and code page support, see *Work Files and Print Files on Mainframe Platforms* in the *Unicode and Code Page Support* documentation.

## **Syntax Description**

Operand Definition Table:

Operand	Possible Structure			Possible Formats										Referencing Permitted	Dynamic Definition			
operand1	C	S	A	G	N	ΑĮ	JN	J	? I	F	В	D	T	L	C	G	yes	no

**Note:** Neither Format C nor Format G is valid for Natural Connection.

Syntax Element Description:

Syntax Element	Description
work-file-number	Work File Number:
	The work file number (as defined to Natural) to be used.
VARIABLE	Variable Entry:
	It is possible to write records with different fields to the same work file with different WRITE WORK FILE statements. In this case, the VARIABLE entry must be specified in all WRITE WORK FILE statements. The records on the external file will be written in variable format. Natural will write all output files as variable-blocked (unless you specify a record format and block size in the execution JCL).
	When the operand list includes a dynamic variable (that could change in size for different executions of the WRITE WORK FILE statement), the VARIABLE entry must be specified in all WRITE WORK FILE statements.
	Variable Index Range:
	When writing an array to a work file, you can specify a variable index range for the array. For example:
	WRITE WORK FILE work-file-number VARIABLE #ARRAY (I:J)
operand1	Fields to Be Written:
	With <code>operand1</code> you specify the fields to be written to the work file. These fields may be database fields, user-defined variables, system variables and/or fields read from another work file using the <code>READ WORK FILE</code> statement.
	An array may be referenced completely or partially to select the occurrences that are to be written to the work file.
	Group Operands to be Written:
	A group may be referenced using the group name. All fields belonging to the referenced group will be written to the work file, the sequence is determined by the sequence of the fields in the group. Fields resulting from a redefinition of the referenced group are <i>not</i> written to the work file. If the referenced group is defined as an array, the individual fields of the group are written to the work file as arrays in the definition sequence.
	For the group definition

Syntax Element	Description						
	1 GROUP1 (1:3) 2 FIELD1 (A2) 2 FIELD2 (A3) 1 REDEFINE GROUP1 2 FIELD3 (A15)						
	the statement						
	WRITE WORK FILE 1 GROUP1(*)						
	is equivalent to						
	WRITE WORK FILE 1 GROUP1.FIELD1(*) GROUP1.FIELD2(*)						
	The statement						
	WRITE WORK FILE 1 GROUP1.FIELD3						
	is equivalent to						
	WRITE WORK FILE 1 GROUP1.FIELD1(1) GROUP1.FIELD2(1)  GROUP1.FIELD1(2) GROUP1.FIELD2(2)  GROUP1.FIELD1(3) GROUP1.FIELD2(3)						

## **External Representation of Fields**

Fields written with a WRITE WORK FILE statement are represented in the external file according to their internal definition. No editing is performed on the field values.

For fields of format A and B, the number of bytes in the external file is the same as the internal length definition as defined in the Natural program. No editing is performed and a decimal point is not represented in the value.

For fields of format N, the number of bytes on the external file is the sum of internal positions before and after the decimal point. The decimal point is not represented on the external file.

For fields of format P, the number of bytes on the external file is the sum of positions before and after the decimal point, plus 1 for the sign, divided by 2, rounded upward to a full byte.

**Note**: No format conversion is performed for fields that are written to a work file.

Examples of field representations:

Field Defin	ition	Output Record
#FIELD1	(A10)	10 bytes
#FIELD2	(B15)	15 bytes
#FIELD3	(N1.3)	4 bytes
#FIELD4	(NO.7)	7 bytes
#FIELD5	(P1.2)	2 bytes
#FIELD6	(P6.0)	4 bytes

Special Considerations for System Functions

#### **Special Considerations for System Functions**

For the special considerations that apply when WRITE WORK FILE is used for the Natural system function AVER, NAVER, SUM or TOTAL, see *Format/Length Requirements for AVER, NAVER, SUM and TOTAL* in the *System Functions* documentation.

## **Handling of Large and Dynamic Variables**

Work File Type	Handling
	Work file type UNFORMATTED can be used to write variables whose size exceeds the maximum record length. See also <i>Work File Access With Large and Dynamic Variables</i> .
FORMATTED	A dynamic variable is written in its currently defined length (including length 0).

## **Example**

```
** Example 'WWFEX1': WRITE WORK FILE

*************************

DEFINE DATA LOCAL

1 EMPLOY-VIEW VIEW OF EMPLOYEES

2 PERSONNEL-ID

2 NAME

END-DEFINE

*

FIND EMPLOY-VIEW WITH CITY = 'LONDON'

WRITE WORK FILE 1

PERSONNEL-ID NAME

END-FIND

*

END
```

# Index

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