

# Natural

## Natural Connection

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This document applies to Natural Version 9.2.3 and all subsequent releases.

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

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Natural Connection provides an access method required for transferring data, reports, Natural objects and sources from a Natural mainframe computer to a PC.

The prerequisite for the use of Natural Connection is Entire Connection. For information on Entire Connection, refer to the relevant documentation.

This documentation is organized under the following headings:

<b>Main Functionality</b>	Describes the main functionality that is relevant for the mainframe.
<b>Preparing to Use Natural Connection</b>	Describes the tasks that must be accomplished to allow download and upload.
<b>Natural Statements</b>	Describes the Natural statements that are relevant for processing information between the mainframe and the PC by using Natural Connection.
<b>Processing Work Files</b>	Describes restrictions on the use of work file attributes, the support of work file formats and the impact of READ loops.



**Note:** See also *Installing Natural Connection* in the *Installation for z/OS* documentation.

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# 1

## About this Documentation

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## Document Conventions

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Convention	Description
<b>Bold</b>	Identifies elements on a screen.
Monospace font	Identifies service names and locations in the format <i>folder.subfolder.service</i> , APIs, Java classes, methods, properties.
<i>Italic</i>	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.
	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 (...).

## Online Information and Support

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### Product Documentation

You can find the product documentation on our documentation website at <https://documentation.softwareag.com>.

### Product Training

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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 <https://github.com/softwareag> and <https://hub.docker.com/publishers/softwareag> and discover additional Software GmbH resources.

## Product Support

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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

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Software AG 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.



## 2 Main Functionality

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This chapter describes the main functionality provided by Natural Connection that is relevant for the mainframe.

For details regarding the features of the PC component, see the Entire Connection documentation.

## Interactive Data Transfer

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Data can be downloaded to and uploaded from the PC directly to/from an online program.

Data transfer and conversion to many formats (for example, Lotus 1-2-3, dBASE, ASCII, HTML, XML, Basic, DIF, Binary) is performed in one step. Sophisticated compression techniques are used.

## Integration

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Using Natural Connection, you can create integrated applications that use both mainframe and PC resources.

For example, Super Natural creates files that you can then further process on the PC. Connect uses Natural Connection to exchange documents with the PC. In this way, graphics, spreadsheets, or binary data can be distributed to other users.

Mainframe applications can use PC printers.

## Security

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A key consideration for any information network is effective security and control. Natural Security on the mainframe provides comprehensive control facilities.

Detailed security profiles are assigned on a user-by-user basis to control access to data and programs.

Other significant objects secured are the individual keywords in the Natural syntax. This can restrict some users, for example, to retrieving data from mainframe databases, while others have the full capability for retrieval and update of mainframe data.

Natural Security also protects against excessive use of system resources by individual users. This is vital when PC users may be employing powerful mainframe features for the first time.

As an additional safeguard, Natural Connection can also encrypt all data downloaded from Natural.

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## Preparing to Use Natural Connection

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This chapter describes the tasks that must be accomplished to allow download and upload.

In order to download and upload data, a work file must be designated as a PC file.

To download reports, a printer must be designated as a PC printer.

## Displaying Work File and Printer Settings

To display your current work file and printer settings, enter the Natural system command `SYSTP` at the `NEXT` prompt. This invokes the `SYSTP` utility and a screen similar to the following appears:

```
11:07:18          ***** NATURAL SYSTP UTILITY *****          2005-06-16
User SAG              - Work File Information -              TID DAEFTCI7

M No.   Type      Name      Recfm  Lrecl  Blksz  Status
-----
  1  COMPLETE  CMWKF01      VB           4628  Available for Input/Output
  2  COMPLETE  CMWKF02      VB           4628  Available for Input/Output
  3  COMPLETE  CMWKF03      VB           4628  Available for Input/Output
  4  COMPLETE  CMWKF04      VB           4628  Available for Input/Output
  5   PC              VB           4628  Available for Input/Output
  6   PC              VB           4628  Available for Input/Output
  7   PC              VB           4628  Available for Input/Output

Top of List
Command ==>
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10---PF11---PF12---
Cont Help Menu Exit Sel Pos -- - + ++ Print Work Canc
```

The standard PC files are work files 5, 6 and 7 as shown in the example above. For more information, see *SYSTP Utility* in the *Utilities* documentation.

## Defining Work Files and Printers

You can define work files and printers statically in your Natural parameter module, or dynamically when invoking Natural:

### ■ Work Files

Use the `NTWORK` macro or `WORK` parameter for work file definitions.

### ■ Printers

Use the `NTPRINT` macro or `PRINT` parameter for printer definitions.

For detailed information on these macros and parameters, see the *Parameter Reference*.

Remember, however, that the download and upload modules provided by Natural Connection use work file 7. For further information on transferring Natural objects, see *Data Transfer* which is part of the *Terminal Emulation* section of the Entire Connection documentation.

## Activating the PC Connection

To upload and download data to/from a PC, the PC connection must be active. You activate the PC connection from the mainframe.

### ➤ To activate the PC connection

- Use the Natural terminal command `%+`.

Or:

Invoke Natural with the dynamic parameter `PC=ON`.

Or:

Use the `SET CONTROL '+'` statement in a Natural program.

With the terminal command `%+`, you can also set an additional option:

Option	Description
<code>%+N</code>	The PC connection is activated. In addition, no field names are sent when downloading or uploading data.

If you attempt to upload or download data without the PC connection being activated, a message appears indicating that the PC connection is not active.

If you enter %+ and the PC connection is already active, a message appears indicating that the PC connection is already active.

## Deactivating the PC Connection

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### ➤ To deactivate the PC connection

- Use the Natural terminal command %-.

Or:

Use the SET CONTROL ' - ' statement in a Natural program.



## 4 Natural Statements

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This chapter lists the Natural statements required to process information between the mainframe and the PC by using Natural Connection.

For detailed information on these statements, refer to the relevant sections in the *Statements* documentation.

The Natural statements that apply to Natural Connection can be divided into the following groups:

Group	Statement
Transfer Data	DOWNLOAD PC FILE (synonym for WRITE WORK FILE)
	UPLOAD PC FILE (synonym for READ WORK FILE)
Download Reports	DISPLAY
	PRINT
	WRITE
Close a PC File	CLOSE PC FILE (synonym for CLOSE WORK FILE)



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## Processing Work Files and Nested Loops

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This chapter describes restrictions on the use of work file attributes, the support of work file formats and the impact of READ loops.

## Work File Format and Attributes

---

Below are the restrictions that apply to the use of work file attributes:

- Accessing PC work files is restricted to a fixed record length of 1073741823 bytes or 32767 bytes when using the statement `WRITE WORK FILE VARIABLE`. Depending on the Entire Connection version installed on the PC, additional restrictions may apply as described below.
- Natural Connection does not support work files of the type `UNFORMATTED`. A work file is always transferred in formatted mode and contains record-oriented data only. When a work file of the type `UNFORMATTED` is opened, Natural Connection switches to the type `FORMATTED` and executes any `WRITE WORK FILE` statement with the option `VARIABLE`. To transfer byte-streamed data, see [Streaming](#) below.

## Maximum File Transfer Record Length for Natural Connection

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The maximum record length supported for file transfer depends on the version of Entire Connection installed on the PC.

For Entire Connection up to Version 4.2, the maximum record length is limited by the number of bytes that can be displayed on the appropriate 3270 model. For example, for a 3270 Model 2 device the record length is  $24 \times 80 = 1920$  bytes. Since all data buffers are enclosed by a header and trailer, the resulting net record length is 1887 bytes.

For Entire Connection Version 4.3.1, the maximum record length is limited to 32 KB - 1 byte = 32767 bytes.

As of Entire Connection Version 4.3.2 Fix Level 1 and Entire Screen Builder Version 5.2.1, the maximum record length is increased to 1 GB - 1 byte = 1073741823 bytes. But writing work files in variable format (`WRITE WORK VARIABLE`) is still restricted to a maximum record length of 32 KB - 1 byte.

## Streaming

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Entire Connection provides the option to transfer byte-streamed data that are non-record-oriented. A byte-streamed data transfer is activated when a `READ WORK FILE` or `WRITE WORK FILE` statement is coded with only one single operand of binary format.

### Downloading and Uploading Binary Data

Binary data is usually object code or executable code that does not contain displayable or printable characters. To prevent standard character translations being performed during data transfer, Natural and Entire Connection use special methods for transferring binary data.

#### ➤ To download binary data

- 1 Define a binary variable.
- 2 If the last block of downloaded data contains less data than the block size chosen, insert `X'FF'` at the position that marks the end of the binary data. (If you omit `X'FF'`, the rest of the last block will be filled with `X00`.)

#### ➤ To upload binary data

- 1 Define a binary variable.
- 2 Remove `X'FF` from the last block. `X'FF` marks the end of the binary data.

## Dynamic Variables in READ WORK FILE

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If you define a dynamic variable of the format binary or alphanumeric as operand of a `READ WORK FILE` statement, when processing the corresponding `READ` loop, any resize operation on this variable will only be valid until the next `READ` is performed. While processing the `READ`, Natural resizes all dynamic variables to the size they had when the work file was opened. This is required in the open process which determines the record layout. The record layout is mandatory for processing the corresponding work file. The record layout is valid until the next close of the work file occurs.

Exception: An internal resize cannot be performed for inner loops if nested `READ` loops are processed on the same work file. See also the programming recommendations about nested loops below. If a dynamic variable of size 0 is used as the only operand of a `READ WORK FILE` statement, Natural issues the error NAT1500.

## Nested READ Loops

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Do not specify nested `READ` loops on one work file. The result of the inner loop(s) can be unpredictable if the operands of the inner loop do not correspond to the operands of the outer loop. The reason is that all records uploaded from the PC are processed in the format that was determined when the work file was opened in the outermost loop.

Below are example programs that demonstrate the unpredictable results the inner loop(s) of nested `READ` loops can have:

- [Example of Inner READ Loop](#)
- [Example of READ Loop and CALLNAT](#)

### Example of Inner READ Loop

In the example program `PCNESTED`, during `READ` processing, another `READ` is performed:

```
/* PCNESTED
/*
DEFINE DATA LOCAL
  1 #REC1    (A) DYNAMIC
  1 #NUMBER (N10)
END-DEFINE
*
MOVE ALL 'TEST RECORD 1' TO #REC1 UNTIL 100
READ WORK FILE 1 #REC1
  READ WORK FILE 1 #NUMBER
  DISPLAY #NUMBER
END-WORK
END-WORK
END
```

### Example of READ Loop and CALLNAT

In the example program `PCMAIN` and subprogram `PCRSUB01`, during `READ` loop processing, an external object is called:

```
/* PCMAIN
/*
DEFINE DATA
LOCAL
  1 RECL (A2000)
  1 REDEFINE RECL
    2 RECNR (N4)
  1 CO    (N4)
END-DEFINE
```

```

*
WRITE WORK 1 COMMAND
  'SET PCFILE 2 UP DATA C:/TSTPCAM/PCMAIN.TXT'
READ WORK 2 RECL
  DISPLAY RECL (AL=72)
  CALLNAT 'PCRSUB01' RECL
END-WORK
END

```

**Subprogram PCRSUB01:**

```

/*Subprogram PCRSUB01
/*
DEFINE DATA
PARAMETER
  1 RECL (A2000)
LOCAL
  1 #CC1 (A20)
  1 #CC2 (N4)
*
END-DEFINE
READ WORK 2 RECL
  #CC1 #CC2
  DISPLAY #CC1 #CC2
END-WORK
END

```

## Subsequent READ Loops

If a READ loop is terminated by a conditional `ESCAPE`, close the work file explicitly with the `CLOSE WORK FILE` statement so that the same work file can be processed in a subsequent READ in the same object.

Exception: You can omit the `CLOSE WORK FILE` if you need not read the file again from the beginning, and if the subsequent READ uses the same record layout as the preceding one.

Below is an example that demonstrates how to correctly code a program with two READ loops on one work file.

## Example of Loop with ESCAPE and CLOSE

In the example program PCESCAPE, the work file is explicitly closed after the first READ loop has been terminated by ESCAPE BOTTOM so that the second READ loop must reopen the work file:

```
/*PCESCAPE
/*
DEFINE DATA
LOCAL
  1 #CC1          (A20)
  1 #CC2          (A40)
  1 #COUNTER      (I2)
*
END-DEFINE
READ WORK 2 #CC1
  DISPLAY #CC2
  ADD 1 TO #COUNTER
  IF #COUNTER GE 3
    ESCAPE BOTTOM
  END-IF
END-WORK
CLOSE WORK FILE 2
*
READ WORK 2 #CC2
  DISPLAY #CC2
END-WORK
END
```

## Buffer Allocation for Large Upload Records

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If Natural Connection uploads a record that is larger than one physical block, Natural Connection collects all blocks that belong to the record in the appropriate work file area. The record will then be decompressed and passed to the Natural data area.

The total space allocated by all temporary buffers is up to 3 times the size of the record to be uploaded.

### Example Statement

```
READ WORK FILE 1 #var
```

where 1 is the number of the work file and #var a variable of the format B 10000. In this case, the temporary Natural work area requires approximately 30000 bytes.



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