

# **Natural**

## **TP Monitor Interfaces**

Version 8.2.7

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This document applies to Natural Version 8.2.7 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 provides interfaces that allow the Natural nucleus to access a TP monitor for online transaction processing and an operating system (OS) for batch processing.

For general information, see also the section *TP/OS Interface* in the *Natural System Architecture* documentation.

This documentation provides detailed information on the operation of Natural with the supported TP monitor systems.

<b>Using Natural with TP Monitors</b>	Provides general information on the usage of Natural with TP Monitors.
<b>Natural under CICS</b>	Describes the functionality of Natural CICS Interface and the operation and individual components of Natural in a CICS environment.
<b>Natural under CICS - Natural CICS Interface Version 8.3 for z/OS</b>	Describes the functionality of Natural CICS Interface Version 8.3 for z/OS and the operation and individual components of Natural in a CICS environment.
<b>Natural under Com-plete/SMARTS</b>	Describes how to operate Natural in a Com-plete/SMARTS environment.
<b>Natural under IMS TM</b>	Describes how to run Natural under IMS TM.
<b>Natural under TSO</b>	Comprises general information about the Natural TSO Interface and data sets.
<b>Natural under TIAM</b>	Describes how to run Natural under TIAM.
<b>Natural under openUTM</b>	Describes how to run Natural under <i>openUTM</i> .

### **Notation** *vrs* or *vr*

When used in this documentation, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

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# I Using Natural with TP Monitors

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# 1 Using Natural with TP Monitors

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- TP Monitor Systems Supported by Natural ..... 4
- Using Natural in a Teleprocessing Environment ..... 4

## TP Monitor Systems Supported by Natural

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Natural supports the following teleprocessing monitor systems:

TP Monitor	Operating System or Environment
CICS	z/OS, z/VSE
Com-plete	z/OS, z/VSE
IMS TM	z/OS
TSO	z/OS
TIAM	BS2000
openUTM	BS2000

For information on using Natural with a specific TP monitor, refer to the TP monitor interface descriptions in this documentation.

## Using Natural in a Teleprocessing Environment

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This section covers the following topics:

- [Embedding Natural in a TP Environment](#)
- [Relevant Natural Profile Parameters](#)
- [Calling Natural Transactions under a TP Monitor](#)
- [Monitoring and Controlling TP-Monitor-Specific Natural Characteristics](#)
- [Terminating a Natural Session](#)
- [Example Programs](#)

### Embedding Natural in a TP Environment

In a teleprocessing monitor environment, Natural operates as a standard TP program and follows the rules that apply to programs executing under the control of this TP monitor.

As the Natural code is fully reentrant, it is shared between all Natural users and only a work area exists on an individual per-user basis (and only for the duration of this user's Natural session).

Natural user programs (transactions) can be executed together with native TP programs to form an integrated system comprising both Natural and conventional programs.

## Relevant Natural Profile Parameters

There are various Natural profile parameters that apply if Natural is used with a TP monitor.

For an overview of these parameters, see *TP Monitor Interfaces in Profile Parameters Grouped by Category* in the *Natural Parameter Reference* documentation .

## Calling Natural Transactions under a TP Monitor

The Natural transactions can be called by invoking the TP program called Natural and supplying the system command `LOGON` and the name of the Natural transaction to be executed in the stack.

Multiple commands/transactions and input data for the commands/transactions can be passed using the stack when calling Natural.

## Monitoring and Controlling TP-Monitor-Specific Natural Characteristics

The Natural utility `SYSTP` provides various functions which can be used to monitor and control characteristics of Natural that are specific to TP monitors.

`SYSTP` is available under the TP monitors Com-plete, CICS, IMS TM, TSO, TIAM and *openUTM*.

For further information, see *SYSTP Utility*.

## Terminating a Natural Session

The Natural session can be terminated by executing the Natural statement `TERMINATE` or the system command `FIN`.

## Example Programs

The Natural library `SYSEXTP` contains several example programs for specific functions that apply only under certain TP monitors.

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# II Natural under CICS

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This document describes the functionality of the Natural CICS Interface (product code NCI) and the operation and individual components of Natural in a CICS environment.

[Natural CICS Interface Functionality](#)

[Natural CICS Generation Parameters](#)

[Customizing VSAM RRDS Roll Files](#)

[Natural in CICS MRO Environments](#)

[CICS Node Error Program Considerations for Natural](#)

[CICS 3270 Bridge Support](#)

[Natural CICS Interface Threadsafe Considerations](#)

[Natural CICS Interface Support for CICS Channels and Containers](#)

[Natural CICS Interface and IBM Language Environment \(LE\)](#)

[Special Natural CICS Functionality](#)

[Natural CICS Sample Programs](#)

[Invoking Natural from User Programs](#)

[Asynchronous Natural Processing under CICS](#)

[Logging Natural Sessions under CICS](#)

[Natural CICS Performance Considerations](#)

[Natural Print and Work Files Under CICS](#)

## References to CICS Tables

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

**Notation** *vrs* or *vr*

When used in this document, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

**Related Documents:**

- *Installing Natural CICS Interface Version on z/OS* in the *Natural Installation* documentation
- *Installing Natural CICS Interface on z/VSE* in the *Natural Installation* documentation
- *Natural under CICS Abend Codes and Error Messages, Natural under CICS Informational Messages and NCISCPRI Warnings and Error Messages* in the *Natural Messages and Codes* documentation
- *Error Messages from the Natural Swap Pool Manager Valid under CICS and openUTM* in the *Natural Messages and Codes* documentation
- SYSTP - this Natural utility provides various TP-monitor-specific functions
- *Natural as a Server under CICS*

## 2 Natural CICS Interface Functionality

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This chapter describes the functionality of the Natural CICS Interface.

## Natural CICS Interface

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The Natural CICS Interface is implemented in command level Assembler, thus allowing Natural to be compatible with the CICS Multiple Region Option and the debugging facility CEDF.

The Natural CICS Interface controls session initialization, roll-in restart (in pseudo-conversational mode), terminal I/O, database access, ABEND processing, Natural local buffer pool calls and the loading, linking to and releasing of external subroutines. In addition, all roll I/O operations are made from the Natural CICS Interface.

## Natural Nucleus under CICS

---

The Natural nucleus is a combination of the reentrant Natural module and various support routines, which are delivered as source programs requiring site-dependent assemblies and as load modules.

The CICS-related components of the Natural nucleus are:

- the Natural CICS Interface module `NCISTART`

This is the entry routine, which in particular prepares the Natural CICS Interface Language Environment (LE) linkage; see [Natural CICS Interface and IBM Language Environment \(LE\)](#). The module is CICS version dependent.

- the Natural CICS Interface module `NCIROOT`

This module holds all CICS related logic as CICS services and CICS control block access. The module is CICS version dependent.

- the Natural CICS parameter module `NCIPARM`

This module holds Natural CICS Interface runtime and system environment generation options. The module is not CICS version dependent, although some of the parameters should be set depending on the CICS version.

- the Natural CICS Interface object-only part `NCINUC`

This module holds service routines called by the Natural nucleus and Natural CICS Interface system control logic. These routines are independent of CICS and CICS version and are dealing with CICS by calling CICS service routines in `NCIROOT` and `NCISTART`.

- the Natural CICS Interface module `NCIXCALL`

This module is a separate program in CICS, that is, it is not linked to the Natural nucleus, as it is invoked via EXEC CICS LINK from 3GL programs called by Natural; see *Natural 3GL CALLNAT Interface* in the *Operations* documentation. The module is CICS version dependent.

## System Control under CICS

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Natural features specific to CICS include the organization of dynamic storage in threads and the additional capability of handling these threads so that the Natural CICS System Control Program can more efficiently handle dynamic storage.

The Natural CICS System Control Program was initially developed to overcome the 64 KB GET-MAIN limit under CICS. It provides complete storage allocation and management functions, including roll file I/O operations and relocation functions for pseudo-conversational users.

In order to enhance the pseudo-conversational processing capabilities of Natural with CICS, the System Control Program uses threads, a contiguous amount of storage which is set up for each user. This structure allows Natural to manage dynamic storage with minimal CICS involvement.

A complete understanding of system control can be attained from the following discussion of its structure and operation. Ensure that you understand this mechanism before starting the installation procedure of Natural under CICS.

## OSCOR/GETVIS - Natural Components in CICS Dynamic or Operating System Storage

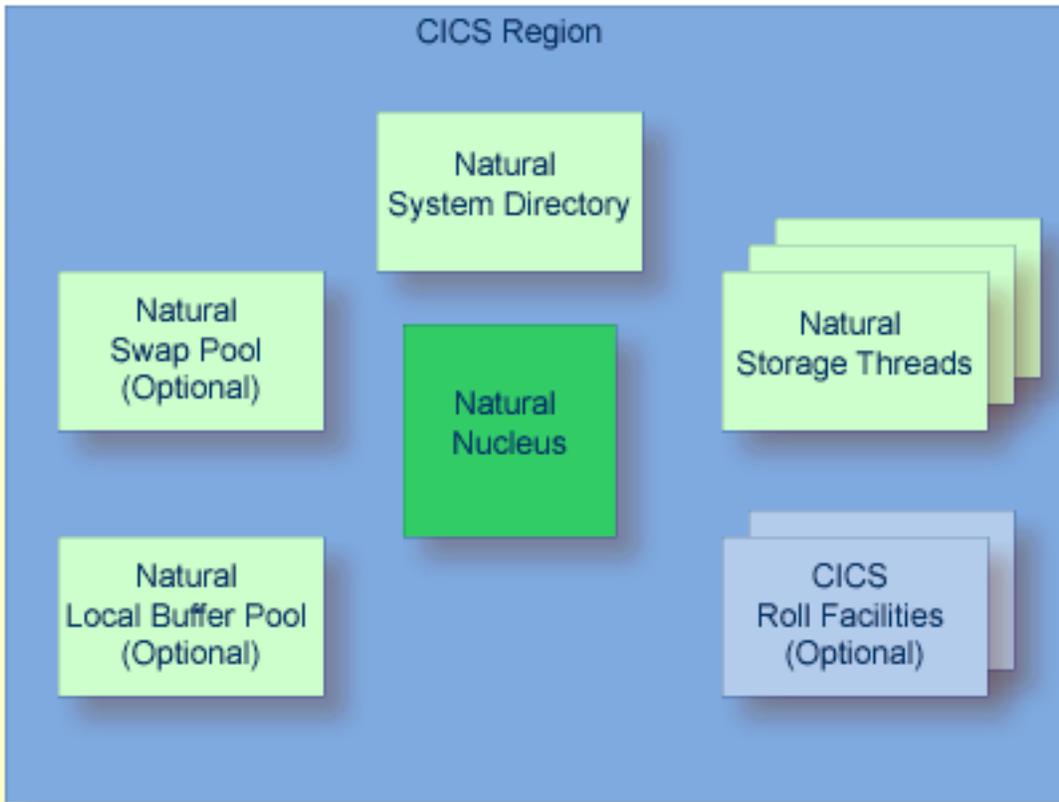
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### Scenario 1:

Single CICS Region

The diagram below shows the components of the Natural system that reside in CICS dynamic storage. The components are explained under the following headings:

- *Natural Storage Threads under CICS*
- *Natural Local Buffer Pool under CICS*
- *Natural Swap Pool under CICS*
- *Natural Roll Facilities*

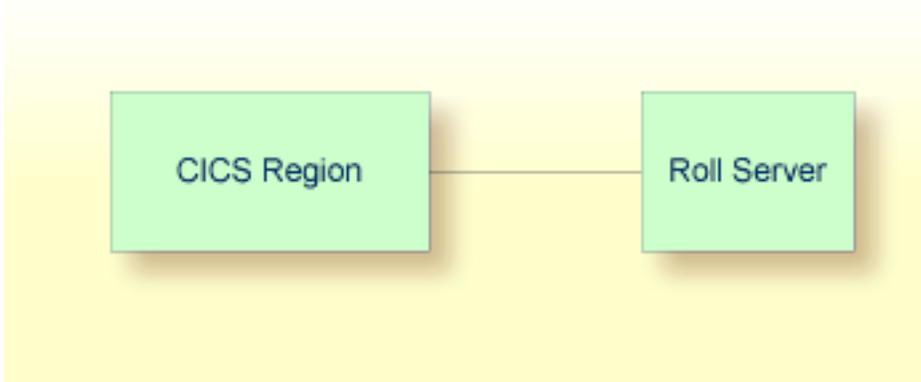


Scenario 1 applies when running Natural locally in a single CICS application region under z/OS or z/VSE.

 **Note:** Note Concerning z/OS Systems: Additional scenarios are possible. The following three diagrams show combinations of z/OS systems, CICS regions, the *Natural Roll Server* and the *Natural Authorized Services Manager*.

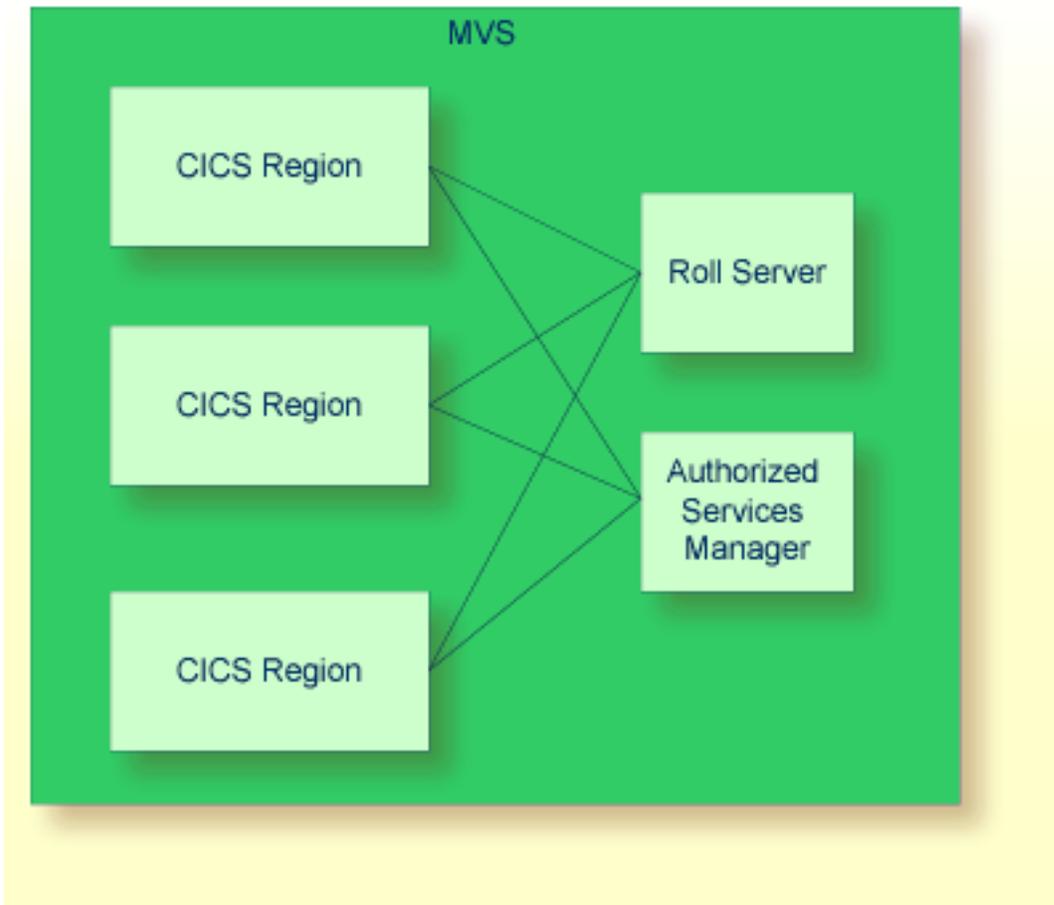
**Scenario 2:**

Single z/OS With Single CICS Region, Single Roll Server



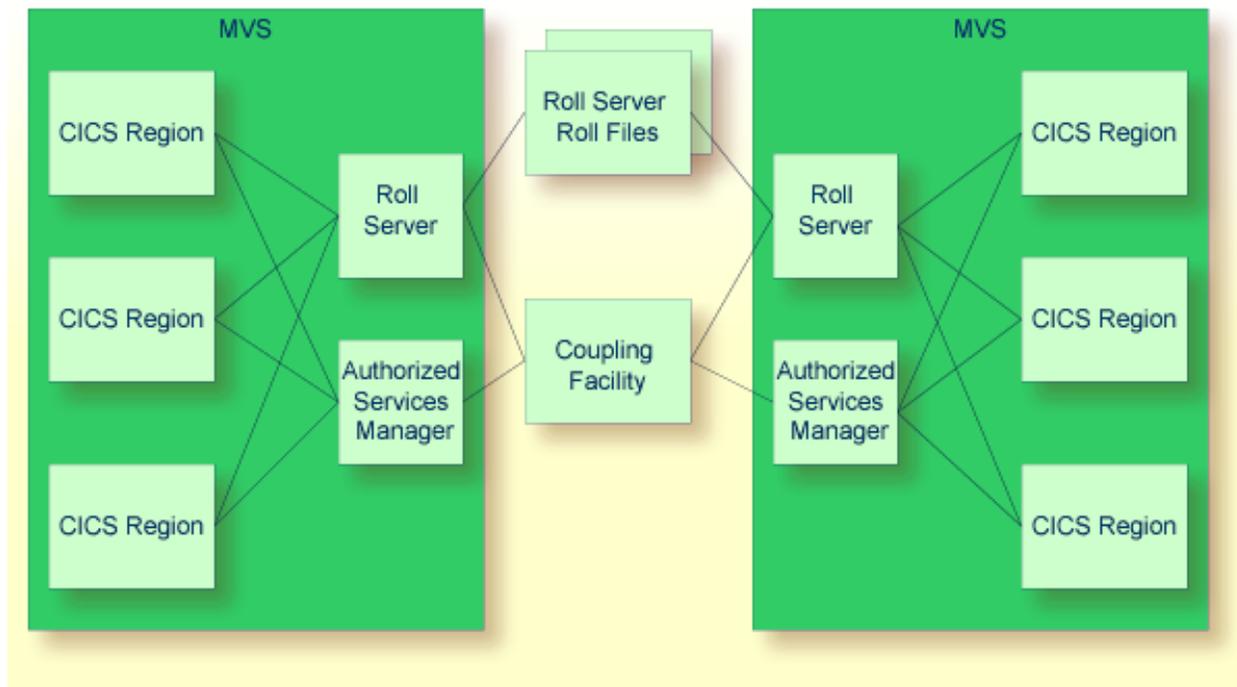
**Scenario 3:**

Single z/OS With Multiple CICS Regions, Single Roll Server and (Optional) Authorized Services Manager



**Scenario 4:**

Multiple z/OS With Multiple CICS Regions, Multiple Roll Servers/Authorized Services Managers



**Parameter Settings Required for the Above Scenarios**

Module	Scenario 1	Scenario 2	Scenario 3	Scenario 4
NTBPI (BPI)	TYPE=SWAP, SIZE= <i>nnn</i>	n/a	n/a	n/a
NCMDIR CICSPLX	NO	NO	YES/MODE	YES/MODE
NCMDIR SIPSERV	NO	NO/YES	yes	yes
NCMDIR ROLLSRV	NO	yes	yes	yes
Roll Server	n/a	none	none	<i>name</i>
CF structure name				
Authorized Services Manager/SIP	n/a	n/a	SIP slot number/size	XCF group name/CF structure name

The Natural CICS Interface requires a SIP slot size of 256 bytes.

**Note:** For the scenarios 2, 3 and 4, the very first Natural session initializing the NCI environment must have the `SUBSID` parameter set to the value of the corresponding *Roll Server* and/or *Authorized Services Manager*.

## Natural Storage Threads under CICS

---

A thread is a contiguous storage area from where Natural requests all its required storage. It can either be storage shared by several Natural users or, in 31-bit mode environments, CICS user storage above the 16 MB line dedicated to a specific task.

Each storage thread can be seen as the “address space” for a Natural user. Each memory allocation request issued by the Natural nucleus is transferred to the system control program to be satisfied from the storage thread.

Storage threads are allocated when the Natural CICS Interface is initialized. They are allocated in a CICS region or partition, in which case they are permanent (shared) threads or they are allocated during the start of a Natural CICS task, in which case they are exclusive threads (task-dependent user storage).

The technique of storage threads was implemented with Natural for the following reasons:

- To overcome the 64 KB limitation of CICS for user storage in non-31-bit mode systems.
- To be able to optimize rolling (formerly, each piece of user storage had to be written to the roll medium; now, as there is a contiguous storage area, this area is compressed by making the relevant portions contiguous to each other before rolling out).
- The Natural CICS Interface tries to satisfy all `GETMAIN` requests of a Natural session from its thread. This is faster than `GETMAIN` requests by means of CICS service calls. This is particularly true for CICS command level calls, as the CICS `EXEC` Interface Program (`EIP`) is involved, too.

A thread is released by the owning task with every screen I/O. This is true for both conversational and pseudo-conversational tasks. When a session is resumed, its storage is rolled into a thread again, unless its storage is still there; that is, no other task used the thread in between.

The Natural thread selection algorithm balances thread usage to minimize roll I/Os. This means that the more threads there are, the better is the chance of finding the old data thus preventing a roll-in. However, the more threads there are, the more paging the operating system must perform to keep all threads efficiently in real storage.

Threads are grouped together depending on their size and their type; that is, whether they have been pre-allocated as permanently shared storage or via a `GETMAIN` request. The decision on which kind of thread group to use, is controlled by the CICS transaction code at session initialization time. All storage threads belonging to the same group have the same size.

The thread should be defined as small as possible; see also the *Buffer Usage Statistics* function of the Natural utility `SYSTP` in the Natural *Utilities* documentation. However, the thread must still be large enough to hold the session with the largest sizes.

If you have separate Natural development and production environments, the rule is to have more smaller threads in the production environment (to serve production requests as soon as possible) and fewer larger threads in the development environment (as Natural programmers normally need larger Natural sizes and have longer “think times”).

The very first Natural session allocates all permanent (shared) threads.

## Natural Roll Facilities under CICS

---

As permanent storage threads are shared by several users and as larger threads allocated via GETMAIN should not be kept for too much time, a Natural task releases its thread with each terminal I/O. Previously, however, the user data have to be saved to be able to restart the Natural session after the terminal I/O has been performed.

Session data can be saved by using

- the Natural Roll Server with its local roll buffer and roll files;
- the CICS Roll Facilities;
- the Natural swap pool.

See also the various [component scenarios](#). For more information, see *Roll Server* in the *Natural Operations* documentation.

## CICS Roll Facilities

---

CICS Roll Facilities are local CICS storage facilities. They can be either CICS main or auxiliary temporary storage or VSAM relative record data sets (RRDS) which the user has previously defined to CICS. These files allow Natural to store a user's compressed dynamic storage when a roll-out occurs.

When a swap pool is used, the CICS roll facilities only serve as backup for the swap pool. The choice of the roll medium is of greater importance when no swap pool is used, since it affects Natural performance and throughput.

Every CICS service request causes CICS system overhead. So, the larger the CFSIZE/record size for the roll facility is, the less CPU overhead occurs due to fewer CICS service calls to roll a Natural session. On the other hand, larger CFSIZE/record size also means more VSAM buffer space allocated for the roll facility.

See [Performance Considerations](#) for further information on roll facilities.



**Caution:** When using the Roll Server, the swap pool and the CICS Roll Facilities are not available.

## Natural Local Buffer Pool under CICS

---

The Natural local buffer pool contains all Natural modules during execution and copies of Natural modules once they have been loaded from the Adabas or VSAM system file.

The local buffer pool must be large enough to minimize the number of Natural program loads. However, if the local buffer pool is too large, this means wasted storage and may introduce paging overhead.

The local buffer pool is allocated as `GETMAIN` storage, that is, `EXEC CICS GETMAIN SHARED` with all CICS Transaction Server versions or a `GETVIS` request with `CICS/VSE` in `z/VSE`. Sufficient storage must be available in the partition or in the relevant CICS DSA.

A local buffer pool is optional, as Natural can also run with a global buffer pool, which can be shared with other Natural environments such as *Natural in Batch Mode* (`z/OS` and `z/VSE`) or *Natural under TSO* or *Natural under IMS* (under `z/OS` only).

## Natural Swap Pool under CICS

---

The Natural swap pool offers the possibility to “swap” a compressed Natural session from the thread into a main storage area instead of doing expensive roll I/Os.

The swap pool is allocated as `GETMAIN` storage, that is, `EXEC CICS GETMAIN SHARED` with all CICS Transaction Server versions or a `GETVIS` request with `CICS/VSE` in `z/VSE`. Sufficient storage must be available in the partition or in the relevant CICS DSA.

The options for the swap management are set in the Natural CICS source module `NCISCPCB` and by using the Natural profile parameter `BPI`.

The size, name and cache size of the swap pool are specified using profile parameter `BPI` or the corresponding macro `NTBPI` in the Natural parameter module, that is, the `NTBPI` or `BPI` settings in effect for the Natural session initializing the NCI environment are taken.

For further details on the swap pool, see *Natural Swap Pool* in the *Natural Operations* documentation and [Using the Natural Swap Pool under CICS](#).

### Note concerning `z/OS` Systems

The swap pool can only be used when running Natural under CICS locally in a single CICS region. However, even in such a scenario, you should consider using the Roll Server instead, because it

runs asynchronously to the CICS region and because it can provide more roll buffers in its data space than the swap pool. When using the Roll Server, the swap pool and the Roll Facilities are not available under CICS.

## Natural CICS Interface System Control Records in CICS Temporary Storage

---

The Natural CICS Interface remembers its permanent `GETMAINED` storages, that is, storages acquired via `EXEC CICS GETMAIN SHARED` or operating system `GETMAIN` requests for `OSCOR/GETVIS` storage, in NCI system control records in CICS main temporary storage.

These system control records are kept for two reasons:

1. System recovery:

As all NCI related storages are chained of the NCI system directory, the system control records can be used to re-construct storage chains in case of storage corruptions.

2. Clean up old NCI system after CICS `NEWCOPY` of NCI system directory module:

At NCI system environment initialization, NCI checks for existing system control records, and, if found, NCI frees the associated permanent storages prior to the installation of the new environment.

The CICS temporary storage queue names of these control records are `prefixXCR`, where `prefix` is the common prefix for Natural CICS components (see `NCIPARM` generation parameter `PREFIX`) and `X` is a hexadecimal value, namely

x'01'	for the main system control record holding information about NCI system directory extension, shared threads ( <code>TYPE=SHR</code> ), and secondary SIR blocks (see <code>NCMDIR</code> generation parameter <code>USERS</code> ).
x'02'	for the parms system control record holding information about the NCI shared profile parameters retrieved via file input (see <code>NCIPARM</code> generation parameter <code>PRMDEST</code> ).
x'03'	for the pools system control record holding information about all local pools belonging to the NCI environment including a potential swap pool.

 **Important:** As the NCI system control records describe a local NCI environment, these CICS MAIN temporary storage queues must be kept also in the CICS AOR. This is particularly true when running Natural in CICSplex.

## NCIDIREX - System Directory Module Name Exit Interface

---

The name of the Natural CICS Interface system directory module is *prefix* CB by default (see `PREFIX` parameter of `NCMPRM` macro) unless specified explicitly via the `DIRNAME` parameter of the `NCIPRM` macro.

The `NCIDIREX` exit interface is to set/modify the name of the Natural CICS Interface system directory module at run-time. This makes it possible to use the same NCI driver/ `NCIPARM`, but use different NCI environments (thread groups/thread sizes, etc) by accessing different system directory modules, depending for example on CICS system ID, transaction ID.

The first 5 characters of the directory module name are also used as part of CICS temporary storage queue names related to the relevant NCI environment. So when running more than one Natural CICS environment in a CICS region, the relevant system directory module names must be different in the first 5 characters.

The `NCIDIREX` interface exit is called using standard linkage conventions (Registers 13, 14, 15 and 1) but in addition with Registers 4 and 5 holding CICS EIB and EISTG addresses to enable the exit to call CICS services.

Source module `XNCIDIRX` contains a sample system directory module name exit.

## NCIDTPEX - DTP Terminal I/O Exit Interface

---

Natural sessions may also be executed using distributed transaction processing (DTP), that is, using APPC or MRO conversations. Formally, such Natural sessions have a terminal associated (CICS TCTTE), however, this is a terminal out of a pool (see CICS SESSIONS / CONNECTIONS) and the “terminal” may change from Natural dialog step to dialog step, that is, such “terminals” cannot be used as key to save a session's context over a “screen I/O”. Because of this nature, such Natural sessions are treated by default as asynchronous sessions (`TTYTYPE=ASYN/ASYL`), and Natural does not deal/communicate with these terminals, as they are no 3270 devices.

However, there is an exit interface `NCIDTPEX` available, which allows you to run the Natural session in a “conversational way”:

- when the exit is available, Natural sets up a terminal bound session (`TTYTYPE=3270`);
- Natural terminal input and output operations (`RECEIVE/SEND/CONVERSE`) are *not* handled by Natural, but passed to the exit for further processing.

The source modules `XNCIDTPX` and `XNCITIOX` contain samples of DTP terminal exits.

## Control Use of NCIDTPEX

You can set the `FDTPIX` generation parameter of the `NCMPRM` macro to `YES` to cause a potential DTP exit to be invoked for all terminal types. This can be helpful, for example, if you want to analyze terminal output before a `EXEC CICS SEND` operation is executed, or if you want to suppress screen I/Os.

## NCITIDEX - Terminal ID Exit Interface

---

The 4-character CICS terminal ID which is unique per CICS region is used by the Natural CICS Interface as part of the session key (SIP server, roll server, CICS temporary storage queues). For compatibility with Natural, the Natural CICS Interface uses an 8-character field. This NCI terminal ID can be made unique over several CICS regions by appending the CICS system ID to the CICS terminal ID (see `UNITID` parameter of `NCMPRM` macro).

Alternatively, the `NCITIDEX` terminal ID exit interface can be used to set that NCI terminal ID. It should be noted that for CICS purposes (for example, temporary storage queue names, etc) just the first four characters of the NCI terminal ID are taken. Therefore these 4-character strings must be unique.

The `NCITIDEX` exit interface is particularly interesting for session managers under CICS in order to distinguish multiple Natural sessions running at the same physical terminal.

The terminal ID set by a `NCITIDEX` exit is used “externally” by the Natural CICS Interface and is the default for the Natural system variable `*INIT-ID` for “internal” Natural use. (The `*INIT-ID` system variable can subsequently be modified by the `NCIUIDEX` / `NATUEX1` user ID exit interface.)

The `NCITIDEX` interface exit is called by using standard linkage conventions (Registers 13, 14, 15 and 1), but in addition by using the Registers 4 and 5 holding CICS EIB and EISTG addresses to enable the exit to call CICS services.

Source module `XNCITIDX` contains a sample terminal ID exit.

### Restrictions

Certain Natural CICS Interface functions cannot work if the first four characters of the logical terminal ID do not match the physical terminal.

As a consequence,

- you cannot send a message to a logical terminal by way of message switching,
- you cannot use the `SYSTP` utility or `NEP` to flush a session at a logical terminal.

## NCIUIDEX - User ID Exit Interface

---

Natural provides the `NATUEX1` user exit interface to determine whether or not a user is authorized to use Natural and to set various Natural system variables.

Whenever a Natural user session is started, the `NATUEX1` interface exit is called using standard linkage conventions (Registers 13, 14, 15 and 1).

In a CICS environment, the standard linkage conventions are not sufficient in order to issue CICS service calls and to obtain addressability of CICS control blocks.

Therefore the Natural CICS Interface delivers the load module `NCIUEX1` as a `NATUEX1` interface exit in a CICS environment. This module just sets up addressability in CICS and calls the `NCIUIDEX` interface exit by using standard linkage conventions (Registers 13, 14, 15 and 1), but in addition by passing CICS related addresses in other registers: R4 (EIB), R5 (EISTG), R6 (TCTTE).

Thus, if you want to issue requests requiring addressability of the CICS environment, the `NCIUIDEX` user ID exit interface should be used rather than the standard `NATUEX1` interface.

Source module `XNCIUIDX` contains a sample user ID exit.



**Important:** With each installation of a new CICS release, the `NCIUIDEX` interface exit must be reassembled and linked.

## NCIXIDEX - Transaction ID Exit Interface

---

By default, Natural always uses the transaction ID the pseudo-conversational session was started with. This transaction ID can be changed within Natural by using `CALLNAT CMTRNSET` (library `SYSEXTP`). The `NCIXIDEX` transaction ID exit interface can also be used to change the Natural pseudo-conversational transaction ID.

The `NCIXIDEX` interface exit is called by using standard linkage conventions (Registers 13, 14, 15 and 1), but in addition by using the Registers 4 and 5 holding CICS EIB and EISTG addresses to enable the exit to call CICS services. Source module `XNCIXIDX` contains a sample transaction ID exit.



**Note:** The transaction ID exit is only invoked prior to pseudo-conversational screen I/Os under control of the Natural CICS Interface; that is, the exit is not invoked for conversational screen I/Os (for example, `SET CONTROL 'N'`) or when Natural is invoked from a front-end program via `EXEC CICS LINK`.

## Natural CICS Interface Debugging Facilities

The following topics are covered:

- [Using the TPF Parameter](#)
- [Using the UPSI Parameter](#)
- [Using Asynchronous Natural Sessions](#)

### Using the TPF Parameter

The dynamic parameter `TPF=(TPF1,TPF2,TPF3,TPF4,TPF5,TPF6,TPF7,TPF8)` can be set for driver-specific options by specifying "1" for the corresponding option.

Supported options are:

TPF1	Invoke Adabas linkage module via EXEC CICS LINK with Adabas parameter in TWA and CICS COMMAREA rather than via DCI.  Enables debugging of Adabas-related problems via CEDF.
TPF2	Dump the whole Natural swap pool.  With this parameter setting, the entire Natural swap pool is included in a CICS transaction dump.
TPF3	Dump the whole Natural buffer pool.  With this parameter setting, the entire Natural buffer pool is included in a CICS transaction dump.  <b>Note:</b> Usually the Natural buffer pool is not required in a dump, as all objects from the buffer pool relevant to a session are dumped anyway; so this option may only be required in the case of a buffer pool problem.
TPF4	Dump the whole EDITOR buffer pool.  With this parameter setting, the EDITOR buffer pool is included in a CICS transaction dump.
TPF6	Handle terminal I/O errors by NCI.  With this parameter setting, NCI will not pass control back to Natural for terminal I/O errors, but will handle it by itself, which results in one of the error messages NT06 - NT13.
TPF7	Force abend in case of NCI system errors.  With this parameter setting, a program check is forced in case of NSxx, NIxx, NRxx or NUSnnnn error messages. This is particularly helpful when a debugging tool intercepting abends is active. Then the error can be analyzed directly online.

When specifying 0 (which can also be omitted), the corresponding option is not set, for example:

`TPF=(0,0,0,1)` which is equivalent to `TPF=(,, ,1)`

## Using the UPSI Parameter

The Natural CICS interface reacts on certain settings of the Natural profile parameter `UPSI`:

### Natural Trace Extension

With profile parameter `ETRACE=ON` or `ETRACE=(ON,NOGTF)`:

- `UPSI=XXXX10XX` causes all `CMTRACE` trace records to be written to the Natural CICS Interface message destination (see `NCIPARM MSGDEST` parameter) in addition to the CICS trace (message number `NCI0110`).
- `UPSI=XXXX11XX` causes all `CMTRACE` trace records to be written to the console (`WTO`) in addition to the CICS trace.

### Natural CICS Interface Submit to POWER/VSE Debugging

The Natural CICS Interface uses VSE cross-partition communications (`XPCC`) for submission to `POWER/VSE`. These `XPCC` service calls can be traced by setting the `UPSI` profile parameter:

- `UPSI=XXXX10XX` causes the `XPCC` trace records to be written to the Natural CICS Interface message destination (see `NCIPARM MSGDEST` parameter) (message number `NCI0210`).
- `UPSI=XXXX11XX` causes the `XPCC` trace records to be written to console (`WTO`).

## Using Asynchronous Natural Sessions

If the first 5 characters in the dynamic parameter string for starting Natural are `ASYN,`, the Natural CICS Interface will always setup an asynchronous Natural session, regardless of whether the session is terminal-bound or not.

This may be helpful for testing purposes, particularly with `EDF` or with other debugging tools installed.

## Natural CICS Interface CICS TWA Usage

The Natural transactions are all defined with a `TWA` size of 128 bytes, although the Natural CICS Interface just uses the first 88 bytes of the CICS transaction work area (`TWA`) for Natural processing of the following functions:

- on calling Adabas for the Adabas parameter list (up to 32 bytes), the Natural CICS Interface saves the `TWA` contents before calling Adabas and restores it after the Adabas call.
- on calling external programs for the parameter list address pointers (up to 20 bytes, see the Natural `CALL` statement), the Natural CICS Interface saves the `TWA` contents before calling the external program and restores the `TWA` call portion after the external program call.

- on invoking a back-end program for the termination message and potential termination data (80 bytes, see *Back-End Program Calling Conventions* in the *Natural Operations* documentation).
- on returning control to a “LINK” front-end caller for the termination message and potential termination data at session end and the termination message area fully reset to low-value at Natural dialog step end respectively, that is, 80 bytes at session and dialog step end.
- for passing LE information at CICS task start (up to 88 bytes, just at start of task).

User programs (front-end, back-end, called external programs) can also take advantage of the CICS TWA to communicate besides Natural, but they should not use the TWA portion used by Natural; for such cases, it is highly recommended to increase the TWA size of the Natural transactions and use TWA portions outside the first 128 bytes.

# 3 Natural CICS Generation Parameters

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- NTSWPRM Macro Parameters ..... 37
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This part of the Natural CICS Interface documentation describes the Natural CICS generation parameters.

### References to CICS Tables

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, TST, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

### Related Documents

- *Installing the Natural CICS Interface on z/OS* in the *Natural Installation for z/OS* documentation or *Installing the Natural CICS Interface on z/VSE* in the *Natural Installation for z/VSE* documentation
- Natural utility SYSTP which provides various TP-monitor-specific functions
- For information on operation and the individual components of Natural in a CICS environment, see the following sections in the *Operations* documentation:
  - *Node Error Program Considerations for Natural*
  - *CICS 3270 Bridge Considerations*
  - *Special Natural CICS Functionality*
  - *Natural CICS Sample Programs*
  - *NCIUIDEX User ID Exit Interface*
  - *Invoking Natural from User Programs*
  - *Asynchronous Natural Processing under CICS*
  - *Logging Natural Sessions under CICS*
  - *Performance Considerations*
  - *Natural CICS Interface Debugging Facilities*
  - *Natural Print and Work Files Under CICS*

## NCISPCB Generation Parameters

The Natural CICS Interface system directory is generated by assembling and linking the NCISPCB source module; see the corresponding step in *Installing the Natural CICS Interface on z/OS* in the *Natural Installation for z/OS* documentation or *Installing the Natural CICS Interface on z/VSE* in the *Natural Installation for z/VSE* documentation.

NCISPCB contains the following macros:

- [NCMDIR](#)
- [NCMTGD](#)
- [NTSWPRM](#)

The purpose of these macros and the individual parameters which can be specified in the macros NCMDIR and NCMTGD are described in the following sections.

### NCMDIR Macro Parameters

The NCMDIR macro is mandatory and must be specified as the first macro in the NCISPCB source module. It contains various options for the system. The individual parameters which can be specified in the NCMDIR macro are described below.

[CICSPLX](#) | [ROLLSRV](#) | [SIPSERV](#) | [SUBSID](#) | [TSKEY](#) | [TSRECSZ](#) | [USERS](#)

#### CICSPLX - Switching of CICS Application Region

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
YES	The Natural CICS Interface keeps all session relevant data as the Session Information Records (SIRs) and the session data over a pseudo-conversational screen I/O outside of a local CICS Application Owning Region (AOR), thus enabling the switching of CICS AORs.  Setting this parameter to YES also requires the profile parameter ADAMODE to be set to greater than 0.
MODE	This setting almost has the same meaning as YES; the only exception is that CICSPLX=MODE allows an ADAMODE=0 profile parameter specification, that is, CICS AOR switching is not possible, but a Natural session may survive the restart of a CICS AOR in an MRO environment.
NO	Vital Natural session data is kept in the local CICS AOR, which in fact disables CICS AOR switching.

Value:	Explanation:
	This is the default value.

Natural PLEX support means that a Natural CICS session removes all its footprints that exist in a CICS application region at CICS task end, as it might never come back into this region. Therefore all Natural CICS session relevant data must be kept outside of a CICS application region, that is, Natural under CICS passes its session information records (SIRs) to the *Authorized Services Manager*'s SIP handler and the session data to the *Natural Roll Server* at CICS task end. In addition to that, all modules 'held', that is, modules not linked to Natural but directly invoked via standard linkage conventions as RCA modules or the Adabas linkage module, have to be released at CICS task end. It also requires that the restart information is kept in a CICS terminal owning region (TOR) in case of COMARET=YES, or in a CICS data owning region (DOR), which is shared by all participating CICS AORs, in case of COMARET=NO, see the COMARET parameter for details.

If YES or MODE has been specified, and the NCMDIR SUBSID parameter has not been set, the value of the Natural profile parameter SUBSID in effect for the Natural session initializing the NCI environment will be taken.

 **Caution:** Setting this parameter to YES or to MODE automatically sets SIPSERV and the ROLLSRV parameters to YES.

### ROLLSRV - Roll Server Rolling

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
NO	This is the default value, if CICSPLX=NO and SIPSERV=NO. If CICSPLX or SIPSERV is YES, ROLLSRV=YES is forced.
YES	Specifying YES causes the Natural CICS Interface to use the <i>Natural Roll Server</i> as roll facility only.

If the Natural Roll Server is to be used to save and restore the Natural session data over a screen I/O, this parameter must be set to YES, when the CICSPLX and SIPSERV parameters are both set to NO. If YES has been specified (or forced) and the NCMDIR SUBSID parameter has not been set, the value of the Natural profile parameter SUBSID in effect for the Natural session initializing the NCI environment will be taken.

Note that, for the purposes of the Natural CICS Interface, the Natural profile parameter SUBSID is only honored if it is specified dynamically or in the parameter module. It is ignored if it is specified in a parameter string by a profile parameter SYS or PROFILE or in an alternate parameter module (as specified with the profile parameter PARM).

## SIPSERV - Authorized Services Manager's Session Information Pool

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
NO	This is the default value, if CICSPLX=NO. If CICSPLX is not NO, SIPSERV=YES is forced.
YES	Causes the Natural CICS Interface to keep its session information records (SIRs) in the <i>Authorized Services Manager's</i> session information pool.

With this parameter set or forced to YES, the Natural session information records are kept outside a CICS region, thus enabling Natural to switch a CICS application region after a pseudo-conversational screen I/O.

If YES is specified (or forced) and the NCMDIR SUBSID parameter has not been set, the value of the Natural profile parameter SUBSID in effect for the Natural session initializing the NCI environment will be taken.

Note that, for the purposes of the Natural CICS Interface, the Natural profile parameter SUBSID is only honored if it is specified dynamically or in the parameter module. It is ignored if it is specified in a parameter string by a profile parameter SYS or PROFILE or in an alternate parameter module (as specified with the profile parameter PARM).

 **Caution:** If YES is effective for this parameter, the ROLLSRV parameter is forced to YES, unless already specified.

## SUBSID - Sub-System ID

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
SUBSID=XXXX	Defines the sub-system ID for the Natural Roll Server and/or for the <i>Authorized Services Manager</i> .

This parameter defines the Natural sub-system ID to be used for the Natural Roll Server and/or for the *Authorized Services Manager*. If this parameter is not specified, the value of the Natural profile parameter SUBSID will be taken.

Note that, for the purposes of the Natural CICS Interface, the Natural profile parameter SUBSID is only honored if it is specified dynamically or in the parameter module. It is ignored if it is specified in a parameter string by a profile parameter SYS or PROFILE or in an alternate parameter module (as specified with the profile parameter PARM).

### TSKEY - Prefixes for Natural CICS Temporary Storage Key

This parameter defines the constant prefixes of the temporary storage queues (see explanation below).

Possible values are:

Value:	Explanation:
TSKEY=( <i>xxxx,yyyy</i> )	<i>xxxx</i> defines the prefix for roll data, whereas <i>yyyy</i> defines the prefix for pseudo-conversational restart data.
(NAT2, NCOM)	This is the default value.

When CICS temporary storage (main or auxiliary) is to be used for the Natural CICS Interface roll facility or for the communication area for pseudo-conversational Natural tasks (as described with the **NCMPRM** macro parameter **COMARET**), names for queues of task dependent unique temporary storage must be specified.

These queue names consist of a constant 4-byte key and a task-related key. For terminal-dependent tasks, this task-related key corresponds to the terminal ID, for asynchronous non-terminal tasks it corresponds the CICS unique task number. The constant prefix of the temporary storage queue names is defined by the **TSKEY** parameter.

The Natural CICS Interface requires two 4-byte prefixes: one for roll data and one for pseudo-conversational restart data. *xxxx* defines the prefix for roll data, *yyyy* defines the prefix for pseudo-conversational restart data. The two prefixes must be different from each other and exclusive for Natural under CICS.

When running in a CICSplex environment, the CICS temporary storage prefix for Natural session restart information must be defined in a CICS TST as **REMOTE/SHARED** to be accessible in all participating CICS regions.

### TSRECSZ - Record Sizes for Main and Auxiliary Temporary Storage

This parameter defines the maximum record length for rolling of data if CICS temporary storage is to be used as Natural CICS Interface roll facility.

Possible values are:

Value:	Explanation:
( <i>nnnnn, mmmmm</i> )	<p>The first subparameter <i>nnnnn</i> applies to CICS main temporary storage and must be in the range of 4096 to 32763 or 0 or one of the keywords <b>MAX</b>, <b>YES</b> or <b>NO</b>;</p> <ul style="list-style-type: none"> <li>■ if numeric non-zero, this value is used unconditionally;</li> <li>■ if set to 0 or <b>NO</b>, CICS main temporary storage cannot be used for a Natural roll facility;</li> <li>■ if set to <b>MAX</b> or <b>YES</b>, a record size of 32763 is taken.</li> </ul>

Value:	Explanation:
	<p>The second subparameter <i>mmmmm</i> applies to CICS auxiliary temporary storage and must be in the range of 3976 to 32763 or 0 or one of the keywords MAX, YES or NO;</p> <ul style="list-style-type: none"> <li>■ if numeric non-zero, this value is used unconditionally; if set to MAX, a record size of 32763 is taken;</li> <li>■ if set to NO, CICS auxiliary temporary storage cannot be used for a Natural roll facility;</li> <li>■ if set to 0 or YES, the Natural CICS Interface sets the record length which fits into an auxiliary temporary storage control interval, that is, CI size minus VSAM control information minus CICS control information.</li> </ul> <p>A user-defined record size greater than CI size results in fewer (logical) roll I/Os at the expense of additional CICS overhead due to writing spanned records.</p>
(32748,0)	This is the default value.

### USERS - Session Information Record

This parameter specifies the number of session information record slots (SIRs).

Possible values are:

Value:	Explanation:
( <i>nnnnn</i> , <i>mmm</i> )	<p>The subparameter <i>nnnnn</i> defines the number of SIRs to be held in the Natural CICS directory module itself. <i>nnnnn</i> must be in the range from 1 to 32767. When the SIR slots in the directory are occupied, the Natural CICS Interface acquires a CICS shared storage segment, large enough to hold the number of SIRs defined by <i>mmm</i>, which must be in the range from 0 to 255.</p> <p>If the subparameter <i>mmm</i> is 0 or omitted, the system does not acquire additional storage for SIRs if no free SIR slot is available in the system directory. If so, the Natural CICS system is actually restricted to the number of users specified by the first subparameter.</p> <p>If a value other than 0 is specified for <i>mmm</i>, secondary storage segments are allocated automatically as required. Allocated secondary segments are freed again if they are no longer needed.</p>
(100,20)	This is the default value.

The Natural CICS Interface permanently holds information about all active Natural sessions. Per session a so-called Session Information Record (SIR) is maintained.

These SIRs are kept

- in a Coupling Facility when running in a z/OS Parallel Sysplex environment;
- in a data space of the *Natural Authorized Services Manager* when running in multiple CICS regions inside a single z/OS system;
- in a CICS region's main storage when running in a single CICS AOR (locally).

However, whenever a Natural session is active in a CICS region, it will occupy a SIR slot in the current application region.

When running locally in a single CICS AOR, the **USERS** parameter applies to all Natural sessions. When running in a CICSplex environment, **USERS** applies to the subset of Natural sessions which is currently active in each of the participating CICS AORs.

## NCMTGD Macro Parameters

---

The **NCMTGD** macro is mandatory and must be specified for each thread group. The Natural CICS Interface allows you to define groups of threads. These groups are controlled/chosen by the CICS transaction ID at session initialization. The common thread size for the various groups may differ and the groups can have different options. The thread group definitions are part of the Natural CICS system directory, as they are relevant to the whole system, not just to a single session.

The individual parameters which can be specified in an **NCMTGD** macro are described below.

**PFKEY** | **PRIMERF** | **THRDSIZE** | **THREADS** | **TRAN** | **TYPE** | **XTRAN**

### PFKEY - PF/PA Keys for Thread Group

This parameter defines a single CICS transaction or a list of them.

Possible values are:

Value:	Explanation:
xxx	Possible values for xxx are: PF1 to PF24, PA1 to PA3.
(xxx,xxx,...)	Also a list of keys can be specified. This has to be enclosed in parantheses, for example, PFKEY=(PF12, PF14).

No default value is provided.

When starting a session, the Natural CICS Interface scans through all thread group definitions for the current transaction ID, or PF or PA key. If it cannot be found, the first thread group is taken as default.

 **Caution:** At least one transaction ID (in character or hexadecimal format) or one transaction initiating attention identifier must be specified for all groups, except for the first group, which is used as the default group.

## PRIMERF - Natural CICS Primary Roll Facility

This parameter defines the Natural CICS Interface primary roll facility for all tasks defined in the associated thread group. Therefore, this parameter does not apply to thread groups with `TYPE=NONE`.

Possible values are:

Value:	Explanation:
VSAM	The Natural CICS Interface VSAM RRDS roll files are taken as the primary roll facility. CICS auxiliary temporary storage is considered as the secondary roll facility, which means that it is used if all primary roll files become full or unavailable.
AUX	CICS auxiliary temporary storage is taken as primary roll facility of the Natural CICS Interface.
MAIN	CICS main temporary storage is taken as Natural CICS Interface primary roll facility.
NONE	The associated sessions do not roll at all. NONE is not valid for <code>TYPE=SHR</code> groups and for groups with <code>TYPE=ALIAS</code> redefining <code>TYPE=SHR</code> groups.

No default value is provided.

This parameter is ignored when using the *Natural Roll Server*; if you force a Natural session with Roll Server to run conversationally with no rolling, value `NONE` is taken.

Points to be observed:

- `PRIMERF=VSAM` and `PRIMERF=AUX` have the same effect, when no VSAM RRDS roll file is available in the CICS system.
- `PRIMERF=AUX` and `PRIMERF=MAIN` have the same effect, when auxiliary temporary storage is not defined in the CICS system.
- If auxiliary temporary storage is not defined in the CICS system, a specification of `PRIMERF=VSAM` implies that CICS main temporary storage is considered as secondary roll facility, in case the VSAM RRDS roll files become unavailable or full.
- If CICS main temporary storage is to be used as roll facility, the record size is defined by the `TSRECSZ` parameter.

 **Important:** Note that sessions that are associated with thread groups defined with `PRIMERF=NONE` cannot roll due to the lack of a roll facility and are therefore conversational by design.

## THRDSZE - Thread Size

This parameter defines the common thread size for `TYPE=GETM` and `TYPE=SHR` groups.

Possible values are:

Value:	Explanation:
<i>nnn</i>	The thread size <i>nnn</i> can be equal to 40 or greater.

No default value is provided.

Note that this parameter defines the *logical* thread size that is available to Natural. However, the Natural CICS Interface NCI adds another 2 KB to the logical thread size for internal administration purposes. This means that the *physical* thread size or length of the thread `GETMAIN` request is by 2 KB greater than the `THRDSZE` value.

In case of `TYPE=GETM`, additional 16 bytes for the heading and trailing CICS storage accounting areas (SAAs) have to be considered.

Important Notes:

1. For `GETMAINS` of more than 512 KB, CICS aligns these storages at MB boundaries.
2. When using transaction isolation (z/OS only), CICS internally uses 1 MB “pages” in the EUDSA (see the *CICS Performance Guide for details*).

These two facts lead to storage fragmentation and should be kept in mind when setting an appropriate `EDSALIM` in CICS.

## THREADS - Number of Threads or Tasks Per Thread Group

This parameter specifies the number of threads or tasks as described below.

Possible values are:

Value:	Explanation:
<i>nnn</i>	The number of threads can be equal to 510 or less.

No default value is provided.

For `TYPE=SHR` thread groups, the `THREADS` parameter is mandatory and defines the number of threads which are to be allocated via `GETMAIN` (`SVC` or `SHARED`, depending on CICS version) during installation.

For `TYPE=GETM` and `TYPE=NONE` thread groups, the `THREADS` parameter is optional and determines the maximum number of concurrently active Natural tasks per thread group. For these thread

group types, the `THREADS` parameter does not control storage usage in contrast to `TYPE=SHR` thread groups (see also [Controlling Storage Usage](#)).

The number of threads or the number of tasks per thread group is defined by providing thread control blocks (TCBs).

While for `TYPE=SHR` thread groups, each thread is closely connected to its TCB. Threads are shared by queueing up on the associated TCB. Thread groups of `TYPE=GETM` and `TYPE=NONE` only queue up on a TCB to get active.

While sessions with `TYPE=SHR` thread groups compete for threads, the other session types compete for TCBs with a thread already allocated (`TYPE=GETM`) or with no allocated thread at all (`TYPE=NONE`).

When the `THREADS` parameter is non-zero, the Natural profile parameters `DBROLL` and `MAXROLL` and the calls to `CMROLL` are handled differently for `TYPE=GETM/NONE` thread groups: As threads cannot be released, the TCB resource held is released, which activates the session with the session data kept in storage.

### TRAN - Transaction IDs for Thread Group

This parameter defines a single CICS transaction or a list of them.

Possible values are:

Value:	Explanation:
(see below)	One or more CICS transaction codes defined in the PCT for Natural.

No default value is provided.

The `TRAN` parameter expects transaction IDs to be in character format; transaction IDs with non-alphanumeric characters have to be enclosed in apostrophes.

When starting a session, the Natural CICS Interface scans through all thread group definitions for the current transaction ID, or PF or PA key. If it cannot be found, the first thread group is taken as default.

A list of transaction IDs has to be enclosed in parentheses, for example, `TRAN=(NATU, XYZ)`.

 **Caution:** At least one transaction ID (in character or hexadecimal format) or one transaction initiating attention identifier must be specified for all groups, except for the first group, which is used as the default group.

## TYPE - Thread Type for Group

This parameter defines which type of thread is to be used for a given group.

Possible values are:

Value:	Explanation:
SHR	<p>CICS shared storage threads are used. The threads available for a thread group are shared by all CICS transactions defined for this group. Thread selection when starting a CICS task is done by an ENQUEUE/DEQUEUE technique. If currently no thread is available, a wait queue for this thread group is maintained.</p> <p>This is the default value.</p> <p>When running in a z/OS Parallel Sysplex environment, the Natural parameter RELO=OFF forces sessions with TYPE=SHR threads to be conversational to prevent a CICS region switch.</p>
GETM	<p>Threads allocated via GETMAIN are used, which means that a thread is actually acquired performing a CICS GETMAIN operation - EXEC CICS GETMAIN FLENGTH - with the thread group's common thread size. Using threads allocated via GETMAIN, each Natural task has exclusive thread storage available until it is terminated; that is, for pseudo-conversational tasks from screen I/O to screen I/O.</p> <p>If the Natural parameter RELO=OFF or PSEUDO=OFF is specified, tasks using threads allocated via GETMAIN are forced to be conversational, as there is no guarantee that after a FREEMAIN of the thread a subsequent GETMAIN obtains the same storage in memory. As thread storage allocated via GETMAIN exclusively belongs to the owning task, however, such tasks can be defined as non-rollable (see the <a href="#">PRIMERF</a> parameter), which means that a given thread belongs to a given task until the end of the Natural session. If so, the task is conversational by design and no rolling is done.</p>
NONE	<p>No threads are used by transactions defined in this thread group and all Natural GETMAIN requests are directly passed to CICS for an EXEC CICS GETMAIN FLENGTH request. By design, such tasks cannot roll and are therefore conversational.</p>
ALIAS	<p>The current NCMTGD macro provides different options for the thread group defined by the previous NCMTGD macro specification. However, only thread groups of TYPE=GETM and TYPE=SHR can be redefined by one or more NCMTGD TYPE=ALIAS macro requests.</p> <p>Up to 99 thread groups are supported, which means that up to 99 NCMTGD macro specifications with TYPE other than ALIAS are recognized.</p>

## XTRAN - Hexadecimal Transaction IDs for Thread Group

This parameter is equivalent to the [TRAN](#) parameter, but it expects the transaction ID to be in hexadecimal format.

Possible values are:

Value:	Explanation:
(see below)	Possible values: one or more CICS transaction codes defined in the PCT for Natural.

No default value is provided.

A list of transaction IDs in hexadecimal format has to be enclosed in parantheses, for example, XTRAN=(D5C1E3E4, E7E8E9).

 **Caution:** At least one transaction ID (in character or hexadecimal format) or one transaction initiating attention identifier must be specified for all groups, except for the first group, which is used as the default group.

## NTSWPRM Macro Parameters

The NTSWPRM macro is used to define the various aspects of the swap pool. If no swap pool is to be used, omit this macro. For more information, see *Natural Swap Pool* in the Natural Operations documentation.

## NCIPARM Generation Parameters

The Natural CICS Interface parameter module is generated by assembling the NCIPARM source module; see the corresponding step in *Installing the Natural CICS Interface on z/OS* in the Natural Installation for z/OS documentation or *Installing the Natural CICS Interface on z/VSE* in the Natural Installation for z/VSE documentation. It holds the NCMPRM macro definition.

The purpose of the NCMPRM macro and the parameters which can be specified in it are described in the following section.

## NCMPRM Macro Parameters

The macro `NCMPRM` determines all Natural session options that are relevant in a CICS environment. This macro is part of the Natural CICS parameter module, which is created in the corresponding step in *Installing Natural CICS Interface on z/OS* or *Installing Natural CICS Interface on z/VSE* in the Natural *Installation* documentation.

A sample `NCMPRM` macro definition, including all default values, is contained in the `NCIPARM` source module in data set `NCI $nnn$ .SRCE`.

The individual parameters of the `NCMPRM` macro are described below.

`BACKEND` | `BACKOUT` | `BACKRPL` | `CALLRPL` | `CHAP` | `CNTCALL` | `COMARET` | `DIRNAME` | `DUPTID` | `FDTPIX` | `LOGDEST` | `MSGDEST` | `MSGPFX` | `MSGTRAN` | `PREFIX` | `PRMDEST` | `PSTRNID` | `RCVASYN` | `RESENDC` | `RESENDS` | `RJEDEST` | `RJEUSER` | `SLCALL` | `SLNOHLD` | `SNDLAST` | `STORVIO` | `TERMVAR` | `TRANCHK` | `TTYCNLS` | `UCTRAN` | `UNITID` | `USERID`

### BACKEND - Back-End Program Invocation Control

This parameter defines whether a specified back-end program or transaction is to be invoked after the session has terminated (normally or abnormally).

The `BACKEND` parameter has two sub-parameters. The second sub-parameter is optional. It controls if a back-end program is to be invoked in the event of a terminal error. This also includes session clean-up tasks started by NEP.

Possible values are YES/NO for both sub-parameters, but the default values are different.

Value:	Explanation:
YES	Same as <code>BACKEND=(YES,NO)</code> .  This is the default if the <code>BACKEND</code> parameter is omitted. A potential back-end program or transaction is always invoked, particularly after task abends, but not in the case of terminal errors.  When a back-end program is invoked, the Natural termination message and return code are passed to the CICS transaction work area (TWA). In addition, the same information can be passed to a CICS <code>COMMAREA</code> , as described with the <code>BACKRPL</code> parameter.
(YES,YES)	Same as <code>BACKEND=(,YES)</code> . A potential backend program or transaction is always invoked, particularly after abends including terminal errors.
NO	Forces <code>BACKEND=(NO,NO)</code> . A potential back-end program or transaction is only invoked if the Natural session has been terminated normally; that is, with a Natural termination message.

## BACKOUT - Backout Transaction in the Case of Unrecoverable Abends

This parameter defines whether the Natural CICS Interface is to perform a transaction backout by means of an EXEC CICS SYNCPOINT ROLLBACK call or not.

Possible values are:

Value:	Explanation:
YES	All pending file updates are backed out.  This is the default value.
NO	All pending file updates are committed.

Because of its abnormal termination exit, the Natural CICS Interface intercepts all abends. If an abend is not recoverable, all resources of the abending session are released and the session is terminated via EXEC CICS RETURN; that is, it is terminated “normally” in terms of CICS. Thus, at the end of the task, “pending” file updates are not automatically backed out by CICS.

## BACKRPL - Location of Parameter List for Back-End Program

This parameter controls where and how the back-end parameters are passed to a back-end program.

Possible values are:

Value:	Explanation:
ALL	This is the default.  The Natural back-end parameter area mapped by macro NAMBCKP is passed both in the CICS TWA and in a CICS COMMAREA (including potential termination data).
COMA	The Natural back-end parameter area mapped by macro NAMBCKP (including potential termination data) is passed in a CICS COMMAREA only, not in the CICS TWA.
DATA	The Natural back-end parameter area mapped by macro NAMBCKP is passed in the CICS TWA only, a CICS COMMAREA just holds potential termination data; if no termination data is available, no COMMAREA is passed.
TWA	The Natural back-end parameter area mapped by macro NAMBCKP is passed in the CICS TWA only, no CICS COMMAREA is passed.



### Notes:

1. The BACKRPL parameter replaces and supersedes the old NCIPARM parameter COMAMSG.
2. This parameter applies to back-end programs only, not to back-end transactions.

## CALLRPL - Location of Parameter List for External Subroutine Programs CALled by Natural via EXEC CICS LINK

This parameter controls where and how the CALL parameter lists are passed to external subroutine programs.

Possible values for the first sub-parameter are:

Value:	Explanation:
ALL	This is the default.  The Natural parameter list addresses are passed both in the CICS TWA and in a CICS COMMAREA; the length of the passed COMMAREA is controlled by the second sub-parameter.
COMA	The Natural parameter list addresses are passed in a CICS COMMAREA only, not in the CICS TWA; the length of the passed COMMAREA is controlled by the second sub-parameter.
TWA	The Natural parameter list addresses are passed in the CICS TWA only, not in a CICS COMMAREA; that is, the COMMAREA length then is 0.

Possible values for the second sub-parameter are:

Value:	Explanation:
2	This is the default.  Only the parameter address list address and the field description list address (R1 and R2, as described with the CALL statement) are passed in a CICS COMMAREA; that is, the COMMAREA length is 8.
3	The field length list address (R3, as described with the CALL statement) is passed in addition in a COMMAREA; that is, the COMMAREA length is 12.
4	The field length list address and the large field length list address (R4, as described with the CALL statement) are passed in addition in a COMMAREA; that is, the COMMAREA length is 16.

Example:

```
CALLRPL=(ALL,2)
```

This is the default setting.



### Notes:

1. The CALLRPL parameter replaces and supersedes the old NCIPARM parameters COMACAL and FLDLEN.
2. The second sub-parameter applies only if the first sub-parameter is ALL or COMA.
3. If the CICS TWA is to be used, it always holds all 4 parameter list addresses.

4. If the CICS COMMAREA length is greater than 0, the last parameter address passed gets a flag saying it is the last address in the list. This flag is set in the high order bit in the address field.
5. The CALLRPL parameter does not apply, when passing parameter values in a CICS COMMAREA (%P=C); a CICS COMMAREA then is used regardless of the CALLRPL parameter setting.

### CHAP - Change Task's Dispatching Priority

This parameter defines how the Natural CICS Interface is to treat long-running tasks reaching the DBROLL and/or MAXROLL call limits.

Possible values are:

Value:	Explanation:
YES	The task's dispatching priority is decremented by 1 every time it reaches the DBROLL and/or MAXROLL call limits. The original task dispatching priority is re-established at the next screen I/O.
NO	The session is suspended.  This is the default value.

### CNTCALL - CICS Call Passing Automatically Data in Container

With SET CONTROL 'P=C' the CALL statement parameter data is passed in a CICS COMMAREA on the EXEC CICS LINK rather than parameter data pointers. As a CICS COMMAREA is limited to 32 KB, EXEC CICS LINK with a COMMAREA greater than 32 KB will fail due to a LENGERR condition.

The CNTCALL parameter enables you to automatically use a container on EXEC CICS LINK when the data to be passed exceeds the maximum COMMAREA length of 32 KB. This functionality only works if the CICS Transaction Server in your z/OS environment supports channels and containers.

The default container name then is NCI-COMMAREA unless explicitly specified via the application programming interface USR4204N prior to the Natural CALL statement.

Possible values are:

Value:	Explanation:
YES	When the COMMAREA data would exceed 32 KB, the Natural CICS Interface automatically uses a CICS container on the EXEC CICS LINK, using NCI-COMMAREA as default name.
NO	When the COMMAREA data would exceed 32 KB, the Natural CALL statement fails with a NAT0920 message and reason code LENGERR (hexadecimal 16).

### COMARET - CICS COMMAREA Usage for Task Control

This parameter defines whether the Natural CICS Interface is to take advantage of the CICS command level COMMAREA facility when terminating and restarting pseudo- conversational tasks.

Possible values are:

Value:	Explanation:
YES	A pseudo-conversational Natural task saves its restart information into a CICS COMMAREA, unless it has been invoked with EXEC CICS LINK or the equivalent CICS macro request.  This is the default value.
NO	Forces Natural to place its restart information into CICS main temporary storage, which results in more overhead because of additional CICS service calls necessary to place and retrieve this information.  The CICS temporary storage key used consists of a prefix string (as defined with the NCMDIR parameter <a href="#">TSKEY</a> and of the terminal ID. If running in a CICSplex environment, the CICS temporary storage key prefix must be defined in a CICS TST as REMOTE/SHARED to be accessible in all participating CICS regions.

Actually the COMARET parameter can provide compatibility to Natural Version 1 in terms of where to put pseudo-conversational restart data.

### DIRNAME - Name of Natural CICS Interface System Directory Module

This parameter specifies the name of the Natural CICS Interface system directory module.

Possible values are:

Value:	Explanation:
(see below)	Any valid module name.
<i>prefix</i> CB	<i>prefix</i> is the common prefix for programs and files, see <a href="#">PREFIX</a> parameter.  This is the default value.

The first 5 characters of the directory module name are also used as part of CICS temporary storage queue names related to the relevant NCI environment. So when running more than one Natural CICS environment in a CICS region, the relevant system directory module names must be different in the first 5 characters.

Note that the specified or defaulted Natural CICS Interface system directory module name may be modified at run-time via the NCI system directory module name exit interface [NCIDIREX](#). This makes it possible to use the same NCI driver/NCIPARM, but use different NCI environments (thread groups/thread sizes, etc.) depending for example on CICS system ID, transaction ID.

## DUPTID - Handle Duplicate Terminal ID

The Natural CICS Interface requires unique terminal IDs, because the terminal ID is the key for its session information records (SIRs). This is normally guaranteed for a single CICS region, but not necessarily over several CICS regions sharing the same SIP server.

The `DUPTID` parameter determines how the Natural CICS Interface has to deal with duplicate terminal IDs, that is, when a new session is to be started and an SIR already exists for this terminal ID.

Possible values are:

Value:	Explanation:
YES	If a duplicate terminal ID is encountered, the Natural CICS Interface internally forces the old session to terminate and, after that, starts a new session.  This is the default value.
NO	When an SIR already exists for the new session's terminal ID, the Natural CICS Interface terminates the new session and issues the message NS19. For an explanation and remedial actions, see <i>Natural under CICS Messages, SCP Processing Errors in the Messages and Codes</i> documentation.

A terminal ID exit interface is available to create unique 8-character terminal IDs, for example, by appending the 4-character CICS system ID to the physical 4-character CICS terminal ID, which results in a logical Natural terminal ID.

## FDTPX - Force Use of NCIDTPEX Exit for all Terminal Types

This parameter determines whether the `NCIDTPEX` terminal I/O exit interface is called for all types of terminal used in your environment.

Possible values are:

Value:	Explanation:
YES	The <code>NCIDTPEX</code> interface is called for all terminal types.
NO	The <code>NCIDTPEX</code> interface is only called for distributed transaction processing (DTP) using APPC or MRO conversions.  This is the default value.

For detailed information on `NCIDTPEX`, see [NCIDTPEX - DTP Terminal I/O Exit Interface](#) in the section *Natural CICS Interface Functionality*.

## LOGDEST - Natural CICS Logging Destination

This parameter specifies the name of a CICS destination, where the Natural CICS Interface writes its session log records to.

Possible values are:

Value:	Explanation:
<i>name</i>	Any valid destination name.
NLOG	This is the default value.

A CICS destination control table entry must be defined for the optional Natural CICS log data set.

## MSGDEST - Destination ID for Natural Error Message Logging

This parameter specifies the name of the CICS destination to be used by the Natural CICS Interface for NCI informational messages and to log the Natural session termination message if a session terminates abnormally.

Possible values are:

Value:	Explanation:
<i>name</i>	Any valid destination name
NERR	This is the default value.

Since these messages are in character format, any already available CICS destination (for example, CSSL) can be used rather than defining a new one.

## MSGPFX - Generate NCI Message Prefix for WTL Messages

The Natural CICS Interface uses a prefix for all messages it sends to the `MSGDEST` destination. This prefix has a length of approximately 48 bytes and comprises the following information:

- NCI message number,
- CICS region `SYSID`,
- terminal ID or the string `ASYN` for non-terminal tasks,
- user ID,
- transaction ID,
- date and time.

By default, the message prefix is also appended to those messages which are output through `CMWTL`.

Possible values are:

Value:	Explanation:
YES	The NCI message prefix is appended to all messages which are issued through CMWTL.  This is the default value.
NO	The NCI message prefix is not appended to the messages which are issued through CMWTL. The messages are issued unchanged.

### MSGTRAN - Internal Message Switching Transaction ID

This parameter specifies the transaction ID internally used by the Natural message switching and asynchronous session flushing facilities.

Possible values are:

Value:	Explanation:
(see below)	Any valid CICS transaction ID.
NMSG	This is the default value.

This transaction ID must be different from any transaction ID used to invoke Natural, and it must be defined in CICS.

### PREFIX - Common Prefix for Programs and Files

This parameter defines a common module prefix for the Natural CICS components as the Natural CICS system directory *prefixCB*, the CICS 3270 Bridge XFAINTU exit *prefixXFA*, the VSAM roll files *prefixRn*, where  $n=1-9$ , and system control records in CICS main temporary storage holding information about all permanent GETMAIN storages by the Natural CICS Interface as local pools and shared threads. The TS control record keys are of the form *prefixXCR*, where *X* is an unprintable character. In general, it is good practice to use this common prefix for all programs that relate to the Natural CICS Interface, for example, *prefixDRV* for the Natural CICS Interface module, *prefixNEP* for the Natural CICS Interface node error program.

Possible values are:

Value:	Explanation:
XXXXX	The <i>prefix</i> can be 1 to 5 bytes long and must conform to the naming conventions for programs and files.

No default value is provided.

**PRMDEST - Name of the Natural CICS Profile Parameter Input Destination**

This parameter specifies the name of a CICS destination containing Natural dynamic profile parameters.

Possible values are:

Value:	Explanation:
<i>name</i>	Any valid destination name
NPRM	This is the default value.

At system initialization time, the Natural CICS Interface retrieves Natural dynamic profile parameters and saves them in its environment. At session start, potential other profile parameters (entered by way of terminal input or by a front-end caller) are concatenated at the end of the parameter string which was retrieved from the PRMDEST destination, that is, explicit dynamic profile parameters can be used to overwrite the Natural CICS Interface system profile parameters read from PRMDEST.

A CICS destination control table entry must be defined for the optional Natural CICS Interface profile parameter input destination, normally an extra partition destination.

**PSTRNID - Control of \*INIT-PROGRAM Variable Setting**

When a Natural task is activated by a front-end program, the PSTRNID parameter determines, how the Natural system variable \*INIT-PROGRAM is set.

Possible values are:

Value:	Explanation:
YES	*INIT-PROGRAM is set to the actual transaction ID used for Natural CICS pseudo-conversational task processing, which is not necessarily the transaction ID of the task which originally started the Natural session.  This is the default value.
NO	*INIT-PROGRAM is set to the transaction ID of the task, which originally started the Natural session.

## RCVASYN - Recover Asynchronous Session

This parameter defines how the Natural CICS Interface treats asynchronous sessions.

Possible values are:

Value:	Explanation:
YES	<p>This is the default value.</p> <p>The Natural CICS Interface forces some Natural profile parameter settings for non-terminal sessions to prevent unexpected input or abends due to NT06, NT11 or other I/O errors.</p> <p>RCVASYN=YES forces the following parameter settings:</p> <ul style="list-style-type: none"> <li>■ CM=OFF , MENU=OFF , PC=OFF</li> <li>■ TTYPE=ASYL if the SENDER specification is blank, not specified or a CICS transient data queue, or if <b>CONSOLE</b> is specified.</li> <li>■ SENDER='msgdest' if the SENDER specification is blank or not specified.</li> <li>■ OUTDEST='sender' if the OUTDEST specification is blank or not specified.</li> <li>■ INTENS=1 , EJ=OFF if the SENDER specification is <b>CONSOLE</b> or a CICS transient data queue which is not set up for print control characters.</li> </ul>
NO	<p>The Natural CICS Interface does not do anything specific for non-terminal sessions; it is the user's responsibility to set appropriate Natural profile parameters for an asynchronous Natural session; see <i>Asynchronous Natural Processing</i>.</p>

## RESENDC - Check for Screen Re-sending after Subroutine Calls

Natural optimizes the 3270 output data stream by default. The screen imaging technique used by Natural makes it possible for Natural to always remember the map most recently sent. Thus, when sending a new map, Natural actually sends "updates" of the old map only. With this logic, a screen image can get destroyed by 3GL programs called by Natural which perform screen I/Os themselves.

Possible values are:

Value:	Explanation:
YES	<p>The Natural CICS Interface checks whether any called 3GL programs have performed screen I/Os. If so, the Natural CICS Interface causes Natural to send a full screen with the next screen I/O.</p> <p>This is the default value.</p>
NO	<p>The Natural CICS Interface causes Natural to send only updates.</p>

### RESENDS - Screen Re-send Check after Pseudo-Conversational Session Resume

Natural optimizes the 3270 output data stream by default. The screen imaging technique used by Natural makes it possible that Natural always remembers the map most recently sent. Thus, Natural only sends “updates” when sending a new map, too. With this logic a screen image can get destroyed, for example, by message switching (CICS CMSG transaction) during pseudo-conversational screen I/O.

Possible values are:

Value:	Explanation:
YES	During the Natural session, the Natural CICS Interface also recognizes screen I/Os from outside and causes Natural to re-send the screen most recently issued.  This is the default value.
NO	Natural only sends “updates” when sending a new map.

### RJEDEST - Name of the Natural CICS Submit Destination

The parameter applies to z/OS-type operating systems only.

Possible values are:

Value:	Explanation:
(see below)	Destination name.
NRJE	This is the default value.

RJEDEST specifies the *destination name* of the CICS extra partition destination used by the NATRJE utility for submitting jobs via the JES internal reader facility.

 **Caution:** An appropriate CICS destination must be defined in the CICS DCT and start-up JCL; see also the corresponding step in *Installing the Natural CICS Interface on z/OS* in the *Natural Installation for z/OS* documentation or *Installing the Natural CICS Interface on z/VSE* in the *Natural Installation for z/VSE* documentation.

Function code L or B (*parm3* of the NATRJE CALL statement) must be set for the last NATRJE call.

When L is specified and *nrje* is an extra partition destination, the destination is closed, which in turn triggers the start of the internal reader.

When B is specified and *nrje* is an indirect destination, the destination is not closed; in this case, a trailing /\*EOF card must be submitted in order to trigger the start of the internal reader.

For further information on the Natural NATRJE utility, refer to the Natural *Utilities* documentation.

## RJEUSER - Submit to POWER User ID Setting

This parameter only applies to z/VSE operating systems using the POWER spooling system.

Possible values are:

Value:	Explanation:
YES	Same as RJEUSER=(YES,CICS).  This is the default value.  The Natural system variable *INIT-USER is used as the XPCC user ID and the POWER JECL must be set up appropriately by the user.
(YES,NAT)	The Natural system variable *USER is used as the XPCC user ID and the POWER JECL must be set up appropriately by the user.
NO	The user ID 'R000' is used as the XPCC user ID for all jobs submitted by the Natural CICS Interface.

In z/VSE operating systems, Natural under CICS performs job submission by means of XPCC macro requests.

The XPCC macro requires the specification of a user ID, thus giving access to the submitted job's list or punch output to the submitting user only, unless appropriate LDEST/PDEST parameters have been specified in the \* \$\$ JOB statement or appropriate DEST parameters have been specified in the \*\$\$ LST or \*\$\$ PUN statement respectively.

Using the special user ID 'R000', however, gives common access to list or punch output of a submitted job without having to code appropriate target destinations in the JECL.

## SLCALL - Standard Linkage Call

The Natural CALL statement invokes a dynamic non-Natural program using CICS conventions, that is, via an EXEC CICS LINK. A dynamic non-Natural program can also be invoked with standard linkage conventions (for example, BALR/BASR/BASSM 14,15) if an appropriate indicator is set in the Natural program before the CALL statement is executed; see also the terminal command %P=S, %P=SC, %P=L and %P=LS.

 **Caution:** The terminal commands %P=S, %P=SC, %P=L and %P=LS bypass the SLCALL automatism of using a certain linkage convention.

SLCALL enables you to automatically use a certain linkage convention. This is particularly relevant in CICS systems where the CICS macro level API is no longer supported, which is the case in CICS Version 3.2 or above and in all CICS/TS versions.

Possible values are:

Value:	Explanation:
YES	The Natural CICS Interface determines whether the module to be called is a valid CICS command level program by looking for the string DFH at the module's load point. If DFH is found, the program is invoked via an EXEC CICS LINK. If DFH is not found, the module is treated according to standard linkage conventions and is invoked via BALR/BASSM 14, 15.
NO	The linkage convention is not used. This is the default value.

### SLNOHLD - Load Option for External Programs to Be Invoked via Standard Linkage Conventions

This parameter defines how the Natural CICS Interface treats non-LE external programs to be invoked via standard linkage conventions (that is, dynamic non-CICS programs and RCA programs) in a non-CICSplex environment.

Possible values are:

Value:	Explanation:
YES	<p>This is the default value.</p> <p>The Natural CICS Interface loads all non-LE external programs to be invoked via standard linkage conventions (including RCA programs) via EXEC CICS LOAD without the HOLD option, thus allowing these programs to be NEWCOPYed while the Natural session is suspended/waiting in a pseudo-conversational screen I/O.</p> <p>SLNOHLD=YES corresponds to the processing which the Natural CICS Interface does for LE programs in general and for non-LE programs in a CICSplex environment anyhow.</p>
NO	<p>This is how Natural worked eversince.</p> <p>The Natural CICS Interface loads all non-LE external programs to be invoked via standard linkage conventions (including RCA programs) via EXEC CICS LOAD HOLD, that is, such a program is fixed in storage for some time depending on the DELETE profile parameter setting, RCA programs until session end.</p>

### SNDLAST - LAST Option Usage for EXEC CICS SEND Commands

This parameter is useful for SNA terminals (LUTYPE2) with bracket protocol to force "end bracket" for pseudo-conversational screen I/Os.

Possible values are:

Value:	Explanation:
YES	The LAST option is used for EXEC CICS SEND commands before the task terminates in pseudo-conversational mode.  This is the default value.
NO	The LAST option is not used.

### STORVIO - Storage Violation Trap

This parameter provides for a storage violation trap for external program calls with call option %P=C(C).

Value:	Explanation:						
NO	The storage violation trap is deactivated.  This is the default value.						
(mm, nn)	The storage violation trap is activated by specifying any STORVIO sub-parameter.  The first sub-parameter specifies a tolerance value in the range from 0 to 255: the storage size for the extra %C(C) GETMAIN is increased by this value to try to prevent real CICS storage violations.  The second sub-parameter specifies, how to react on a detected storage violation. Possible values: <table border="1" data-bbox="354 1010 1481 1482"> <tbody> <tr> <td>0</td> <td>Just a NCI0250 storage violation message is issued, no other special interaction.  This is the default value for sub-parameters.</td> </tr> <tr> <td>1 - 32767</td> <td>In addition to the NCI0250 message, a NAT0920 condition is raised with the specified value passed as reason code; as in the CICS world the NAT0920 reason code normally holds the EIBRESP value of a failing EXEC CICS LOAD or LINK request, it is recommended <i>not</i> to specify a value in the range of valid CICS EIBRESP values, that is, better leave values 1 to 255 to CICS.</td> </tr> <tr> <td>32768 or higher</td> <td>In addition to the NCI0250 message, an S0C3 abend is forced, which raises a NAT0954 condition.</td> </tr> </tbody> </table>	0	Just a NCI0250 storage violation message is issued, no other special interaction.  This is the default value for sub-parameters.	1 - 32767	In addition to the NCI0250 message, a NAT0920 condition is raised with the specified value passed as reason code; as in the CICS world the NAT0920 reason code normally holds the EIBRESP value of a failing EXEC CICS LOAD or LINK request, it is recommended <i>not</i> to specify a value in the range of valid CICS EIBRESP values, that is, better leave values 1 to 255 to CICS.	32768 or higher	In addition to the NCI0250 message, an S0C3 abend is forced, which raises a NAT0954 condition.
0	Just a NCI0250 storage violation message is issued, no other special interaction.  This is the default value for sub-parameters.						
1 - 32767	In addition to the NCI0250 message, a NAT0920 condition is raised with the specified value passed as reason code; as in the CICS world the NAT0920 reason code normally holds the EIBRESP value of a failing EXEC CICS LOAD or LINK request, it is recommended <i>not</i> to specify a value in the range of valid CICS EIBRESP values, that is, better leave values 1 to 255 to CICS.						
32768 or higher	In addition to the NCI0250 message, an S0C3 abend is forced, which raises a NAT0954 condition.						

## TERMVAR - Terminal ID Variable for Natural Work Files

This parameter enables a Natural user to have exclusive Natural work files under CICS without having to know the terminal ID.

Possible values are:

Value:	Explanation:
XXXX	Variable <code>XXXX</code> is a four-character string. See explanation below.
&TID	This is the default value.

As terminal IDs are unique in a CICS system, exclusive work files in CICS temporary storage usually contain the CICS terminal ID. The parameter `TERMVAR` allows you to define a variable. If this variable is found in a work file name, it will be replaced by the actual terminal ID. Strings with non-alphanumeric characters must be enclosed in apostrophes (`'`).

Note that for non-terminal sessions the packed CICS task number is used as a *logical* terminal ID.

 **Caution:** The variable string must not contain the substring `'**'`, because Natural will replace this substring with the work file number, which makes it impossible to insert the terminal ID.

## TRANCHK - Check Input Map for Transaction ID

If a connection to a CICS session gets lost or dropped (for example, when a session manager is installed) without having terminated the session, another user can get into this open session when calling CICS. Usually, the first action of a user in a CICS environment is to enter a transaction ID.

Possible values are:

Value:	Explanation:
YES	The Natural CICS Interface checks whether the first 4 bytes of the transaction ID entered by the user matches the Natural transaction ID. If so, the Natural CICS Interface assumes a “restart” after a connection has been lost or dropped. All resources of the “old” session are freed and a new session is started.
NO	Data entered by the user are not checked for the Natural transaction ID.  This is the default value.

## TTYCNLSL - Control Console Communication

This parameter is for compatibility with previous versions of the Natural CICS Interface. It controls session and device characteristics for Natural sessions started through a console device by using, for example, the `MODIFY` command (z/OS) or the `MSG Fm` command (z/VSE).

Possible values are:

Value:	Explanation:
YES	<p>The <code>*DEVICE</code> system variable is set to <code>TTY</code>: communication with the console is in 3270 data stream holding <code>TTY</code> control orders.</p> <p>The <code>PSEUDO</code> profile parameter is evaluated allowing or disallowing the session to run in pseudo-conversational mode.</p>
NO	<p>The <code>*DEVICE</code> system variable is set to <code>BATCH</code> forcing batch/command-line mode: each line is output separately to the console by an <code>EXEC CICS WRITE OPERATOR</code> command.</p> <p>The <code>PSEUDO</code> profile parameter is ignored: the session runs in conversational mode to indicate that a session is pending.</p> <p>This is the default value.</p>

## UCTRAN - Lower/Mixed Case Support in Natural

This parameter enables or disables the lower/mixed case support by the Natural CICS Interface.

Possible values are:

Value:	Explanation:
YES	<p>Same as <code>UCTRAN=(YES,YES)</code>. NCI lower/mixed case support is fully enabled.</p> <p>This is the default value.</p>
NO	<p>Same as <code>UCTRAN=(NO,YES)</code>. NCI lower/mixed case support is disabled for pseudo-conversational screen I/Os.</p>

The first subparameter controls NCI mixed case support after a pseudo-conversational screen I/O, while the second subparameter controls NCI mixed case support after a conversational screen I/O; the latter also includes NTC uploads.

### First Subparameter (pseudo-conversational screen I/Os)

To accomplish lower/mixed case support for pseudo-conversational Natural sessions, it is necessary that the terminal input be not already translated to upper case before the Natural nucleus gets control. Therefore, the Natural CICS Interface by default switches terminals defined with `UCTRAN(YES)` into mixed mode (`UCTRAN(TRANID)`) for the lifetime of the Natural session.

As for security reasons any modification of CICS definitions/control blocks may not be desired, the Natural CICS Interface can be prevented from modifying a terminal's upper case translation status by setting this NCIPARM parameter UCTRAN to NO. If so, the user must define a terminal as running in "lower case" (CICS TYPETERM parameter UCTRAN(TRANID/NO)) to be able to use the Natural lower/mixed case support.

As all CICS versions supported by the current Natural Version provide "case switching" on transaction level via the UCTRAN parameter in a transaction's PROFILE, this NCIPARM parameter should be set to NO, thus leaving lower/mixed case support to CICS.



**Note:** In CICS, the combination of the UCTRAN parameters in both TYPETERM and PROFILE definitions determine how CICS treats the terminal input of a pseudo-conversational transaction (for details see CICS Resource Definition Manual or others). Therefore it is always advisable that mainly the PROFILE associated to a transaction defines the required upper case translation status thus making an application unaffected by any TYPETERM upper case translation mode changes.

### Second Subparameter (conversational screen I/O)

Lower/mixed case support for conversational I/Os means that the Natural CICS Interface uses the "as is" option on the CICS terminal input requests (CONVERSE/RECEIVE ASIS). If the second subparameter is set to NO, the Natural CICS Interface does the conversational CICS terminal input requests without the "as is" option,

### UNITID - Establish Unique Terminal IDs

This parameter helps to make the CICS terminal ID for Natural purposes unique over more than one CICS region.

Possible values are:

Value:	Explanation:
YES	The Natural CICS Interface appends a CICS system ID (local SYSID if no MRO, otherwise TOR SYSID) to the 4-byte CICS terminal ID, thus creating an 8-byte logical terminal ID.
NO	The Natural CICS Interface uses the CICS terminal ID as it is. This is the default value.

This parameter is of interest when resources are shared as SIP server or roll server by several CICS regions, particularly in non-CICSplex: If the same terminal IDs are used in several CICS environments, this parameter helps to provide unique terminal IDs for Natural. Inside the Natural CICS Interface, Natural terminal IDs are 8-byte fields, and a combination of 8-byte terminal ID and 8-byte CICS user ID is taken as key for SIP and the roll server.

The result of this parameter is used by the Natural CICS Interface for the session key and the roll server key and by Natural for the system variable \*INIT-ID.

**Notes:**

1. A terminal ID exit (`NCITIDEX`) possibly will post-process that logical terminal ID.
2. Also a user ID exit (`NCIUIDEX` and `NATUEX1`) may post-process the `*INIT-ID` system variable.
3. This parameter also applies to *Natural Advanced Facilities* (NAF) printers, that is, the printers have to be defined appropriately in the NAF spooling and report management system `NATSPool`, or a user ID exit should be used to post-process the `*INIT-ID` for printers.
4. For non-terminal sessions, the Natural CICS Interface always sets up an 8-byte logical *terminal ID* consisting of the packed CICS task number and the CICS system ID; that is, `UNITID=YES` is forced for asynchronous tasks with the CICS task number taken as terminal ID.

**USERID - Deal with CICS User ID**

This parameter defines how Natural under CICS should deal with a CICS user ID for a Natural session.

The first subparameter is for terminal bound CICS sessions, the second subparameter for non-terminal, that is, asynchronous, DPLeD, etc. CICS sessions, the third subparameter is for program-to-program sessions, that is, DTP, APPC.

Possible values are:

Value:	Explanation:
ANY	Any non-blank value returned by <code>EXEC CICS ASSIGN USERID (..)</code> is considered to be valid. This is the default value.
YES	A non-blank value returned by <code>EXEC CICS ASSIGN USERID (..)</code> is considered to be valid if it is different from the CICS default user ID and, for terminal bound sessions only, if the user has signed on in CICS.
NO	The value returned by <code>EXEC CICS ASSIGN USERID (..)</code> is ignored.

**Further Processing**

When a CICS user ID is invalid or ignored, the edited (unpacked) CICS task number is taken for non-terminal, that is, asynchronous or DPLeD, etc., CICS sessions; for terminal bound sessions, the 3-byte CICS operator ID is taken when it is non-blank, otherwise the CICS terminal ID is taken; for DTP sessions the pseudo terminal ID is taken.

**Notes:**

1. CICS terminal IDs are unique within a CICS region, while CICS user IDs and operator IDs are not necessarily unique. However, CICS terminal IDs may have duplicates in other CICS regions resulting in duplicate user IDs in Adabas.

2. Natural user ID exit NATUEX1 or Natural CICS user ID exit interface [NCIUIDEX](#) may be used to customize the content of the system variable \*INIT-USER.
3. The USERID parameter replaces the old NCIPARM parameter SIGNON.

## NCIZNEP Generation Parameters

---

Potential NCIZNEP generation parameters are specified via SYSPARM specification in the PARM parameter of the High Level Assembler (HLASM) EXEC JCL statement, for example:

```
... ,PARM='SYSPARM(MSGTRAN=nmsg,TSKEY=ncom,PURGE=no)'
```

The individual parameters are described below.

[MSGTRAN](#) | [NEPTRAN](#) | [PURGE](#) | [TSKEY](#)

### MSGTRAN - Internal Message Switching Transaction ID

This parameter specifies the transaction ID internally used by the Natural message switching and asynchronous session flushing facilities.

Possible values are:

Value:	Explanation:
(see below)	Any valid CICS transaction ID.
NMSG	This is the default value.

This parameter has the same meaning as the [MSGTRAN](#) parameter in NCIPARM and must be specified identically.

The Natural CICS Interface clean-up function is done by starting an asynchronous task to resume the terminal-bound session and to terminate it logically. Normally, the original transaction ID of the session is used therefor. This original transaction ID cannot be used if there is a front-end program calling Natural, as most likely the front-end is not prepared for being invoked asynchronously without a terminal. In such situations the message switching transaction ID of the Natural CICS Interface is used to deal with Natural directly.

## NEPTRAN - Transaction ID for the NCIZNEP Module

This parameter specifies the transaction ID for the Natural/CICS Interface node error program (NEP) NCIZNEP in an MRO environment, when the parameter [PURGE](#) is set to YES, see below.

Possible values are:

Value:	Explanation:
(see below)	Any valid CICS transaction ID.
NCOM	This is the default value.

## PURGE - Purge Active Natural Task

This parameter defines how NCIZNEP is to treat Natural sessions currently active, when the Natural/CICS Interface node error program (NEP) is invoked.

Possible values are:

Value:	Explanation:
No	This is the default value for compatibility reasons.  The active Natural task is <i>not</i> purged. The active task will continue to run until a terminal I/O later on will result in abend NT08 due to a CICS TERMERR condition, as the terminal no longer exists.
Yes	The active Natural task is purged immediately.  This functionality is supported in CICS Transaction Server systems only.

In MRO environments, a node error program is triggered in the CICS TOR; as the Natural session most likely is active in a CICS AOR, the task purge cannot be done in the TOR. Therefore a transaction ID is required (see [NEPTRAN](#) above) to start a “partner” NEP task in the AOR to do the task purge.



**Note:** PURGE=YES requires that the relevant Natural transactions are defined as purgeable (SPURGE(YES)).

## TSKEY - Prefix for Natural CICS Temporary Storage Key

This parameter defines the constant prefix of the temporary storage queue holding the NCI pseudo-conversational restart data.

Possible values are:

Value:	Explanation:
XXXX	XXXX defines the prefix for pseudo-conversational restart data.
NETR	This is the default value.

This parameter has the same meaning as the second subparameter of the parameter [TSKEY](#) in [NCISPCB](#) and must be specified identically.

# 4 Customizing VSAM RRDS Roll Files

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- Increasing the Number of VSAM RRDS Roll Files ..... 60
- Decreasing the Number of VSAM RRDS Roll Files ..... 61
- Changing the Characteristics of the VSAM RRDS Roll Files ..... 61

This part of the Natural CICS Interface documentation describes the customization of VSAM RRDS roll files.

- [Increasing the Number of VSAM RRDS Roll Files](#)
- [Decreasing the Number of VSAM RRDS Roll Files](#)
- [Changing the Characteristics of the VSAM RRDS Roll Files](#)

This section does not apply if you are using the Natural Roll Server.

### References to CICS Tables

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

This chapter covers the following topics:

## Increasing the Number of VSAM RRDS Roll Files

---

Up to nine VSAM RRDS roll files can be allocated. Each roll file has an ID consisting of a user-defined prefix followed by a fixed suffix. The prefix can be 1 to 9 characters long. The suffix consists of two characters from R1 to R9.

To add a new VSAM roll file, perform the following steps:

1. Create an empty VSAM RRDS conforming to your local site standards. Then initialize the data set using the batch program `NCISCPRI`, which must have been assembled during the Natural installation. The `SPACE` and `RECORDSIZE` attributes can differ between different roll files, so you can modify them as required to find the best values in your environment.
2. Create an FCT entry and change the CICS JCL accordingly, using the prefix/suffix for both.

The new roll file becomes available when the Natural CICS Interface is initialized again.

## Decreasing the Number of VSAM RRDS Roll Files

---

Perform the following steps:

1. Ensure that Natural is not active.
2. Either delete the FCT and JCL definitions or delete the file.

The number of roll files is adjusted when the Natural CICS Interface is initialized again.

## Changing the Characteristics of the VSAM RRDS Roll Files

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Perform the following steps:

1. Execute the procedures described above for decreasing the number of roll files.
2. Execute the procedures for increasing the number of roll files.



# 5

## Natural in CICS MRO Environments

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- NCIPARM Parameter COMARET Set to YES ..... 64
- NCIPARM Parameter COMARET Set to NO ..... 64

This part of the Natural CICS Interface documentation describes the functionality of Natural in CICS Multi-Region (MRO) Environments.

### References to CICS Tables

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

Special considerations apply when running Natural in a CICS multi-region (MRO) environment.

This chapter covers the following topics:

## NCIPARM Parameter COMARET Set to YES

---

When the `NCIPARM` parameter `COMARET` is set to `YES`, Natural session data are kept in two different CICS regions:

- The session restart information is kept in the `COMMAREA` linked to the terminal entry in the CICS terminal owning region (TOR).
- The actual session data are kept in the CICS application owning region (AOR); that is, the thread, swap pool, or roll facility.

This may lead to inconsistencies when, for example, the AOR is restarted, but the TOR still contains old “pending” Natural sessions; resuming such a session results in a corresponding error message.

## NCIPARM Parameter COMARET Set to NO

---

When `COMARET` is set to `NO`, all Natural session data are kept in the AOR, thus preventing the inconsistencies mentioned above.

However, there may be a security concern when a terminal is removed from the TOR (either back to VTAM or by switching the session manager or power off), and another terminal dialing to this TOR receives the ID of the removed terminal and enters the Natural transaction code: then this terminal resumes the session of the previously removed terminal because of the restart information in the AOR's temporary storage, which contains the terminal ID as part of the queue name.

To prevent such a situation, a node error program (NEP) can be installed (see [Node Error Program Considerations for Natural](#) and [Natural CICS Sample Programs](#)), which terminates a Natural session when the associated terminal is removed.



# 6 CICS Node Error Program Considerations for Natural

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- Situations Not under Control of Natural CICS Interface ..... 68
- Recovery Mechanisms ..... 68
- NCIZNEP Functionality ..... 69
- Special Considerations ..... 70
- Example Dummy Program ..... 70

This chapter discusses CICS node error program considerations.

See also:

- For information on installing a CICS node error program, refer to the corresponding section in *Installing Natural CICS Interface on z/OS* or *Installing Natural CICS Interface on z/VSE* in the *Natural Installation* documentation.

## Normal Situation

---

Whenever a Natural session is active, CICS resources such as thread storage, roll facility entries (that is, records in a VSAM RRDS file or in a CICS temporary storage queue), swap pool slots etc. are used.

If these resources are under the control of the Natural CICS Interface, they are correctly released whenever a session terminates normally or abnormally.

## Situations Not under Control of Natural CICS Interface

---

The following cases cannot be controlled by the Natural CICS Interface:

1. A non-Natural program called by Natural issues an `EXEC CICS ABEND CANCEL` command or the equivalent CICS macro request: the CICS task is canceled without the Natural CICS Interface receiving control to properly release all session resources.
2. Some CICS monitor products offer tools to purge CICS tasks, bypassing any abnormal termination exit set by the application. If a Natural task is canceled this way, the Natural CICS Interface has no chance to release the resources still owned by the session.
3. A user disconnects a terminal from the CICS region (by switching the power off or using an adequate session manager function) while a Natural session is currently not active in CICS (pseudo-conversational screen I/O).

## Recovery Mechanisms

---

The Natural CICS Interface provides some recovery mechanisms to recover from such situations; for example:

Whenever a new Natural session is to be started, a table is scanned for another Natural session still active with the same terminal ID. If such a session exists, it is logically terminated, and all its resources are released prior to starting the new one.

However, it may take quite a long time between logically terminating the session and releasing its resources, and there may also be a security concern:

When the `NCIPARM` generation parameter `COMARET` is set to `NO`, the information to resume a Natural session is kept in a CICS temporary storage record with the terminal ID being part of the temporary storage queue name. If another CICS user tries to start Natural with this terminal ID, he/she will resume the old Natural session rather than starting a new one.

The third case in the above list is the most crucial one. CICS provides a node error program (NEP) exit interface, which can be used in these cases to trigger the Natural CICS Interface to terminate the lost session. An appropriate program called `NCIZNEP` is provided in the Natural CICS source library (see [Natural CICS Sample Programs](#)); it must be called by a `DFHZNEP` node error program.

Based on session restart information (`NEXTTRANSID` and restart data in `COMMAREA` or CICS temporary storage), the Natural CICS Interface tries to resume the session and terminate it logically.

## NCIZNEP Functionality

Based on restart information (`NEXTTRANSID` and restart data in `COMMAREA` or CICS temporary storage) of a terminal bound session, which is currently pending in a pseudo-conversational screen I/O, `NCIZNEP` tries to resume the session asynchronously and terminate it logically.

Optionally, `NCIZNEP` can also try to purge an active Natural session. This functionality is available for CICS Transaction Server systems only. To enable this functionality, specify `PURGE=YES` in `SYS Parm` for the `NCIZNEP` assembly.

MRO/CICSplex environments:

- The program `NCIZNEP` must be defined also in the AOR.
- A transaction ID has to be defined for the program `NCIZNEP` in the AOR.
- This transaction ID must also be set via the `NEPTRAN` parameter in `SYS Parm` for the `NCIZNEP` assembly.

Upon completion, `NCIZNEP` indicates to the caller (normally `DFHZNEP`), by clearing the parameter input, whether it has successfully completed its work; that is, launching the Natural session clean-up task.

This is in particular of interest, if more than one Natural CICS versions are active in a CICS system: clean-up function of a specific `NCIZNEP` may fail, because the Natural session to be tidied up is a different Natural CICS Interface version. `DFHZNEP` now can test whether the called `NCIZNEP` (for example, `NCIvrNEP`, where `vr` represents the current Natural version) was successful, and if not, call another `NCIZNEP` (for example, `NCInnNEP`, where `nn` may be any preceding Natural version).

## Special Considerations

---

There are still some items to be considered:

- The Natural CICS source library contains two sample node error programs: `XNCINEP1` for CICS/VSE Version 2.3, and `XNCINEP2` for CICS/TS. Both sample programs do not perform anything special for the Natural CICS environment, they merely call (via `LINK`) the `NCIZNEP` program, which then deals with Natural under CICS.
- `DFHZNEP` may already be customized for a specific installation; as only one node error program is possible, the logic of the relevant `XNCINEPx` program should be adapted to the existing `DFHZNEP` logic.
- In MRO environments, `DFHZNEP` and `NCIZNEP` must be installed in the TOR.
- In CICS 3.3 or above, the `NCIZNEP` program must be defined with `EXECKEY(CICS)`.
- In the case described under item 3. above, `DFHZNEP` may receive control more than once for various internal error codes, since each internal error code is related to a specific CICS error message, but there may be more than one error message resulting from a given action.
- Upon completion `NCIZNEP` indicates to the caller (normally `DFHZNEP`) — by clearing the parameter input — if it has successfully completed its work, that is, launching the Natural session clean-up task.
- The CICS control block constellation may have changed each time a node error program has been invoked, for example, the `COMMAREA` and `NEXTTRANSID` information in the `TCTTE` may have been lost after a certain node error event. In this case the `NCIPARM` parameter `COMARET` must be set appropriately, which means that you cannot choose a node error event for your node error program to be invoked when passing the Natural pseudo-conversational session restart data in a CICS `COMMAREA` that has already been cleaned up by CICS.

## Example Dummy Program

---

If you want to know how many times and with what error codes `DFHZNEP` is invoked on certain actions and how the `TCTTE` should look, write a dummy node error program, which only issues CICS trace requests showing the requested information.

The following sample enables a `DFHZNEP` error processor to receive control for all possible error codes passed to `DFHZNEP`:

```
.  
DFHSNEP TYPE=INITIAL  
  
ORG NEPTT  
  
DC 256X'03' invoke error processor '3' for ALL error codes  
  
ORG ,  
  
DFHSNEP TYPE=ERRPROC,GROUP=3,CODE=49  
.  
  
set up requested information and issue trace request(s)
```



# 7 CICS 3270 Bridge Support

---

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- NCIXFATU - NCI Source Module ..... 74
- Profile Parameter DSC=OFF Recommended ..... 74

This chapter of the Natural CICS Interface documentation describes the CICS 3270 Bridge support.

## Default Support of CICS 3270 Bridge

---

By default, the Natural CICS Interface supports the CICS 3270 Bridge by being able to deal with “bridged devices”, that is, terminals which are emulated via a CICS 3270 bridge exit.

## Full CICS 3270 Bridge Support

---

If you want full CICS 3270 Bridge support, you have to install the NCI source module `NCIXFATU`. Refer to the corresponding installation step in *Installing Natural CICS Interface on z/OS* or *Installing Natural CICS Interface on z/VSE* in the *Natural Installation* documentation.

## NCIXFATU - NCI Source Module

---

The `NCIXFATU` module actually is a CICS `XFAINTU` Global User Exit (GLUE). Its purpose is to release Natural resources in case the bridge facility's keep-time has expired and an associated Natural session has not been terminated yet.

The `NCIXFATU` module provides the same functionality for Natural as a Node Error Program (NEP) provides for “real” terminals.

## Profile Parameter DSC=OFF Recommended

---

When you are using the CICS 3270 Bridge, you are recommended to start a Natural session with profile parameter `DSC=OFF` (data-stream compression for 3270-type terminals disabled) to force Natural always to send full screens rather than the delta to the previous screen.

# 8 Natural CICS Interface Threadsafe Considerations

---

The Natural CICS Interface can be defined threadsafe and can take advantage of OTE TCBs to improve through-put.

This means that the Natural CICS Interface has to provide for extra serialization via CICS ENQ / DEQ when not running under the QR TCB.

To minimize these serialization efforts, it is highly recommended

- to use `TYPE=GETM` threads without the `THREADS` parameter specified (or `THREADS=0`),
- to use the *Natural Roll Server* rather than roll facilities in CICS.



## Notes:

1. Adabas in CICS has to be threadsafe too, that is, this functionality cannot be used with Adabas versions prior to Version 8.
2. All user programs defined as `CSTATIC` have to be threadsafe.
3. All dynamic user programs which are invoked via standard linkage conventions either explicitly (that is, using the terminal command `%P=S`, `%P=SC`, `*P=L` or `%P=LS`) or implicitly (that is, when the `NCIPARM` generation parameter `SLCALL` is set to `YES`) have to be threadsafe.



# 9 Natural CICS Interface Support for CICS Channels and Containers

---

The IBM CICS Transaction Server for z/OS supports channels and containers for EXEC CICS LINK. In this respect CICS containers can be considered as named COMMAREAs without the 32 KB limit.

The Natural CICS Interface supports CICS containers in two ways:

1. Via a special SET CONTROL 'P=CC', the CALL statement parameter data is passed in a container.
2. When the NCIPARM system generation parameter `CNTCALL` is set to YES, a %P=C CALL automatically uses a CICS container rather than a CICS COMMAREA, when the parameter data passed with the CALL statement exceeds 32 KB.

In both cases, the default container name is NCI-COMMAREA unless a container name is defined explicitly via application programming interface USR4204N prior to the “real” CALL statement.



# 10 Natural CICS Interface and IBM Language Environment

(LE)

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The Natural CICS Interface supports LE programs. This document contains information on LE enablement of Natural under CICS.

## CICS Transaction Server for z/OS - LE-compliant

---

If supported by the CICS Transaction Server for z/OS installed at your site, the Natural CICS Interface is LE-compliant by itself, that is, a Natural CICS Interface task can directly CALL (standard linkage conventions, not CICS LINK) LE programs written in languages such as C, COBOL or PL/I, when

- SET CONTROL 'P=LS' has been specified,
- SET CONTROL 'P=S' has been specified,
- NCIPARM parameter `SLCALL=YES` has been specified and the program to be called is *not* a CICS program.

To make the Natural CICS Interface LE-compliant, set the CICS translator option LEASM when installing the Natural CICS Interface starter module NCISTART and the Natural CICS Interface RPC server front-end module NCISFED (see the corresponding step in *Installing the Natural CICS Interface on z/OS* in the *Natural Installation for z/OS* documentation or *Installing the Natural CICS Interface on z/VSE* in the *Natural Installation for z/VSE* documentation); this CICS translator option must not be set for any other Natural CICS Interface component or user exit.

## CICS Transaction Server for z/VSE - non-LE-compliant

---

Even if the Natural CICS Interface is not LE-compliant with the CICS Transaction Server installed at your site (due to missing support for LE-enabled assemblers), it still provides LE functionality for LE-compliant 3GL front-end program calls; see the sample program XNCIFRCN (COBOL), XNCIFRPN (PL/I) or XNCIFRDN (C), and the section *Natural CICS Sample Programs*.

Alternatively, LE compliance of the Natural CICS Interface nucleus can be achieved by linking one of the three delivered LE-compliant front-end stubs NCILEFC (COBOL), NCILEFP (PL/1) or NCILEFD (C) to the Natural CICS Interface nucleus; in this case the 3GL front-end stub has to be INCLUDED *before* the NCISTART module.

In order to notify the Natural CICS Interface about the underlying LE enclave, the LE-compliant 3GL front-end program first must call the NCI LE stub program NCILESTB by passing the CICS TWA address (see the samples mentioned above); this program checks if it is running LE-enabled, that is, if an LE enclave does exist, and sets up appropriate information for the Natural CICS Interface in the CICS TWA. For the Natural CICS Interface to run LE compliant, a front-end caller therefore must not pass front-end parameters in the CICS TWA.

In addition, for LE compliance of the Natural CICS Interface nucleus, the CICS-supplied EXEC interface stub DFHELII has to be used for installation (see *Installing Natural CICS Interface on z/VSE* in the Natural *Installation* documentation), rather than the DFHEAI stub module.



# 11 Special Natural CICS Functionality

---

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This chapter of the Natural CICS Interface documentation explains special Natural CICS functionality.

## Calling Non-Natural Programs

---

One of the first actions a Natural task does at its start, is to activate an exit for abnormal termination processing. This exit is used to release all resources including the thread in the case of an abnormal termination. Therefore, a non-Natural program must not issue `EXEC CICS ABEND CANCEL` or the equivalent macro level request, as such a request cancels the current session ignoring any active exit. If so, Natural is not able to clean up its resources, and the thread and the roll facility are not released.

A thread is assigned to a Natural task whenever a Natural program is active. This is also true when non-Natural programs are called (following CICS linkage conventions).

Therefore, such programs should not do excessive I/Os and other work load without Natural receiving control in between. If a non-Natural program is doing conversational screen I/Os, you can code a `SET CONTROL 'P=V'` statement in the Natural program that calls the non-Natural program before the calling statement: this indicates that parameter data are copied out of the thread and the session is rolled out before calling the non-Natural program.

### Calling Non-Natural Programs via Standard Linkage Conventions

A non-Natural program is invoked (CALLED) by Natural in the way programs are invoked within the underlying operating and/or TP-monitor system.

In CICS, non-Natural programs are invoked by means of `EXEC CICS LINK` requests. However, when, for example, the same subroutine program (not issuing any CICS or operating system request) is to be used for both batch and online processing, a non-Natural program may also be invoked by using CICS standard linkage conventions; that is, via `BALR R14,R15`.

For further information, see the terminal command `%P=S` in the *Terminal Commands documentation*. See also the parameter `SLCALL` in macro `NCMPRM`.

### Calling Non-Natural Programs with Parameter Values in a COMMAREA or in a Container

By default, non-Natural programs are called with the addresses of the request parameter lists (see the description of the `CALL` statement in the *Natural Statements documentation*) passed in the `TWA` and/or a `COMMAREA` (depending on the setting of the `NCIPARM` parameter `CALLRPL`).

A more CICS-like method is to pass the parameter values in a CICS `COMMAREA` or a CICS Container (see *Natural CICS Interface Support for CICS Channels and Containers*), particularly when the called program resides in another CICS region - Distributed Program Link (DPL) -, as addresses within the “calling” region are not accessible by the “called” region.

For details and restrictions, see the terminal commands %P=C and %P=CC in the *Terminal Commands* documentation.

### Prerequisite:

This functionality requires `CALLRPL` to be set to `YES` in `NCIPARM`.

When the parameter values are passed in a CICS `COMMAREA` or CICS container, no parameter list pointers are passed in the CICS `TWA`, regardless of the `CALLRPL` setting.

## Dummy Screen I/Os with Natural under CICS

If a `SET CONTROL 'Q0'` statement is placed before a Natural statement that causes a screen I/O, the terminal output is not executed by Natural under CICS. Consequently, both the `Enter` key and user input are not passed back to Natural.

This functionality may be useful in the following situations:

1. When leaving pseudo-conversational screen I/Os to non-Natural programs called by Natural. The non-Natural program performs the `EXEC CICS SEND` operation and returns to Natural. Due to the `SET CONTROL 'Q0'` statement, the next Natural screen I/O terminates the task of a pseudo-conversational session. Upon screen input, Natural receives control and invokes the non-Natural program again, which then performs the `EXEC CICS RECEIVE`.
2. When changing the Natural pseudo-conversational transaction ID “in-flight” without requiring a terminal operator intervention:

```
MOVE *INIT-ID TO termid
CALLNAT 'CMTRNSET' trnid /* change the restart transaction ID

* starting a task on your terminal forces an interrupt as if
* pressing any attention identifier

CALL 'CMTASK' USING trnid
H'0000' H'00000000' termid
SET CONTROL 'Q0'
INPUT 'DUMMY' /* dummy I/O, which you will never see
WRITE 'HELLO' *INIT-PROGRAM /* now the new transaction ID is active ↵
```

3. When switching to an application outside Natural, perhaps even in another CICS AOR (application-owning region), without requiring a terminal operator intervention:

```
* starting a task on your terminal forces an interrupt as if
* pressing any attention identifier

CALL 'CMTASK' USING trnid data-length start-data termid
SET CONTROL 'QQ'
INPUT 'DUMMY'                /* dummy I/O, which you will never see
WRITE 'HELLO' *INIT-PROGRAM  /* now the new transaction ID is active
```

In this case, it is the responsibility of the application being invoked to stack the Natural restart data when they are passed in a CICS COMMAREA, as a COMMAREA most likely is used by the new (pseudo-conversational) application, too.

## NCISTART - Natural CICS Nucleus

---

NCISTART (that is, the Natural CICS nucleus with NCISTART as entry point) is eligible to be placed into the CICS PLTSD for CICS quiesce stage 1 or 2 execution.

- When executed in quiesce stage 1, NCISTART force-terminates all active Natural sessions prior to performing the SYSTP snapshot function (described in *SYSTP Utility* in the *Natural Utilities* documentation).
- When executed in quiesce stage 2, NCISTART performs the SYSTP snapshot function.

NCISTART holds logic to be called (via a CICS LINK) by a node error program with the relevant CICS terminal entry address either in the CICS COMMAREA (with CICS/TS) or at the beginning of the TWA (with CICS/VSE Version 2.3).

# 12 Natural CICS Sample Programs

---

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- Sample Programs for Use with z/VSE ..... 90

This part of the Natural CICS Interface documentation contains an overview of the Natural CICS sample programs.

## Sample Programs in Natural CICS Source Library

---

The following sample programs are supplied in the Natural CICS source library:

- [Front-End Programs](#)
- [Back-End Programs](#)
- [User Exits](#)
- [Subprogram Calls](#)
- [Node Error Programs](#)
- [Other Programs](#)

### Front-End Programs

Name	Language	Function
XNCIFRNP	Assembler	Initialization program that initializes the Natural CICS environment at CICS start-up.
XNCIFRNL	Assembler	Front-end program for invoking Natural via EXEC CICS LINK.
XNCIFRNR	Assembler	Front-end program for invoking Natural via EXEC CICS RETURN IMMEDIATE.
XNCIFRNS	Assembler	Front-end program for invoking Natural via EXEC CICS START.
XNCIFRNX	Assembler	Front-end program for invoking Natural via EXEC CICS XCTL.
XNCIFRNN	Assembler	Front-end program for invoking Natural via EXEC CICS LINK without front-end parameters.
XNCIFRCL	COBOL	Front-end program for invoking Natural via EXEC CICS LINK.
XNCIFRCN	COBOL	This is a dummy front-end program for invoking Natural via EXEC CICS LINK for LE compliance.
XNCIFRCR	COBOL	Front-end program for invoking Natural via EXEC CICS RETURN IMMEDIATE.
XNCIFRCS	COBOL	Front-end program for invoking Natural via EXEC CICS START.
XNCIFRCX	COBOL	Front-end program for invoking Natural via EXEC CICS XCTL.
XNCIFRPL	PL/1	Front-end program for invoking Natural via EXEC CICS LINK.
XNCIFRPN	PL/1	This is a dummy front-end program for invoking Natural via EXEC CICS LINK for LE compliance.
XNCIFRPR	PL/1	Front-end program for invoking Natural via EXEC CICS RETURN IMMEDIATE.
XNCIFRPS	PL/1	Front-end program for invoking Natural via EXEC CICS START.
XNCIFRPX	PL/1	Front-end program for invoking Natural via EXEC CICS XCTL.
XNCIFRDN	C	This is the dummy front-end program for invoking Natural via EXEC CICS LOAD and BASR for LE compliance.

## Back-End Programs

Name	Language	Function
XNCIBACK	Assembler	Termination Data Dump: This back-end program displays the Natural termination message and any termination data in dump format. If invoked from an asynchronous task, the Natural termination message will be issued on the operator console, and potential termination data will be dumped. NCIBACK can also be invoked by a back-end transaction (RET=xxxx or RTI=xxxx or STR=xxxx, where xxxx is the transaction code associated with XNCIBACK).

## User Exits

Name	Language	Function
XNCIDIRX	Assembler	System Directory Module Name Exit: This source module contains a sample system directory module name exit (see also <a href="#">NCIDIREX - System Directory Module Name Exit Interface</a> ).
XNCIDTPX	Assembler	DTP Terminal Exit: This source module contains a sample DTP terminal exit (see also <a href="#">NCIDTPEX - DTP Terminal I/O Exit Interface</a> ).
XNCIRDC1	Assembler	Exit for SYSRDC: This program provides a sample exit for the SYSRDC utility; see the relevant section in the <i>Utilities</i> documentation.
XNCITIDX	Assembler	Terminal ID Exit: This program provides a sample user exit to test the terminal ID and/or to set a logical terminal or session ID (see also <a href="#">NCITIDEX - Terminal ID Exit Interface</a> ).
XNCITIOX	Assembler	DTP Terminal Exit: This source module contains a terminal I/O exit that is more general than the XNCIDTPX sample (see also <a href="#">NCIDTPEX - DTP Terminal I/O Exit Interface</a> ).
XNCIUIDX	Assembler	User ID Exit: This program provides a sample user exit to test/set the user ID (see also <a href="#">NCIUIDEX User ID Exit Interface</a> ).
XNCIXIDX	Assembler	Transaction ID Exit: This program provides a sample user exit to test/set the pseudo-conversational transaction ID (see also <a href="#">NCIXIDEX Transaction ID Exit Interface</a> ).

## Subprogram Calls

Name	Language	Function
XNCI3GC1	COBOL	This program provides a sample COBOL call to a Natural subprogram under CICS.
XNCI3GC2	COBOL	This program provides a sample COBOL call to a Natural subprogram under CICS.
XNCI3GC3	COBOL	This program provides a sample COBOL call to a Natural subprogram under CICS.
XNCI3GP1	PL/1	This program provides a sample PL/1 call to a Natural subprogram under CICS.
XNCI3GP2	PL/1	This program provides a sample PL/1 call to a Natural subprogram under CICS.
XNCI3GP3	PL/1	This program provides a sample PL/1 call to a Natural subprogram under CICS.

## Node Error Programs

Name	Language	Function
XNCINEP1	Assembler	This node error program calls NCIZNEP using the CICS macro level.
XNCINEP2	Assembler	This node error program calls NCIZNEP using the CICS command level.

## Other Programs

Name	Language	Function
XNCIUCTR	Assembler	Upper/lower case switch: This program serves to switch the terminal into upper/lower case mode.
XNCIGNIT	Assembler	"Good Night" program: This sample program calls NCIZNEP for Natural session clean-up.

## Sample Programs for Use with z/VSE

---

For z/VSE, the sample programs written in Assembler are supplied as A books. The sample programs written in COBOL are supplied as C books. The sample programs written in PL/1 are supplied as P books. The sample programs written in C are supplied as H books.

# 13 Invoking Natural from User Programs

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This section of the Natural CICS Interface documentation describes the various ways of how Natural can be invoked from user programs.

## Commands for Activating a Natural Session

---

This section covers the following topics

- Using EXEC CICS XCTL or EXEC CICS LINK
- Using EXEC CICS RETURN IMMEDIATE
- Using EXEC CICS START
- Using Distributed Program Link (DPL)
- Sample Programs
- Using the External Subroutine CMTASK

A Natural session can be activated by user front-end programs with one of the following commands:

- EXEC CICS XCTL
- EXEC CICS LINK
- EXEC CICS RETURN IMMEDIATE
- EXEC CICS START

or the equivalent CICS macro level requests.

### Using EXEC CICS XCTL or EXEC CICS LINK

When using EXEC CICS XCTL/LINK, the parameters used by Natural can be passed in a CICS COMMAREA or in the TWA.

- Natural determines the location of the startup parameters by inspecting the length of the COMMAREA passed to it during session initialization.
- If the length is 22, Natural tries to locate the parameters in the COMMAREA, otherwise it is assumed that they have been passed in the TWA.

To identify a front-end program properly, it is mandatory that the first 4 bytes of the front-end parameter list represent the current transaction ID.

The transaction ID associated with the front-end program must have a TWA size that is equal to or greater than the Natural TWA size; see also *ncitransact* in *Installing Natural CICS Interface on z/OS* or *Installing Natural CICS Interface on z/VSE* in the *Natural Installation* documentation.

## Using EXEC CICS RETURN IMMEDIATE

When using EXEC CICS RETURN IMMEDIATE, the front-end parameters used by Natural can be passed in a CICS COMMAREA and the dynamic parameters used by Natural can be passed with INPUTMSG (...) and INPUTMSGLEN (...) of the EXEC CICS RETURN IMMEDIATE command.

## Using EXEC CICS START

When using EXEC CICS START, the front-end and dynamic parameters used by Natural can be passed with FROM (...) and LENGTH (...) of the EXEC CICS START command. The parameters are described on the following page.

## Using Distributed Program Link (DPL)

When using EXEC CICS LINK with the SYSID parameter pointing to a remote region, the front-end and dynamic parameters used by Natural have to be passed in a CICS COMMAREA. In addition also a TRANSID parameter has to be specified naming the transaction code of a mirror transaction with a TWA size satisfying Natural's requirements.

It should be noted that the same restrictions as for asynchronous Natural sessions apply to Natural sessions invoked via DPL, that is, no input is possible (therefor the same dynamic parameter settings are recommended) and the caller just gets control back after Natural session termination.

## Sample Programs

A series of sample programs for the various programming techniques is supplied in the Natural CICS source library; see also [Natural CICS Sample Programs](#)

## Using the External Subroutine CMTASK

It is possible to start a Natural session from a Natural program by calling the external subroutine CMTASK. Refer to the sample Natural program ASYNCICS in library SYSEXP.

## Front-End Parameters

---

The following list of parameters must be supplied to invoke Natural from a user front-end program:

Pos.	Contents
1 - 4	<p><b>Invoking transaction ID</b></p> <p>This value must be equal to the current transaction ID. Via the invoking transaction ID, Natural identifies that it was called by a user front-end program.</p> <p>When being called with XCTL, the transaction is restarted at the end of the Natural session via RETURN with TRANS ID, unless a return program name is specified (see 5th parameter).</p>
5 - 8	<p><b>Address/offset of dynamic parameter string</b></p> <p>If dynamic parameter overwrites are to be evaluated, this value should be set to the address located 12 bytes before the dynamic parameter assignment string.</p> <p>When being called with START or DPL, the field must be set to the offset (relative to the start of the front-end parameter list) of the address located 12 bytes before the dynamic parameter assignment string.</p>
9 - 10	<p><b>Length of the dynamic parameter string</b></p> <p>Zero indicates that no parameters are to be passed. 32760 is the maximum length allowed. If the maximum value is exceeded, the session is terminated with a corresponding error message.</p>
11 - 14	<p><b>Natural transaction ID</b></p> <p>The value specified is the transaction ID to be used for controlling a pseudo-conversational Natural session, when being called with START or XCTL. This transaction is invoked each time the Natural session is restarted in pseudo-conversational mode; that is, with each terminal I/O.</p> <p>If the Natural transaction ID is not specified, Natural restarts the transaction ID which initiated the current CICS task, and the front-end program regains control after each pseudo-conversational I/O.</p>
15 - 22	<p><b>Back-end program name</b></p> <p>This 8-byte value is the program name to which control is transferred at the end of the Natural session with a CICS XCTL command, rather than restarting the calling transaction ID via RETURN with TRANSID.</p> <p>If this field is numeric in the first byte, Natural simply RETURNS without activating any back-end. Please note that this field can be superseded by the Natural profile parameter PROGRAM.</p> <p>For the conventions of calling non-Natural back-end programs, refer to the Natural Operations documentation.</p>

---

## Front-End Invoked via LINK

---

On return to the front-end, Natural indicates in the TWA if the session has terminated or not: when the session has terminated, the TWA holds regular back-end information (see Back-end Program Calling Conventions in the *Operations* documentation), else Natural puts the NEXTTRANSID into the first four bytes of the TWA.

If Natural is running in pseudo-conversational mode (profile parameter PSEUDO set to ON) and has been invoked by EXEC CICS LINK (or the equivalent CICS macro level request), the original invoking transaction is invoked each time Natural writes to a terminal and waits for input, which means that Natural issues a “logical” CICS RETURN TRANSID (..) after having written its restart information into CICS temporary storage.

The invoking transaction must recognize this situation (for example, by checking whether a NEXTTRANSID has been sent or by the existence of NCOMxxxx TS records - where NCOM is the Natural CICS parameter generation option and xxxx is the terminal ID -) and pass control back to Natural.

The advantage of this method is that, during the session, the front-end program can decide to pass control to another application (for example, COBOL) and to resume the Natural session later.

For further details see the PSEUDO parameter description in the *Parameter Reference* documentation.

Per design, Natural treats a LINK front-end program as a back-end program at session termination, that is, the *Back-End Program Calling Conventions* apply.

### In CICSplex Environments

Make sure that the NCOMxxxx TS records can be accessed by all participating CICS AORs (for example via appropriate CICS TST definitions).

Alternatively the LINK front-end program can also pick up the NCI session restart information in CICS temporary storage on task termination and pass it in a CICS COMMAREA by itself; such a COMMAREA has then to be put into CICS temporary storage again prior to invoking Natural for session resume.

## Front-End Invoked via RETURN IMMEDIATE

---

This front-end technique only works for terminal-bound Natural sessions. Natural scans for start-up parameters supplied with the COMMAREA. Note that when using this technique, potential dynamic parameters cannot be passed chained to the front-end parameters, that is, the dynamic parameters' address fields must be zero. Instead, potential dynamic parameters can be passed via terminal input data, which are obtained by Natural by an EXEC CICS RECEIVE command.

## Front-End Invoked via START

---

If the Natural session is a started task (that is, invoked by an EXEC CICS START or EXEC CICS LINK/XCTL command by a front-end user program which has been STARTed), Natural first scans for startup parameters supplied with the COMMAREA, then it scans for parameters in the TWA and finally it tries to obtain the necessary parameters by an EXEC CICS RETRIEVE command.

## Front-End Invoked via XCTL

---

If the Natural session is initiated from a front-end program with XCTL and no return program is specified (that is, neither a fifth parameter in the session startup parameters nor a PROGRAM specification in the Natural dynamic parameters or the NTPRM macro), Natural restarts the user front-end transaction at session termination via RETURN with TRANSID by internally simulating a PROGRAM='RET=xxx' specification, with xxx being the front-end transaction code.

To avoid a loop condition, logic must be included into the user front-end routine to decide whether a new session is to be started or an old session is to be resumed.

## Front-End Invoked via Distributed Program Link (DPL)

---

If the Natural session is invoked via DPL, Natural first determines if it is directly invoked in the server region or indirectly via EXEC CICS LINK/XCTL by a local front-end program. When being invoked directly, Natural retrieves the start parameters from the CICS COMMAREA. When being invoked indirectly, Natural scans for startup parameters supplied with the COMMAREA, then it scans for parameters in the TWA. On return Natural passes regular back-end data in the TWA when there is a local LINK front-end program available, otherwise it returns the termination message and potential back-end data in the remote client's COMMAREA.

## Invoking Front-End Program as Back-End

---

If the Natural session is initiated from a front-end program and this program is also specified to be the return program, the user front-end should also check for the initiating transaction ID.

In particular this applies if the front-end program is not in pseudo-conversational mode but Natural is in conversational mode.

In this case Natural is invoked again rather than getting terminated, but this time without detecting that it is called by a front-end program, as the first parameter in the startup parameters is the Natural transaction ID.



# 14 Asynchronous Natural Processing under CICS

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This chapter contains special considerations that apply when you are using asynchronous Natural under CICS.

## Asynchronous Natural Processing

---

Asynchronous Natural processing is generally discussed in the section *Asynchronous Processing* in the *Operations* documentation; however, some additional considerations apply when running under CICS. These are described in the following sections.

## Asynchronous Natural Sessions under CICS

---

Make sure that appropriate `SENDER` and `OUTDEST` destinations are specified for an asynchronous Natural session; otherwise, any output (for example, unexpected error messages) will lead to an abnormal termination.

Also, make sure that a suitable message switching transaction ID (`MSGTRAN`) is specified in the Natural parameter module and defined in CICS.

In addition to CICS terminal IDs and transient data destinations for `SENDER` and `OUTDEST`, the following keywords are supported by the Natural CICS Interface:

DUMMY	Any output is ignored.
CONSOLE	Any output is routed to the operator console.  When dealing with the console, the terminal type should be switched accordingly, using the profile parameter <code>TTYTYPE</code> or the terminal command <code>%T=</code> set to <code>ASYL</code> or other.

By default, the 3270 data stream protocol is used for output of an asynchronous Natural session under CICS.

It is also possible to send Natural output data without any 3270 terminal or printer control information to, for example, a CICS message destination such as `CSSL`. This can be accomplished by switching into line mode using a `SET CONTROL 'T='` statement or by starting with profile parameter `TTYTYPE=xxxx`, where `xxxx` is `BTCH` or `ASYL`. All Natural output is then sent line by line, with a leading ASA control character when the Natural profile parameter `EJ` is set to `ON`; with `EJ=OFF`, no control character is sent at all.



**Caution:** When `SET CONTROL 'T=xxxx'` or `SET CONTROL '+'` is used, or when personal-computer support is enabled (profile parameter `PC` set to `ON`), the Natural system variable `*DEVICE` will be modified, which means that it can no longer be used to determine an asynchronous Natural session.

Note that some parameter settings for asynchronous Natural sessions can be forced by setting the `NCMPRM` generation parameter `RCVASYN` to YES.

## Testing and Debugging

---

Recent CICS versions offer a transaction CEDX which enables tracing of asynchronous tasks in CICS. In earlier CICS versions, this functionality did not exist, that is, such debugging was only possible with terminal-bound tasks.

The Natural CICS Interface offers some assistance in this case: You can test asynchronous Natural sessions by starting that session from a terminal, but either with `ASYN`, as the very first five characters in the dynamic parameter string, or with the profile parameter `TTYPE=xxxx`, where `xxxx` is `ASYN` or `ASYL`. The Natural CICS Interface then sets up an asynchronous Natural session.

Please, note that this emulation is only 100 percent in terms of Natural; CICS keeps on treating the task as terminal bound.

---

# 15 Logging Natural Sessions under CICS

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This chapter describes how information about Natural sessions can be logged in a file which can be processed and evaluated in batch mode.

## Logging Facility

---

Optionally, information about Natural sessions can be logged in a file which can be processed and evaluated in batch mode.

In contrast to the online *SYSTP Utility*, which just gives a snap shot of the current system usage, this logging facility can be used to keep track of the Natural CICS system usage over a longer period of time.

### Special Considerations

- It is possible that several Natural CICS environments (that is, several system directories with unique threads, roll facilities, swap and buffer pools) share the same Natural log destination. When an SCP environment is initialized, a “system ID” is written into the system directory. This system ID is part of an evaluation program to “sort” log records by Natural CICS system environment.
- You are recommended to define the Natural log file in the Natural application CICS, as logging to a “remote” log file would degrade performance.
- When running the log file evaluation program (see *SYSTP in Batch Mode* in the *Natural Utilities* documentation), the log file should be closed in CICS, otherwise unpredictable results may happen due to the last buffer being still in storage or the EOF record missing on file.
- Sufficient disk space should be reserved for the Natural log file; preferably the log file should be defined using secondary allocation (if the file runs full in z/VSE, the z/VSE message `NO MORE AVAILABLE EXTENTS` is issued and the operator is asked to enter new extents or cancel CICS).

## Natural Log File Definition

---

The Natural log file is a sequential disk file; that is, an “extra partition destination” in terms of CICS. By default, the internal (logical) name of the log file is `NLOG`; this name can be changed by specifying the `LOGDEST` parameter in the `NCMPRM` macro.

The log file has to be defined in a CICS DCT as `TYPE=EXTRA` with associated data set control information (`TYPE=SDSCI` entry in DCT). This file must also be defined in the CICS start-up JCL (`DD` statement in z/OS, `DLBL` statement in z/VSE).

## Natural Log Records

---

The following records are logged in the Natural log file:

- [Natural CICS System Restart Record](#)
- [Natural Session Termination Record](#)

### Natural CICS System Restart Record

Length=96

After successful SCP system initialization, a record that holds the initialization date and time as well as other system data like the common system prefix, the number of RCBs or the number of thread groups, is written to the log file.

When this first log request fails, the Natural log file is flagged in the system directory as not available and no further logging takes place.

System restart records are written whenever the system highwater marks are reset by the corresponding system administration function of the `SYSTP` utility. In addition to the system start information, these records contain the terminal ID and the user ID of the `SYSTP` user.

### Natural Session Termination Record

Length=216

On (normal or abnormal) termination of a Natural session, a session log record is written to the log file. This record is internally split into six parts:

1. The record control part which holds the actual session statistics:
  - the current date and time (that is, the date and time when the session terminated),
  - the system ID which indicates the Natural CICS environment in which the session was active,
  - the record type = session record.

The record control part is common to all Natural log records to distinguish the different record types. Macro `NCMLOG` holds the record layouts.

2. The user session part which holds the actual session statistics:
  - the terminal ID,
  - the (last) user ID,
  - the session start date and time,
  - the maximum storage allocated by the session,

- the number of session resumes/swap ins/roll ins,
  - the maximum number of records rolled by the session (if any).
3. The thread group part which holds the current data of the thread group associated with the session:
- the thread group number,
  - the number of TCB slots in the group (if any),
  - the common thread size of the group,
  - the maximum storage allocated in the group by any session,
  - the maximum number of sessions active in the group,
  - the maximum wait queue size of the group (with `TYPE=SHR` thread groups) and the maximum number of sessions concurrently active in the group (with `TYPE=GETM` thread groups),
  - the number of times this maximum wait queue size was reached.
4. The thread part which holds the data of the `TYPE=SHR` thread used as last thread by the session (if used at all):
- the thread name,
  - the thread use count,
  - the highest thread storage used by any session,
  - the number of session resumes/roll-ins into this thread,
  - the maximum wait queue size of this thread,
  - the number of times this maximum wait queue size was reached.
5. The roll facility part which holds information about the roll facility to which the session was assigned (if it was at all):
- the roll facility name,
  - the maximum number of sessions assigned to this roll facility,
  - the record size of the roll facility,
  - the slot size of the roll facility,
  - the number of slots in this roll facility,
  - the maximum number of roll-outs to / roll-ins from this roll facility.
6. The system directory part which holds statistics about the global system usage:
- the maximum number of UCB block extensions,
  - the maximum number of sessions active in the system,
  - the maximum number of sessions concurrently active in SCP,
  - the number of SCP system recoveries.

By design, session termination records are stored by session date and time. This means that parts 3 to 6 of a later session record always hold more current information than those of a previous one. Parts 3 to 6 of the record are used by the log file evaluation program to refresh the corresponding information provided; that is, information on the thread group, thread, roll facility and SCB.

This technique is used to keep up-to-date information about the Natural CICS system resources in case CICS terminates in an uncontrolled manner.

The session termination log records, of course, reflect only resources which have been used by the corresponding sessions. Therefore, these records may not reflect the full SCP environment. Reports of a full SCP environment can be obtained by making a snapshot of the whole environment by either using the SYSTP *System Administration Facilities* or placing Natural under CICS into the CICS PLTSD (as described in the section *Special Natural CICS Functionality*).

System snapshot records in the Natural log file represent session termination records without session-specific information as listed under part 2.



# 16 Natural CICS Performance Considerations

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This chapter contains guidelines for setting up Natural in a CICS environment.

## Environment-Specific Considerations

---

The following environment-specific considerations should be noted:

- When running Natural in a CICSplex environment (z/OS only), you must use the Natural Roll Server.
- When running Natural locally in a single CICS region, however, you have several possibilities.

One possibility (z/OS only) is to use the Natural Roll Server. The benefit of this versus using CICS roll facilities and a swap pool is that the Natural Roll Server runs asynchronously to the CICS region and can provide more roll buffers in its data space than the swap pool.

## Choosing the Roll Facility

---

This section covers the following sections:

- [Control Interval](#)
- [VSAM Roll Files versus CICS Temporary Storage](#)
- [Using CICS Auxiliary Temporary Storage](#)
- [Using CICS Main Temporary Storage](#)
- [Using VSAM RRDS Roll Files](#)
- [Using the Natural Swap Pool under CICS](#)

### Control Interval

You are strongly recommended to define both roll facilities, VSAM and auxiliary temporary storage, with the largest possible control interval size of 32 KB. This minimizes the number of I/Os and the CPU overhead necessary to perform the rolling.

Reasons for a control interval size of less than 32 KB might be the better exploitation of disk tracks or the usage of virtual storage for the VSAM buffers.

## VSAM Roll Files versus CICS Temporary Storage

With the same CISIZE/record size, temporary storage causes less CPU overhead than VSAM roll files:

To write  $n$  records to temporary storage you have to issue  $n+1$  CICS requests (that is, 1 for DELETEQ and  $n$  for PUTQ) while you have to issue  $2n$  requests for VSAM roll files because of the VSAM transaction logic:  $n$  times (READ for UPDATE plus REWRITE).

For VSAM update requests, a physical I/O is always performed, whereas for temporary storage (AUX) records, buffering takes place, so that in many cases, records to be read are still found in the buffers.

However, CICS temporary storage may become a bottleneck when it is also being used by other applications.

VSAM roll files for Natural can overcome this situation (although at the expense of additional VSAM buffer space) especially when I/O contention can be avoided. VSAM roll files with optimum/maximum CISIZE/record size are particularly efficient when this record size cannot be specified for the CICS temporary storage file due to other requirements.

CICS temporary storage should be used whenever it can be dedicated to Natural. If CICS temporary storage is also used by other applications, you should evaluate whether the Natural performance is better when using VSAM roll files.

If Natural with CICS temporary storage does not perform worse, you should choose CICS temporary storage as roll facility and use the “saved” VSAM roll file buffer space for more TS buffers or for an additional thread.

## Using CICS Auxiliary Temporary Storage

The primary roll facility is VSAM RRDS; the default type of temporary storage is AUXILIARY.

If you are using VSAM roll files, the Natural CICS Interface uses temporary storage (AUX) if all roll files become full or unusable during a CICS session.

However, if you do not wish to use roll files or if the roll files are incorrectly installed, Natural under CICS uses temporary storage (AUX) for all rolling. When temporary storage (AUX) is used as roll file, the control interval size for this file must be at least 4 KB. If auxiliary temporary storage is not available, main temporary storage is used instead.

The number of VSAM buffers defined by the CICS SIT parameter TS should be increased to a reasonable value to reduce the number of physical I/Os. The CICS statistics should be checked for bottlenecks in this area.

## Using CICS Main Temporary Storage

With CICS main temporary storage as roll facility, no I/O is performed on rolling, but due to large main storage amounts used, tuning considerations may be required due to increased paging.

## Using VSAM RRDS Roll Files

The VSAM roll files should be considered for normal CICS VSAM file tuning, for example, `BUFNO` and `STRNO` parameters in the `FCT`. The CICS shutdown statistics should be checked for bottlenecks in this area.

As the roll files serve as a kind of page data set for Natural, everything which slows down the Natural rolling should be avoided, as there is journaling and logging; dynamic transaction backout (DTB) and forward recovery for roll files is useless and only causes overhead.

## In MRO Environments

For performance reasons the VSAM roll files should be defined in the same CICS system in which the Natural applications are running; MRO function shipping should not be invoked. CICS local shared resources (LSR) can be used if there are enough buffers available.

## Separate LSR Pool for Natural

The definition of a separate LSR pool for Natural roll files is recommended, with the number of strings (`STRNO`) greater than the number of threads. The number of buffers should also be greater than the number of threads. A greater number of buffers increase the look-aside hit ratio.

## Using the Natural Swap Pool under CICS

You are strongly recommended to use a swap pool rather than a large number of VSAM temporary storage (`AUX`) buffers or temporary storage (`MAIN`).

The Natural swap manager handles the compressed session storage very efficiently and reduces CPU and I/O overhead. The size of the swap pool should be as large as possible. For example, a swap pool of 2.5 MB would be required to hold 50 sessions which fit into 50 KB slots.

From a performance point of view, it does not make any sense to use main temporary storage as a backup facility for the swap pool, since both of these facilities use CICS main storage. In general though, using the swap pool is more advantageous, because CICS services overhead is eliminated. Rather than overflowing to main temporary storage, it would be better to enlarge the swap pool and to use disk storage (that is, VSAM roll files or auxiliary storage) as its backup facility.

If virtual storage becomes a bottleneck, the number of roll facility buffers and possibly the number of threads should be minimized to the benefit of the swap pool.

When using the Natural swap pool cache, a roll buffer of the size of the largest Natural thread is required for transferring Natural session data between the swap pool and its (data space) cache. This roll buffer is taken from the `GETMAIN` for the swap pool, that is, the size of the storage actually available for the swap pool is the specified size minus the size of the largest Natural thread.

Therefore a Natural swap pool cache is only allocated when both the size of the swap pool and the size of its cache are at least twice the size of the largest Natural thread.

## Shared Storage Threads versus GETMAINED Threads

---

This covers section the following sections

- [Storage Usage](#)
- [Controlling Storage Usage](#)
- [Swapping/Rolling](#)
- [Considerations for CICS/TS](#)
- [Conclusion](#)

### Storage Usage

Shared storage threads are pre-allocated during Natural CICS system initialization, which means that the storage covered by these threads is dedicated to the Natural CICS system, regardless of whether there are active sessions or not. On the other hand, `GETMAINED` threads only exist while the CICS task is active.

### Controlling Storage Usage

With shared storage threads (`TYPE=SHR`), Natural under CICS always uses what has been pre-allocated during the initialization of Natural; therefore, the size of storage used by Natural threads is easily predictable. For `GETMAINED` threads (`TYPE=GETM`), however, the actual storage used depends on the number of Natural sessions that are currently active.

Although Natural itself has no mechanism for setting the maximum number of `GETMAINED` threads, this can be controlled by grouping the Natural transaction codes into a `TRANCLASS` (`TCLASS` prior to CICS Version 4.1). When a transaction code belongs to such a class, the maximum number of parallel tasks can be regulated by the `MAXACTIVE` parameter in the `TRANCLASS` definition (or by using the `CMXT` parameter of the CICS system initialization table (SIT) prior to CICS Version 4.1).

## Swapping/Rolling

When a Natural session releases its shared storage thread, session data are kept in the thread in uncompressed format, unless another session needs to use this particular thread. If so, the new session is responsible for saving the old session's data.

Such an activity is called “deferred rolling”. It enables you to eliminate rolling or swapping entirely, provided that the number of available threads is greater or equal to the number of concurrently active Natural sessions.

Conversely, sessions that use `GETMAINED` threads always save their data prior to the `FREEMAIN` operation at CICS task termination, which leads to a roll/swap overhead regardless of the number of concurrently active Natural sessions.

In environments with high volumes of Natural transactions, there is practically no difference between saving session data via the “immediate” or the “deferred” rolling method.

In busy Natural environments with a high ratio of Natural sessions to program storage threads, there is more roll-in/roll-out overhead, since these threads are shared by several Natural sessions. A potential problem in this situation is thread contention caused by Natural tasks with long-running Adabas requests; that is, with many Adabas calls.

To prevent such tasks from “locking” a thread for too long, they can be forced to release their thread by using Natural profile parameter `DBROLL` appropriately.

For `GETMAINED` threads, however, contention between two or more Natural sessions never occurs, since a `TYPE=GETM` thread belongs exclusively to the Natural session it was allocated for.

`TYPE=GETM` threads can thus be considered “single-use” resources that are never shared, whereas `TYPE=SHR` threads can be considered “multi-use” resources that may be shared.

## Considerations for CICS/TS

The most important feature of CICS/TS in z/OS is transaction isolation, which means that a task's storage can be protected against other tasks.

To take advantage of this facility with Natural, `TYPE=GETM` threads should be used, since these threads are subject to transaction isolation, whereas “shared” `TYPE=SHR` threads are not. Also additional CICS overhead occurs for `TYPE=SHR` threads with CICS/TS.

While the thread selection algorithm for `TYPE=GETM` threads is trivial (when a Natural task is started, a thread is allocated via `CICS GETMAIN`), for `TYPE=SHR` threads, it is more complicated: the Natural threads environment is managed by `NCISTART` (queueing and balancing), whereas CICS does not know anything about Natural threads. In contrast to `TYPE=GETM` threads, where CICS would release the thread at the latest at the end of the task, with `TYPE=SHR` threads, Natural has to assign/release them to/from their sessions. In order to do so, Natural maintains a list of thread control blocks (TCBs).

Although Natural always keeps an exit active to be able to release session resources unknown to CICS (for example, `TYPE=SHR` threads) in the case of abnormal task termination, situations may occur where a Natural task terminates without its thread being marked as free in the associated TCB (for example, if an `EXEC CICS ABEND CANCEL` request has been issued in a non-Natural program called by Natural, or if Natural sessions have been flushed by any `KILL` transactions of a performance monitor).

To prevent problems with threads inadvertently left busy, Natural under CICS always checks in its thread selection algorithm whether the CICS task associated to a busy thread is still existing; if not, the thread is released.

With CICS versions prior to CICS/TS, this checking for active CICS tasks was done by control-block jumping, which means that Natural was checking for an active task by testing the consistency of the task's `EISTG`, `TCA` and `TQE` control blocks. With CICS/TS, because of transaction isolation, the storage of another task may not be accessible at all.

To accomplish this function in CICS/TS, `NCISTART` issues an `EXEC CICS INQUIRE STORAGE TASK()` request for any thread identified as busy in the thread selection routine. This means that there may have been some CICS requests before the task is finally `ENQueued` for thread resources. The same CICS command is also used for the serialization of Natural sessions (for example, deferred rolling of `TYPE=SHR` threads).

## Conclusion

Both `TYPE=SHR` and `TYPE=GETM` threads have their advantages and disadvantages. However, with CICS/TS, `TYPE=GETM` threads are preferred, because of:

- the support of transaction isolation (z/OS only),
- more CICS-like tuning possibilities,
- worse performance of `TYPE=SHR` threads.

## CICS Parameter Settings

---

CICS SIT parameters `AMXT` and `CMXT` should be used to control the number of concurrent Natural tasks.

The number specified should be greater than the number of threads. You should also consider to specify a separate transaction class with a suitable `CMXT` parameter for asynchronous Natural tasks and for Natural Advanced Facilities spool tasks so as to prevent logouts of “normal” Natural terminal tasks by too many of such “background” tasks occupying threads. Special thread groups can be defined for these transactions.

CICS dumps for Natural transactions should be suppressed, unless requested from Software AG personnel for debugging purposes. Natural itself generates dumps (via `EXEC CICS DUMP`) for non-

program check abends, and also for program checks if the Natural session parameter `DU` is set to `ON`. When no Natural dump is generated, a CICS dump is redundant and just causes overhead (particularly when creating a system/region dump, since the whole CICS system is halted until the snap dump is completed).

CICS trace is essential when analyzing problems, although it introduces system overhead. Also CICS performance monitoring tools and accounting packages cause system overhead of up to 30 percent and more. Some packages internally turn on the CICS trace and then intercept it. You should be aware of this potential system overhead. Also remember that the Natural CICS Interface uses the CICS command level application programming interface: CICS command level requests produce much more trace entries (apart from other overhead) than CICS macro level requests.

## Line Compression Systems

---

Natural itself optimizes its data streams by means of RA (repeat to address) and other techniques as screen imaging etc. If other line compression systems are installed, the Natural transactions should be excluded from being processed by these systems, as this would introduce overhead without achieving any benefit.

## Pseudo-Conversational versus Conversational Transactions

---

When resuming a session, conversational Natural tasks are locked to their initial thread, which means that a conversational task has to wait for this thread if it is currently not available. Pseudo-conversational Natural tasks, however, are flexible to roll into any available thread.

In other words, the “classical” advantage of conversational tasks - less I/Os for saving/restoring data over screen I/O operations - does not apply for Natural because of its thread technique.

## Natural and Adabas

---

Since a Natural task in CICS waits for completion of an Adabas call, the servicing Adabas region/partition should always have higher priority than the CICS region/partition to minimize wait time.

## CICS Monitoring Products

---

CICS monitoring products may offer facilities to purge CICS tasks, bypassing any abnormal termination exit set by the application.



**Caution:** Such facilities should not be used to cancel Natural tasks, as Natural may not be able to clean up its resources, and, even worse, the Natural CICS system may be left in an inconsistent state depending on what this task was doing.

To cancel Natural sessions, the Cancel/Flush Session functions of the Natural `SYSTP` utility should be used instead; see the relevant section in the Natural *Utilities* documentation for details.



# 17 Natural Print and Work Files under CICS

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- CICS Temporary Storage Print and Work Files ..... 120
- CICS Transient Data Print and Work Files ..... 121

This chapter discusses the use of Natural print and work files under CICS.

## Customizing Print and Work File Usage

---

The Natural CICS Interface supports Natural print and work files in CICS either as CICS transient data queues or as CICS temporary storage queues, both auxiliary and main.

To customize usage, set the following subparameters in the `PRINT` and `WORK` profile parameter:

```
AM=CICS, TYPE=TD/AUX/MAIN, DEST=queueName
```

For more information, follow the links shown below:

- `WORK` profile parameter description and how to set the above subparameter values, see the `NTWORK` parameter macro.
- `PRINT` profile parameter description and how to set the above subparameter values, see the `NTPRINT` parameter macro.

The Natural CICS Interface print file support has been provided for tracing and logging purposes. It is not intended for dealing with reports. In particular, the keyword parameters for `DEFINE PRINTER` such as `PRTY`, `CLASS`, `COPIES`, etc., are not honored at all.

## CICS Temporary Storage Print and Work Files

---

CICS temporary storage queues, both auxiliary and main, for CICS print and work files are `RECFM=V` files by design, available for input and output.

Although in Natural under CICS there is no exclusive control of a specific TS queue by a Natural session, you can automatically create session- or terminal-dependent printfiles or work files by specifying the string defined in the `NCIPARM` parameter `TERMVAR` (&TID is the default) in the subparameter `DEST` of profile parameter `PRINT` or in the subparameter `DEST` of the profile parameter `WORK`. When such a string is found within the eight-character `DEST` subparameter, it is replaced by the actual terminal ID.

## In CICSplex Environment

When running in a CICSplex environment, Natural print and work files in CICS temporary storage must be defined as `TYPE=SHARED` or `TYPE=REMOTE` in a CICS TST.

## NCI System Queues

In Natural under CICS, NCI system queues cannot be accessed. (NCI system queues are TS queues with a prefix defined in the `TSKEY` parameter of macro `NCMDIR`.)

## CICS Transient Data Print and Work Files

---

A CICS transient data queue for a Natural CICS print and work file must be defined in the CICS DCT. For indirect destinations, the attributes of the *base* destinations are propagated. In particular, the attributes of an *extra-partition* destination, such as `RECFM` or `TYPEFLE`, determine the Natural work file attributes.

*Intra-partition* destinations have `RECFM=V` set by design and are available for both input and output.

CICS transient data print and work files are “shared files” in the sense that more than one session may issue I/Os against such a file.



# III

## Natural under CICS - Natural CICS Interface Version 8.3

---

This document describes the functionality of the Natural CICS Interface Version 8.3 (product code NCI) for z/OS and the operation and individual components of Natural in a CICS environment.

[Natural CICS Interface Functionality](#)

[Natural CICS Generation Parameters](#)

[Customizing VSAM RRDS Roll Files](#)

[Natural in CICS MRO Environments](#)

[CICS Node Error Program Considerations for Natural](#)

[CICS 3270 Bridge Support](#)

[Threadsafe Considerations](#)

[Support for CICS Channels and Containers](#)

[IBM Language Environment \(LE\) and Natural CICS Interface](#)

[Special Natural CICS Functionality](#)

[Natural CICS Sample Programs](#)

[Invoking Natural from User Programs](#)

[Asynchronous Natural Processing under CICS](#)

[Logging Natural Sessions under CICS](#)

[Natural CICS Performance Considerations](#)

[Natural Print and Work Files Under CICS](#)

### References to CICS Tables:

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

**Notation** *vrs* or *vr*:

When used in this document, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

**Related Topics:**

- *Installing Natural CICS Interface on z/OS* in the *Natural Installation* documentation
- *Natural under CICS Abend Codes and Error Messages, Natural under CICS Informational Messages and NCISCPRI Warnings and Error Messages* in the *Natural Messages and Codes* documentation
- *Error Messages from the Natural Swap Pool Manager Valid under CICS and openUTM* in the *Natural Messages and Codes* documentation
- *SYSTP Utility* - this Natural utility provides various TP monitor-specific functions.
- *Natural as a Server under CICS*

# 18 Natural CICS Interface Functionality - Natural CICS

## Interface Version 8.3

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This chapter describes the functionality of the Natural CICS Interface.

## Natural CICS Interface

---

The Natural CICS Interface is implemented in command level Assembler, thus allowing Natural to be compatible with the CICS Multiple Region Option and the debugging facility CEDF.

The Natural CICS Interface controls session initialization, roll-in restart (in pseudo-conversational mode), terminal I/O, database access, ABEND processing, Natural local buffer pool calls and the loading, linking to and releasing of external subroutines. In addition, all roll I/O operations are made from the Natural CICS Interface.

## Natural Environment-Dependent Nucleus for CICS

---

The Natural environment-dependent nucleus (described in the Natural *Installation* documentation) for CICS consists of the following components:

- The object module `NCINUCM` specific to z/OS.

This module holds the logic required for calling operating-system and CICS services.

This module also holds the entry routine, which in particular prepares the Natural CICS Interface Language Environment (LE) linkage; see [Natural CICS Interface and IBM Language Environment \(LE\)](#). The module is CICS version dependent.

- The `NTCICSP` macro of the Natural parameter module (see *CICSP - Environment Parameters for Natural CICS Interface the Parameter Reference* documentation).

This macro holds Natural CICS Interface parameters required for runtime and system environment generation options. The module is not CICS version dependent, although some of the parameters should be set depending on the CICS version.

- The object module `NCINUC`.

This module holds the Natural CICS Interface system control logic and service routines used by the environment-dependent nucleus. The service routines are independent of CICS and CICS version and are dealing with CICS by calling CICS service routines in the `NCINUCM` module.

- The object module `NCIXCALM`.

This module is a separate program in CICS, that is, it is not linked to the Natural nucleus, as it is invoked via `EXEC CICS LINK` from 3GL programs called by Natural; see *Natural 3GL CALLNAT Interface* in the *Operations* documentation. The module is independent of the CICS version.

## CICS Shutdown under Natural

The Natural environment-dependent nucleus is eligible to be placed into the CICS PLTSD for CICS quiesce stage 1 or 2 execution.

- When executed in quiesce stage 1, Natural CICS Interface force-terminates all active Natural sessions prior to performing the SYSTP snapshot function (described in *SYSTP Utility* in the *Natural Utilities* documentation).
- When executed in quiesce stage 2, Natural CICS Interface performs the SYSTP snapshot function.

Natural CICS Interface holds logic to be called (via a CICS LINK) by a node error program with the relevant CICS terminal entry address either in the CICS COMMAREA.

## System Control under CICS

---

Natural features specific to CICS include the organization of dynamic storage in threads and the additional capability of handling these threads so that the Natural CICS System Control Program can more efficiently handle dynamic storage.

The Natural CICS System Control Program was initially developed to overcome the 64 KB GET-MAIN limit under CICS. It provides complete storage allocation and management functions, including roll file I/O operations and relocation functions for pseudo-conversational users.

In order to enhance the pseudo-conversational processing capabilities of Natural with CICS, the System Control Program uses threads, a contiguous amount of storage which is set up for each user. This structure allows Natural to manage dynamic storage with minimal CICS involvement.

A complete understanding of system control can be attained from the following discussion of its structure and operation. Ensure that you understand this mechanism before starting the installation procedure of Natural under CICS.

## Natural Components in CICS Dynamic Storage

---

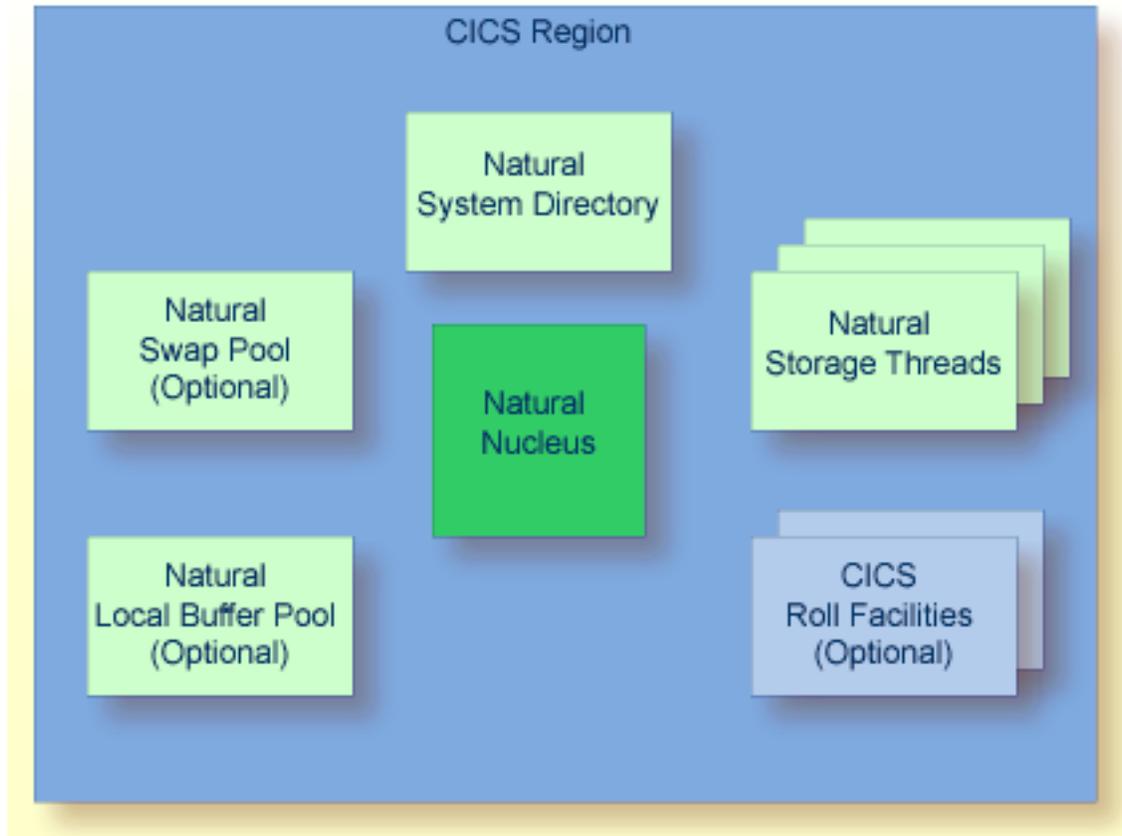
### Scenario 1:

#### Single CICS Region

The diagram below shows the components of the Natural system that reside in CICS dynamic storage. The components are explained under the following headings:

- *Natural Storage Threads under CICS*
- *Natural Local Buffer Pool under CICS*

- *Natural Swap Pool under CICS*
- *Natural Roll Facilities*



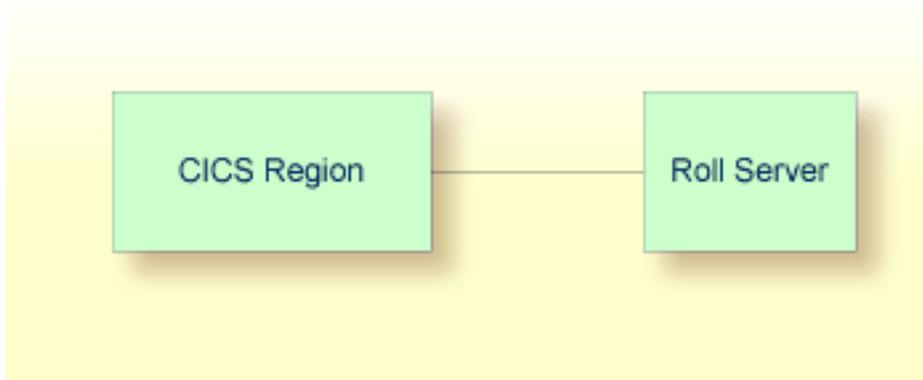
Scenario 1 applies when running Natural locally in a single CICS application region under z/OS.

**Note for z/OS:**

Additional scenarios are possible. The following three diagrams show combinations of z/OS systems, CICS regions, the *Natural Roll Server* and the *Natural Authorized Services Manager* (described in the *Operations* documentation).

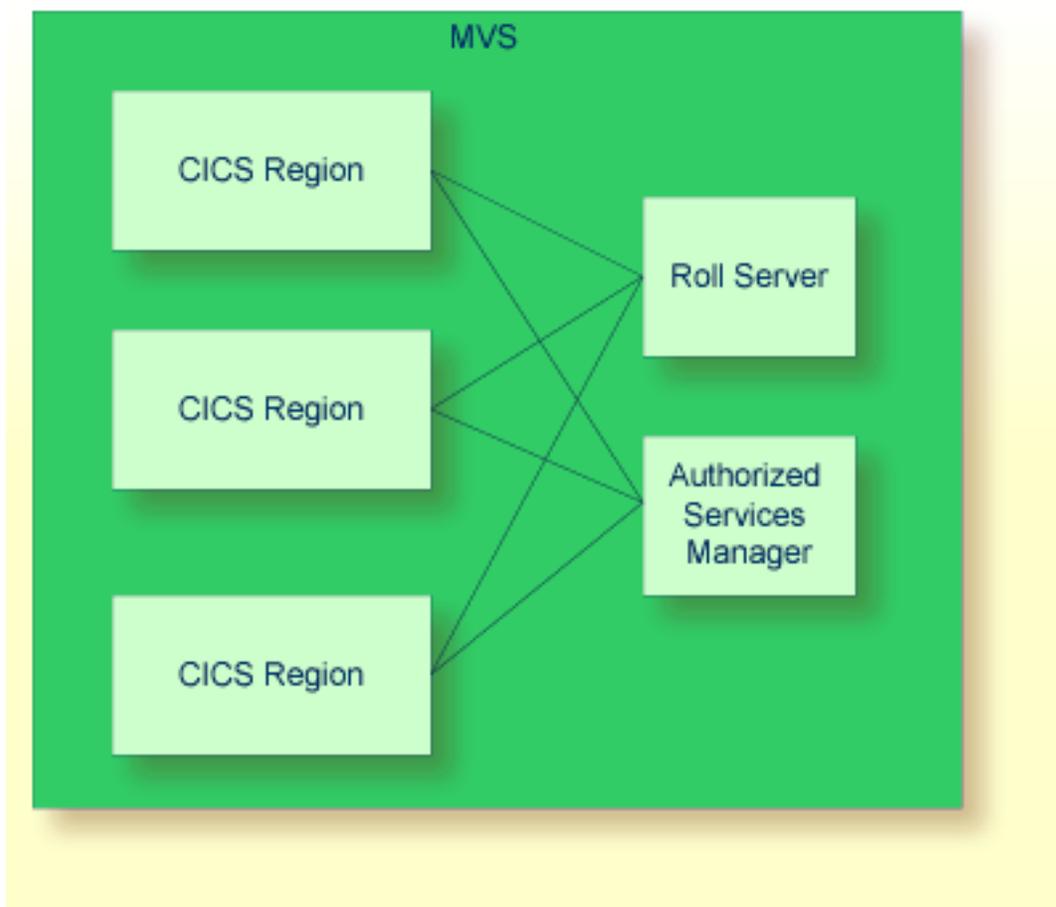
**Scenario 2:**

Single z/OS With Single CICS Region, Single Roll Server



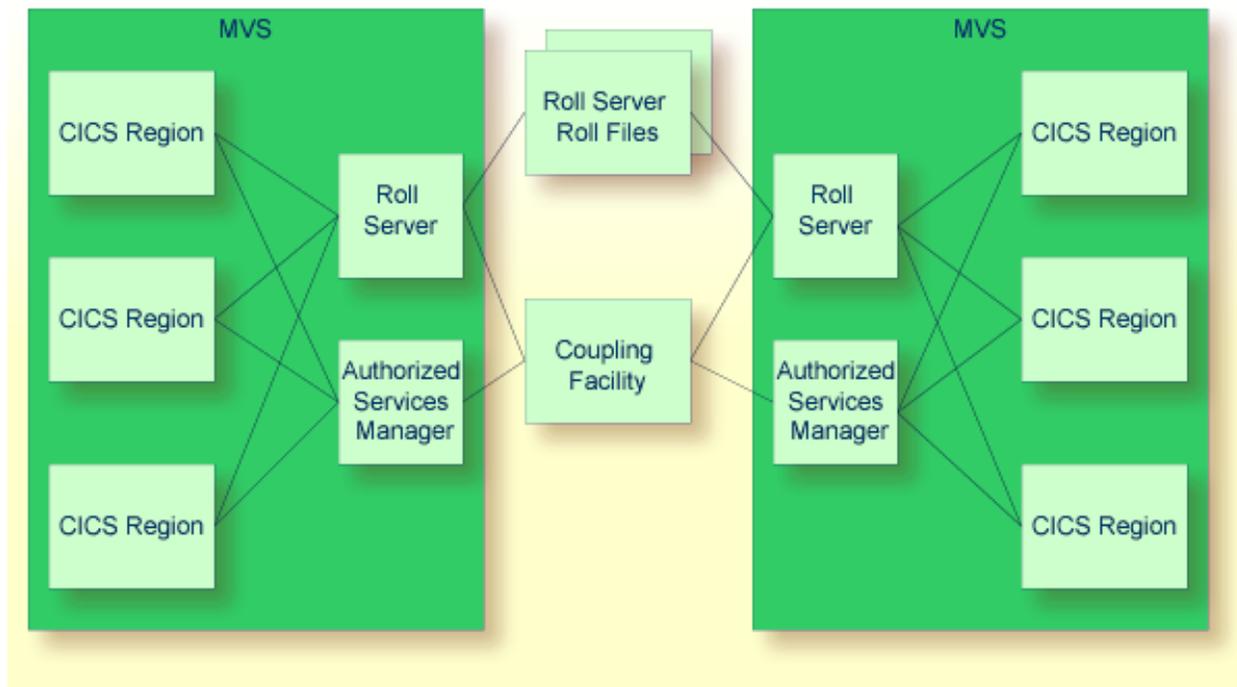
**Scenario 3:**

Single z/OS With Multiple CICS Regions, Single Roll Server and (Optional) Authorized Services Manager



**Scenario 4:**

Multiple z/OS With Multiple CICS Regions, Multiple Roll Servers/Authorized Services Managers



**Parameter Settings Required for the Above Scenarios**

Module	Scenario 1	Scenario 2	Scenario 3	Scenario 4
NTBPI (BPI)	TYPE=SWAP, SIZE= <i>nnn</i>	n/a	n/a	n/a
NCMDIR CICSPLX	NO	NO	YES/MODE	YES/MODE
NCMDIR SIPSERV	NO	NO/YES	yes	yes
NCMDIR ROLLSRV	NO	yes	yes	yes
Roll Server	n/a	none	none	<i>name</i>
CF structure name				
Authorized Services Manager/SIP	n/a	n/a	SIP slot number/size	XCF group name/CF structure name

The Natural CICS Interface requires a SIP slot size of 256 bytes.

**Note:** For the scenarios 2, 3 and 4, the very first Natural session initializing the NCI environment must have the `SUBSID` parameter set to the value of the corresponding *Roll Server* and/or *Authorized Services Manager*.

## Natural Storage Threads under CICS

---

A thread is a contiguous storage area from where Natural requests all its required storage. It can either be storage shared by several Natural users or, in 31-bit mode environments, CICS user storage above the 16 MB line dedicated to a specific task.

Each storage thread can be seen as the “address space” for a Natural user. Each memory allocation request issued by the Natural nucleus is transferred to the system control program to be satisfied from the storage thread.

Storage threads are allocated when the Natural CICS Interface is initialized. They are allocated in a CICS region or partition, in which case they are permanent (shared) threads or they are allocated during the start of a Natural CICS task, in which case they are exclusive threads (task-dependent user storage).

The technique of storage threads was implemented with Natural for the following reasons:

- To overcome the 64 KB limitation of CICS for user storage in non-31-bit mode systems.
- To be able to optimize rolling (formerly, each piece of user storage had to be written to the roll medium; now, as there is a contiguous storage area, this area is compressed by making the relevant portions contiguous to each other before rolling out).
- The Natural CICS Interface tries to satisfy all `GETMAIN` requests of a Natural session from its thread. This is faster than `GETMAIN` requests by means of CICS service calls. This is particularly true for CICS command level calls, as the CICS `EXEC` Interface Program (`EIP`) is involved, too.

A thread is released by the owning task with every screen I/O. This is true for both conversational and pseudo-conversational tasks. When a session is resumed, its storage is rolled into a thread again, unless its storage is still there; that is, no other task used the thread in between.

The Natural thread selection algorithm balances thread usage to minimize roll I/Os. This means that the more threads there are, the better is the chance of finding the old data thus preventing a roll-in. However, the more threads there are, the more paging the operating system must perform to keep all threads efficiently in real storage.

Threads are grouped together depending on their size and their type; that is, whether they have been pre-allocated as permanently shared storage or via a `GETMAIN` request. The decision on which kind of thread group to use, is controlled by the CICS transaction code at session initialization time. All storage threads belonging to the same group have the same size.

The thread should be defined as small as possible; see also the *Buffer Usage Statistics* function of the `SYSTP` utility described in the Natural *Utilities* documentation. However, the thread must still be large enough to hold the session with the largest sizes.

If you have separate Natural development and production environments, the rule is to have more smaller threads in the production environment (to serve production requests as soon as possible) and fewer larger threads in the development environment (as Natural programmers normally need larger Natural sizes and have longer “think times”).

The very first Natural session allocates all permanent (shared) threads.

## Natural Roll Facilities under CICS

---

As permanent storage threads are shared by several users and as larger threads allocated via GETMAIN should not be kept for too much time, a Natural task releases its thread with each terminal I/O. Previously, however, the user data have to be saved to be able to restart the Natural session after the terminal I/O has been performed.

Session data can be saved by using

- the Natural Roll Server with its local roll buffer and roll files;
- the CICS Roll Facilities;
- the Natural swap pool.

See also the various [component scenarios](#). For more information, see *Roll Server* in the *Natural Operations* documentation.

## CICS Roll Facilities

---

CICS Roll Facilities are local CICS storage facilities. They can be either CICS main or auxiliary temporary storage or VSAM relative record data sets (RRDS) which the user has previously defined to CICS. These files allow Natural to store a user's compressed dynamic storage when a roll-out occurs.

When a swap pool is used, the CICS roll facilities only serve as backup for the swap pool. The choice of the roll medium is of greater importance when no swap pool is used, since it affects Natural performance and throughput.

Every CICS service request causes CICS system overhead. So, the larger the CFSIZE/record size for the roll facility is, the less CPU overhead occurs due to fewer CICS service calls to roll a Natural session. On the other hand, larger CFSIZE/record size also means more VSAM buffer space allocated for the roll facility.

See [Performance Considerations](#) for further information on roll facilities.



**Caution:** When using the Roll Server, the swap pool and the CICS Roll Facilities are not available.

## Natural Local Buffer Pool under CICS

---

The Natural local buffer pool contains all Natural modules during execution and copies of Natural modules once they have been loaded from the Adabas or VSAM system file.

The local buffer pool must be large enough to minimize the number of Natural program loads. However, if the local buffer pool is too large, this means wasted storage and may introduce paging overhead.

The local buffer pool is allocated as `GETMAIN` storage, that is, `EXEC CICS GETMAIN SHARED` with all CICS Transaction Server versions. Sufficient storage must be available in the partition or in the relevant CICS DSA.

A local buffer pool is optional, as Natural can also run with a global buffer pool, which can be shared with other Natural environments such as *Natural in Batch Mode*, *Natural under TSO* or *Natural under IMS*.

## Natural Swap Pool under CICS

---

The Natural swap pool offers the possibility to “swap” a compressed Natural session from the thread into a main storage area instead of doing expensive roll I/Os.

The swap pool is allocated as `GETMAIN` storage, that is, `EXEC CICS GETMAIN SHARED` with all CICS Transaction Server versions. Sufficient storage must be available in the partition or in the relevant CICS DSA.

The options for the swap management are set in the Natural CICS source module `NCISPCB` and by using the Natural profile parameter `BPI`.

The size, name and cache size of the swap pool are specified using profile parameter `BPI` or the corresponding macro `NTBPI` in the Natural parameter module, that is, the `NTBPI` or `BPI` settings in effect for the Natural session initializing the NCI environment are taken.

For further details on the swap pool, see *Natural Swap Pool* in the *Natural Operations* documentation and *Using the Natural Swap Pool under CICS*.

### Note for z/OS:

The swap pool can only be used when running Natural under CICS locally in a single CICS region. However, even in such a scenario, you should consider using the Roll Server instead, because it

runs asynchronously to the CICS region and because it can provide more roll buffers in its data space than the swap pool. When using the Roll Server, the swap pool and the Roll Facilities are not available under CICS.

## Natural CICS Interface System Control Records in CICS Temporary Storage

---

The Natural CICS Interface (NCI) remembers its permanent GETMAINED storages, that is, storages acquired via EXEC CICS GETMAIN SHARED in NCI system control records in CICS main temporary storage.

These system control records are kept for two reasons:

1. System recovery:

As all NCI related storages are chained of the NCI system directory, the system control records can be used to re-construct storage chains in case of storage corruptions.

2. Clean up old NCI system after CICS NEWCOPY of NCI system directory module:

At NCI system environment initialization, NCI checks for existing system control records, and, if found, NCI frees the associated permanent storages prior to the installation of the new environment.

The CICS temporary storage queue names of these control records are *prefixXCR*, where *prefix* is the common prefix for Natural CICS components (see NTCICSP macro parameter PREFIX) and *X* is a hexadecimal value, namely

x'01'	for the main system control record holding information about NCI system directory extension, shared threads (TYPE=SHR), and secondary SIR blocks (see NCMDIR generation parameter USERS).
x'02'	for the parms system control record holding information about the NCI shared profile parameters retrieved via file input (see the PRMDEST parameter of the NTCICSP macro).
x'03'	for the pools system control record holding information about all local pools belonging to the NCI environment including a potential swap pool.

 **Important:** As the NCI system control records describe a local NCI environment, these CICS MAIN temporary storage queues must be kept also in the CICS AOR. This is particularly true when running Natural in CICSplex.

## NCIDIREX - System Directory Module Name Exit Interface

---

The name of the Natural CICS Interface system directory module is *prefix* CB by default (see PREFIX parameter of the NTCICSP macro) unless specified explicitly via the DIRNAME parameter of the NTCICSP macro.

The NCIDIREX exit interface is to set/modify the name of the Natural CICS Interface system directory module at run-time. This makes it possible to use the same NCI driver/ Natural parameter module, but use different NCI environments (thread groups/thread sizes, etc) by accessing different system directory modules, depending for example on CICS system ID, transaction ID.

The first 5 characters of the directory module name are also used as part of CICS temporary storage queue names related to the relevant NCI environment. So when running more than one Natural CICS environment in a CICS region, the relevant system directory module names must be different in the first 5 characters.

The NCIDIREX interface exit is called using standard linkage conventions (Registers 13, 14, 15 and 1) but in addition with Registers 4 and 5 holding CICS EIB and EISTG addresses to enable the exit to call CICS services.

Source module `XNCIDIRX` contains a sample system directory module name exit.

## NCIDTPEX - DTP Terminal I/O Exit Interface

---

Natural sessions may also be executed using distributed transaction processing (DTP), that is, using APPC or MRO conversations. Formally, such Natural sessions have a terminal associated (CICS TCTTE), however, this is a terminal out of a pool (see CICS SESSIONs / CONNECTIONs) and the “terminal” may change from Natural dialog step to dialog step, that is, such “terminals” cannot be used as key to save a session's context over a “screen I/O”. Because of this nature, such Natural sessions are treated by default as asynchronous sessions (TTYTYPE=ASYN/ASYL), and Natural does not deal/communicate with these terminals, as they are no 3270 devices.

However, there is an exit interface NCIDTPEX available, which allows you to run the Natural session in a “conversational way”:

- when the exit is available, Natural sets up a terminal bound session (TTYTYPE=3270);
- Natural terminal input and output operations (RECEIVE/SEND/CONVERSE) are *not* handled by Natural, but passed to the exit for further processing.

The source modules `XNCIDTPX` and `XNCITIOX` contain samples of DTP terminal exits.

## Control Use of NCIDTPEX

You can set the `FDTPX` generation parameter of the `NTCICSP` macro to `ON` to cause a potential DTP exit to be invoked for all terminal types. This can be helpful, for example, if you want to analyze terminal output before a `EXEC CICS SEND` operation is executed, or if you want to suppress screen I/Os.

## NCITIDEX - Terminal ID Exit Interface

---

The 4-character CICS terminal ID which is unique per CICS region is used by the Natural CICS Interface as part of the session key (SIP server, roll server, CICS temporary storage queues). For compatibility with Natural, the Natural CICS Interface uses an 8-character field. This NCI terminal ID can be made unique over several CICS regions by appending the CICS system ID to the CICS terminal ID (see `UNITID` parameter of the `NTCICSP` macro).

Alternatively, the `NCITIDEX` terminal ID exit interface can be used to set that NCI terminal ID. It should be noted that for CICS purposes (for example, temporary storage queue names, etc) just the first four characters of the NCI terminal ID are taken. Therefore these 4-character strings must be unique.

The `NCITIDEX` exit interface is particularly interesting for session managers under CICS in order to distinguish multiple Natural sessions running at the same physical terminal.

The terminal ID set by a `NCITIDEX` exit is used “externally” by the Natural CICS Interface and is the default for the Natural system variable `*INIT-ID` for “internal” Natural use. (The `*INIT-ID` system variable can subsequently be modified by the `NCIUIDEX` / `NATUEX1` user ID exit interface.)

The `NCITIDEX` interface exit is called by using standard linkage conventions (Registers 13, 14, 15 and 1), but in addition by using the Registers 4 and 5 holding CICS EIB and EISTG addresses to enable the exit to call CICS services.

Source module `XNCITIDX` contains a sample terminal ID exit.

### Restrictions

Certain Natural CICS Interface functions cannot work if the first four characters of the logical terminal ID do not match the physical terminal.

As a consequence,

- you cannot send a message to a logical terminal by way of message switching,
- you cannot use the `SYSTP` utility or `NEP` to flush a session at a logical terminal.

## NCIUIDEX - User ID Exit Interface

---

Natural provides the NATUEX1 user exit interface to determine whether or not a user is authorized to use Natural and to set various Natural system variables.

Whenever a Natural user session is started, the NATUEX1 interface exit is called using standard linkage conventions (Registers 13, 14, 15 and 1).

In a CICS environment, the standard linkage conventions are not sufficient in order to issue CICS service calls and to obtain addressability of CICS control blocks.

Therefore the Natural CICS Interface delivers the load module NCIUEX1 as a NATUEX1 interface exit in a CICS environment. This module just sets up addressability in CICS and calls the NCIUIDEX interface exit by using standard linkage conventions (Registers 13, 14, 15 and 1), but in addition by passing CICS related addresses in other registers: R4 (EIB), R5 (EISTG), R6 (TCTTE).

Thus, if you want to issue requests requiring addressability of the CICS environment, the NCIUIDEX user ID exit interface should be used rather than the standard NATUEX1 interface.

Source module XNCIUIDX contains a sample user ID exit.



**Important:** With each installation of a new CICS release, the NCIUIDEX interface exit must be reassembled and linked.

## NCIXIDEX - Transaction ID Exit Interface

---

By default, Natural always uses the transaction ID the pseudo-conversational session was started with. This transaction ID can be changed within Natural by using CALLNAT CMTRNSET (library SYSEXTP). The NCIXIDEX transaction ID exit interface can also be used to change the Natural pseudo-conversational transaction ID.

The NCIXIDEX interface exit is called by using standard linkage conventions (Registers 13, 14, 15 and 1), but in addition by using the Registers 4 and 5 holding CICS EIB and EISTG addresses to enable the exit to call CICS services. Source module XNCIXIDX contains a sample transaction ID exit.



**Note:** The transaction ID exit is only invoked prior to pseudo-conversational screen I/Os under control of the Natural CICS Interface; that is, the exit is not invoked for conversational screen I/Os (for example, SET CONTROL 'N') or when Natural is invoked from a front-end program via EXEC CICS LINK.

## Natural CICS Interface Debugging Facilities

The following topics are covered:

- [Using the TPF Parameter](#)
- [Using the UPSI Parameter](#)
- [Using Asynchronous Natural Sessions](#)

### Using the TPF Parameter

The dynamic parameter `TPF=(TPF1,TPF2,TPF3,TPF4,TPF5,TPF6,TPF7,TPF8)` can be set for driver-specific options by specifying "1" for the corresponding option.

Supported options are:

TPF1	Invoke Adabas linkage module via EXEC CICS LINK with Adabas parameter in TWA and CICS COMMAREA rather than via DCI.  Enables debugging of Adabas-related problems via CEDF.
TPF2	Dump the whole Natural swap pool.  With this parameter setting, the entire Natural swap pool is included in a CICS transaction dump.
TPF3	Dump the whole Natural buffer pool.  With this parameter setting, the entire Natural buffer pool is included in a CICS transaction dump.  <b>Note:</b> Usually the Natural buffer pool is not required in a dump, as all objects from the buffer pool relevant to a session are dumped anyway; so this option may only be required in the case of a buffer pool problem.
TPF4	Dump the whole EDITOR buffer pool.  With this parameter setting, the EDITOR buffer pool is included in a CICS transaction dump.
TPF6	Handle terminal I/O errors by NCI.  With this parameter setting, NCI will not pass control back to Natural for terminal I/O errors, but will handle it by itself, which results in one of the error messages NT06 - NT13.
TPF7	Force abend in case of NCI system errors.  With this parameter setting, a program check is forced in case of NSxx, NIxx, NRxx or NUSnnnn error messages. This is particularly helpful when a debugging tool intercepting abends is active. Then the error can be analyzed directly online.

When specifying 0 (which can also be omitted), the corresponding option is not set, for example:

`TPF=(0,0,0,1)` which is equivalent to `TPF=(, , , 1)`

## Using the UPSI Parameter

The Natural CICS interface reacts on certain settings of the Natural profile parameter UPSI:

### Natural Trace Extension

With profile parameter `ETRACE=ON` or `ETRACE=(ON,NOGTF)`:

- `UPSI=XXXX10XX` causes all CMTRACE trace records to be written to the Natural CICS Interface message destination (see the MSGDEST parameter of the NTCICSP macro) in addition to the CICS trace (message number NCI0110).
- `UPSI=XXXX11XX` causes all CMTRACE trace records to be written to the console (WTO) in addition to the CICS trace.

## Using Asynchronous Natural Sessions

If the first 5 characters in the dynamic parameter string for starting Natural are `ASYN,`, the Natural CICS Interface will always setup an asynchronous Natural session, regardless of whether the session is terminal-bound or not.

This may be helpful for testing purposes, particularly with EDF or with other debugging tools installed.

## Natural CICS Interface CICS TWA Usage

---

The Natural transactions are all defined with a TWA size of 128 bytes, although the Natural CICS Interface just uses the first 88 bytes of the CICS transaction work area (TWA) for Natural processing of the following functions:

- on calling Adabas for the Adabas parameter list (up to 32 bytes), the Natural CICS Interface saves the TWA contents before calling Adabas and restores it after the Adabas call.
- on calling external programs for the parameter list address pointers (up to 20 bytes, see the Natural `CALL` statement), the Natural CICS Interface saves the TWA contents before calling the external program and restores the TWA call portion after the external program call.
- on invoking a back-end program for the termination message and potential termination data (80 bytes, see *Back-End Program Calling Conventions* in the *Natural Operations* documentation).
- on returning control to a "LINK" front-end caller for the termination message and potential termination data at session end and the termination message area fully reset to low-value at Natural dialog step end respectively, that is, 80 bytes at session and dialog step end.
- for passing LE information at CICS task start (up to 88 bytes, just at start of task).

User programs (front-end, back-end, called external programs) can also take advantage of the CICS TWA to communicate besides Natural, but they should not use the TWA portion used by

Natural; for such cases, it is highly recommended to increase the TWA size of the Natural transactions and use TWA portions outside the first 128 bytes.

# 19 Natural CICS Generation Parameters - Natural CICS

## Interface Version 8.3

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This part of the Natural CICS Interface documentation describes the Natural CICS generation parameters.

For the parameters used to start the Natural CICS, see the section *CICS Startup Parameters* in *Installing Natural CICS Interface on z/OS* in the *Natural Installation* documentation.

### References to CICS Tables:

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, TST, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

### Related Topics:

- *Installing Natural CICS Interface on z/OS* in the *Natural Installation* documentation.
- *SYSTP Utility* - Natural utility which provides various TP monitor-specific functions.
- For information on operation and the individual components of Natural in a CICS environment, see the following sections in the *Operations* documentation:
  - [\*Node Error Program Considerations for Natural\*](#)
  - [\*CICS 3270 Bridge Considerations\*](#)
  - [\*Special Natural CICS Functionality\*](#)
  - [\*Natural CICS Sample Programs\*](#)
  - [\*NCIUIDEX User ID Exit Interface\*](#)
  - [\*Invoking Natural from User Programs\*](#)
  - [\*Asynchronous Natural Processing under CICS\*](#)
  - [\*Logging Natural Sessions under CICS\*](#)
  - [\*Performance Considerations\*](#)
  - [\*Natural CICS Interface Debugging Facilities\*](#)
  - [\*Natural Print and Work Files Under CICS\*](#)

## NCISPCB Generation Parameters

The Natural CICS Interface system directory is generated by assembling and linking the NCISPCB source module; see the corresponding step in *Installing Natural CICS Interface on z/OS* in the Natural *Installation* documentation.

NCISPCB contains the following macros:

- NCMDIR
- NCMTGD
- NTSWPRM

The purpose of these macros and the individual parameters which can be specified in the macros NCMDIR and NCMTGD are described in the following sections.

## NCMDIR Macro Parameters

The NCMDIR macro is mandatory and must be specified as the first macro in the NCISPCB source module. It contains various options for the system. The individual parameters which can be specified in the NCMDIR macro are described below.

CICSPLX | ROLLSRV | SIPSERV | SUBSID | TSKEY | TSRECSZ | USERS

### CICSPLX - Switching of CICS Application Region

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
YES	The Natural CICS Interface keeps all session relevant data as the Session Information Records (SIRs) and the session data over a pseudo-conversational screen I/O outside of a local CICS Application Owning Region (AOR), thus enabling the switching of CICS AORs.  Setting this parameter to YES also requires the profile parameter ADAMODE to be set to greater than 0.
MODE	This setting almost has the same meaning as YES; the only exception is that CICSPLX=MODE allows an ADAMODE=0 profile parameter specification, that is, CICS AOR switching is not possible, but a Natural session may survive the restart of a CICS AOR in an MRO environment.
NO	Vital Natural session data is kept in the local CICS AOR, which in fact disables CICS AOR switching.  This is the default value.

Natural PLEX support means that a Natural CICS session removes all its footprints that exist in a CICS application region at CICS task end, as it might never come back into this region. Therefore all Natural CICS session relevant data must be kept outside of a CICS application region, that is, Natural under CICS passes its session information records (SIRs) to the *Authorized Services Manager*'s SIP handler and the session data to the *Natural Roll Server* at CICS task end. In addition to that, all modules 'held', that is, modules not linked to Natural but directly invoked via standard linkage conventions as RCA modules or the Adabas linkage module, have to be released at CICS task end. It also requires that the restart information is kept in a CICS terminal owning region (TOR) in case of COMARET=YES, or in a CICS data owning region (DOR), which is shared by all participating CICS AORs, in case of COMARET=NO, see the COMARET parameter for details.

If YES or MODE has been specified, and the NCMDIR SUBSID parameter has not been set, the value of the Natural profile parameter SUBSID in effect for the Natural session initializing the NCI environment will be taken.



**Caution:** Setting this parameter to YES or to MODE automatically sets SIPSERV and the ROLLSRV parameters to YES.

### ROLLSRV - Roll Server Rolling

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
NO	This is the default value, if CICSPLX=NO and SIPSERV=NO. If CICSPLX or SIPSERV is YES, ROLLSRV=YES is forced.
YES	Specifying YES causes the Natural CICS Interface to use the <i>Natural Roll Server</i> as roll facility only.

If the Natural Roll Server is to be used to save and restore the Natural session data over a screen I/O, this parameter must be set to YES, when the CICSPLX and SIPSERV parameters are both set to NO. If YES has been specified (or forced) and the NCMDIR SUBSID parameter has not been set, the value of the Natural profile parameter SUBSID in effect for the Natural session initializing the NCI environment will be taken.

Note that, for the purposes of the Natural CICS Interface, the Natural profile parameter SUBSID is only honored if it is specified dynamically or in the Natural parameter module. It is ignored if it is specified in a parameter string by a profile parameter SYS or PROFILE or in an alternate parameter module (as specified with the profile parameter PARM).

## SIPSERV - Authorized Services Manager's Session Information Pool

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
NO	This is the default value, if CICSPLX=NO. If CICSPLX is not NO, SIPSERV=YES is forced.
YES	Causes the Natural CICS Interface to keep its session information records (SIRs) in the <i>Authorized Services Manager's</i> session information pool.

With this parameter set or forced to YES, the Natural session information records are kept outside a CICS region, thus enabling Natural to switch a CICS application region after a pseudo-conversational screen I/O.

If YES is specified (or forced) and the NCMDIR SUBSID parameter has not been set, the value of the Natural profile parameter SUBSID in effect for the Natural session initializing the NCI environment will be taken.

Note that, for the purposes of the Natural CICS Interface, the Natural profile parameter SUBSID is only honored if it is specified dynamically or in the parameter module. It is ignored if it is specified in a parameter string by a profile parameter SYS or PROFILE or in an alternate parameter module (as specified with the profile parameter PARM).

 **Caution:** If YES is effective for this parameter, the ROLLSRV parameter is forced to YES, unless already specified.

## SUBSID - Sub-System ID

This parameter is applicable under z/OS only.

Possible values are:

Value:	Explanation:
XXXX	Defines the sub-system ID for the Natural Roll Server and/or for the <i>Authorized Services Manager</i> .

This parameter defines the Natural sub-system ID to be used for the Natural Roll Server and/or for the *Authorized Services Manager*. If this parameter is not specified, the value of the Natural profile parameter SUBSID will be taken.

Note that, for the purposes of the Natural CICS Interface, the Natural profile parameter SUBSID is only honored if it is specified dynamically or in the Natural parameter module. It is ignored if it is specified in a parameter string by a profile parameter SYS or PROFILE or in an alternate parameter module (as specified with the profile parameter PARM).

## TSKEY - Prefixes for Natural CICS Temporary Storage Key

This parameter defines the constant prefixes of the temporary storage queues (see explanation below).

This parameter has the same meaning as the `TSKEY` parameter in the `NCIZNEP` module (see the Natural *Installation* documentation) and must be specified identically.

Possible values are:

Value:	Explanation:
( <i>xxxx</i> , <i>yyyy</i> )	<i>xxxx</i> defines the prefix for roll data, whereas <i>yyyy</i> defines the prefix for pseudo-conversational restart data.
(NAT2, NCOM)	This is the default value.

When CICS temporary storage (main or auxiliary) is to be used for the Natural CICS Interface roll facility or for the communication area for pseudo-conversational Natural tasks (as described with the `COMARET` parameter of the `NTCICSP` macro), names for queues of task dependent unique temporary storage must be specified.

These queue names consist of a constant 4-byte key and a task-related key. For terminal-dependent tasks, this task-related key corresponds to the terminal ID, for asynchronous non-terminal tasks it corresponds the CICS unique task number. The constant prefix of the temporary storage queue names is defined by the `TSKEY` parameter.

The Natural CICS Interface requires two 4-byte prefixes: one for roll data and one for pseudo-conversational restart data. *xxxx* defines the prefix for roll data, *yyyy* defines the prefix for pseudo-conversational restart data. The two prefixes must be different from each other and exclusive for Natural under CICS.

When running in a CICSplex environment, the CICS temporary storage prefix for Natural session restart information must be defined in a CICS TST as `REMOTE/SHARED` to be accessible in all participating CICS regions.

## TSRECSZ - Record Sizes for Main and Auxiliary Temporary Storage

This parameter defines the maximum record length for rolling of data if CICS temporary storage is to be used as Natural CICS Interface roll facility.

Possible values are:

Value:	Explanation:
( <i>nnnnn</i> , <i>mmmmm</i> )	<p>The first subparameter <i>nnnnn</i> applies to CICS main temporary storage and must be in the range of 4096 to 32763 or 0 or one of the keywords MAX, YES or NO;</p> <ul style="list-style-type: none"> <li>■ if numeric non-zero, this value is used unconditionally;</li> <li>■ if set to 0 or NO, CICS main temporary storage cannot be used for a Natural roll facility;</li> <li>■ if set to MAX or YES, a record size of 32763 is taken.</li> </ul> <p>The second subparameter <i>mmmmm</i> applies to CICS auxiliary temporary storage and must be in the range of 3976 to 32763 or 0 or one of the keywords MAX, YES or NO;</p> <ul style="list-style-type: none"> <li>■ if numeric non-zero, this value is used unconditionally; if set to MAX, a record size of 32763 is taken;</li> <li>■ if set to NO, CICS auxiliary temporary storage cannot be used for a Natural roll facility;</li> <li>■ if set to 0 or YES, the Natural CICS Interface sets the record length which fits into an auxiliary temporary storage control interval, that is, CI size minus VSAM control information minus CICS control information.</li> </ul> <p>A user-defined record size greater than CI size results in fewer (logical) roll I/Os at the expense of additional CICS overhead due to writing spanned records.</p>
(32748, 0)	This is the default value.

### USERS - Session Information Record

This parameter specifies the number of session information record slots (SIRs).

Possible values are:

Value:	Explanation:
( <i>nnnnn</i> , <i>mmm</i> )	<p>The subparameter <i>nnnnn</i> defines the number of SIRs to be held in the Natural CICS directory module itself. <i>nnnnn</i> must be in the range from 1 to 32767. When the SIR slots in the directory are occupied, the Natural CICS Interface acquires a CICS shared storage segment, large enough to hold the number of SIRs defined by <i>mmm</i>, which must be in the range from 0 to 255.</p> <p>If the subparameter <i>mmm</i> is 0 or omitted, the system does not acquire additional storage for SIRs if no free SIR slot is available in the system directory. If so, the Natural CICS system is actually restricted to the number of users specified by the first subparameter.</p> <p>If a value other than 0 is specified for <i>mmm</i>, secondary storage segments are allocated automatically as required. Allocated secondary segments are freed again if they are no longer needed.</p>
(100, 20)	This is the default value.

The Natural CICS Interface permanently holds information about all active Natural sessions. Per session a so-called Session Information Record (SIR) is maintained.

These SIRs are kept

- in a Coupling Facility when running in a z/OS Parallel Sysplex environment;
- in a data space of the *Natural Authorized Services Manager* when running in multiple CICS regions inside a single z/OS system;
- in a CICS region's main storage when running in a single CICS AOR (locally).

However, whenever a Natural session is active in a CICS region, it will occupy a SIR slot in the current application region.

When running locally in a single CICS AOR, the `USERS` parameter applies to all Natural sessions. When running in a CICSplex environment, `USERS` applies to the subset of Natural sessions which is currently active in each of the participating CICS AORs.

## NCMTGD Macro Parameters

---

The `NCMTGD` macro is mandatory and must be specified for each thread group. The Natural CICS Interface allows you to define groups of threads. These groups are controlled/chosen by the CICS transaction ID at session initialization. The common thread size for the various groups may differ and the groups can have different options. The thread group definitions are part of the Natural CICS system directory, as they are relevant to the whole system, not just to a single session.

The individual parameters which can be specified in an `NCMTGD` macro are described below.

`PFKEY` | `PRIMERF` | `THRDSZE` | `THREADS` | `TRAN` | `TYPE` | `XTRAN`

### PFKEY - PF/PA Keys for Thread Group

This parameter defines a single CICS transaction or a list of them.

Possible values are:

Value:	Explanation:
<code>xxx</code>	Possible values for <code>xxx</code> are: PF1 to PF24, PA1 to PA3.
<code>(xxx,xxx,...)</code>	Also a list of keys can be specified. This has to be enclosed in parantheses, for example, <code>PFKEY=(PF12, PF14)</code> .

No default value is provided.

When starting a session, the Natural CICS Interface scans through all thread group definitions for the current transaction ID, or PF or PA key. If it cannot be found, the first thread group is taken as default.



**Caution:** At least one transaction ID (in character or hexadecimal format) or one transaction initiating attention identifier must be specified for all groups, except for the first group, which is used as the default group.

### PRIMERF - Natural CICS Primary Roll Facility

This parameter defines the Natural CICS Interface primary roll facility for all tasks defined in the associated thread group. Therefore, this parameter does not apply to thread groups with `TYPE=NONE`.

Possible values are:

Value:	Explanation:
VSAM	The Natural CICS Interface VSAM RRDS roll files are taken as the primary roll facility. CICS auxiliary temporary storage is considered as the secondary roll facility, which means that it is used if all primary roll files become full or unavailable.
AUX	CICS auxiliary temporary storage is taken as primary roll facility of the Natural CICS Interface.
MAIN	CICS main temporary storage is taken as Natural CICS Interface primary roll facility.
NONE	The associated sessions do not roll at all. NONE is not valid for <code>TYPE=SHR</code> groups and for groups with <code>TYPE=ALIAS</code> redefining <code>TYPE=SHR</code> groups.

No default value is provided.

This parameter is ignored when using the *Natural Roll Server*; if you force a Natural session with Roll Server to run conversationally with no rolling, value `NONE` is taken.

Points to be observed:

- `PRIMERF=VSAM` and `PRIMERF=AUX` have the same effect, when no VSAM RRDS roll file is available in the CICS system.
- `PRIMERF=AUX` and `PRIMERF=MAIN` have the same effect, when auxiliary temporary storage is not defined in the CICS system.
- If auxiliary temporary storage is not defined in the CICS system, a specification of `PRIMERF=VSAM` implies that CICS main temporary storage is considered as secondary roll facility, in case the VSAM RRDS roll files become unavailable or full.
- If CICS main temporary storage is to be used as roll facility, the record size is defined by the `TSRECSZ` parameter.



**Important:** Note that sessions that are associated with thread groups defined with `PRIMERF=NONE` cannot roll due to the lack of a roll facility and are therefore conversational by design.

### THRDSZE - Thread Size

This parameter defines the common thread size for `TYPE=GETM` and `TYPE=SHR` groups.

Possible values are:

Value:	Explanation:
<i>nnn</i>	The thread size <i>nnn</i> can be equal to 40 or greater.

No default value is provided.

Note that this parameter defines the *logical* thread size that is available to Natural. However, the Natural CICS Interface NCI adds another 2 KB to the logical thread size for internal administration purposes. This means that the *physical* thread size or length of the thread `GETMAIN` request is by 2 KB greater than the `THRDSZE` value.

In case of `TYPE=GETM`, additional 16 bytes for the heading and trailing CICS storage accounting areas (SAAs) have to be considered.

Important Notes:

1. For `GETMAINs` of more than 512 KB, CICS aligns these storages at MB boundaries.
2. When using transaction isolation (z/OS only), CICS internally uses 1 MB “pages” in the EUDSA (see the *CICS Performance Guide for details*).

These two facts lead to storage fragmentation and should be kept in mind when setting an appropriate `EDSALIM` in CICS.

### THREADS - Number of Threads or Tasks Per Thread Group

This parameter specifies the number of threads or tasks as described below.

Possible values are:

Value:	Explanation:
<i>nnn</i>	The number of threads can be equal to 510 or less.

No default value is provided.

For `TYPE=SHR` thread groups, the `THREADS` parameter is mandatory and defines the number of threads which are to be allocated via `GETMAIN` (`SVC` or `SHARED`, depending on CICS version) during installation.

For `TYPE=GETM` and `TYPE=NONE` thread groups, the `THREADS` parameter is optional and determines the maximum number of concurrently active Natural tasks per thread group. For these thread

group types, the `THREADS` parameter does not control storage usage in contrast to `TYPE=SHR` thread groups (see also [Controlling Storage Usage](#)).

The number of threads or the number of tasks per thread group is defined by providing thread control blocks (TCBs).

While for `TYPE=SHR` thread groups, each thread is closely connected to its TCB. Threads are shared by queueing up on the associated TCB. Thread groups of `TYPE=GETM` and `TYPE=NONE` only queue up on a TCB to get active.

While sessions with `TYPE=SHR` thread groups compete for threads, the other session types compete for TCBs with a thread already allocated (`TYPE=GETM`) or with no allocated thread at all (`TYPE=NONE`).

When the `THREADS` parameter is non-zero, the Natural profile parameters `DBROLL` and `MAXROLL` and the calls to `CMROLL` are handled differently for `TYPE=GETM/NONE` thread groups: As threads cannot be released, the TCB resource held is released, which activates the session with the session data kept in storage.

### TRAN - Transaction IDs for Thread Group

This parameter defines a single CICS transaction or a list of them.

Possible values are:

Value:	Explanation:
(see below)	One or more CICS transaction codes defined in the PCT for Natural.

No default value is provided.

The `TRAN` parameter expects transaction IDs to be in character format; transaction IDs with non-alphanumeric characters have to be enclosed in apostrophes.

When starting a session, the Natural CICS Interface scans through all thread group definitions for the current transaction ID, or PF or PA key. If it cannot be found, the first thread group is taken as default.

A list of transaction IDs has to be enclosed in parentheses, for example, `TRAN=(NATU, XYZ)`.

 **Caution:** At least one transaction ID (in character or hexadecimal format) or one transaction initiating attention identifier must be specified for all groups, except for the first group, which is used as the default group.

## TYPE - Thread Type for Group

This parameter defines which type of thread is to be used for a given group.

Possible values are:

Value:	Explanation:
SHR	<p>CICS shared storage threads are used. The threads available for a thread group are shared by all CICS transactions defined for this group. Thread selection when starting a CICS task is done by an ENQUEUE/DEQUEUE technique. If currently no thread is available, a wait queue for this thread group is maintained.</p> <p>This is the default value.</p> <p>When running in a z/OS Parallel Sysplex environment, the Natural parameter RELO=OFF forces sessions with TYPE=SHR threads to be conversational to prevent a CICS region switch.</p>
GETM	<p>Threads allocated via GETMAIN are used, which means that a thread is actually acquired performing a CICS GETMAIN operation - EXEC CICS GETMAIN FLENGTH - with the thread group's common thread size. Using threads allocated via GETMAIN, each Natural task has exclusive thread storage available until it is terminated; that is, for pseudo-conversational tasks from screen I/O to screen I/O.</p> <p>If the Natural parameter RELO=OFF or PSEUDO=OFF is specified, tasks using threads allocated via GETMAIN are forced to be conversational, as there is no guarantee that after a FREEMAIN of the thread a subsequent GETMAIN obtains the same storage in memory. As thread storage allocated via GETMAIN exclusively belongs to the owning task, however, such tasks can be defined as non-rollable (see the <a href="#">PRIMERF</a> parameter), which means that a given thread belongs to a given task until the end of the Natural session. If so, the task is conversational by design and no rolling is done.</p>
NONE	<p>No threads are used by transactions defined in this thread group and all Natural GETMAIN requests are directly passed to CICS for an EXEC CICS GETMAIN FLENGTH request. By design, such tasks cannot roll and are therefore conversational.</p>
ALIAS	<p>The current NCMTGD macro provides different options for the thread group defined by the previous NCMTGD macro specification. However, only thread groups of TYPE=GETM and TYPE=SHR can be redefined by one or more NCMTGD TYPE=ALIAS macro requests.</p> <p>Up to 99 thread groups are supported, which means that up to 99 NCMTGD macro specifications with TYPE other than ALIAS are recognized.</p>

## XTRAN - Hexadecimal Transaction IDs for Thread Group

This parameter is equivalent to the [TRAN](#) parameter, but it expects the transaction ID to be in hexadecimal format.

Possible values are:

Value:	Explanation:
(see below)	Possible values: one or more CICS transaction codes defined in the PCT for Natural.

No default value is provided.

A list of transaction IDs in hexadecimal format has to be enclosed in parantheses, for example, XTRAN=(D5C1E3E4, E7E8E9).

 **Caution:** At least one transaction ID (in character or hexadecimal format) or one transaction initiating attention identifier must be specified for all groups, except for the first group, which is used as the default group.

## NTSWPRM Macro Parameters

The NTSWPRM macro is used to define the various aspects of the swap pool. If no swap pool is to be used, omit this macro. For more information, see *Natural Swap Pool* in the Natural Operations documentation.

## NTCICSP Macro Parameters

The parameters required for Natural CICS Interface are generated by assembling the Natural parameter module which holds the required NTCICSP macro definitions. The Natural parameter module is created in the corresponding installation step in *Installing Natural CICS Interface on z/OS* in the Natural *Installation* documentation.

The NTCICSP macro determines all Natural session options that are relevant in a CICS environment. The individual parameters contained in the NTCICSP macro are described in *CICSP - Environment Parameters for Natural CICS Interface* in the *Parameter Reference* documentation.



# 20 Customizing VSAM RRDS Roll Files - Natural CICS

## Interface Version 8.3

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- Decreasing the Number of VSAM RRDS Roll Files ..... 157
- Changing the Characteristics of the VSAM RRDS Roll Files ..... 157

This part of the Natural CICS Interface documentation describes the customization of VSAM RRDS roll files.

- [Increasing the Number of VSAM RRDS Roll Files](#)
- [Decreasing the Number of VSAM RRDS Roll Files](#)
- [Changing the Characteristics of the VSAM RRDS Roll Files](#)

This section does not apply if you are using the Natural Roll Server.

#### References to CICS Tables:

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

This chapter covers the following topics:

## Increasing the Number of VSAM RRDS Roll Files

---

Up to nine VSAM RRDS roll files can be allocated. Each roll file has an ID consisting of a user-defined prefix followed by a fixed suffix. The prefix can be 1 to 9 characters long. The suffix consists of two characters from R1 to R9.

To add a new VSAM roll file, perform the following steps:

1. Create an empty VSAM RRDS conforming to your local site standards. Then initialize the data set using the batch program `NCISCPRI`, which must have been assembled during the Natural installation. The `SPACE` and `RECORDSIZE` attributes can differ between different roll files, so you can modify them as required to find the best values in your environment.
2. Create an FCT entry and change the CICS JCL accordingly, using the prefix/suffix for both.

The new roll file becomes available when the Natural CICS Interface is initialized again.

## Decreasing the Number of VSAM RRDS Roll Files

---

Perform the following steps:

1. Ensure that Natural is not active.
2. Either delete the FCT and JCL definitions or delete the file.

The number of roll files is adjusted when the Natural CICS Interface is initialized again.

## Changing the Characteristics of the VSAM RRDS Roll Files

---

Perform the following steps:

1. Execute the procedures described above for decreasing the number of roll files.
2. Execute the procedures for increasing the number of roll files.



# 21 Natural in CICS MRO Environments - Natural CICS

## Interface Version 8.3

---

- NTCICSP Parameter COMARET Set to ON ..... 160
- NTCICSP Parameter COMARET Set to OFF ..... 160

This part of the Natural CICS Interface documentation describes the functionality of Natural in CICS Multi-Region (MRO) Environments.

### References to CICS Tables:

Where appropriate, any references to CICS tables (DCT, FCT, PCT, PPT, TCT, etc.) can be considered as references to the corresponding:

- assembly-type resource definitions,
- online resource definitions via CEDA,
- batch resource definitions via DFHCSDUP.

Special considerations apply when running Natural in a CICS multi-region (MRO) environment.

This chapter covers the following topics:

## NTCICSP Parameter COMARET Set to ON

---

When the NTCICSP parameter COMARET is set to ON, Natural session data are kept in two different CICS regions:

- The session restart information is kept in the COMMAREA linked to the terminal entry in the CICS terminal owning region (TOR).
- The actual session data are kept in the CICS application owning region (AOR); that is, the thread, swap pool, or roll facility.

This may lead to inconsistencies when, for example, the AOR is restarted, but the TOR still contains old “pending” Natural sessions; resuming such a session results in a corresponding error message.

## NTCICSP Parameter COMARET Set to OFF

---

When COMARET is set to OFF, all Natural session data are kept in the AOR, thus preventing the inconsistencies mentioned above.

However, there may be a security concern when a terminal is removed from the TOR (either back to VTAM or by switching the session manager or power off), and another terminal dialing to this TOR receives the ID of the removed terminal and enters the Natural transaction code: then this terminal resumes the session of the previously removed terminal because of the restart information in the AOR's temporary storage, which contains the terminal ID as part of the queue name.

To prevent such a situation, a node error program (NEP) can be installed (see [Node Error Program Considerations for Natural](#) and [Natural CICS Sample Programs](#)), which terminates a Natural session when the associated terminal is removed.



# 22 CICS Node Error Program Considerations for Natural - Natural CICS Interface Version 8.3

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This chapter discusses CICS node error program considerations.

See also:

- For information on installing a CICS node error program, refer to the corresponding section in *Installing Natural CICS Interface on z/OS* in the *Natural Installation* documentation.

## Normal Situation

---

Whenever a Natural session is active, CICS resources such as thread storage, roll facility entries (that is, records in a VSAM RRDS file or in a CICS temporary storage queue), swap pool slots etc. are used.

If these resources are under the control of the Natural CICS Interface, they are correctly released whenever a session terminates normally or abnormally.

## Situations Not under Control of Natural CICS Interface

---

The following cases cannot be controlled by the Natural CICS Interface:

1. A non-Natural program called by Natural issues an EXEC CICS ABEND CANCEL command or the equivalent CICS macro request: the CICS task is canceled without the Natural CICS Interface receiving control to properly release all session resources.
2. Some CICS monitor products offer tools to purge CICS tasks, bypassing any abnormal termination exit set by the application. If a Natural task is canceled this way, the Natural CICS Interface has no chance to release the resources still owned by the session.
3. A user disconnects a terminal from the CICS region (by switching the power off or using an adequate session manager function) while a Natural session is currently not active in CICS (pseudo-conversational screen I/O).

## Recovery Mechanisms

---

The Natural CICS Interface provides some recovery mechanisms to recover from such situations; for example:

Whenever a new Natural session is to be started, a table is scanned for another Natural session still active with the same terminal ID. If such a session exists, it is logically terminated, and all its resources are released prior to starting the new one.

However, it may take quite a long time between logically terminating the session and releasing its resources, and there may also be a security concern:

When the `NTCICSP` macro parameter `COMARET` is set to `OFF`, the information to resume a Natural session is kept in a CICS temporary storage record with the terminal ID being part of the temporary storage queue name. If another CICS user tries to start Natural with this terminal ID, he/she will resume the old Natural session rather than starting a new one.

The third case in the above list is the most crucial one. CICS provides a node error program (NEP) exit interface, which can be used in these cases to trigger the Natural CICS Interface to terminate the lost session. An appropriate module called `NCIZNEP` is provided in the Natural CICS Interface (see [Natural CICS Sample Programs](#)); it must be called by a `DFHZNEP` node error program.

Based on session restart information (`NEXTTRANSID` and restart data in `COMMAREA` or CICS temporary storage), the Natural CICS Interface tries to resume the session and terminate it logically.

## NCIZNEP Functionality

---

Based on restart information (`NEXTTRANSID` and restart data in `COMMAREA` or CICS temporary storage) of a terminal bound session, which is currently pending in a pseudo-conversational screen I/O, `NCIZNEP` tries to resume the session asynchronously and terminate it logically.

Optionally, `NCIZNEP` can also try to purge an active Natural session. This functionality is available for CICS Transaction Server systems only. To enable this functionality, specify `PURGE=YES` for the `NCIZNEP` module link. See the installation procedure for the Natural CICS Interface and the section *CICS Startup Parameters* in *Installing Natural CICS Interface on z/OS* in the *Natural Installation* documentation.

MRO/CICSplex environments:

- The module `NCIZNEP` must be defined also in the AOR.
- A transaction ID has to be defined for the module `NCIZNEP` in the AOR.
- This transaction ID must also be set via the `NEPTRAN` parameter in the CICS startup parameters in the `NCIZNEP` module as described in *Installing Natural CICS Interface on z/OS* in the *Natural Installation* documentation.

Upon completion, `NCIZNEP` indicates to the caller (normally `DFHZNEP`), by clearing the parameter input, whether it has successfully completed its work; that is, launching the Natural session clean-up task.

This is in particular of interest, if more than one Natural CICS versions are active in a CICS system: clean-up function of a specific `NCIZNEP` may fail, because the Natural session to be tidied up is a different Natural CICS Interface version. `DFHZNEP` now can test whether the called `NCIZNEP` (for

example, `NCI $vr$ NEP`, where  $vr$  represents the current Natural version) was successful, and if not, call another `NCI $nn$ NEP` (for example, `NCI $nn$ NEP`, where  $nn$  may be any preceding Natural version).

## Special Considerations

---

There are still some items to be considered:

- The Natural CICS source library contains the sample node error program `XNCINEP2` for CICS. This sample programs does not perform anything special for the Natural CICS environment, it merely calls (via `LINK`) the `NCIZNEP` module, which then deals with Natural under CICS.
- `DFHZNEP` may already be customized for a specific installation; as only one node error program is possible, the logic of the relevant `XNCINEP $x$`  program should be adapted to the existing `DFHZNEP` logic.
- In MRO environments, `DFHZNEP` and `NCIZNEP` must be installed in the TOR.
- The `NCIZNEP` module must be defined with `EXECKEY(CICS)`.
- In the case described under item 3. above, `DFHZNEP` may receive control more than once for various internal error codes, since each internal error code is related to a specific CICS error message, but there may be more than one error message resulting from a given action.
- Upon completion `NCIZNEP` indicates to the caller (normally `DFHZNEP`) — by clearing the parameter input — if it has successfully completed its work, that is, launching the Natural session clean-up task.
- The CICS control block constellation may have changed each time a node error program has been invoked, for example, the `COMMAREA` and `NEXTTRANSID` information in the `TCTTE` may have been lost after a certain node error event. In this case, the `NTCICSP` macro parameter `COMARET` must be set appropriately, which means that you cannot choose a node error event for your node error program to be invoked when passing the Natural pseudo-conversational session restart data in a CICS `COMMAREA` that has already been cleaned up by CICS.

## Example Dummy Program

---

If you want to know how many times and with what error codes `DFHZNEP` is invoked on certain actions and how the `TCTTE` should look, write a dummy node error program, which only issues CICS trace requests showing the requested information.

The following sample enables a `DFHZNEP` error processor to receive control for all possible error codes passed to `DFHZNEP`:

```
.  
DFHSNEP TYPE=INITIAL  
  
ORG NEPTT  
  
DC 256X'03' invoke error processor '3' for ALL error codes  
  
ORG ,  
  
DFHSNEP TYPE=ERRPROC,GROUP=3,CODE=49  
.  
  
set up requested information and issue trace request(s)
```

---

# 23

## CICS 3270 Bridge Support - Natural CICS Interface Version

### 8.3

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This chapter of the Natural CICS Interface documentation describes the CICS 3270 Bridge support.

## Default Support of CICS 3270 Bridge

---

By default, the Natural CICS Interface supports the CICS 3270 Bridge by being able to deal with “bridged devices”, that is, terminals which are emulated via a CICS 3270 bridge exit.

## Full CICS 3270 Bridge Support

---

If you want full CICS 3270 Bridge support, you have to install the NCI load module NCIXFATM. Refer to the corresponding installation step in *Installing Natural CICS Interface on z/OS* in the Natural *Installation* documentation.

## NCIXFATM - NCI Load Module

---

The NCIXFATM module is a CICS XFAINTU Global User Exit (GLUE). Its purpose is to release Natural resources in case the bridge facility's keep-time has expired and an associated Natural session has not been terminated yet.

The NCIXFATM module provides the same functionality for Natural as a Node Error Program (NEP) provides for “real” terminals.

## Profile Parameter DSC=OFF Recommended

---

When you are using the CICS 3270 Bridge, you are recommended to start a Natural session with profile parameter DSC=OFF (data-stream compression for 3270-type terminals disabled) to force Natural always to send full screens rather than the delta to the previous screen.

# 24 Threadsafe Considerations - Natural CICS Interface

## Version 8.3

---

The Natural CICS Interface can be defined threadsafe and can take advantage of OTE TCBs to improve through-put.

This means that the Natural CICS Interface has to provide for extra serialization via CICS ENQ / DEQ when not running under the QR TCB.

To minimize these serialization efforts, it is highly recommended

- to use `TYPE=GETM` threads without the `THREADS` parameter specified (or `THREADS=0`),
- to use the *Natural Roll Server* rather than roll facilities in CICS.



### Notes:

1. Adabas in CICS has to be threadsafe too, that is, this functionality cannot be used with Adabas versions prior to Version 8.
2. All user programs defined as `CSTATIC` have to be threadsafe.
3. All dynamic user programs which are invoked via standard linkage conventions either explicitly (that is, using the terminal command `%P=S`, `%P=SC`, `*P=L` or `%P=LS`) or implicitly (that is, when the `NTCICSP` macro parameter `SLCALL` is set to `ON`) have to be threadsafe.



# 25 Support for CICS Channels and Containers - Natural CICS

## Interface Version 8.3

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The IBM CICS Transaction Server for z/OS supports channels and containers for EXEC CICS LINK. In this respect CICS containers can be considered as named COMMAREAs without the 32 KB limit.

The Natural CICS Interface supports CICS containers in two ways:

1. Via a special SET CONTROL 'P=CC', the CALL statement parameter data is passed in a container.
2. When the NTCICSP macro parameter CNTCALL is set to ON, a %P=C CALL automatically uses a CICS container rather than a CICS COMMAREA, when the parameter data passed with the CALL statement exceeds 32 KB.

In both cases, the default container name is NCI-COMMAREA unless a container name is defined explicitly via application programming interface USR4204N prior to the “real” CALL statement.



# 26 IBM Language Environment (LE) and Natural CICS

## Interface Version 8.3

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- CICS Transaction Server for z/OS - LE-compliant ..... 176

The Natural CICS Interface supports LE programs. This document contains information on LE enablement of Natural under CICS.

## CICS Transaction Server for z/OS - LE-compliant

---

If supported by the CICS Transaction Server for z/OS installed at your site, the Natural CICS Interface is LE-compliant by itself, that is, a Natural CICS Interface task can directly `CALL` (standard linkage conventions, not CICS LINK) LE programs written in languages such as C, COBOL or PL/I, when

- `SET CONTROL 'P=LS'` has been specified,
- `SET CONTROL 'P=S'` has been specified,
- `NTCICSP` macro parameter `SLCALL=ON` has been specified and the program to be called is *not* a CICS program.

# 27 Special Natural CICS Functionality - Natural CICS Interface

## Version 8.3

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▪ Dummy Screen I/Os with Natural under CICS .....	179

This chapter of the Natural CICS Interface documentation explains special Natural CICS functionality.

## Calling Non-Natural Programs

---

One of the first actions a Natural task does at its start, is to activate an exit for abnormal termination processing. This exit is used to release all resources including the thread in the case of an abnormal termination. Therefore, a non-Natural program must not issue `EXEC CICS ABEND CANCEL` or the equivalent macro level request, as such a request cancels the current session ignoring any active exit. If so, Natural is not able to clean up its resources, and the thread and the roll facility are not released.

A thread is assigned to a Natural task whenever a Natural program is active. This is also true when non-Natural programs are called (following CICS linkage conventions).

Therefore, such programs should not do excessive I/Os and other work load without Natural receiving control in between. If a non-Natural program is doing conversational screen I/Os, you can code a `SET CONTROL 'P=V'` statement in the Natural program that calls the non-Natural program before the calling statement: this indicates that parameter data are copied out of the thread and the session is rolled out before calling the non-Natural program.

### Calling Non-Natural Programs via Standard Linkage Conventions

A non-Natural program is invoked (CALLED) by Natural in the way programs are invoked within the underlying operating and/or TP monitor system.

In CICS, non-Natural programs are invoked by means of `EXEC CICS LINK` requests. However, when, for example, the same subroutine program (not issuing any CICS or operating system request) is to be used for both batch and online processing, a non-Natural program may also be invoked by using CICS standard linkage conventions; that is, via `BALR R14,R15`.

For further information, see the terminal command `%P=S` in the *Terminal Commands documentation*. See also the parameter `SLCALL` in the macro `NTCICSP`.

### Calling Non-Natural Programs with Parameter Values in a COMMAREA or in a Container

By default, non-Natural programs are called with the addresses of the request parameter lists (see the description of the `CALL` statement in the *Natural Statements documentation*) passed in the `TWA` and/or a `COMMAREA` (depending on the setting of the `NTCICSP` macro parameter `CALLRPL`).

A more CICS-like method is to pass the parameter values in a CICS `COMMAREA` or a CICS Container (see [Natural CICS Interface Support for CICS Channels and Containers](#)), particularly when the called program resides in another CICS region - Distributed Program Link (DPL) -, as addresses within the “calling” region are not accessible by the “called” region.

For details and restrictions, see the terminal commands %P=C and %P=CC in the *Terminal Commands* documentation.

### Prerequisite:

This functionality requires CALLRPL to be set to ON in NTCICSP.

When the parameter values are passed in a CICS COMMAREA or CICS container, no parameter list pointers are passed in the CICS TWA, regardless of the CALLRPL setting.

## Dummy Screen I/Os with Natural under CICS

If a SET CONTROL 'Q0' statement is placed before a Natural statement that causes a screen I/O, the terminal output is not executed by Natural under CICS. Consequently, both the Enter key and user input are not passed back to Natural.

This functionality may be useful in the following situations:

1. When leaving pseudo-conversational screen I/Os to non-Natural programs called by Natural. The non-Natural program performs the EXEC CICS SEND operation and returns to Natural. Due to the SET CONTROL 'Q0' statement, the next Natural screen I/O terminates the task of a pseudo-conversational session. Upon screen input, Natural receives control and invokes the non-Natural program again, which then performs the EXEC CICS RECEIVE.
2. When changing the Natural pseudo-conversational transaction ID “in-flight” without requiring a terminal operator intervention:

```
MOVE *INIT-ID TO termid
CALLNAT 'CMTRNSET' trnid /* change the restart transaction ID

* starting a task on your terminal forces an interrupt as if
* pressing any attention identifier

CALL 'CMTASK' USING trnid
H'0000' H'00000000' termid
SET CONTROL 'Q0'
INPUT 'DUMMY' /* dummy I/O, which you will never see
WRITE 'HELLO' *INIT-PROGRAM /* now the new transaction ID is active ↵
```

3. When switching to an application outside Natural, perhaps even in another CICS AOR (application-owning region), without requiring a terminal operator intervention:

```
* starting a task on your terminal forces an interrupt as if
* pressing any attention identifier

CALL 'CMTASK' USING trnid data-length start-data termid
SET CONTROL 'QQ'
INPUT 'DUMMY'                /* dummy I/O, which you will never see
WRITE 'HELLO' *INIT-PROGRAM  /* now the new transaction ID is active
```

In this case, it is the responsibility of the application being invoked to stack the Natural restart data when they are passed in a CICS COMMAREA, as a COMMAREA most likely is used by the new (pseudo-conversational) application, too.

# 28 Natural CICS Sample Programs - Natural CICS Interface

## Version 8.3

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- Sample Programs in Natural CICS Source Library ..... 182

This part of the Natural CICS Interface documentation contains an overview of the Natural CICS sample programs.

## Sample Programs in Natural CICS Source Library

The following sample programs are supplied in the Natural CICS source library:

- [Front-End Programs](#)
- [Back-End Programs](#)
- [User Exits](#)
- [Subprogram Calls](#)
- [Node Error Program](#)
- [Other Programs](#)

### Front-End Programs

Name	Language	Function
XNCIFRNP	Assembler	Initialization program that initializes the Natural CICS environment at CICS start-up.
XNCIFRNL	Assembler	Front-end program for invoking Natural via EXEC CICS LINK.
XNCIFRNR	Assembler	Front-end program for invoking Natural via EXEC CICS RETURN IMMEDIATE.
XNCIFRNS	Assembler	Front-end program for invoking Natural via EXEC CICS START.
XNCIFRNX	Assembler	Front-end program for invoking Natural via EXEC CICS XCTL.
XNCIFRNN	Assembler	Front-end program for invoking Natural via EXEC CICS LINK without front-end parameters.
XNCIFRCL	COBOL	Front-end program for invoking Natural via EXEC CICS LINK.
XNCIFRCN	COBOL	This is a dummy front-end program for invoking Natural via EXEC CICS LINK for LE compliance.
XNCIFRCR	COBOL	Front-end program for invoking Natural via EXEC CICS RETURN IMMEDIATE.
XNCIFRCS	COBOL	Front-end program for invoking Natural via EXEC CICS START.
XNCIFRCX	COBOL	Front-end program for invoking Natural via EXEC CICS XCTL.
XNCIFRPL	PL/1	Front-end program for invoking Natural via EXEC CICS LINK.
XNCIFRPN	PL/1	This is a dummy front-end program for invoking Natural via EXEC CICS LINK for LE compliance.
XNCIFRPR	PL/1	Front-end program for invoking Natural via EXEC CICS RETURN IMMEDIATE.
XNCIFRPS	PL/1	Front-end program for invoking Natural via EXEC CICS START.
XNCIFRPX	PL/1	Front-end program for invoking Natural via EXEC CICS XCTL.
XNCIFRDN	C	This is the dummy front-end program for invoking Natural via EXEC CICS LOAD and BASR for LE compliance.

## Back-End Programs

Name	Language	Function
XNCIBACK	Assembler	Termination Data Dump: This back-end program displays the Natural termination message and any termination data in dump format. If invoked from an asynchronous task, the Natural termination message will be issued on the operator console, and potential termination data will be dumped. NCIBACK can also be invoked by a back-end transaction (RET=xxxx or RTI=xxxx or STR=xxxx, where xxxx is the transaction code associated with XNCIBACK).

## User Exits

Name	Language	Function
XNCIDIRX	Assembler	System Directory Module Name Exit: This source module contains a sample system directory module name exit (see also <a href="#">NCIDIREX - System Directory Module Name Exit Interface</a> ).
XNCIDTPX	Assembler	DTP Terminal Exit: This source module contains a sample DTP terminal exit (see also <a href="#">NCIDTPEX - DTP Terminal I/O Exit Interface</a> ).
XNCIRDC1	Assembler	Exit for SYSRDC: This program provides a sample exit for the SYSRDC utility; see the relevant section in the <i>Utilities</i> documentation.
XNCITIDX	Assembler	Terminal ID Exit: This program provides a sample user exit to test the terminal ID and/or to set a logical terminal or session ID (see also <a href="#">NCITIDEX - Terminal ID Exit Interface</a> ).
XNCITIOX	Assembler	DTP Terminal Exit: This source module contains a terminal I/O exit that is more general than the XNCIDTPX sample (see also <a href="#">NCIDTPEX - DTP Terminal I/O Exit Interface</a> ).
XNCIUIDX	Assembler	User ID Exit: This program provides a sample user exit to test/set the user ID (see also <a href="#">NCIUIDEX User ID Exit Interface</a> ).
XNCIXIDX	Assembler	Transaction ID Exit: This program provides a sample user exit to test/set the pseudo-conversational transaction ID (see also <a href="#">NCIXIDEX Transaction ID Exit Interface</a> ).

## Subprogram Calls

Name	Language	Function
XNCI3GC1	COBOL	This program provides a sample COBOL call to a Natural subprogram under CICS.
XNCI3GC2	COBOL	This program provides a sample COBOL call to a Natural subprogram under CICS.
XNCI3GC3	COBOL	This program provides a sample COBOL call to a Natural subprogram under CICS.
XNCI3GP1	PL/1	This program provides a sample PL/1 call to a Natural subprogram under CICS.
XNCI3GP2	PL/1	This program provides a sample PL/1 call to a Natural subprogram under CICS.
XNCI3GP3	PL/1	This program provides a sample PL/1 call to a Natural subprogram under CICS.

## Node Error Program

Name	Language	Function
XNCINEP2	Assembler	This node error program calls the NCIZNEP module using the CICS command level.

## Other Programs

Name	Language	Function
XNCIUCTR	Assembler	Upper/lower case switch: This program serves to switch the terminal into upper/lower case mode.
XNCIGNIT	Assembler	"Good Night" program: This sample program calls the NCIZNEP module for Natural session clean-up.

# 29 Invoking Natural from User Programs - Natural CICS

## Interface Version 8.3

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▪ Front-End Parameters .....	187
▪ Front-End Invoked via LINK .....	189
▪ Front-End Invoked via RETURN IMMEDIATE .....	190
▪ Front-End Invoked via START .....	190
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▪ Front-End Invoked via Distributed Program Link (DPL) .....	190
▪ Invoking Front-End Program as Back-End .....	191

This section of the Natural CICS Interface documentation describes the various ways of how Natural can be invoked from user programs.

## Commands for Activating a Natural Session

---

This section covers the following topics

- Using EXEC CICS XCTL or EXEC CICS LINK
- Using EXEC CICS RETURN IMMEDIATE
- Using EXEC CICS START
- Using Distributed Program Link (DPL)
- Sample Programs
- Using the External Subroutine CMTASK

A Natural session can be activated by user front-end programs with one of the following commands:

- EXEC CICS XCTL
- EXEC CICS LINK
- EXEC CICS RETURN IMMEDIATE
- EXEC CICS START

or the equivalent CICS macro level requests.

### Using EXEC CICS XCTL or EXEC CICS LINK

When using EXEC CICS XCTL/LINK, the parameters used by Natural can be passed in a CICS COMMAREA or in the TWA.

- Natural determines the location of the startup parameters by inspecting the length of the COMMAREA passed to it during session initialization.
- If the length is 22, Natural tries to locate the parameters in the COMMAREA, otherwise it is assumed that they have been passed in the TWA.

To identify a front-end program properly, it is mandatory that the first 4 bytes of the front-end parameter list represent the current transaction ID.

The transaction ID associated with the front-end program must have a TWA size that is equal to or greater than the Natural TWA size; see also *ncitransact* in *Installing Natural CICS Interface on z/OS* in the Natural *Installation* documentation.

## Using EXEC CICS RETURN IMMEDIATE

When using EXEC CICS RETURN IMMEDIATE, the front-end parameters used by Natural can be passed in a CICS COMMAREA and the dynamic parameters used by Natural can be passed with INPUTMSG (...) and INPUTMSGLEN (...) of the EXEC CICS RETURN IMMEDIATE command.

## Using EXEC CICS START

When using EXEC CICS START, the front-end and dynamic parameters used by Natural can be passed with FROM (...) and LENGTH (...) of the EXEC CICS START command. The parameters are described on the following page.

## Using Distributed Program Link (DPL)

When using EXEC CICS LINK with the SYSID parameter pointing to a remote region, the front-end and dynamic parameters used by Natural have to be passed in a CICS COMMAREA. In addition also a TRANSID parameter has to be specified naming the transaction code of a mirror transaction with a TWA size satisfying Natural's requirements.

It should be noted that the same restrictions as for asynchronous Natural sessions apply to Natural sessions invoked via DPL, that is, no input is possible (therefor the same dynamic parameter settings are recommended) and the caller just gets control back after Natural session termination.

## Sample Programs

A series of sample programs for the various programming techniques is supplied in the Natural CICS source library; see also [Natural CICS Sample Programs](#)

## Using the External Subroutine CMTASK

It is possible to start a Natural session from a Natural program by calling the external subroutine CMTASK. Refer to the sample Natural program ASYNCICS in library SYSEXP.

## Front-End Parameters

---

The following list of parameters must be supplied to invoke Natural from a user front-end program:

Pos.	Contents
1 - 4	<p><b>Invoking transaction ID</b></p> <p>This value must be equal to the current transaction ID. Via the invoking transaction ID, Natural identifies that it was called by a user front-end program.</p> <p>When being called with XCTL, the transaction is restarted at the end of the Natural session via RETURN with TRANS ID, unless a return program name is specified (see 5th parameter).</p>
5 - 8	<p><b>Address/offset of dynamic parameter string</b></p> <p>If dynamic parameter overwrites are to be evaluated, this value should be set to the address located 12 bytes before the dynamic parameter assignment string.</p> <p>When being called with START or DPL, the field must be set to the offset (relative to the start of the front-end parameter list) of the address located 12 bytes before the dynamic parameter assignment string.</p>
9 - 10	<p><b>Length of the dynamic parameter string</b></p> <p>Zero indicates that no parameters are to be passed. 32760 is the maximum length allowed. If the maximum value is exceeded, the session is terminated with a corresponding error message.</p>
11 - 14	<p><b>Natural transaction ID</b></p> <p>The value specified is the transaction ID to be used for controlling a pseudo-conversational Natural session, when being called with START or XCTL. This transaction is invoked each time the Natural session is restarted in pseudo-conversational mode; that is, with each terminal I/O.</p> <p>If the Natural transaction ID is not specified, Natural restarts the transaction ID which initiated the current CICS task, and the front-end program regains control after each pseudo-conversational I/O.</p>
15 - 22	<p><b>Back-end program name</b></p> <p>This 8-byte value is the program name to which control is transferred at the end of the Natural session with a CICS XCTL command, rather than restarting the calling transaction ID via RETURN with TRANSID.</p> <p>If this field is numeric in the first byte, Natural simply RETURNS without activating any back-end. Please note that this field can be superseded by the Natural profile parameter PROGRAM.</p> <p>For the conventions of calling non-Natural back-end programs, refer to the Natural Operations documentation.</p>

## Front-End Invoked via LINK

---

On return to the front-end, Natural indicates in the TWA if the session has terminated or not: when the session has terminated, the TWA holds regular back-end information (see *Back-end Program Calling Conventions* in the *Operations* documentation), else Natural puts the NEXTTRANSID into the first four bytes of the TWA.

If Natural is running in pseudo-conversational mode (profile parameter PSEUDO set to ON) and has been invoked by EXEC CICS LINK (or the equivalent CICS macro level request), the original invoking transaction is invoked each time Natural writes to a terminal and waits for input, which means that Natural issues a “logical” CICS RETURN TRANSID (..) after having written its restart information into CICS temporary storage.

The invoking transaction must recognize this situation (for example, by checking whether a NEXTTRANSID has been sent or by the existence of NCOMxxxx TS records - where NCOM is the Natural CICS parameter generation option and xxxx is the terminal ID -) and pass control back to Natural.

The advantage of this method is that, during the session, the front-end program can decide to pass control to another application (for example, COBOL) and to resume the Natural session later.

For further details see the PSEUDO parameter description in the *Parameter Reference* documentation.

Per design, Natural treats a LINK front-end program as a back-end program at session termination, that is, the *Back-End Program Calling Conventions* apply.

### In CICSplex Environments

Make sure that the NCOMxxxx TS records can be accessed by all participating CICS AORs (for example via appropriate CICS TST definitions).

Alternatively the LINK front-end program can also pick up the NCI session restart information in CICS temporary storage on task termination and pass it in a CICS COMMAREA by itself; such a COMMAREA has then to be put into CICS temporary storage again prior to invoking Natural for session resume.

## Front-End Invoked via RETURN IMMEDIATE

---

This front-end technique only works for terminal-bound Natural sessions. Natural scans for start-up parameters supplied with the COMMAREA. Note that when using this technique, potential dynamic parameters cannot be passed chained to the front-end parameters, that is, the dynamic parameters' address fields must be zero. Instead, potential dynamic parameters can be passed via terminal input data, which are obtained by Natural by an EXEC CICS RECEIVE command.

## Front-End Invoked via START

---

If the Natural session is a started task (that is, invoked by an EXEC CICS START or EXEC CICS LINK/XCTL command by a front-end user program which has been STARTed), Natural first scans for startup parameters supplied with the COMMAREA, then it scans for parameters in the TWA and finally it tries to obtain the necessary parameters by an EXEC CICS RETRIEVE command.

## Front-End Invoked via XCTL

---

If the Natural session is initiated from a front-end program with XCTL and no return program is specified (that is, neither a fifth parameter in the session startup parameters nor a PROGRAM specification in the Natural dynamic parameters or the NTPRM macro), Natural restarts the user front-end transaction at session termination via RETURN with TRANSID by internally simulating a PROGRAM='RET=xxx' specification, with xxx being the front-end transaction code.

To avoid a loop condition, logic must be included into the user front-end routine to decide whether a new session is to be started or an old session is to be resumed.

## Front-End Invoked via Distributed Program Link (DPL)

---

If the Natural session is invoked via DPL, Natural first determines if it is directly invoked in the server region or indirectly via EXEC CICS LINK/XCTL by a local front-end program. When being invoked directly, Natural retrieves the start parameters from the CICS COMMAREA. When being invoked indirectly, Natural scans for startup parameters supplied with the COMMAREA, then it scans for parameters in the TWA. On return Natural passes regular back-end data in the TWA when there is a local LINK front-end program available, otherwise it returns the termination message and potential back-end data in the remote client's COMMAREA.

## Invoking Front-End Program as Back-End

---

If the Natural session is initiated from a front-end program and this program is also specified to be the return program, the user front-end should also check for the initiating transaction ID.

In particular this applies if the front-end program is not in pseudo-conversational mode but Natural is in conversational mode.

In this case Natural is invoked again rather than getting terminated, but this time without detecting that it is called by a front-end program, as the first parameter in the startup parameters is the Natural transaction ID.



# 30 Asynchronous Natural Processing under CICS - Natural CICS Interface Version 8.3

---

- Asynchronous Natural Processing ..... 194
- Asynchronous Natural Sessions under CICS ..... 194
- Testing and Debugging ..... 195

This chapter contains special considerations that apply when you are using asynchronous Natural under CICS.

## Asynchronous Natural Processing

Asynchronous Natural processing is generally discussed in the section *Asynchronous Processing* in the *Operations* documentation; however, some additional considerations apply when running under CICS. These are described in the following sections.

## Asynchronous Natural Sessions under CICS

Make sure that appropriate `SENDER` and `OUTDEST` destinations are specified for an asynchronous Natural session; otherwise, any output (for example, unexpected error messages) will lead to an abnormal termination.

Also, make sure that a suitable message switching transaction ID (`MSGTRAN`) is specified in the `NTCICSP` macro of the Natural parameter module and defined in CICS.

In addition to CICS terminal IDs and transient data destinations for `SENDER` and `OUTDEST`, the following keywords are supported by the Natural CICS Interface:

DUMMY	Any output is ignored.
CONSOLE	Any output is routed to the operator console.  When dealing with the console, the terminal type should be switched accordingly, using the profile parameter <code>TTYTYPE</code> or the terminal command <code>%T=</code> set to <code>ASYL</code> or other.

By default, the 3270 data stream protocol is used for output of an asynchronous Natural session under CICS.

It is also possible to send Natural output data without any 3270 terminal or printer control information to, for example, a CICS message destination such as `CSSL`. This can be accomplished by switching into line mode using a `SET CONTROL 'T='` statement or by starting with profile parameter `TTYTYPE=xxxx`, where `xxxx` is `BTCH` or `ASYL`. All Natural output is then sent line by line, with a leading `ASA` control character when the Natural profile parameter `EJ` is set to `ON`; with `EJ=OFF`, no control character is sent at all.



**Caution:** When `SET CONTROL 'T=xxxx'` or `SET CONTROL '+'` is used, or when personal-computer support is enabled (profile parameter `PC` set to `ON`), the Natural system variable `*DEVICE` will be modified, which means that it can no longer be used to determine an asynchronous Natural session.

Note that some parameter settings for asynchronous Natural sessions can be forced by setting the NTCICSP macro parameter RCVASYN to ON.

## Testing and Debugging

---

Recent CICS versions offer a transaction CEDX which enables tracing of asynchronous tasks in CICS. In earlier CICS versions, this functionality did not exist, that is, such debugging was only possible with terminal-bound tasks.

The Natural CICS Interface offers some assistance in this case: You can test asynchronous Natural sessions by starting that session from a terminal, but either with ASYN, as the very first five characters in the dynamic parameter string, or with the profile parameter TTYPE=xxxx, where xxxx is ASYN or ASYL. The Natural CICS Interface then sets up an asynchronous Natural session.

Please, note that this emulation is only 100 percent in terms of Natural; CICS keeps on treating the task as terminal bound.

---

# 31 Logging Natural Sessions under CICS - Natural CICS

## Interface Version 8.3

---

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▪ Natural Log File Definition .....	198
▪ Natural Log Records .....	199

This chapter describes how information about Natural sessions can be logged in a file which can be processed and evaluated in batch mode.

## Logging Facility

---

Optionally, information about Natural sessions can be logged in a file which can be processed and evaluated in batch mode.

In contrast to the online *SYSTP Utility*, which just gives a snap shot of the current system usage, this logging facility can be used to keep track of the Natural CICS system usage over a longer period of time.

### Special Considerations

- It is possible that several Natural CICS environments (that is, several system directories with unique threads, roll facilities, swap and buffer pools) share the same Natural log destination. When an SCP environment is initialized, a “system ID” is written into the system directory. This system ID is part of an evaluation program to “sort” log records by Natural CICS system environment.
- You are recommended to define the Natural log file in the Natural application CICS, as logging to a “remote” log file would degrade performance.
- When running the log file evaluation program (see *SYSTP in Batch Mode* in the *Natural Utilities* documentation), the log file should be closed in CICS, otherwise unpredictable results may happen due to the last buffer being still in storage or the EOF record missing on file.
- Sufficient disk space should be reserved for the Natural log file; preferably the log file should be defined using secondary allocation.

## Natural Log File Definition

---

The Natural log file is a sequential disk file; that is, an “extra partition destination” in terms of CICS. By default, the internal (logical) name of the log file is `NLOG`; this name can be changed by specifying the `LOGDEST` parameter in the `NTCICSP` macro.

The log file has to be defined in a CICS DCT as `TYPE=EXTRA` with associated data set control information (`TYPE=SDSCI` entry in DCT). This file must also be defined in the CICS start-up JCL (`DD` statement).

## Natural Log Records

---

The following records are logged in the Natural log file:

- [Natural CICS System Restart Record](#)
- [Natural Session Termination Record](#)

### Natural CICS System Restart Record

Length=96

After successful SCP system initialization, a record that holds the initialization date and time as well as other system data like the common system prefix, the number of RCBs or the number of thread groups, is written to the log file.

When this first log request fails, the Natural log file is flagged in the system directory as not available and no further logging takes place.

System restart records are written whenever the system highwater marks are reset by the corresponding system administration function of the SYSTP utility (see the Natural *Utilities* documentation). In addition to the system start information, these records contain the terminal ID and the user ID of the SYSTP user.

### Natural Session Termination Record

Length=216

On (normal or abnormal) termination of a Natural session, a session log record is written to the log file. This record is internally split into six parts:

1. The record control part which holds the actual session statistics:
  - the current date and time (that is, the date and time when the session terminated),
  - the system ID which indicates the Natural CICS environment in which the session was active,
  - the record type = session record.

The record control part is common to all Natural log records to distinguish the different record types. Macro NCMLLOG holds the record layouts.

2. The user session part which holds the actual session statistics:
  - the terminal ID,
  - the (last) user ID,
  - the session start date and time,
  - the maximum storage allocated by the session,

- the number of session resumes/swap ins/roll ins,
  - the maximum number of records rolled by the session (if any).
3. The thread group part which holds the current data of the thread group associated with the session:
- the thread group number,
  - the number of TCB slots in the group (if any),
  - the common thread size of the group,
  - the maximum storage allocated in the group by any session,
  - the maximum number of sessions active in the group,
  - the maximum wait queue size of the group (with `TYPE=SHR` thread groups) and the maximum number of sessions concurrently active in the group (with `TYPE=GETM` thread groups),
  - the number of times this maximum wait queue size was reached.
4. The thread part which holds the data of the `TYPE=SHR` thread used as last thread by the session (if used at all):
- the thread name,
  - the thread use count,
  - the highest thread storage used by any session,
  - the number of session resumes/roll-ins into this thread,
  - the maximum wait queue size of this thread,
  - the number of times this maximum wait queue size was reached.
5. The roll facility part which holds information about the roll facility to which the session was assigned (if it was at all):
- the roll facility name,
  - the maximum number of sessions assigned to this roll facility,
  - the record size of the roll facility,
  - the slot size of the roll facility,
  - the number of slots in this roll facility,
  - the maximum number of roll-outs to / roll-ins from this roll facility.
6. The system directory part which holds statistics about the global system usage:
- the maximum number of UCB block extensions,
  - the maximum number of sessions active in the system,
  - the maximum number of sessions concurrently active in SCP,
  - the number of SCP system recoveries.

By design, session termination records are stored by session date and time. This means that parts 3 to 6 of a later session record always hold more current information than those of a previous one. Parts 3 to 6 of the record are used by the log file evaluation program to refresh the corresponding information provided; that is, information on the thread group, thread, roll facility and SCB.

This technique is used to keep up-to-date information about the Natural CICS system resources in case CICS terminates in an uncontrolled manner.

The session termination log records, of course, reflect only resources which have been used by the corresponding sessions. Therefore, these records may not reflect the full SCP environment. Reports of a full SCP environment can be obtained by making a snapshot of the whole environment by either using the *System Administration Facilities* function of the SYSTP utility (see the *Natural Utilities* documentation) or placing Natural under CICS into the CICS PLTSD (as described in the section *Special Natural CICS Functionality*).

System snapshot records in the Natural log file represent session termination records without session-specific information as listed under part 2.



# 32 Natural CICS Performance Considerations - Natural CICS

## Interface Version 8.3

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This chapter contains guidelines for setting up Natural in a CICS environment.

## Environment-Specific Considerations

---

The following environment-specific considerations should be noted:

- When running Natural in a CICSplex environment (z/OS only), you must use the Natural Roll Server.
- When running Natural locally in a single CICS region, however, you have several possibilities.

One possibility (z/OS only) is to use the Natural Roll Server. The benefit of this versus using CICS roll facilities and a swap pool is that the Natural Roll Server runs asynchronously to the CICS region and can provide more roll buffers in its data space than the swap pool.

## Choosing the Roll Facility

---

This section covers the following sections:

- [Control Interval](#)
- [VSAM Roll Files versus CICS Temporary Storage](#)
- [Using CICS Auxiliary Temporary Storage](#)
- [Using CICS Main Temporary Storage](#)
- [Using VSAM RRDS Roll Files](#)
- [Using the Natural Swap Pool under CICS](#)

### Control Interval

You are strongly recommended to define both roll facilities, VSAM and auxiliary temporary storage, with the largest possible control interval size of 32 KB. This minimizes the number of I/Os and the CPU overhead necessary to perform the rolling.

Reasons for a control interval size of less than 32 KB might be the better exploitation of disk tracks or the usage of virtual storage for the VSAM buffers.

## VSAM Roll Files versus CICS Temporary Storage

With the same CISIZE/record size, temporary storage causes less CPU overhead than VSAM roll files:

To write  $n$  records to temporary storage you have to issue  $n+1$  CICS requests (that is, 1 for DELETEQ and  $n$  for PUTQ) while you have to issue  $2n$  requests for VSAM roll files because of the VSAM transaction logic:  $n$  times (READ for UPDATE plus REWRITE).

For VSAM update requests, a physical I/O is always performed, whereas for temporary storage (AUX) records, buffering takes place, so that in many cases, records to be read are still found in the buffers.

However, CICS temporary storage may become a bottleneck when it is also being used by other applications.

VSAM roll files for Natural can overcome this situation (although at the expense of additional VSAM buffer space) especially when I/O contention can be avoided. VSAM roll files with optimum/maximum CISIZE/record size are particularly efficient when this record size cannot be specified for the CICS temporary storage file due to other requirements.

CICS temporary storage should be used whenever it can be dedicated to Natural. If CICS temporary storage is also used by other applications, you should evaluate whether the Natural performance is better when using VSAM roll files.

If Natural with CICS temporary storage does not perform worse, you should choose CICS temporary storage as roll facility and use the “saved” VSAM roll file buffer space for more TS buffers or for an additional thread.

## Using CICS Auxiliary Temporary Storage

The primary roll facility is VSAM RRDS; the default type of temporary storage is AUXILIARY.

If you are using VSAM roll files, the Natural CICS Interface uses temporary storage (AUX) if all roll files become full or unusable during a CICS session.

However, if you do not wish to use roll files or if the roll files are incorrectly installed, Natural under CICS uses temporary storage (AUX) for all rolling. When temporary storage (AUX) is used as roll file, the control interval size for this file must be at least 4 KB. If auxiliary temporary storage is not available, main temporary storage is used instead.

The number of VSAM buffers defined by the CICS SIT parameter TS should be increased to a reasonable value to reduce the number of physical I/Os. The CICS statistics should be checked for bottlenecks in this area.

## Using CICS Main Temporary Storage

With CICS main temporary storage as roll facility, no I/O is performed on rolling, but due to large main storage amounts used, tuning considerations may be required due to increased paging.

## Using VSAM RRDS Roll Files

The VSAM roll files should be considered for normal CICS VSAM file tuning, for example, `BUFNO` and `STRNO` parameters in the `FCT`. The CICS shutdown statistics should be checked for bottlenecks in this area.

As the roll files serve as a kind of page data set for Natural, everything which slows down the Natural rolling should be avoided, as there is journaling and logging; dynamic transaction backout (DTB) and forward recovery for roll files is useless and only causes overhead.

## In MRO Environments

For performance reasons the VSAM roll files should be defined in the same CICS system in which the Natural applications are running; MRO function shipping should not be invoked. CICS local shared resources (LSR) can be used if there are enough buffers available.

## Separate LSR Pool for Natural

The definition of a separate LSR pool for Natural roll files is recommended, with the number of strings (`STRNO`) greater than the number of threads. The number of buffers should also be greater than the number of threads. A greater number of buffers increase the look-aside hit ratio.

## Using the Natural Swap Pool under CICS

You are strongly recommended to use a swap pool rather than a large number of VSAM temporary storage (`AUX`) buffers or temporary storage (`MAIN`).

The Natural swap manager handles the compressed session storage very efficiently and reduces CPU and I/O overhead. The size of the swap pool should be as large as possible. For example, a swap pool of 2.5 MB would be required to hold 50 sessions which fit into 50 KB slots.

From a performance point of view, it does not make any sense to use main temporary storage as a backup facility for the swap pool, since both of these facilities use CICS main storage. In general though, using the swap pool is more advantageous, because CICS services overhead is eliminated. Rather than overflowing to main temporary storage, it would be better to enlarge the swap pool and to use disk storage (that is, VSAM roll files or auxiliary storage) as its backup facility.

If virtual storage becomes a bottleneck, the number of roll facility buffers and possibly the number of threads should be minimized to the benefit of the swap pool.

When using the Natural swap pool cache, a roll buffer of the size of the largest Natural thread is required for transferring Natural session data between the swap pool and its (data space) cache. This roll buffer is taken from the `GETMAIN` for the swap pool, that is, the size of the storage actually available for the swap pool is the specified size minus the size of the largest Natural thread.

Therefore a Natural swap pool cache is only allocated when both the size of the swap pool and the size of its cache are at least twice the size of the largest Natural thread.

## Shared Storage Threads versus GETMAINED Threads

---

This covers section the following sections

- [Storage Usage](#)
- [Controlling Storage Usage](#)
- [Swapping/Rolling](#)
- [Considerations for CICS/TS](#)
- [Conclusion](#)

### Storage Usage

Shared storage threads are pre-allocated during Natural CICS system initialization, which means that the storage covered by these threads is dedicated to the Natural CICS system, regardless of whether there are active sessions or not. On the other hand, `GETMAINED` threads only exist while the CICS task is active.

### Controlling Storage Usage

With shared storage threads (`TYPE=SHR`), Natural under CICS always uses what has been pre-allocated during the initialization of Natural; therefore, the size of storage used by Natural threads is easily predictable. For `GETMAINED` threads (`TYPE=GETM`), however, the actual storage used depends on the number of Natural sessions that are currently active.

Although Natural itself has no mechanism for setting the maximum number of `GETMAINED` threads, this can be controlled by grouping the Natural transaction codes into a `TRANCLASS` (`TCLASS` prior to CICS Version 4.1). When a transaction code belongs to such a class, the maximum number of parallel tasks can be regulated by the `MAXACTIVE` parameter in the `TRANCLASS` definition (or by using the `CMXT` parameter of the CICS system initialization table (SIT) prior to CICS Version 4.1).

## Swapping/Rolling

When a Natural session releases its shared storage thread, session data are kept in the thread in uncompressed format, unless another session needs to use this particular thread. If so, the new session is responsible for saving the old session's data.

Such an activity is called “deferred rolling”. It enables you to eliminate rolling or swapping entirely, provided that the number of available threads is greater or equal to the number of concurrently active Natural sessions.

Conversely, sessions that use `GETMAINED` threads always save their data prior to the `FREEMAIN` operation at CICS task termination, which leads to a roll/swap overhead regardless of the number of concurrently active Natural sessions.

In environments with high volumes of Natural transactions, there is practically no difference between saving session data via the “immediate” or the “deferred” rolling method.

In busy Natural environments with a high ratio of Natural sessions to program storage threads, there is more roll-in/roll-out overhead, since these threads are shared by several Natural sessions. A potential problem in this situation is thread contention caused by Natural tasks with long-running Adabas requests; that is, with many Adabas calls.

To prevent such tasks from “locking” a thread for too long, they can be forced to release their thread by using Natural profile parameter `DBROLL` appropriately.

For `GETMAINED` threads, however, contention between two or more Natural sessions never occurs, since a `TYPE=GETM` thread belongs exclusively to the Natural session it was allocated for.

`TYPE=GETM` threads can thus be considered “single-use” resources that are never shared, whereas `TYPE=SHR` threads can be considered “multi-use” resources that may be shared.

## Considerations for CICS/TS

The most important feature of CICS/TS in z/OS is transaction isolation, which means that a task's storage can be protected against other tasks.

To take advantage of this facility with Natural, `TYPE=GETM` threads should be used, since these threads are subject to transaction isolation, whereas “shared” `TYPE=SHR` threads are not. Also additional CICS overhead occurs for `TYPE=SHR` threads with CICS/TS.

While the thread selection algorithm for `TYPE=GETM` threads is trivial (when a Natural task is started, a thread is allocated via CICS `GETMAIN`), for `TYPE=SHR` threads, it is more complicated: the Natural threads environment is managed by the environment-dependent nucleus (queueing and balancing), whereas CICS does not know anything about Natural threads. In contrast to `TYPE=GETM` threads, where CICS would release the thread at the latest at the end of the task, with `TYPE=SHR` threads, Natural has to assign/release them to/from their sessions. In order to do so, Natural maintains a list of thread control blocks (TCBs).

Although Natural always keeps an exit active to be able to release session resources unknown to CICS (for example, `TYPE=SHR` threads) in the case of abnormal task termination, situations may occur where a Natural task terminates without its thread being marked as free in the associated TCB (for example, if an `EXEC CICS ABEND CANCEL` request has been issued in a non-Natural program called by Natural, or if Natural sessions have been flushed by any `KILL` transactions of a performance monitor).

To prevent problems with threads inadvertently left busy, Natural under CICS always checks in its thread selection algorithm whether the CICS task associated to a busy thread is still existing; if not, the thread is released.

With CICS versions prior to CICS/TS, this checking for active CICS tasks was done by control-block jumping, which means that Natural was checking for an active task by testing the consistency of the task's `EISTG`, `TCA` and `TQE` control blocks. With CICS/TS, because of transaction isolation, the storage of another task may not be accessible at all.

To accomplish this function in CICS/TS, the environment-dependent nucleus issues an `EXEC CICS INQUIRE STORAGE TASK()` request for any thread identified as busy in the thread selection routine. This means that there may have been some CICS requests before the task is finally `ENQueued` for thread resources. The same CICS command is also used for the serialization of Natural sessions (for example, deferred rolling of `TYPE=SHR` threads).

## Conclusion

Both `TYPE=SHR` and `TYPE=GETM` threads have their advantages and disadvantages. However, with CICS/TS, `TYPE=GETM` threads are preferred, because of:

- the support of transaction isolation (z/OS only),
- more CICS-like tuning possibilities,
- worse performance of `TYPE=SHR` threads.

## CICS Parameter Settings

---

CICS SIT parameters `AMXT` and `CMXT` should be used to control the number of concurrent Natural tasks.

The number specified should be greater than the number of threads. You should also consider to specify a separate transaction class with a suitable `CMXT` parameter for asynchronous Natural tasks and for Natural Advanced Facilities spool tasks so as to prevent logouts of “normal” Natural terminal tasks by too many of such “background” tasks occupying threads. Special thread groups can be defined for these transactions.

CICS dumps for Natural transactions should be suppressed, unless requested from Software AG personnel for debugging purposes. Natural itself generates dumps (via `EXEC CICS DUMP`) for non-

program check abends, and also for program checks if the Natural session parameter DU is set to ON. When no Natural dump is generated, a CICS dump is redundant and just causes overhead (particularly when creating a system/region dump, since the whole CICS system is halted until the snap dump is completed).

CICS trace is essential when analyzing problems, although it introduces system overhead. Also CICS performance monitoring tools and accounting packages cause system overhead of up to 30 percent and more. Some packages internally turn on the CICS trace and then intercept it. You should be aware of this potential system overhead. Also remember that the Natural CICS Interface uses the CICS command level application programming interface: CICS command level requests produce much more trace entries (apart from other overhead) than CICS macro level requests.

## Line Compression Systems

---

Natural itself optimizes its data streams by means of RA (repeat to address) and other techniques as screen imaging etc. If other line compression systems are installed, the Natural transactions should be excluded from being processed by these systems, as this would introduce overhead without achieving any benefit.

## Pseudo-Conversational versus Conversational Transactions

---

When resuming a session, conversational Natural tasks are locked to their initial thread, which means that a conversational task has to wait for this thread if it is currently not available. Pseudo-conversational Natural tasks, however, are flexible to roll into any available thread.

In other words, the “classical” advantage of conversational tasks - less I/Os for saving/restoring data over screen I/O operations - does not apply for Natural because of its thread technique.

## Natural and Adabas

---

Since a Natural task in CICS waits for completion of an Adabas call, the servicing Adabas region/partition should always have higher priority than the CICS region/partition to minimize wait time.

## CICS Monitoring Products

---

CICS monitoring products may offer facilities to purge CICS tasks, bypassing any abnormal termination exit set by the application.



**Caution:** Such facilities should not be used to cancel Natural tasks, as Natural may not be able to clean up its resources, and, even worse, the Natural CICS system may be left in an inconsistent state depending on what this task was doing.

To cancel Natural sessions, the Cancel/Flush Session functions of the SYSTP utility should be used instead; see the relevant section in the Natural *Utilities* documentation for details.



# 33 Natural Print and Work Files under CICS - Natural CICS

## Interface Version 8.3

---

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- CICS Temporary Storage Print and Work Files ..... 214
- CICS Transient Data Print and Work Files ..... 215

This chapter discusses the use of Natural print and work files under CICS.

## Customizing Print and Work File Usage

---

The Natural CICS Interface supports Natural print and work files in CICS either as CICS transient data queues or as CICS temporary storage queues, both auxiliary and main.

To customize usage, set the following subparameters in the `PRINT` and `WORK` profile parameter:

```
AM=CICS, TYPE=TD/AUX/MAIN, DEST=queuename
```

For more information, follow the links shown below:

- `WORK` profile parameter description and how to set the above subparameter values, see the `NTWORK` parameter macro.
- `PRINT` profile parameter description and how to set the above subparameter values, see the `NTPRINT` parameter macro.

The Natural CICS Interface print file support has been provided for tracing and logging purposes. It is not intended for dealing with reports. In particular, the keyword parameters for `DEFINE PRINTER` such as `PRTY`, `CLASS`, `COPIES`, etc., are not honored at all.

## CICS Temporary Storage Print and Work Files

---

CICS temporary storage queues, both auxiliary and main, for CICS print and work files are `RECFM=V` files by design, available for input and output.

Although in Natural under CICS there is no exclusive control of a specific TS queue by a Natural session, you can automatically create session- or terminal-dependent printfiles or work files by specifying the string defined in the `NTCICSP` macro parameter `TERMVAR` (&TID is the default) in the subparameter `DEST` of profile parameter `PRINT` or in the subparameter `DEST` of the profile parameter `WORK`. When such a string is found within the eight-character `DEST` subparameter, it is replaced by the actual terminal ID.

## In CICSplex Environment

When running in a CICSplex environment, Natural print and work files in CICS temporary storage must be defined as `TYPE=SHARED` or `TYPE=REMOTE` in a CICS TST.

## NCI System Queues

In Natural under CICS, NCI system queues cannot be accessed. (NCI system queues are TS queues with a prefix defined in the `TSKEY` parameter of macro `NCMDIR`.)

## CICS Transient Data Print and Work Files

---

A CICS transient data queue for a Natural CICS print and work file must be defined in the CICS DCT. For indirect destinations, the attributes of the *base* destinations are propagated. In particular, the attributes of an *extra-partition* destination, such as `RECFM` or `TYPEFLE`, determine the Natural work file attributes.

*Intra-partition* destinations have `RECFM=V` set by design and are available for both input and output.

CICS transient data print and work files are “shared files” in the sense that more than one session may issue I/Os against such a file.



# IV

## Natural under Complete/SMARTS

---



# 34 Natural under Com-plete/SMARTS

---

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This document describes the functionality of the Natural Com-plete/SMARTS Interface (product code NCF) and the operation and individual components of Natural in a Com-plete environment.



**Note:** SMARTS is an acronym for “Software AG Multi-Architecture Runtime System”. It constitutes a runtime layer that allows POSIX-like applications to run on mainframe operating systems. Software AG products communicate with the operating system through the SMARTS layer.

#### Related Documents:

- Com-plete documentation set for details of the Com-plete product
- *Online Processing* in the *Natural System Architecture* documentation
- *Installing the Natural Com-plete/SMARTS Interface on z/OS* in the *Installation for z/OS* documentation.
- *Installing the Natural Com-plete/SMARTS Interface on z/VSE* in the *Installation for z/VSE* documentation
- *SYSTP Utility* in the *Natural Utilities* documentation
- *Natural under Com-plete/SMARTS User Abend Codes* in the *Natural Codes and Messages* documentation

## Driver Parameters for the Natural Com-plete/SMARTS Interface

---

For information on the driver parameters that are available for the Natural Com-plete/SMARTS Interface, refer to the description of profile parameter `COMP` or parameter macro `NTCOMP` in the *Parameter Reference* documentation. `COMP` (or `NTCOMP`) comprises several keyword subparameters whose use is explained in the following sections.

### Use of the Abend Exits

---

The `ABEXIT` exits can generally be deactivated by setting the keyword subparameter `SPIEA` to `OFF`.

The `ABEXIT` exit is called during Com-plete's EOJ handling for an abnormal program termination processing.

By default, an `OCX` abend is interpreted by the `ABEXIT` exit routine.

- When running with `DU=ON/SNAP/ABEND`, the Natural session is dumped and correctly terminated with error message `NAT9974`.
- When running with `DU=FORCE`, the `ABEXIT` exit routine is disabled, an immediate dump during Com-plete is produced.

- If `LE370=ON` is specified in the `NTCOMP` macro, or is specified dynamically, and the abend occurs while an LE program has control, user-written or language-specific condition handlers are ignored. The abend is handled by the `ABEXIT` exit routine, the Natural error message `NAT0950` or `NAT9967` occurs.

If `DU=OFF`, Natural responds with error message `NAT0950`, `NAT0954`, `NAT0955` or `NAT0956`, and the entire abend PSW and the Registers 0 to 15 are contained in the IOCB at offset `x'290'`.

## Storage Usage

---

At session initialization, the amount of space defined with the keyword subparameter `NTHSIZE` is allocated as thread `GETMAIN` above or below the 16 MB line, depending on the keyword subparameter `THABOVE`, for usage by Natural.

The Natural profile parameter `WPSIZE` determines the sizes of below and above work pools. By default, the size of the below subpool is set to 32 KB.

Therefore, you must catalog the Natural Com-plete front part with the Com-plete utility `ULIB`, `RG size = 36 KB` or larger.

The remaining areas within the Com-plete thread parts below and/or above (Com-plete `ULIB RG=specification` and/or `THABOVESIZE=specification`) are used by Com-plete for the following:

- user subroutines,
- increasing of variable buffers inside the Natural thread,
- subproducts doing “physical” `GETMAIN` requests, this enforces the Natural work pool allocation.

For more details concerning the `ULIB RG` and `THABOVESIZE` parameters, refer to the *Com-plete Utilities* documentation.

## Support for Back-end Programs

---

Natural passes the following string to a back-end program:

- the Natural return code (fullword),
- the Natural termination message (A72),
- the length of the termination area (fullword),
- the termination data.

This string is mapped by the `NAMBCKP` macro.

The `XNCFBACK` source module is an example of a Natural back-end program in a Com-plete environment. It is written as reentrant code and can be loaded as `RESIDENTPAGE` program or once per user.

## Com-plete Support in Natural Batch Runs

---

If you use the Com-plete services in a Natural batch run, the batch user ID remains logged on at the end of the batch run.

To avoid this situation, include the module `COMPBTCH` from the Com-plete distribution library in the batch Natural nucleus. This resolves the entry point for module `EOJ`, which is called at the end of the Natural batch job for termination clean-up.

The module `NCFAM` is used to access Com-plete print/work files. It has to be included in the linking of the Natural nucleus, together with the module `COMPBTCH` from the Com-plete distribution library.

## Asynchronous Natural Processing under Com-plete/SMARTS

---

Asynchronous Natural processing is discussed in the section *Asynchronous Processing* in the *Natural Operations* documentation; however, some additional considerations apply when Natural is run under Com-plete.

Make sure that appropriate `SENDER` and `OUTDEST` destinations are specified for an asynchronous Natural session; otherwise, any output will lead to an abnormal termination.

In addition to Com-plete terminal IDs for `SENDER` and `OUTDEST`, the following keywords are supported by the Natural Com-plete/SMARTS interface:

Profile Parameter	Possible Values	Explanation
SENDER	DUMMY	Output is ignored.
	TID	Output destination.
	LUNAME	
OUTDEST	DUMMY	Output is ignored.
	CONSOLE	Output destination.
	LUNAME	

By default, the 3270 data stream protocol is used for output of an asynchronous Natural session running under Com-plete.

An example to start an asynchronous Natural transaction under Com-plete can be found in the library `SYSEXTP`, program `ASYNCOMP`.

## Invoking Natural from User Programs

---

The Com-plete `FETCH` function is used to invoke Natural from a user front-end program under Com-plete; see the *Com-plete Application Programmer's Manual* for details.

## Storage Thread Key Handling

---

If you want to use protection mode between Com-plete and your application program, you must set the Natural profile parameter `SKEY` to `OFF` in the Natural parameter module. The application program runs in the corresponding thread key.

You can improve performance of the application program under Com-plete by activating the Storage-Protection Override facility on your machine.

Set the thread key to 9 in the Com-plete startup parameter `THREAD-GROUP` for your Natural subgroup.

The front-end driver sets the Natural application automatically to the privileged mode if the thread key is 9, and uses the `SPKA` instruction for the key switch handling instead of the Com-plete function `MODIFY` with the function codes `THRD/TCS`.

Storage key switching is not performed for any Natural or editor buffer pool call.

## Support for User Exit Handling during Session Initialization

---

During session initialization, it is possible to pass user-specific session information about the activation of a user exit to Natural. The exit is called before Natural has been initialized, after the driver/IOCB initialization is complete.

The driver passes as a parameter the address of the IOCB in Register 1, whereas the exit is activated/deactivated by the Com-plete functions `COLOAD/CODEL`; see the *Com-plete Application Programmer's Manual* for details.

The `NCFUEXIT` source module is an example of a user exit. The user exit module can be defined with the keyword subparameter `EXIT`.

## Use of the SMARTS Server Environment

---

With the SMARTS Server Environment, it is possible to use the SMARTS portable file system as a container for input and output files as well as data sets on the native file system. It depends on the setting of the SMARTS parameters `CDI_DRIVER` and `MOUNT_FS` whether the environment variable refers to a the portable file system or to a native file system. For more information, see the *SMARTS Installation and Operations Manual*.

If environment variables are not defined, the normal data sets are accessed as described in the section *Data Sets Used by Natural under z/OS Batch* in the *Natural Operations* documentation.

The following topics are covered below:

- [Input/Output](#)
- [Print File/Work File](#)

### Input/Output

Input/output in the SMARTS Server Environment is performed by DLL `NCF42IO`.

`NCF42IO` must be loaded into the resident area. If `NCF42IO` is loaded into the application program thread, the Natural session is terminated with a `NAT9980` error message.

Supported environment variables:

- **`CMPRINT` - Primary Report Output**
- **`CMSYNIN` - Primary Command Input**
- **`CMOBJIN` - Input for Natural INPUT Statements**

These environment variables are described below.

#### **`CMPRINT` - Primary Report Output**

Syntax:

```
CMPRINT=/pathname/filename[,][mode]
```

Where

<i>pathname</i>	Specifies the location of the output file.  If <i>pathname</i> refers to a portable file system, the path will be created; if it refers to a native data set, it must be available.
<i>filename</i>	Specifies the name of the output file.  An asterisk (*) as the file name means that the file name is generated from the actual user ID.  If <i>pathname</i> refers to the native file system and <i>filename</i> is terminated with the slash character (/), the sequential data set <i>pathname/filename</i> will be accessed; if it is not terminated with "/", the member <i>filename</i> in data set <i>pathname</i> will be accessed.
<i>mode</i>	Specifies the file mode as documented in the C Library for the <code>fopen()</code> function. The default is <code>w</code> (write).

Example: Assume `/fs/` is mapped to the native file system and `/pfs/` is mapped to a portable file system.

<code>CMPRINT=/fs/natural/test/print</code>	Member <code>print</code> in data set <code>natural.test</code> is accessed.
<code>CMPRINT=/fs/natural/test/print/</code>	Sequential data set <code>natural.test.print</code> is accessed.
<code>CMPRINT=/pfs/natural/test/print</code>	Member <code>print</code> in <code>/natural/test</code> of the portable file system is accessed.

### CMSYNIN - Primary Command Input

Syntax:

```
CMSTYNIN=/pathname/filename[/]
```

Specifies the *pathname* and *filename* of the appropriate command input file.

If *pathname* refers to the native file system and *filename* is terminated with the "/" character, the sequential data set *pathname/filename* will be accessed; if it is not terminated with a slash (/), the member *filename* in data set *pathname* will be accessed.

### CMOBJIN - Input for Natural INPUT Statements

Syntax:

```
CMOBJIN=/pathname/filename[/]
```

Specifies the *pathname* and *filename* of the appropriate data input file.

If *pathname* refers to the native file system and *filename* is terminated with the slash character (/), the sequential data set *pathname/filename* will be accessed; if it is not terminated with a slash (/), the member *filename* in data set *pathname* will be accessed.

## Print File/Work File

Print file and work file access in the SMARTS Server Environment is performed by DLL NCF42APS.

NCF42APS must be loaded into the resident area. If NCF42APS is loaded into the application program thread, the Natural session is terminated with a NAT9980 error message.

Supported environment variables:

- NAT\_PRINT\_ROOT - Path to the printer files on a PFS or native file system.
- NAT\_WORK\_ROOT - Path to the work files on a PFS or native file system.

Syntax Example:

```
NAT_WORK_ROOT=/qualifier/path1/path2
```

Where

<i>qualifier</i>	Determines whether a SMARTS portable file system or a native, OS-managed file system will be accessed.
<i>path1/path2</i>	Is the path to the location of the file in the appropriate file system.

## Support for Com-plete's Recoverable Session Handling

---

To benefit from Com-plete's recoverable session handling available under z/OS, you have to link the module NCFROLLS to your front-end module. NCFROLLS serves as an interface to the *Natural Roll Server*, which has to be started to support recoverable sessions.

Furthermore, the module ATRRCSS needs not to be linked to your front-end module, because the RRS interface module is part of the Com-plete routine TLOPUSER. When a conversational terminal I/O is to be performed, the Natural thread is written to the Natural roll file in compressed form to allow resuming the Natural session after a Com-plete restart. For non-conversational terminal I/Os and thread locked applications, the Natural thread is not written to the Natural roll file; as a consequence, such sessions cannot be recovered.

## Natural Com-plete/SMARTS Interface Version 8.3 - Documentation Updates

---



**Note:** The documentation updates provided here only cover the changes specific to Natural Com-plete/SMARTS Interface Version 8.3 and above.

For the changes in installation, see *Installing Natural Com-plete/SMARTS Interface Version 8.3.5 on z/OS* in the *Natural Installation* documentation.

### Support for Natural zIIP Enabler under Com-plete

Natural Com-plete/SMARTS Interface Version 8.3 supports the Natural zIIP Enabler under Com-plete if the prerequisites described in the *Natural zIIP Enabler* documentation are met.





## Natural under IMS TM

---

This document describes the functionality of the Natural IMS TM Interface (product code NII) and the operation and individual components of Natural in an IMS TM environment.

[Environments](#)

[Components](#)

[Configuration](#)

[Service Programs](#)

[Service Modules](#)

[User Exits](#)

[Special Functions](#)

[Recovery Handling](#)

### Related Documents:

- Installation - refer to *Installing Natural IMS TM Interface on z/OS* in the *Natural Installation for z/OS* documentation.
- Error Codes - for a list of the error codes and messages that may be issued by the Natural IMS TM Interface (NII), refer to *Natural under IMS TM Error Messages* in the *Natural Messages and Codes* documentation.



# 35

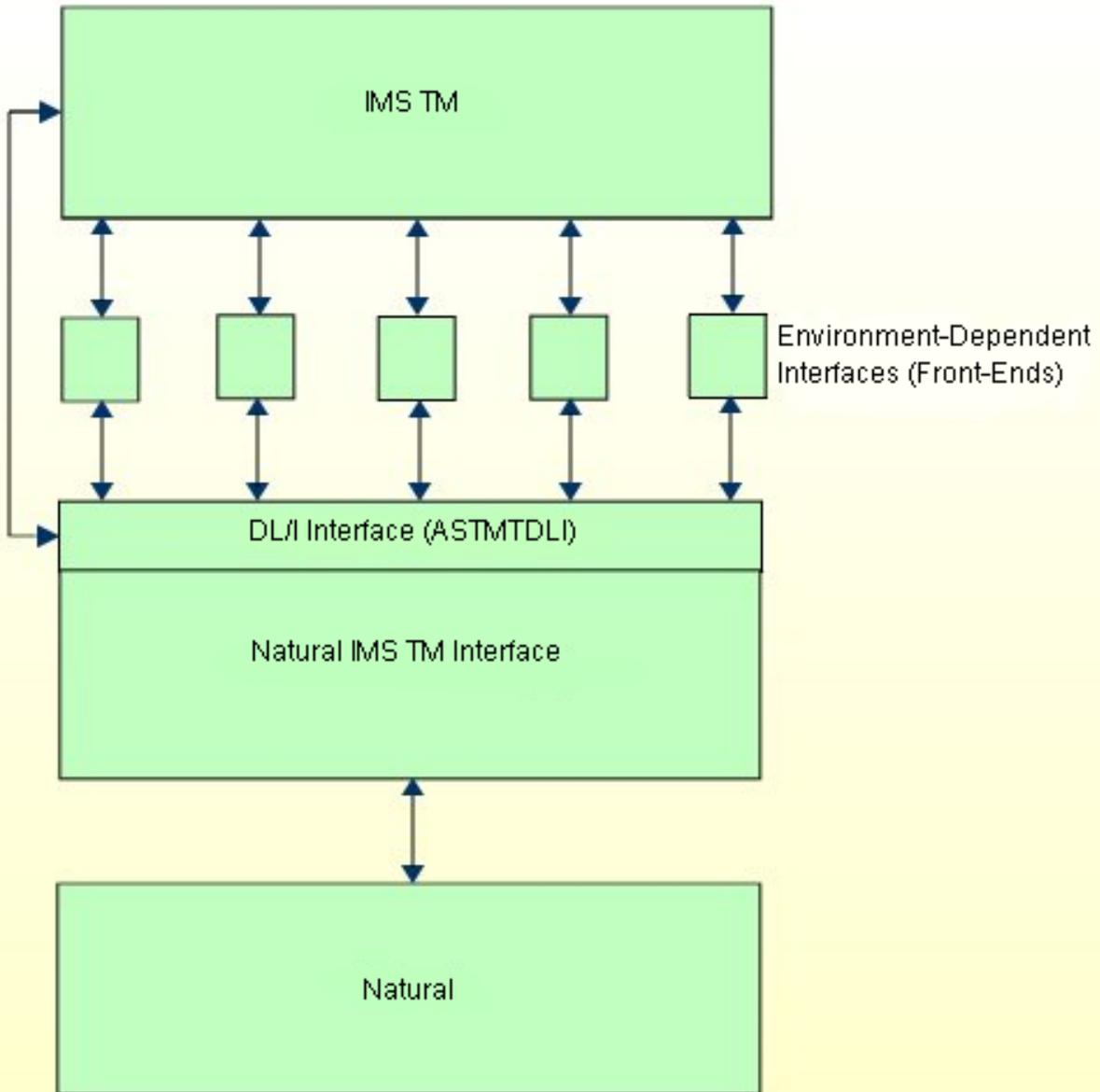
## Natural under IMS TM - Environments

---

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This chapter describes how Natural runs under various IMS TM environments.

## IMS TM Interface Overview



---

## IMS TM Environments

---

IMS TM provides three different types of environments:

- [Natural in a Message Processing Region \(MPP Environment\)](#)
- [Natural in a Batch Message Processing Region \(BMP Environment\)](#)
- [Natural in an Off-line DL/I Batch Region](#)

To be able to use Natural in each of these environments, different environment-specific interfaces are provided for the Natural IMS TM Interface. The task of such an interface is to receive input (usually a terminal input message) from the environment, to pass the input to Natural for processing and to direct the resulting output back to the correct destination (usually a terminal output message). This way, it is possible to use the functionality of Natural in all available IMS TM environments.

In addition to different available environments, within each environment, there are different ways of operating.

### Natural in a Message Processing Region (MPP Environment)

In a message processing region, Natural online transactions can be one of the following:

- [Dialog-Oriented Natural](#)
- [Message-Oriented Natural](#)

#### Dialog-Oriented Natural

A dialog-oriented Natural session establishes an ongoing interaction with an IMS TM screen. Input and output messages to and from Natural are logically related and, across dialog steps, Natural saves information so as to be able to correctly process the next input message. In a dialog-oriented way, Natural can be run as either a conversational or a non-conversational transaction.

In a dialog-oriented environment, Natural can be executed in multiple-message processing regions, as Wait-for-Input (WFI) transaction and with the parallel-scheduling option.

To run Natural in dialog-oriented environments, you either have to use the roll server or roll files (see [The Roll File and Roll Server](#)).

If the Natural IMS TM Interface detects an error situation, a record containing information about this error situation is written to the IMS TM log file (see [Recovery Handling](#)). Thus, all terminals on which Natural is to be executed and all Natural transaction codes have to be authorized to issue the /LOG command using the Automated Operator Interface (AOI).

## Message-Oriented Natural

A message-oriented Natural session processes non-3270-formatted messages from the IMS TM message queue. The input messages are considered to be unrelated to each other and are not part of a dialog. In a message-oriented way, Natural must be run as a non-conversational transaction.

## Natural in a Batch Message Processing Region (BMP Environment)

In a batch message processing region, Natural can have access to the IMS TM message queue by using an input transaction code. With batch-oriented BMP regions, Natural supports symbolic checkpoint and extended restart. The input messages are non-3270-formatted messages.

## Natural in an Off-line DL/I Batch Region

The BMP Natural can also be executed as an off-line DL/I batch job.

If no IOPCB is available, all `END TRANSACTION` and `BACKOUT TRANSACTION` statements are ignored.

For diagnostic purposes, the following feature is available: If Natural has been started with profile parameter `TPF=(1)`, an informal WTO message is issued, indicating the above fact.

## Dialog-Oriented Environments

---

This section discusses special points valid for the dialog-oriented conversational environment only.

- [Special Considerations for a Conversational Environment](#)
- [Special Considerations for a Non-Conversational Environment](#)
- [Special Considerations for an MSC Environment](#)

### Special Considerations for a Conversational Environment

The dialog-oriented conversational environment is implemented by the Conversational MPP Interface which is linked with the Natural parameter module to the Conversational MPP Front-End. This front-end is the IMS TM application program and is scheduled by IMS TM if an input message for the assigned transaction code is available in the IMS TM message queue.

The dialog-oriented conversational environment requires a scratch pad area (SPA) of at least 157 bytes plus the `NRAST` value specified in the `NTIMSPT` macro of the Natural parameter module.

## Special Considerations for a Non-Conversational Environment

The dialog-oriented non-conversational environment is implemented by the Non-Conversational MPP Interface which is linked with the Natural parameter module to the Non-Conversational MPP Front-End. This front-end is the IMS TM application program and is scheduled by IMS TM if an input message for the assigned transaction code is available in the IMS TM message queue.

When a dialog-oriented non-conversational environment is used, the *Natural Authorized Services Manager* with its SIP function enabled and the Physical Input Edit Routine are prerequisites.

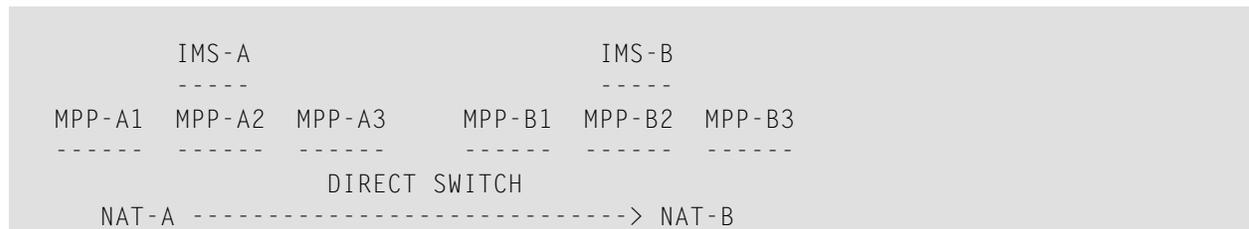
- The *Natural Authorized Services Manager* is used to simulate the IMS TM SPA.
- The Physical Input Edit Routine is used to insert the transaction code in front of the input message.

You must specify the same Natural subsystem ID in the

- SPATID of the NTIMSPE macro (Natural parameter module),
- SPATID of the NIMPIXT macro,
- startup parameters of the Authorized Services Manager.

## Special Considerations for an MSC Environment

Assuming the following environment, the Natural IMS TM Interface prepares the message X'000500006D' for NAT-B, which means that the terminal user has pressed CLEAR.



Two entries must be created in the transaction code table: the first entry is for NAT-A, the second for NAT-B.

These two entries must specify different offsets for the Natural Reserved Area (NRA) and must ensure that these areas do not overlap.

NAT-B detects that a Natural session is to be started in IMS-B in the usual way and therefore gives control to its session-start exit routine. The session-start exit routine checks the input message for the string X'000500006D' and sets to 0 the length of the input message as seen by Natural.

If no additional logic is provided in either the exit NIIXSTAR or the exit NIIXSSTA, Natural starts a new user session in IMS-B.

It is assumed that IMS-A and IMS-B have different dedicated roll files allocated for Natural.

Both (or more) Natural sessions can communicate with each other by transferring data in the SPA when performing direct program-to-program switching.

For the time being, when two or more Natural sessions exist in such an environment, only the “active” session is terminated correctly.

## Message-Oriented Environment

---

This section describes the message-oriented interface for use with Natural for IMS TM.

- [Introduction to the Message-Oriented Environment](#)
- [Operation of the Message-Oriented Environment](#)

### Introduction to the Message-Oriented Environment

This interface is designed to process nett-data input messages, which means that the messages do *not* represent a 3270 data stream. The message-oriented interface is driven by a user-written Natural program which instructs the interface to access the IMS TM message queue for the purpose of retrieving input messages.

The message-oriented interface has been created to support non-conversational, non-terminal driven transactions which must be executed as non-conversational MPP transactions.

### Operation of the Message-Oriented Environment

The message-oriented interface incorporates functions from both the MPP and the BMP interfaces. The BMP interface is used as a basis, since much of the processing required emulates BMP-type transactions.

Since the message-oriented interface is not terminal-oriented, no messages or screen images are automatically generated to be sent to a terminal. The Natural nucleus is informed that it is running in a batch environment; therefore output is interpreted to be printer output and input is expected from a CMSYNIN file. All output which is normally written to CMPRINT is sent to the IMS TM destination specified with the Natural profile parameter SENDER. For details, see [SENDER Destination](#) below.

If Natural attempts to retrieve input data and no input data has been supplied by the application through the STACK command, EOF indicates that no input exists and Natural is terminated.

You can set SENDER to a new value at runtime by using the service module CMSNFPRT.

Except for checkpoint processing, Natural for DL/I and Natural for DB2 process as if they were in BMP mode. This is necessary, since one physical scheduling can (and usually will) process several unrelated input messages. Under the conversational MPP interface, all transactions processed during one Natural session and all DL/I requests within this Natural session are considered

to be related, requiring maintenance of database positioning and PCB usage. With the non-conversational interface, this Natural for DL/I logic is not applicable.

Since transactions which are processed during one scheduling (and one Natural session) are not related to each other, the retention of Natural session information in the roll file is not required. Thus, no roll data set needs to be allocated for this interface. A roll slot area is still allocated via GETMAIN and used to store all Natural control blocks and work areas.

Since processing is performed on a message-by-message basis, there is no need for any relocation logic.

With the message-oriented interface, retrieval of all messages from the message queue is initiated by a front-end Natural program. This program must be user-written to meet your specific processing needs. However, it requires a specific structure, as shown in the following:

```
PROGRAM INITIALIZATION
REPEAT
CALL 'CMGETMSG' MESSAGE-AREA MESSAGE-LENGTH
IF MSG-LL = 0 /* QC on GU to message queue
TERMINATE
FETCH RETURN PGMA MESSAGE-AREA
REPEAT
CALL 'CMGETSEG' MESSAGE-AREA MESSAGE-LENGTH
IF MSG-LL = 0 /* QD on GN to message queue
ESCAPE
FETCH RETURN PGMB MESSAGE-AREA
END-REPEAT
END-REPEAT
END
```

The service module CMGETMSG reads the first message segment. The service module CMGETSEG reads all further message segments.

Since Natural cannot read input from CMSYNIN, it is required to use the Natural stack for input. This is done by using the Natural profile parameter STACK.

It is your responsibility to ensure that the IMS TM message queue is accessed by your application prior to the termination of Natural. If not, the Natural transaction abnormally ends with IMS TM abend code 462, indicating that a GU to the message queue has not been performed.

To obtain these Natural messages even in the case of an abnormal termination, you are recommended to define the first alternate PCB as an EXPRESS PCB.

The message-oriented environment is implemented by the NTRD Interface which is linked with the Natural parameter module to the NTRD Front-End. This front-end can either be called directly by IMS TM or via a bootstrap module that has been generated with the **NIMBOOT** macro.

If it is called directly by IMS TM, this front-end is the IMS TM application program which is scheduled by IMS TM if an input message for the assigned transaction code is available in the IMS

TM message queue. You are recommended to use a Natural profile which contains the required `STACK` parameter. Specify `PROFILE=PROGRAM` in your Natural parameter module and create a profile with a name equal to the transaction code with which the interface is invoked. This way, you have the flexibility to use a different profile with a different `STACK` for each transaction code used.

If it is called via a bootstrap module, this bootstrap module is the IMS TM application program which is scheduled by IMS TM if an input message for the assigned transaction code is available in the IMS TM message queue. This bootstrap module provides a string of dynamic profile parameters, one of which is the `STACK` profile parameter, and calls the NTRD front-end whose name is specified during the generation of the bootstrap module. If you want to call Natural with varying dynamic profile parameter settings, you must generate various bootstrap modules, each using its own string of dynamic profile parameters. Each of these bootstrap modules must be linked under a unique name. Also a unique IMS TM transaction code has to be assigned to each of the resultant load modules.

## Batch Message Processing Environment

---

The Batch Message Processing (BMP) environment is implemented by the BMP Interface which is linked with the Natural parameter module and the work file/print file access routine `NATWKFO` to the BMP Front-End. This front-end is the IMS TM application program which is specified in the BMP JCL.

A standard batch Natural is executed in a Batch Message Processing region. In comparison with the standard batch Natural run, the optional input data set `CONTROL` may be used.

The optional BMP `CONTROL` file contains a maximum of two input cards.

- The first input card contains the following keyword parameters:

Keyword	Meaning
<code>ENV-TAB=</code>	The name of the environment table to be used.
<code>TRNCODE=</code>	The name of the transaction code to be used, see the <a href="#">TRNCODE</a> parameter description.

### Example:

```
ENV-TAB=ENVBMP0 TRNCODE=NATIMS
```

- The second input card of the `CONTROL` file contains dynamic Natural parameters.

### Using Both the `CMPRMIN` Data Set and the `CONTROL` File to Pass Dynamic Natural Parameters

If the `CMPRMIN` data set is also used to pass dynamic Natural parameters, the input of `CONTROL` is appended to the input of `CMPRMIN`. This means the parameters specified in `CONTROL` overwrite the parameters specified in `CMPRMIN`.

## Working without CONTROL File

If the CONTROL file is not used, the name of the environment table is determined by the entry in the transaction code table which corresponds to the transaction code used (transaction-oriented BMP) or to the PSB name used (batch-oriented BMP).

## Support of the Natural WRITE (n) Statement

With the WRITE (n) statement, up to 31 different reports on different printers can be produced within the same Natural program. The reports are sent to the IMS TM terminals specified either in the Natural parameter module or by using the Natural DEFINE PRINTER (n) statement. You have to specify AM=IMS in the NTPRINT macro which controls the report.

To be able to use this statement, define as many additional alternate TP-PCBs in your PSB as the number of parallel reports you want to create within the same Natural program, and specify the number of additional alternate TP-PCBs in your transaction code table by using the WRKPCBS keyword subparameter of the NTIMSPT macro (Natural parameter module).



**Caution:** Be aware that the first alternate TP-PCB is used by the Natural IMS TM Interface.

When using the WRITE (n) statement in a dialog-oriented environment, the following restriction applies:

The generation of a report cannot span one or more screen I/Os. If you want to use the same printer after a screen I/O, you have to close it explicitly before the screen I/O using the CLOSE PRINTER (n) statement.

To create reports, the following keyword subparameters of the NTPRINT macro are relevant:

Keyword Subparameter	Meaning
AM	Must be set to IMS.
DEST	Specifies the IMS TM destination.
BLKSIZE	Specifies the size of the buffer which is sent to the destination. Report lines are buffered.
DRIVER	Specifies the driver to be used to create the report. For a list of possible values, see the PRTDRIV keyword subparameter of the NTIMSPE macro in the Natural parameter module. The driver determines where you want to have the form feed (at the start of the report, the end, both the start and the end, or no form feed), where you want to start your page (on Line 1 or on Line 2 for compatibility with Natural IMS TM Interface Version 2.2) and where you want to print your report (SCS or non-SCS printer). In addition, you can specify that you want to use the JES API.
NAME FORMS	These parameters are only evaluated if you use the JES API.

Keyword Subparameter	Meaning
DISP COPIES CLASS PRTY	

## Hints Concerning NTPRINT and CLOSE PRINTER

### NTPRINT Settings

You are strongly recommended that you always use the defaults for the `OPEN` and `CLOSE` subparameters in the `NTPRINT` macro or `PRINT` profile parameter definition for IMS TM printers (that is, for printers defined with `AM=STD`). This means either do not specify any values for `OPEN` and `CLOSE` or use the defaults `OPEN=ACC` and `CLOSE=CMD`.

This is especially important if you have statically defined a printer in the Natural parameter module for a different access method with other options for `OPEN` and `CLOSE` and if you dynamically overwrite the access method with `AM=IMS`. In this case, always specify `AM=IMS`, `OPEN=ACC`, `CLOSE=CMD` together.



**Note:** The `NTPRINT` options are merged with the dynamically specified `PRINT` options, even though the access method has been overwritten.

Problems which may occur with non-default values:

1. With `OPEN=OBJ` you may print to a wrong destination or get a NAT8211 error if the `OUTPUT` option has been specified in a `DEFINE PRINTER` statement. With `OPEN=OBJ` the printer is opened before the `OUTPUT` overwrite has been evaluated and the printer destination used is not the one which is specified in the `OUTPUT` option but the one specified with the `PRINT` parameter.
2. With `CLOSE=FIN` the printer is not closed at `CLOSE PRINTER` time but at `FIN` time. This means that the `CLOSE` may come after a `GU` has been issued to the message queue and the destination has been reset in the TP PCB. This will lead to NII error NII3641 for IMS TM status code QF (MPP) or A3 (BMP and OBMP/NTRD). With `CLOSE=CMD`, the printer is really closed with the `CLOSE PRINTER` statement.

### Usage of CLOSE PRINTER or DEFINE PRINTER

A report written to an IMS TM printer is implicitly closed by IMS TM with the next `GU` call (that is, either at terminal I/O or through `CMGETMSG`). This means, IMS TM will print the report regardless of a `CLOSE PRINTER` or `DEFINE PRINTER` statement in the program.

For Natural, the printer is still open, and the next `WRITE` statement with the same report number will continue the already printed report which will lead to a NAT1518 error.

**Scenario:**

```

DEFINE PRINTER (1)
  WRITE (1) 'line 1'
  INPUT 'Press ENTER' or CALL 'CMGETMSG' (both issue a GU)
  WRITE (2) 'line 2'

```

The INPUT/CMGETMSG will “physically” close the printer and IMS TM will print a report containing the line 'line 1'.

As the printer is still “logically” open to Natural, the line 'line 2' will not start a new report and error NAT1518 will be caused as the destination is purged by the GU call.

You are therefore strongly recommended to observe the following rule:

 **Caution:** A CLOSE PRINTER statement is required if, after the GU, the report with the same number is continued.

Please note that the DEFINE PRINTER statement does an implicit close in which case the CLOSE PRINTER statement is obsolete, for example:

Correct	Correct	Wrong (NAT1518)
<pre> REPEAT   DEFINE PRINTER (1)   WRITE (1)    INPUT LOOP </pre>	<pre> DEFINE PRINTER (1) REPEAT   WRITE(1)   CLOSE PRINTER (1)   INPUT LOOP </pre>	<pre> DEFINE PRINTER (1) REPEAT   WRITE(1)    INPUT LOOP </pre>

## SET CONTROL 'N' (Terminal Command %N)

The statement SET CONTROL 'N' (Terminal Command %N) does not apply under IMS TM. If it is used under IMS TM, it causes the next logical output screen to be suppressed.

## Support of TS=ON for Natural under IMS TM Messages

All Natural under IMS TM messages are translated into upper case if TS=ON is specified in the Natural session.

## SENDER Destination

In the message-oriented (NTRD) and in the server (SRVD) environment, all output that is normally written to `CMPRINT` is sent to the destination specified with the Natural profile parameter `SENDER`. With `SENDER` you either specify a valid IMS TM destination (usually an `LTERM`) to which the output is sent via the IMS TM message queue or you specify one of the following reserved values:

Value	Meaning
*WTO	Natural output is sent to the job log using a WTO with routing code 11 (programmer information).
*MTO	Natural output is sent to the IMS TM master console using a <code>/BROADCAST MASTER</code> command.
*PRINT $nn$	Natural output is written to Natural printer $nn$ , that is the output is written using an internal <code>WRITE(<math>nn</math>)</code> .  The print file is closed after each output line and the carriage control character of each output line is the blank.



### Notes:

1. If the `/BROADCAST MASTER` command fails (for example, due to authorization problems), an error message is issued using a WTO and all Natural messages, including the current message, are sent to the job log. That is, the `SENDER` destination is internally set to `*WTO`.
2. In case of `*PRINT  $nn$` , you are strongly recommended to use only printers defined with `AM=STD`.
3. You are strongly recommended to code the `SENDER` destination in the Natural profile parameter module. This will ensure that the destination is found even if the Natural initialization fails (e.g. due to an Adabas error NAT3048 or NAT3148).
4. If you really want to specify the `SENDER` destination dynamically, you must enclose the reserved values in single quotes (for example, `SENDER='*WTO'`).

## Support of Natural Profile Parameter PROGRAM

The Natural profile parameter `PROGRAM` is supported in the dialog-oriented environments and in the BMP environment.

In the BMP environment, the parameter `PROGRAM` behaves in the same way as in a standard z/OS batch environment. An example with name `XNIIBACK` is delivered in the `NII vrs.SRCE` data set. It is expected that the invoked back-end program returns to the Natural IMS TM Interface.

In a dialog-oriented environment, the Natural profile parameter `PROGRAM` behaves slightly different as compared to other Natural environments, including the BMP environment.

1. The name specified with the profile parameter `PROGRAM` or the Natural subprogram `CMPGMSET` is the name of an IMS TM transaction code.
2. The specified transaction code is only invoked if the Natural session terminates without an error.
3. The data supplied with the `TERMINATE` statement is passed as input message to the invoked IMS TM transaction.

## Natural Development Server / Natural Web I/O Server Environment

---

This environment enables you to execute a Natural Development Server (NDV) or Natural Web I/O Interface (NWO) Server session under the control of IMS TM, and to have access to IMS TM resources such as IMS TM DB or DB2 databases from within such a session. The server transaction is a non-conversational transaction.

For further information, see:

*Introducing the Natural Web I/O Interface Server IMS Adapter , Installing the Natural Web I/O Interface Server IMS Adapter under z/OS and Configuring the Natural Web I/O Interface Server IMS Adapter in the Natural Web I/O Interface documentation.*

### **Restriction for this environment:**

Access to the IMS TM resources is done using the user ID `EZAIMSLN`. This means no impersonation is used.



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## Natural under IMS TM - Components

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This chapter describes the components of the Natural IMS TM Interface.

## Front-End Module

---

The front-end module receives control from the IMS TM program controller DFSPPC20, except in the server environment where it is called by the call interface NIIBOOTS.

The front-end module must be built during the installation process of the Natural IMS TM Interface described in the *Installation for z/OS* documentation. The front-end-module consists of the following:

- Environment-Dependent Interfaces (Drivers)
- Natural Parameter Module
- Natural Work and Print File Access Method Module NATWKFO (AM=STD)

### Environment-Dependent Interfaces (Drivers)

The environment-dependent interfaces are supplied as the following load modules:

- NIIBMP for the **batch message processing environment**,
- NIICONV for the **conversational dialog-oriented environment**,
- NIINONC for the **non-conversational dialog-oriented environment**,
- NIINTRD for the **message-oriented environment**,
- NIISFE for the **Natural Development Server/Natural Web I/O Interface server environment**,  
and
- NIISRVD for the **server environment**.

The load modules are supplied on the installation medium. You can configure the environment-dependent interfaces with the NTIMSP macro of the Natural parameter module. See also *Natural under IMS TM - Configuration*.

### Natural Parameter Module

The Natural parameter module is built during the installation. In addition to the parameter settings you need to adapt for your Natural environment, you must specify at least one NTIMSPT parameter macro for the Natural IMS TM Interface. See also *Natural under IMS TM - Configuration*.

The Natural parameter module and the individual parameters and macros that can be specified with the Natural parameter module are described in the *Parameter Reference* documentation.

## Natural Work and Print File Access Method Module NATWKFO (AM=STD)

The NATWKFO module is delivered as part of the base Natural. It is used for work file and print file handling for work files and print files defines with AM=STD. It is applicable to the BMP environment, including off-line DL/I batch regions, the message-oriented environment and the server environment. It is not applicable to the dialog-oriented environments.

Some Natural products, such as Natural for DB2 and Natural for DL/I, require that their modules be linked to the Natural IMS TM front-end module. For further information, see the appropriate product documentation.

## Natural IMS TM Interface Module NIINTFM

---

The Natural IMS TM Interface module has to be created during the installation process and is common to all environments.

The interface module consists of the following components:

- [Natural IMS TM Nucleus NIINUC](#)
- [Message Text Module NIIMSGT](#)
- [DL/I Language Interface ASMTDLI](#)

The interface module is fully reentrant and can run above the 16 MB line. It is therefore eligible for the ECSA in order to have only one copy of the interface module for all IMS TM environments.

### Natural IMS TM Nucleus NIINUC

The Natural IMS TM nucleus NIINUC is delivered as a load module and contains all the runtime routines required by the Natural IMS TM Interface.

### Message Text Module NIIMSGT

The message text module NIIMSGT is part of the Natural IMS TM Interface module and is supplied both as a load and a source module. For each possible Natural IMS TM runtime error, it contains the corresponding message text. Each entry is generated by the macro NIMMSGT.

For a detailed description of the macro NIMMSGT, see [NIMMSGT Macro Parameters](#).

## DL/I Language Interface ASMTDLI

The DL/I language interface ASMTDLI is part of IMS TM.

## Physical Input Edit Routine

---

The physical input edit routine is required only in a dialog-oriented, non-conversational environment. It is used to insert the transaction code preceding the message sent to the terminal. This is required as Natural runs in MFS bypass mode and the message sent to the terminal does not contain a transaction code.

The physical input edit routine is generated by using the `NIMPIXT` macro. For further information on the `NIMPIXT` macro, see [NIMPIXT Macro Parameters](#).

Once the physical input edit routine is generated, its name must be specified in the `TYPE` or `LINEGRP` macros of your IMS TM system definition. For all terminals on which the non-conversational environment is supposed to run, you must enable physical editing by using the `EDIT` parameter in the `TERMINAL` macro.

## User Message Table DFSCMTU0

---

The delivered user message table `DFSCMTU0` is required only in a dialog-oriented, non-conversational environment. It contains the error messages for errors detected by the physical input edit routine.

The user message table `DFSCMTU0` must be integrated into the existing user message table of your IMS TM installation. In case of conflicts with already existing user message numbers of your IMS TM installation you may change the message numbers of the delivered `DFSCMTU0` by modifying the `EQUATES`, `PIXTE` and `SIPSE` to create new message number ranges. The new start value of the message number range must be specified in the `NIMPIXT` macro.

## Roll File and Roll Server

---

These components are used in dialog-oriented environments only.

Natural session-related information is held in the Natural thread. With each terminal output, the content of the Natural thread is saved either in a roll file or by using the roll server. The medium is defined by the `ROLLSRV` keyword subparameter in the `NTIMSPE` macro (Natural parameter module) described in the *Parameter Reference* documentation.

## Using Roll Files

To use roll files, the `ROLLSRV` keyword subparameter is set to `OFF`.

A roll slot in the roll file is reserved for each Natural user at Natural session initialization time. The identifier of the slot is the IMS TM `LTERM` at which the Natural session is started. You must therefore ensure that all terminals that use the same set of roll files have different `LTERM` names. This is always the case if the roll files are used by a single IMS TM. The slot is freed when the Natural session terminates normally. In case of an abnormal termination, the roll slot remains allocated, but will be reused when the same user (identified by his `LTERM`) starts a new Natural session.

Roll files are accessed under the DD statements `ROLLF1 - ROLLF5`. The number of roll files used is defined by the `ROLLFN` keyword subparameter in the `NTIMSPE` macro.

If your Natural transaction code is scheduled in more than one MPP region or if you switch between transaction codes running in different MPP regions, you have to use the same roll files in all MPP regions.

If you reformat the roll file(s), make sure that no Natural transactions are active. If a transaction is scheduled after the roll file has been reinitialized, it cannot locate its roll slot on the roll file and abnormally terminates. To avoid this problem, it is recommended that you cold-start IMS TM after the roll file has been reformatted.

The roll files used by Natural under IMS TM have the same layout as the roll files used by the Roll Server and are formatted by the same utility program.



**Note:** The roll files used by Natural under IMS TM must not be shared with the Roll Server. If you use roll files for Natural under IMS TM and the Roll Server at the same time, you must assign an own set of roll files to the Roll Server.

## Using the Roll Server

To use the roll server, the `ROLLSRV` keyword subparameter is set to `ON`.

Instead of using roll files which have to be allocated to each MPP region, you can use the Natural roll server. The roll server offers the following advantages:

- No DD statements in each MPP region.
- One central address space is responsible for access to the roll files.
- Support of main storage buffers to reduce disk I/Os to the roll files.

A slot in the roll server is reserved for each Natural user at Natural session initialization time. The identifier of the slot (roll server user ID) is the IMS TM `LTERM` at which the session is started, concatenated with the z/OS host ID and the IMS TM subsystem ID of the IMS TM dependent region in which the corresponding Natural transaction is scheduled. The slot is freed when the Natural

session terminates normally. In case of an abnormal termination, the slot remains allocated, but will be reused when the same user (identified by his LTERM) starts a new Natural session.

In a z/OS Parallel Sysplex environment you must use the roll server.

For further information on roll files and the roll server, see *Roll Server* in the *Natural Operations* documentation.

## Authorized Services Manager

---

The *Natural Authorized Services Manager* is required in the following cases:

- In a dialog-oriented, non-conversational environment; see *Special Considerations for a Non-Conversational Environment*.
- If Monitoring or Broadcasting is used; see *Monitoring* or *Broadcasting*.
- If Accounting is used and the accounting information is written to SMF; see *Accounting*.
- If buffer pool propagation is used; see the profile parameter BPPROP.

In the first two cases, the optional SIP function must be made available during startup of the Authorized Services Manager.

In a z/OS Parallel Sysplex environment, the SIP must be located in a Coupling Facility.

## Shared Natural Nucleus

---

In an IMS TM environment, the Natural nucleus is always separated from the environment-dependent interface (driver). This means that you have to install the shared Natural nucleus. The same Natural nucleus can be shared by all Natural IMS TM environments.

## Natural Buffer Pool

---

Since Natural under IMS TM is executable in more than one MPP region, it is recommended that the Natural buffer pool be a global buffer pool.

Although you can use a local buffer pool, this is not recommended in terminal-driven environments for performance reasons.

For further information, see *Natural Global Buffer Pool* in the *Natural Operations* documentation.

## Adabas Interface

---

In order to access the Natural system file and Adabas user files, the Adabas interface is required.

By default, the appropriate Adabas interface is dynamically loaded at runtime.

- In terminal-driven dialog-oriented environments, the Adabas IMS TM Interface module `ADALNI` is used.
- In all other environments, the Adabas batch interface module `ADALNK` is used.

You can overwrite the name of the Adabas interface to be used by specifying the Natural profile parameter `ADANAME`.



**Caution:** You must not use the reentrant version of either of these interface modules.

## Preload List

---

It is no longer required to use a preload list with the Natural IMS TM Interface, but for performance reasons it is recommended that you add the names of the following modules to the preload list for the Natural regions:

- the Natural IMS TM front-ends,
- the Natural IMS TM Interface module,
- the Natural shared nucleus,
- the Adabas interface.



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## Natural under IMS TM - Configuration

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The main parameter required to configure the Natural IMS TM Interface are specified with the following profile parameter macros of the Natural parameter module:

- NTIMSP for general parameter settings,
- NTIMSPE for specification of environment-specific parameter sets, and
- NTIMSPT for transaction code definitions.



**Important:** You must at least specify the NTIMSPT macro and define individual parameters for your Natural IMS TM transactions (there are no default values).

In addition to the Natural parameter macros, you can use the optional macros described in the following section. They are provided by the Natural IMS TM Interface.

## NIMMSGT Macro Parameters

---

The macro NIMMSGT generates each entry in the message text module NIIMSGT which is part of the Natural IMS TM Interface module. Each generated entry provides a message text for each possible Natural IMS TM error number.

The NIMMSGT macro is specified in one of the following two ways:

```
Nerror-number [*] NIMMSGT message-text
```

In this case, Natural under IMS TM will display the message text as defined. The message text may be up to 72 characters long.

```
Xerror-number [*] NIMMSGT message-text
```

In this case, Natural under IMS TM will append an error-specific reason code to the current message text. The message text may be up to 64 characters long.

If the error number is followed by an asterisk (\*), a snap dump will be generated when an error occurs. You may adapt the message text to your own requirements. You may also add or delete the DUMP option of a specific error number. You must not modify the error number and the characters N or R that precede the error number.

## NIMPIXT Macro Parameters

The NIMPIXT macro generates the *Physical Input Edit Routine*.

The parameters which can be specified with the macro NIMPIXT are listed in alphabetical order below:

PIXTE | SIPSE | SPATID | WTO | USER

Parameter	Possible Value	Description	Default	Comment
PIXTE	1 - 999	Specifies the start value for error numbers if errors are detected by the physical input edit routine.	400	This value is added to the return code set by the physical input edit routine. The result is the IMS TM error message number in the user message table DFSCMTU0.
SIPSE	1 - 999	Specifies the start value for error numbers if errors are detected by the <i>Authorized Services Manager</i> .	500	This value is added to the return code set by the <i>Authorized Services Manager</i> . The result is the IMS TM error message number in the user message table DFSCMTU0.
SPATID	xxxx	Specifies the Natural subsystem ID for the <i>Authorized Services Manager</i> which is used to save the SPA for the non-conversational driver. Any string up to 4 characters is possible.	None	The value of this parameter must be the same as the value specified for the SPATID keyword subparameter in the NTIMSPE macro (Natural parameter module).
WTO	YES	Specifies whether a WTO message is issued if the <i>Authorized Services Manager</i> fails.	NO	None.
	NO			
USER	xxxxxxxx	Specifies whether a user-specific physical input edit routine is to be called if the NIMPIXT macro does not find the SPA.  If a user-specific input edit routine is to be called, specify the name of the routine.	NO	None.
	NO			

## NIMBOOT Macro Parameters

The macro `NIMBOOT` generates the bootstrap module used by the message-oriented environment or the server call interface used by the server environment.

`NIMBOOT` includes the following parameters:

`TYPE` | `DRIVERN` | `ENVTNAM` | `TRNCODE` | `DYNPARM` | `SERVERN`

Parameter	Possible Values	Default	Comment
TYPE	SERVER	Empty	TYPE specifies the type of the interface module to be generated.  With <code>TYPE=SERVER</code> , the server call interface <code>NIIBOOTS</code> is generated.
	Empty		If nothing is specified, the bootstrap module used by the message-oriented environment is generated.
DRIVERN	Any valid z/OS module name	None	This parameter specifies the name of the front-end module.  If <code>TYPE=SERVER</code> is specified, the front-end module must have been generated for the server environment. If no <code>TYPE</code> is specified the front-end module must have been generated for the message-oriented environment.
ENVTNAM	Any valid z/OS module name	None	This parameter is only used by the bootstrap module for the message-oriented environment ( <code>TYPE</code> is empty).  This parameter specifies the name of the environment table. This parameter is optional. If it is not specified, the environment table is determined by the entry in the transaction code table which corresponds to the transaction code used.
TRNCODE			This parameter is only used by the bootstrap module for the message-oriented environment ( <code>TYPE</code> is empty).  This parameter specifies the name of the transaction code which is internally used by the Natural IMS TM Interface. This parameter is optional and is only honored if <code>TRNCODE=ON</code> is specified in the <code>NTIMSP</code> macro (Natural parameter module). If it is not specified or if <code>TRNCODE=ON</code> is specified in the <code>NTIMSP</code> macro, the transaction code returned by the IMS TM <code>INQY</code> call is used.  The transaction code is used to determine the entry in the transaction code table.
DYNPARM	Any character string of up to 80 characters.	None	This parameter is only used by the bootstrap module for the message-oriented environment ( <code>TYPE</code> is empty).  This parameter is used to define a valid string of up to 80 characters of Natural dynamic parameters.

Parameter	Possible Values	Default	Comment
SERVERN	Any valid z/OS module name	NIIBOOTS	<p>This parameter is only used by the server call interface (<code>TYPE=SERVER</code>).</p> <p>This parameter specifies the name of the server environment. It is only relevant if you want to use several Natural servers in the same region. In this case, you must generate multiple server call interfaces and specify a unique name with <code>SERVERN</code> for each each of them. See Special Functions, <i>Server Environment</i>.</p>



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## Natural under IMS TM - Service Programs

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This chapter describes the service programs of the Natural IMS TM Interface.

## Introduction to the Natural IMS TM Interface Service Programs

---

### Purpose of Natural IMS TM Interface Service Programs

Service programs are Natural subprograms which provide Natural under IMS TM with additional functionality. You can call them from within a Natural program using a standard `CALLNAT` statement.

### Location of Service Programs

The service programs are provided in the library `SYSEXTP` and you must copy them to the `SYSTEM` or `steplib` library. Sample Natural programs to invoke the service programs are also provided in the library `SYSEXTP`.

### Common Return Codes

The last parameter in each service program is the return code whose format is (I4).

The following return code values are common for all service programs:

0	OK
-1	Non-supported function. This is an internal error, please contact Software AG support.

For specific return code values, refer to the individual service program descriptions below.

### Error Handling

If an error occurs, either a Natural error message is issued or the session is terminated with a Natural IMS TM error message; see *Natural under IMS TM Error Messages* in the *Natural Messages and Codes* documentation.

## Description of the Natural IMS TM Interface Service Programs

---

The following service programs are described below:

`NIIBRCST` | `NIICMD` | `NIIDEFT` | `NIIDEFTX` | `NIIDIRT` | `NIIDIRTX` | `NIIMOD` | `NIIGCMD` | `NIIGMSG` | `NIIGSEG` | `NIIGSPA` | `NIIIMSIN` | `NIIISRTF` | `NIIISRTM` | `NIIPCBAD` | `NIIPCOM` | `NIIPMSG` | `NIIPSBAD` | `NIIPSPA` | `NIIPURG` | `NIIRETRM` | `NIISASD` | `NIIU3962`

## NIIBRCST - Send Passed Message to Terminal

Sends the passed message to the specified terminal using the message output descriptor specified in the MOD\_name parameter.

The following parameters are provided:

Parameter	Format/Length
Terminal_name	(A8)
Message	(A1/1:V)
Message_length	(I4)
MOD_name	(A8)
Return_code	(I4)

Specific Return Code Values: None.

Sample Program: NIPGMSG

## NIICMD - Pass IMS TM Command to IMS TM

Passes the IMS TM command specified to IMS TM. If there is a reply, it is moved into the reply area provided. If the reply does not fit into the reply area, it is truncated and the return code is set to 4.

The following parameters are provided:

Parameter	Format/Length	Type
Command	(A1/1:V)	Input
Command_length	(I4)	Input
Reply_area	(A1/1:V)	Input/Output
Reply_area_length	(I4)	Input
Reply_length	(I4)	Output
Status_code	(A2)	Output
Return_code	(I4)	Output

Specific Return Code Values: 4 (reply truncated)

Sample Program: NIPCMD

## NIIDEFT - Prepare Deferred Switch to Natural Transaction Code

---

Prepares a deferred switch to the specified Natural transaction code. With the next terminal I/O, the output is sent to the terminal and the next input from this terminal is processed by the transaction code specified in the parameter `Transaction_code`.

The following parameters are provided:

Parameter	Format/Length	Type
<code>Transaction_code</code>	(A8)	Input
<code>Return_code</code>	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPDEFT

## NIIDEFTX - Prepare Deferred Switch to Non-Natural Transaction Code

---

Prepares a deferred switch to a non-Natural transaction code. With the next terminal I/O, the output is sent to the terminal using the given `MOD_name` and the next input from this terminal is processed by the transaction code specified in the parameter `Transaction code`.

If the suspend flag is set to Y, the Natural session will be suspended and can be resumed later. If the Natural session is resumed, it will first issue the last Natural screen.

If the suspend flag is set to Y you may not switch from a conversational Natural session to a non-conversational transaction code. If you try to do so, a Natural error message is issued.

The following parameters are provided:

Parameter	Format/Length	Type
<code>Transaction_code</code>	(A8)	Input
<code>Transaction_type</code>	(A4)	Input  Possible values:  CONV for conversational NONC for non conversational
<code>Suspend_flag</code>	(A1)	Input  Possible values:

Parameter	Format/Length	Type
		Y - the Natural session will be suspended else the Natural session will be terminated
MOD_name	(A8)	Input
Message	(A1/1:V)	Input
Message_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPDEFTX

## NIIDIRT - Prepare Direct Switch to Natural Transaction Code

Prepares a direct switch to a specified Natural transaction code. On the next terminal write, the CHNG command to the specified transaction code is issued and the Natural screen is inserted using the alternate TP PCB.

If you switch from a conversational Natural session to a non-conversational one, the conversation is terminated and a dummy message using MOD\_name NIIMODNC is inserted. This message unprotects the screen temporarily, and is thus overwritten by the first screen of the non-conversational Natural session.

Parameter	Format/Length	Type
Transaction_code	(A8)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPDIRT

## NIIDIRTX - Prepare Direct Switch to Transaction Code

Prepares a direct switch to the specified transaction code. On the next terminal write, the CHNG call for the new transaction code is issued and the message and or the SPA are inserted using the alternate TP PCB. The transaction type defines the type of the new transaction code.

- If you switch from a conversational transaction code to a non-conversational one, the conversation is finished by issuing a dummy message using MOD\_name NIIMODN, which unprotects the screen

temporarily, thus it will be overwritten by the screen issued from the non conversational transaction code.

- If the suspend flag is set to Y, the Natural session is suspended and may be resumed at a later time. When the Natural session is resumed, the last Natural screen is issued.
- If the suspend flag is set to Y you may not switch from a conversational Natural to a non conversational transaction code. If you try to do so, a Natural error message will be issued.
- If message length is set to zero, no message at all is inserted. This however is only possible if you switch to a conversational transaction code.

The following parameters are provided:

Parameter	Format/Length	Type
Transaction_code	(A8)	Input
Transaction_type	(A4)	Input  Possible values:  CONV for conversational transaction code NONC for non-conversational transaction code
Suspend_flag	(A1)	Input  Possible values:  Y - the Natural session will be suspended else the Natural session will be terminated
Message	(A1/1:V)	Input
Message_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPDIRTX

## NIIEMOD - Modify Setting of Module Output Descriptor

---

Modifies the current setting of the module output descriptor to be used in the insertion of the last message in a Natural session and sets it to the value specified in the parameter MOD\_name.

The following parameters are provided:

Parameter	Format/Length	Type
MOD_name	(A8)	Input
Return_code	(I4)	Output

Sample Program: NIPEMOD

## NIIGCMD - Retrieve Next Reply Segment of Previous IMS TM Command

---

Retrieves the next reply segment of a previously issued IMS TM command. The length of the reply is return in the parameter reply length. If the reply does not fit into the reply area, the reply is truncated and return code 4 is issued.

The following parameters are provided:

Parameter	Format/Length	Type
Reply_area	(A1/1:V)	Input/Output
Reply_area_length	(I4)	Input
Reply_length	(I4)	Output
Status_code	(A2)	Output
Return_code	(I4)	Output

Specific Return Code Values: 4 (reply truncated)

Sample Program: NIPCMD

## NIIGMSG - Retrieve First Segment Next Message

---

Retrieves the first segment of the next message from the message queue by issuing a GU. The message area will contain the retrieved message including the leading LLZZ bytes. If there are no messages in the message queue, LLZZ is set to zero.

The following parameters are provided:

Parameter	Format/Length	Type
Message_area	(A1/1:V)	Output
Message_area_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Programs: NIPGMSG, NIPGSEG

## NIIGSEG - Retrieve Next Segment of Input Message

---

Retrieves the next segment of the input message by issuing a GN call. The message area will contain the retrieved message including the leading LLZZ bytes. If there are no more message segments in the current message, LLZZ is set to zero.

The following parameters are provided:

Parameter	Format/Length	Type
Message_area	(A1/1:V)	Output
Message_area_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPGSEG

## NIIGSPA - Retrieve Data from SPA Beginning

---

Retrieves data from the SPA beginning at the specified offset in the specified length.

The following parameters are provided:

Parameter	Format/Length	Type
Offset	(I4)	Input
Length	(I4)	Input
Area	(A1/1:V)	Input/Output
Return_code	(I4)	Output

Specific Return Code Values: 4

The retrieved data resides entirely or partially within the part of the SPA reserved for Natural.

Sample Program: NIPGSPA

## NIIIMSIN - Retrieve IMS TM Environment Info

Retrieves the IMS TM environment information using the INQY ENVIRON call. If you specify a Reply\_area\_length smaller than 102, the reply will be truncated and you will receive return code X'0100' with reason code X'000C'.

The following parameters are provided:

Parameter	Format/Length	Type
Reply_area	(A1/1:V)	Output
Reply_area_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: *nnxx*

*nn*: The first two bytes contain the AIB return code. *xx*: The second two bytes contain the AIB reason code. AIB denotes "Application Interface Block" and is used when calling IMS TM through the AIBTDLI interface.

Sample Program: NIPIMSIN

## NIIISRTF - Create Multi-Segment Messages

Creates multi-segment messages. NIIISRTF performs the CHNG call for the specified destination and inserts the first message segment without performing a PURG call. Further message segments may be inserted using NIIISRTM. The message has to be terminated using NIIPURG. The LLZZ bytes are created by the service module.

The following parameters are provided:

Parameter	Format/Length	Type
Destination	(A8)	Input
Message	(A1/1:V)	Input
Message_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPISRTM

## NIISRTM - Insert Message Segment into Message Queue

---

Inserts the next message segment into the message queue without performing a CHNG or a PURG call. The LLZZ bytes are created by the service module.

The following parameters are provided:

Parameter	Format/Length	Type
Message	(A1/1:V)	Input
Message_length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPISRTM

## NIIPCBAD - Return PSB Name and PCB Address

---

Returns the currently scheduled PSB name and the address of the PCB identified by the logical name. If the logical PCB name is not defined in the transaction code table, a Natural error message is issued.

The following parameters are provided:

Parameter	Format/Length	Type
PSB_name	(A8)	Output
Logical_PCB_name	(A8)	Input
PCB_address	(B4)	Output
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIIPCBAD

## NIIPCOM - Move Data to Reply Area

---

Moves the data provided in the data area into the reply area specified in the NIIBOOTIS call at the specified offset in the specified length. NIIPCOM may be called from the server environment only.

The following parameters are provided:

Parameter	Format/Length	Type
Offset	(I4)	Input
Data_area	(A1/1:V)	Input
Length	(I4)	Input
Return_code	(I4)	Output

Specific Return Code Values: 4 (calling environment, not server environment)

Sample Program: NIPPCOM

## NIIPMSG - Send Message

---

Sends a message using a given MOD\_name to the destination which is represented by the I/O PCB. The message is taken from the message area in the specified message area length. The message area must not contain the leading LLZZ bytes. In this way you can send MFS-formatted output messages back to the originator of the input message.

The following parameters are provided:

Parameter	Format/Length	Type
Message	(A1/1:V)	Input
Message_length	(I4)	Input
MOD_name	(A8)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPPMSG

## NIIPSBAD - Return PSB Address

---

Returns the address of the PSB which is the address of the PCB address list.

The following parameters are provided:

Parameter	Format/Length	Type
PSB_address	(B4)	Output
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPB00TS

## NIIPSPA - Replace Data in SPA

---

Replaces the data located in the SPA at the specified offset in the given length by the data provided in the data area.

The following parameters are provided:

Parameter	Format/Length	Type
Offset	(I4)	Input
Length	(I4)	Input
Data_area	(A1/1:V)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

An attempt to override the header of the SPA (first 14 bytes) and/or data residing in the Natural-reserved area is refused and a Natural error message is issued.

Sample Program: NIPPSPA

## NIIPURG - Issue PURG Call

---

Issues a PURG call.

The following parameter is provided:

Parameter	Format/Length	Type
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPISRTM

## NIIRETRM - Move Data into Message Area

---

Moves data from the input message beginning at the specified offset in the specified length into the provided message area.

The offset is calculated from the LLZZ bytes.

The following parameters are provided:

Parameter	Format/Length	Type
Offset	(I4)	Input
Length	(I4)	Input
Message_area	(A1/1:V)	Input/Output
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPRETRM

## NIISASD - Modify SENDER and OUTDEST Settings

---

Modifies the current setting of the Natural profile parameters SENDER and OUTDEST.

The following parameters are provided:

Parameter	Format/Length	Type
Sender	(A8)	Input
Outdest	(A8)	Input
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPNTRD

## NIIU3962 - Terminate Session

---

Terminates the session with user abend code U3962 and produces a dump.

The following parameter is provided:

Parameter	Format/Length	Type
Return_code	(I4)	Output

Specific Return Code Values: None.

Sample Program: NIPU3962

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## Natural under IMS TM - Service Modules

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This chapter describes the service modules of the Natural IMS TM Interface.

## Purpose of Service Modules

---

Service modules perform IMS TM-specific functions. They can be called from within a Natural program using the standard Natural CALL interface. Sample programs are loaded by a Natural INPL into the library SYSEXTP.

## Service Module Descriptions

---

This section contains a detailed description of all the service modules in alphabetical order. This includes a list of the parameters available and the name of the module-relevant sample program.

### CMCMMND - Issue IMS TM Operator Commands

---

The module CMCMMND issues IMS TM operator commands and returns the reply segments to the Natural user program.

The following parameters are provided:

Name	Format/Length	Type	Comment
Command		Input	
Command length	(B4)	Input	
Reply		Output	
Length of reply area	(B4)	Input	

The operator command contained in the command area is issued to IMS TM with the indicated length.

If the user has set a non-zero reply length, any reply segments from IMS TM are moved into the reply area over the maximum available length. If the reply area is at least two bytes long, the first two bytes contain the IMS TM status code after the command call has been issued. The two rightmost bytes of the REPLGTH field contain the effective length of the total reply moved into the REPLY field.

If the reply from IMS TM has to be truncated, this is indicated by setting X'80' in the leftmost byte of the REPLGTH field.

Sample Program: NIPSCMND

## CMDEFSW - Deferred Transaction Switch to Natural Transaction Code

---

The module CMDEFSW performs a deferred transaction switch to a Natural transaction code.

The following parameter is provided:

Name	Format/Length	Type	Comment
Trancode		Input	

With the next terminal I/O, the output is sent to the terminal and the next input from this terminal is processed by the transaction code passed as parameter message.

## CMDEFSWX - Deferred Transaction Switch to Non-Natural Transaction Code

---

The module CMDEFSWX performs a deferred switch to a non-Natural transaction code.

The following parameters are provided:

Name	Format/Length	Type	Comment
Trancode		Input	
Message		Input	
Message length		Input	
MOD name		Input	

With the next terminal I/O, the given message with the given MOD name is inserted and the Natural session is terminated.

If the new transaction code is a Natural transaction code, the message and the MOD name passed as parameters are ignored and CMDEFSWX works as [CMDEFSW](#).

Sample Programs: NIPSDEFX.

## CMDIRNMX - Switch to Another Conversational Transaction w/o Message

---

The module `CMDIRNMX` has the same functionality as `CMDIRSWX`, except that no message is inserted to the alternate PCB. Thus, the only parameter you have to provide is `Trancode`.

The following parameter is provided:

Name	Format/Length	Type	Comment
Trancode		Input	

`CMDIRNMX` can also be used to perform a direct switch to another Natural transaction code, because in this case, the `CLEAR` key is given as input message to Natural by default.

If you want to switch to a non-Natural transaction code, it is strongly recommended to use the `TERMINATE` statement in conjunction with service module `CMTRNSET` instead.

```
CALL 'CMTRNSET' TRANCODE /* set transaction code */
TERMINATE                /* terminate Natural and call TRANCODE */
```

## CMDIRNMZ - Switch to Another Conversational Transaction w/o Message

---

The module `CMDIRNMZ` has the same functionality as `CMDIRSWZ`, except that no message is inserted to the alternate PCB. Thus, the only parameter you have to provide is `Trancode`.

The following parameter is provided:

Name	Format/Length	Type	Comment
Trancode		Input	

## CMDIRSWX - Switch to Another Conversational Transaction w. Message

---

The module `CMDIRSWX` performs a direct switch to another conversational transaction and specifies a message that is to be passed on to this new transaction.

The following parameters are provided:

Name	Format/Length	Type	Comment
Trancode		Input	
Message		Input	
Message length	(B4)	Input	

At the next terminal I/O, a change call is executed against the alternate PCB to set its destination to the value of the `Trancode` field. The SPA and the message are then inserted into the alternate PCB.

The new transaction code is checked if it is a Natural or a non-Natural transaction code.

In the case of a non-Natural transaction code, the Natural session is terminated.

In the case of a Natural transaction code, the `CLEAR` key is passed to Natural as input message, which means that Natural reacts as if the terminal user pressed the `CLEAR` key. The type of the new transaction code is automatically honored.

If you want to switch to a non-Natural transaction code, it is strongly recommended to use the `TERMINATE` statement in conjunction with service module `CMTRNSET` instead.

```
CALL 'CMTRNSET' TRANCODE /* set transaction code */
TERMINATE 0 MESSAGE      /* terminate Natural and call TRANCODE with MESSAGE */
```

The message `MESSAGE` is passed in the length of the Natural variable `Message` to the transaction code `Trancode`. The return code of the `TERMINATE` statement must be zero. Otherwise, the Natural session is terminated with termination error message `NAT9987` and the transaction code switch does not take place.

Sample Program: `NIPSDIRX`

## CMDIRSWZ - Switch to Another Conversational Transaction w. Message

The module `CMDIRSWZ` has the same functionality as `CMDIRSWX`.

The following parameters are provided:

Name	Format/Length	Type	Comment
Trancode		Input	
Message		Input	
Message length	(B4)	Input	

The difference compared to `CMDIRSWX` is that, in case of a switch to a non-Natural transaction code, the current Natural session is not terminated. This is done with the following intention:

- A given Natural session gives control to a non-Natural transaction code; the session is not terminated.
- The non-Natural transaction performs a terminal I/O and then switches back to the original Natural transaction, passing data into the SPA.
- The Natural transaction does not start a new session, but continues the old session were it has left it, which means that the roll slot is obtained from the swap pool and control is given to Natural so as to continue with an existing session.

The non-Natural transaction code must pass the message `LLZZD`, where `LL=H'0005'`, `ZZ=X'0000'` and `D=X'6D'` are simulating to Natural that the `CLEAR` key has been pressed. By making the Natural program sensitive to the `CLEAR` key, it is able to recognize that the called non-Natural transaction has come back and it can retrieve the data prepared by the non-Natural transaction for use in subsequent processing.

`CMDIRSWZ` cannot be used if the transaction code to switch to is a Natural transaction code.

Sample Program: `NIPSDIFS`

## CMDISPCB - Get PCB Content

---

The module `CMDISPCB` is used to obtain the contents of a PCB.

The following parameters are provided:

Name	Format/Length	Type	Comment
PCB number	(B4)	Input	
Receiving area		Output	
Area length	(B4)	Input	

After the call is executed, the receiving area contains the contents of the PCB with the requested number in the requested length. A check is made to verify that the requested PCB is within your current PCB list. The first PCB is PCB number 1, the second PCB is PCB number 2, etc. If you specify an invalid number, the field `PCB number` is set to `X'FFFFFFFF'` and no further information is passed to your application program.

Sample Program: NIPSPCBD

## CMEMOD - Modify MOD Name Dynamically

The module CMEMOD allows the MOD name to be modified dynamically for a given LTERM at the normal end of a Natural session.

The following parameter is provided:

Name	Format/Length	Type	Comment
MOD name	(A8)	Input	

At a normal end of a session, the environment-dependent interface inserts the message X'00060000403F' into the IOPCB, using the MOD name whose value is contained in MOD name parameter. This is intended to present a meaningful screen (for example, a general menu) to the terminal user so that he can continue working at the terminal.

## CMGETMSG - Read Next Message

The module CMGETMSG reads the next message from the message queue.

The following parameters are provided:

Name	Format/Length	Type	Comment
Message area		Output	
Message area length	(B4)	Input	

The length is checked to see if the received message fits into the message area. The message is moved including the LLZZ bytes into the message area. If there are no more messages, LL=0 is moved into the message area.

If the message does not fit into the message area, a corresponding error message is returned.

Sample Programs: NIPSGETM and NIPSOBMP.

## CMGETSEG - Read Next Segment

---

The module CMGETSEG reads the next segment of the current message from the message queue.

The following parameters are provided:

Name	Format/Length	Type	Comment
Message area		Output	
Message area length	(B4)	Input	

The length is checked to see if the received message fits into the message area. The message segment is moved into the message area including the LLZZ bytes. If there are no more message segments, LL=0 is moved into the message area.

If the message does not fit into the message area, a corresponding error message is returned.

All read message segments are kept as a concatenated string in the internal input message buffer whose size is specified by the keyword subparameter MISIZE of the NTIMPSPE macro (see the *Parameter Reference* documentation). If you want to avoid an overflow of the internal input message buffer, use the CMGSEGO module instead of CMGETSEG.

Sample Program: NIPSOBMP

## CMGETSPA - Transfer Data from SPA

---

The module CMGETSPA transfers the data from the SPA starting from the given offset in the requested length into the receiving area.

The following parameters are provided:

Name	Format/Length	Type	Comment
Offset	(B4)	Input	
Length	(B4)	Input	
Area	(B4)	Output	

Sample Programs: NIPSGSPA and NIPSPSPA

## CMGSEGO - Read Next Segment

---

The module CMGSEGO reads the next segment of the current message from the message queue.

The following parameters are provided:

Name	Format/Length	Type	Comment
Message area		Output	
Message area length	(B4)	Input	

The length is checked to see if the received message fits into the message area. The message segment is moved into the message area including the LLZZ bytes. If there are no more message segments, LL=0 is moved into the message area.

If the message does not fit into the message area, a corresponding error message is returned.

Only the first and the current message segments are kept in the internal input buffer whose size is specified by the MISIZE keyword subparameter of the NTIMPSPE macro (see the *Parameter Reference* documentation). If you want to keep all message segments, use the CMGETSEG module instead of CMGSEGO.

Sample Program: NIPSOBMP

## CMIMSID - Get MVS Subsystem ID

---

The module CMIMSID enables Natural programs to obtain the MVS subsystem ID of the IMS TM system in which they are currently scheduled.

The following parameter is provided:

Name	Format/Length	Type	Comment
IMSID	(A4)	Output	

After the call is executed, the field IMSID contains the MVS subsystem ID of the IMS TM system in which you are currently scheduled.

The module CMIMSID depends upon an internal IMS TM control block. Therefore, it is an IMS TM release-dependent function that will be updated whenever possible.

## CMIMSINF - System Environment Info

The module CMIMSINF provides system environment information.

The following parameters are provided:

Name	Format/Length	Type	Comment
IMSID	(A4)	Output	The IMS TM ID.
SUFFIX	(A2)	Output	The preload suffix.
APPLGNAM	(A8)	Output	The application group name.
APPLNAM	(A8)	Output	The application name.
NRENT	(B4)	Output	The number of reentrant modules preloaded.
NNONR	(B4)	Output	The number of non-reentrant modules preloaded.

CMIMSINF is also an IMS TM release-dependent module.

Sample Program: NIPSINF

## CMPCBADR - Return PCB Address

The module CMPCBADR returns the address of a PCB which is identified by a logical name. The PSB name is also returned to the Natural program.

The following parameters are provided:

Name	Format/Length	Type	Comment
PSB name	(A8)	Output	
PCB name	(A8)	Input	
PCB address	(B4)	Output	

After the call is executed, the field PCBADR contains the address of the PCB identified in the table module by the logical name PCBNAME in the table entry that corresponds to the currently scheduled transaction code. If the logical name does not exist for this transaction code, X'FFFFFFFF' is returned in the PCBADR field. In any case, the field PSBNAME contains the name of the currently scheduled PSB.

Sample Program: NIPSPCBA

## CMPRNTR - Change Default Hardcopy Destination

The module CMPRNTR changes the default hardcopy destination set by the module NIIIMSHC to the value passed as parameter.

The following parameter is provided:

Name	Format/Length	Type	Comment
Destination	(A8)	Input	

The module CMPRNTR is provided for compatibility reasons only; use the Natural statement SET CONTROL *hdest-id* instead.

## CMPUTMSG - Insert Output Message into IO-PCB

The module CMPUTMSG can be used to insert any given output message of a given length into the IO-PCB, using any given MFS MOD name. In this way, you can send MFS-formatted output messages back to the originator of the input message.

CMPUTMSG takes the number of bytes as indicated in the message length from the message area and inserts them with the specified MOD name in the message queue. There is no restriction upon the length of the message, except that it has to fit into the input message area of the environment-dependent interface.

The following parameters are provided:

Name	Format/Length	Type	Comment
Message area		Input	
Message length	(B4)	Input	
MOD name		Input	

If a non-blank status code is returned in the IO-PCB, Natural error message NAT8272 is issued which contains the status code as variable part.

## CMPUTSPA - Move Data into SPA

---

The module `CMPUTSPA` moves the data with the given length at the specified offset into the SPA.

The following parameters are provided:

Name	Format/Length	Type	Comment
Offset	(B4)	Input	
Length	(B4)	Input	
Data		Input	

A check is done if the specified offset points into the Natural Reserved Area (NRA) within the SPA. If yes, return code 4 is returned.

Sample Program: `NIPSPSPA`

## CMQTRAN - Content of Current Transaction Code Table Entry

---

The module `CMQTRAN` returns the contents of the current entry within the transaction code table.

The following parameters are provided:

Name	Format/Length	Type	Comment
Transaction code		Output	The transaction code under which you are running.
Offset	(B2)	Output	The offset of the NRA with the SPA.
Length	(B2)	Output	The length of the NRA.
Uoffset	(B2)	Output	Not used.
PSB name		Output	The name of the scheduled PSB.
Number of PCBs		Output	The number of PCBs whose addresses you can obtain using the module <code>CMPCBADR</code> .

The logical names by which you can refer to PCBs in the module `CMPCBADR` are not returned because of security considerations; you should be informed by your system about which logical names you are allowed to refer to.

Sample Program: `NIPSQTRA`

## CMQUEUE - Insert Message into Alternate PCB

---

The module CMQUEUE inserts a message into the specified alternate PCB.

The following parameters are provided:

Name	Format/Length	Type	Comment
Destination		Input	
Message		Input	
Message length	(B4)	Input	
TP PCB number	(B4)	Input	Optional

This call causes an immediate change call to set the destination of the specified alternate PCB to the value contained in the field Destination, after which the message is inserted into the alternate PCB with the indicated Message length.

The transaction code is inserted after the LLZZ bytes with a length of 8.

After a PURGE call has been issued, control is returned to the next instruction in the Natural program.

The message can have any length up to the size of the input message area (usually 8000 minus 12 bytes).

The alternate PCB to be used is specified with the last optional parameter. If no TP PCB number is specified with the call, the alternate TP PCB specified with the ALTPCB keyword subparameter of the NTIMSPT macro (Natural parameter module) is used.

Sample Program: NIPSQLOA

## CMQUEUEX - Complete Control over Message Content

---

The module CMQUEUEX provides you with complete control over the contents of a message that is to be queued in the IMS TM input queue.

The following parameters are provided:

Name	Format/Length	Type	Comment
Destination		Input	
Message		Input	
Message length	(B4)	Input	
TP PCB number	(B4)	Input	Optional

This call causes an immediate change call to set the destination of the specified alternate PCB to the value contained in the field Destination, after which the message is inserted into the alternate PCB with the indicated Message length after the LLZZ bytes. The difference compared to CMQUEUE is that the transaction code is *not* inserted after the LLZZ bytes.

After a PURGE call has been issued, control is returned to the next instruction in the Natural program. The message can have any length up to the size of the input message area (usually 8000 minus 12 bytes).

The alternate PCB to be used is specified with the last optional parameter. If no TP PCB number is specified with the call, the alternate TP PCB specified with the ALTPCB keyword subparameter of the NTIMSPT macro (Natural parameter module) is used.

Sample Program: NIPSQUEX

## CMSNFPRT - Set Logical Device Name

---

The module CMSNFPRT sets the logical name of the device to which the Natural messages during the online BMP run is sent.

The following parameter is provided:

Name	Format/Length	Type	Comment
Printer name		Input	

Before calling CMSNFPRT, use the Natural profile parameter SENDER to define the default output destination.

Sample Program: NIPSOBMP

## CMSVC13D - Terminate Natural Session

The module CMSVC13D terminates the Natural session with user abend code U3962 and produces a dump.

Parameters: None

Sample Program: None.

## CMTRNSET - Insert SPA via Alternate PCB

When the Natural session is terminated normally, the Natural IMS TM Interface performs a direct program-to-program switch to the specified transaction code and inserts the SPA via the alternate PCB.

The following parameter is provided:

Name	Format/Length	Type	Comment
Trancode		Input	

Sample Program: NIPSEOSS

## NIIDDEFS - Deferred Switch to Foreign Transaction

The module NIIDDEFS is similar to module CMDEFSWX. If you use NIIDDEFS to perform a deferred switch to a foreign transaction, the current Natural session is suspended, as with module CMDIRSWZ. The suspended Natural session can be resumed at any time by sending back to Natural a message containing the CLEAR key.

The following parameters are provided:

Name	Format/Length	Type	Comment
Transaction code		Input	The transaction code to switch to.
Message		Input	The message to be sent to the foreign transaction code.
Message length	(B4)	Input	
MOD name	(A8)	Input	
Transaction type	(A4)	Input	An A4 variable containing the string CONV if the foreign transaction is conversational and the string NONC if the foreign transaction is non-conversational.

Return Codes:

0	OK
4	The message length is greater than the size of the message area defined in the environment table.
8	You tried to do a deferred switch with suspend from a conversational Natural to a non-conversational foreign transaction, something which cannot be done.
12	The fifth parameter is invalid; it contains neither CONV nor NONC.

Sample Program: NIPSDEFS

## NIIDPURG - Send Multi-Segment Message

---

The module NIIDPURG does not have parameters. It issues a PURGE call using the same alternate PCB that has been used with the NIIDQUMS call and sends multi-segment messages that have been created using the module NIIDQUMS.

Return Codes: Either bytes two and three of the 4-byte return code contain the status code, or the return code has the value 0.

Sample Program: NIPSQLMS

## NIIDQUMS - Create Multi-Segment Message

---

This module creates multi-segment messages. It has basically the same functionality as the module CMQUEUE, with the difference that NIIDQUMS does not issue a PURGE call.

The following parameters are provided:

Name	Format/Length	Type	Comment
Destination		Input	
Message		Input	
Message length	(B4)	Input	
TP PCB number	(B4)	Input	Optional

It is your responsibility to issue the PURGE call using the module NIIDPURG.

The alternate PCB to be used is specified with the last optional parameter. If no TP PCB number is specified with the call, the alternate TP PCB specified with the ALTPCB keyword subparameter of the NTIMSPT macro (Natural parameter module) is used.

Sample Program: NIPSQLMS

## NIIDSETT - Get Foreign Transaction Code

---

In order to perform a correct transaction switch to a foreign transaction code, the type of the foreign transaction code must be known. To obtain this type, the special-purpose module NIIDSETT can be used. If NIIDSETT is not used, the foreign transaction code is assumed to be of the same type as the invoking Natural transaction code. If this is not the case, there will be unpredictable results or the session will terminate abnormally.

The following parameter is provided:

Name	Format/Length	Type	Comment
Transaction type	(A4)	Input	Possible values: CONV for conversational, NONC for non-conversational.



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## Natural under IMS TM - User Exits

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This chapter contains an overview of the user exits that are available with the Natural IMS TM Interface. For each exit, a source module with the same name is provided. Each source module contains a description of the parameter list and of the register conventions.

## NIIXACCT

---

The exit is called before an accounting record is written to the IMS TM log or to SMF. Thus, it makes it possible to modify the content of an accounting record. If `NIIXACCT` returns a non-zero register 15, the accounting record is not written at all.

## NIIXSTAR

---

The exit is called with each transaction step after the SPA and the message have been retrieved and the Natural thread has been rolled in and decompressed. Within this exit, the Natural IOCB and the driver work area are accessible.

A value of 12 in register 15 upon return of `NIIXSSTA` forces the Natural IMS TM Interface to terminate the Natural session. Any other non-zero value in register 15 forces the interface to issue the Natural IMS TM Interface error 3517 with the reason code containing the value in register 15.



**Note:** This exit is not called when a new Natural session is started.

## NIIXSSTA

---

The exit is called when a new Natural user session has been started and the SPA and the Natural IOCB have been initialized. Within this exit, the Natural IOCB and the driver work area are accessible.

A value of 12 in register 15 upon return of `NIIXSSTA` forces the Natural IMS TM Interface to terminate the Natural session. Any other non-zero value in register 15 forces the interface to issue the Natural IMS TM Interface error 3509 with the reason code containing the value in register 15.

## **NIIXSRM**

---

The exit is called before the insertion of the message into the IOPCB.

## **NIIXSRT**

---

The exit is called before the insertion of the SPA into the IOPCB, even at the end of the Natural session. The end-of-session situation can be recognized by a blank transaction code.

## **NIIXTGU0**

---

The exit is called when the service module `CMGETMSG` is used. `NIIXTGU0` receives control immediately after the `GU` call against the IOPCB, regardless of the status code.

## **NIIXJESA**

---

The exit is called when the JES API is used for writing reports. It is called after the options string has been created and may be used to modify the options string.

## **NIIXPRT0**

---

The exit is called when reports are directly written to IMS TM printers. It can be used to set the codes for “form feed” and “new line”.

## **NIIXRFNU**

---

The exit is called when the new Natural session is assigned to a roll file. It can be used to calculate the number of the roll file to be used for this session.

## NIIXTGNO

---

The exit is called when the service module `CMGSEGO` or `CMGETSEG` is used. `NIIXTGNO` receives control immediately after the message segment is retrieved, regardless of the status code.

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## Natural under IMS TM - Special Functions

---

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This chapter describes the use of special functions available with the Natural IMS TM Interface.

## Prerequisites

---

Some of these functions require the *Natural Authorized Services Manager (ASM)*.

- If the ASM is required, it must have been started before the function is used.
- The Natural subsystem used by the ASM must be the same as the one used by the Natural session.
- For accounting and monitoring, the SIP server must have been enabled in addition.

## Accounting

---

The accounting function is only available in dialog-oriented environments. It is activated by setting the environment table keyword subparameter `ACTACTV` to `ON` in the `NTIMSPE` macro of the Natural parameter module.

With each terminal I/O, information about the specific Natural session is written to the IMS TM log or to SMF, depending on the setting of the `ACTLOG` keyword subparameter in the `NTIMSPE` macro.

- If the `ACTACTV` keyword subparameter is set to `CMD`, a `/LOG` command is issued that writes the accounting record to the IMS TM log. All transaction codes must therefore be allowed to use the `/LOG` command. At the beginning of each record an 8-byte header is inserted. This header helps to easily select the accounting records using the IMS TM utility `DFSERA10`. The header string is defined by the environment table keyword subparameter `ACTAHDR` (`NTIMSPE` macro).
- If the `ACTACTV` keyword subparameter is set to `LOG`, the accounting record is written to the IMS TM log using the `LOG` call. With the keyword subparameter `ACTARID` (`NTIMSPE` macro), you specify the log code to be used.
- If the `ACTACTV` subparameter is set to `SMF`, the accounting record is written to SMF using the Authorized Services Manager. With the `ACTARID` subparameter, you specify the SMF record type to be used.

The following information about each Natural user session is stored with each terminal I/O:

- IMS TM ID of the IMS TM system in which the user is active,
- `LTERM` name of the IMS TM terminal on which the session was started,
- user ID of the user of the Natural session (taken from the `IOPCB`),
- number of dialog steps currently performed,
- currently active transaction code,

- currently active PSB name,
- current Natural library name to which the user is logged on,
- currently active Natural program name,
- non-Natural transaction code to which the session is possibly suspended to,
- time and date when the session was started,
- time and date of the last ENTER operation,
- DBID and FNR of the Natural system file (FNAT) for this session,
- DBID and FNR of the Natural user file (FUSER) for this session,
- DBID and FNR of the Natural dictionary file (FDIC) for this session,
- DBID and FNR of the Natural Security system file (FSEC) for this session,
- DBID and FNR of the Natural spool file (FSP00L) for this session,
- DBID and FNR of the Super Natural system file for this session,
- last encountered Natural error number,
- compressed thread length of the last terminal output.

The information is mapped by the DSECT NIMACTR. There are two areas for storing the DBID and FNR of the Natural system files used. In the first area, one byte is used for each DBID and FNR; this is supported for compatibility reasons. In the second area, a fullword is used for each DBID and FNR to support Adabas Version 6 or higher. The accounting record is prefixed with a length and version field.

Before the accounting record is written to the IMS TM log, respectively to SMF, the user exit NIIXACCT is called. You can use this user exit to tailor the accounting record to your requirements. You may also append information to the accounting record. In this case, you must set the length field to the new length.

Since the accounting record is built in the command buffer, the total length must not exceed the value specified with keyword subparameter CMBSIZE (NTIMSPE macro of the Natural parameter module) minus 17 bytes. The maximum length allowed is passed as parameter.

If NIIXACCT returns with a non-zero value in register 15, no accounting record is written.

## Monitoring

---

The monitoring function is only available in dialog-oriented environments. It is activated by setting the environment table keyword subparameter `MONACTV` to `ON` (`NTIMSPE` macro in the Natural parameter module) and uses the SIP function of the Authorized Services Manager. The Natural subsystem must be the same as the one used by the Natural session to be monitored.

You can follow the ongoing activity of all Natural sessions which use the same Natural subsystem by using the Monitoring (M) function of the `SYSTP` utility. For more information on this utility, see `SYSTP` in the Natural *Utilities* documentation. The `SYSTP` session must also use the same Natural subsystem.

## Broadcasting

---

The broadcasting function is only available in dialog-oriented environments. It is activated by setting the environment table keyword subparameter `BROACTV` to `ON` (`NTIMSPE` macro in the Natural parameter module) and uses the SIP function of the Authorized Services Manager.

Once broadcasting is active, it is possible to send broadcast messages to targeted users of a given Natural subsystem. Such users can be:

- all users of the Natural subsystem to which the sender is connected;
- all users of the Natural subsystem within the same IMS TM system as the sender of the message;
- all users of the Natural subsystem within the same IMS TM system as the sender of the message, but additionally restricted to a given transaction code;
- all users of the Natural subsystem within the same IMS TM system as the sender of the message, but additionally restricted to a Natural application;
- all users of the Natural subsystem within the same IMS TM system as the sender of the message, but additionally restricted to a Natural application and to a given `FUSER` system file.

When a session comes to a terminal output, a check is made to see whether the session has to receive a message or not. If not, the normal Natural output is sent. If yes, the message is sent instead of the normal output and, when pressing `ENTER`, the Natural nucleus is instructed to re-send the last screen. In this way, you first see the message and afterwards receive the normal Natural output screen.

If more than one broadcast message is available, the messages are displayed one after the other until the last message has been shown. Afterwards, the normal Natural output screen is displayed.

A broadcast message will be displayed only if its expiration time specified in the message creation procedure has not been exceeded.

When a broadcast message is sent, you must press `RESET` before you can press `ENTER` again. All possible attention IDs have the same effect as pressing `ENTER`.

The utility `SYSTP` can be used to create broadcast messages and to display the contents of all active messages together with the `LTERM/IMSID` of the sender. The text of a message is limited to 72 bytes.

Messages to be broadcast are saved in a pool maintained by the SIP server. They remain there until you delete them using the `SYSTP` utility or until you shut down the Authorized Services Manager.



**Caution:** When a broadcast message is deleted or created, all expired messages are deleted as well.

## Server Environment

---

The server environment allows 3GL applications to execute Natural programs using a call interface. It is available in all supported IMS TM environments and consists of the Natural IMS TM driver `NIISRVD` of the server call interface `NIIBOOTS` and of the service API `NIIPCOM`.

`NIISRVD` and `NIIBOOTS` are delivered as source modules and must be assembled and link-edited on your site. For details, see *Installing the Natural IMS TM Interface on z/OS* in the *Natural Installation for z/OS* documentation.

The server environment allows you to start a Natural session by calling `NIIBOOTS` from any 3GL program. After the Natural session has been started, it returns to the calling 3GL program and waits for further input. The input would normally be expected from `CMSYNIN`, which means that the 3GL program has to simulate Natural's primary input data set.

It is strongly recommended to always put the server Natural on the `NEXT` line. This allows the next call to `NIIBOOTS` to either execute a Natural command or a Natural program. Otherwise, the next call to `NIIBOOTS` would be treated as input for a Natural program which had been started by a previous call to `NIIBOOTS`.

Similarly as with the message-oriented interface, all output normally written to `CMPRINT` is sent to the IMS TM destination specified with the Natural profile parameter `SENDER`. For details about special destinations used by the Natural IMS TM Interface, refer to [Sender Destination](#) in the section *Natural under IMS TM - Environments*.



**Caution:** In an MPP Environment, the same server Natural will be used by all transactions scheduled in this region by default. If you want to use multiple server Naturals in the same MPP region, you must generate multiple server call interfaces. Each server call interface must be generated with a unique name specified with the `NIMBOOT` parameter `SERVERN` and

must be linked under a unique name. It is recommended to name the load module with the name specified with `SERVERN`.

## Call Interface NIIBOOTS

NIIBOOTS is the default name as used in the documentation and in the delivered sample programs. This default name can be changed during installation.

NIIBOOTS requires the following parameters:

- the PSB address (the address of the PCB address list),
- the command area,
- the reply area.

In the command area, the following may be passed:

- the startup parameters,
- any Natural command followed by its input data,
- the NIIBOOTS-specific commands, such as `STAT` and `REFR` (in combination with the startup parameters).

The startup parameters are passed in two contiguous 80-byte areas. The first area contains the name of the environment table and the name of the transaction code to be used as follows:

```
ENV-TAB=environment-table-name  
TRNCODE=transaction-code-name
```

The transaction code is only honored if `TRNCODE=ON` is specified in the `NTIMSP` macro in the Natural parameter module. For details about the usage of the transaction code, refer to the `NIMBOOT` macro in the section *Natural under IMS TM - Configuration*.

The second area contains the dynamic Natural parameters with which the Natural session is to be started.

The reply area is the area in which a reply is to be entered from the executed Natural program using the service API `NIIPCOM`.

Each time it is invoked, NIIBOOTS checks whether the server Natural has been initialized.

- If Natural has not been initialized, a new Natural session is started and the received command is passed to Natural as a dynamic parameter.
- If Natural has been initialized, the string received in the command area is passed to Natural as a Natural command or as a Natural program.

The NIIBOOTS-specific commands `STAT` and `REFR` do the following:

- `STAT` returns `COLD` in the reply area if Natural has not been initialized and `WARM` if it has been initialized.
- `REFR` forces the initialization/reinitialization of Natural, regardless of the current state of Natural.

### ON ERROR Routine Recommended

It is highly recommended to use an `ON ERROR` routine in the executed Natural programs in order to give back to the calling 3GL program some information in the reply area using `NIIPCOM`.

### Return Codes

`NIIBOOTS` passes the return code provided by Natural on the termination of Natural.

### Sample Programs

To illustrate usage of `NIIBOOTS` and `NIIPCOM`, the sample programs `NIPBOOTS` and `NIPPCOM` are provided. `NIPBOOTS` plays the role of the calling 3GL program, `NIPPCOM` is a sample Natural program executed in the server environment and writes the string `NIISVR` into the reply area. The `ON ERROR` routine places the Natural error number in the reply area.

With the sample programs, you can go through the following scenario:

1. Pass the command `STAT`. The string `COLD` is returned to the reply area.
2. Pass the command: `STACK=(LOGON SYSEXTP),SENDER=S0201`, where `S0201` is the `LTERM` name of the assigned printer device in the server Natural. Natural will be initialized and will be ready to receive a Natural command in library `SYSEXTP`. The successful logon message is issued on the assigned printer. Nothing is returned in the reply area.
3. Pass the command `STAT`. The string `WARM` is returned to the reply area.
4. Pass the command `NIPPCOM`. Program `NIPPCOM` is executed and the string `NIPSRVR` is returned to the reply area. Natural is ready to accept the next command in library `SYSEXTP`.
5. Pass the command: `REFR STACK=(LOGON SYSEXTP;NIPPCOM),SENDER=S0201`

Natural is reinitialized and program `NIPPCOM` in library `SYSEXTP` is executed. The reply area contains the string `NIPSRVR`.

6. Pass the command `FIN`. Natural is terminated and no information is passed to the reply area. The return code will contain the return code of the Natural termination. The Natural termination message is issued on the assigned printer device.
7. Pass the command `STAT`. The string `COLD` is returned to the reply area.



# 42 Natural under IMS TM - Recovery Handling

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- Non-Recoverable Errors ..... 304
- Recoverable Errors ..... 305

This chapter describes recovery handling in the Natural IMS TM Interface.

## System and User Abends

---

The Natural IMS TM Interface is protected by an ESTAEX environment which takes control in case of an abend.

- If a user abend is detected, resources are cleaned up and the abend is percolated without giving control to Natural.
- If a system abend is detected, Natural is informed about the abend and, depending on the setting of the Natural profile parameter `DU`, Natural continues with an error message or terminates the session.
- If the support of IBM's Language Environment (LE) is enabled and the abend occurs while an LE program has control, user-written or language-specific condition handlers are honored and Natural is only informed about the abend if the condition is percolated by all LE condition handlers. In this case, the abend is handled by Natural in the following steps before the standard abend handling takes place:
  - the corresponding LE error message is written to `SYSOUT`,
  - an LE snap dump is written to `CEEDUMP` according to LE run-time option `TERMTHDACT`,
  - LE is instructed to resume processing after the Natural `CALL` statement,
  - a special Natural error message (`NAT0950` if `DU=OFF` or `NAT9967` if `DU=ON`) is issued which indicates the LE error number.

In all cases, you can produce a dump which represents the situation at the time when the error occurred (register contents, PSW, etc.). The dump is produced if `DU=ON` or `DU=SNAP` or if the user abend has requested this.

## Non-Recoverable Errors

---

A non-recoverable error is a logical error detected by the Natural IMS TM Interface which cannot be handled by Natural. These situations typically occur during startup, termination or terminal I/O. In all cases, the Natural runtime is not active and can thus not react to the error.

If a non-recoverable error is detected, the Natural IMS TM Interface issues an NII error and terminates the session. The error message is also written to the IMS TM log and to the system log. Depending on the dump option in the error message table, a snap dump is produced.

If you do not wish a message to be written to the IMS TM log, set the `ERRLHDR` keyword subparameter of the `NTIMSPE` macro (Natural parameter module) explicitly to null, that is, you specify `ERRLHDR=.`

If it is not possible to send the error message (for example if the GU has failed), the session abends (user abend).

## **Recoverable Errors**

---

If a logical error is detected by the Natural IMS TM Interface which can be handled by Natural, for example an invalid destination for a report, a Natural error message is issued and Natural proceeds with its standard error handling.



# VI

## Natural under TSO

---



# 43 Natural under TSO

---

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- Driver Parameters for the Natural TSO Interface ..... 310
- Data Sets Used by Natural under TSO ..... 310
- Issuing TSO Commands from Natural under TSO ..... 313

This document describes the functionality of the Natural TSO Interface (product code NTI) and the operation and individual components of Natural under TSO in the operating system z/OS.

**Related Documents:**

- *Installing the Natural TSO Interface on z/OS* in the *Natural Installation for z/OS* documentation.

---

## General Information about the Natural TSO Interface

The Natural TSO interface (NATTSO) consists of a number of service routines interfacing with the z/OS operating system.

NATTSO is supplied as a source module and can be customized to meet your requirements; see also *Installing the Natural TSO Interface on z/OS* in the *Natural Installation for z/OS* documentation. You can either assemble and link NATTSO to the Natural nucleus or you can run it separately by connecting it with a shared nucleus.

NATTSO is fully reentrant and can run above the 16 MB line. Multiple Natural sessions can be started in parallel within one TSO region, and you can toggle between the sessions by means of a SWAPKEY (see the corresponding subparameter of profile parameter TSOP in the *Parameter Reference* documentation).

---

## Driver Parameters for the Natural TSO Interface

For information on the driver parameters that are available for the Natural TSO Interface, refer to the description of profile parameter TSOP or parameter macro NTT SOP in the *Parameter Reference* documentation.

---

## Data Sets Used by Natural under TSO

The following data sets are required if certain functions are used during a Natural TSO session:

CMEDIT	Software AG Editor Work File
CMHCOPY	Hardcopy Print Output
CMPLOG	Dynamic Profile Parameter Report Output
CMPRMIN	Dynamic Profile Parameter Input
CMPRT <i>nn</i>	Additional Reports 01-31
CMTRACE	External Trace Output

NATRJE	Job Submit Output
STEPLIB	Load Library for External Modules
CMWKFnn	Work Files 01-32

These data sets are described below.

Unless otherwise stated below, the default DCB RECFM/LRECL information is as follows:

RECFM=FB and LRECL=80 for sequential input data sets

RECFM=FBA and LRECL=133 for sequential output data sets

### CMEDIT - Software AG Editor Work File

The Software AG editor work file VSAM data set is required if a local or global Software AG editor buffer pool is to be used. If not defined in the JCL or by TSO command ALLOC, the name of the Editor work file specified by subparameter DSNAME of profile parameter EDBP or parameter macro NTEDBP is used by Natural to do the dynamic allocation for the Editor work file.

Alternatively, profile parameter EDPSIZE can be used to run with an auxiliary editor buffer pool, which does not require an editor work file. For more information about the installation of the Software AG editor, refer to *Installing the Software AG Editor on z/OS* in the *Natural Installation for z/OS* documentation.

### CMHCOPY - Hardcopy Print Output

The default name of the hardcopy print output data set is CMHCOPY. It can be changed by one of the following:

- the DEST subparameter of profile parameter PRINT for Print File 0,
- the profile parameter HCDEST, which is an equivalent of PRINT=((0),DEST=...),
- the setting of the system variable \*HARDCOPY during the session,
- the terminal command %H during the session.

The subparameters of the PRINT profile parameter for Print File 0 can be used to change the default values for the hardcopy data set. The default data set name CMHCOPY implies CLOSE=FIN for the hardcopy print data set, that is, after the data set is opened for output, any subsequent change of the hardcopy print output data set name is not honored. If a different name is defined at open time, the hardcopy data set will be closed upon the next terminal I/O.

During the session, the hardcopy data set can be released and reallocated (before open or after close) by the by dynamic allocation (see Natural Application Programming Interface USR2021N).

## **CMPLOG - Dynamic Profile Parameter Report Output**

If the profile parameter `PLOG` is set to `ON` and data set `CMPLOG` is available, the evaluated dynamic profile parameters are written to this data set during session initialization. If data set `CMPLOG` is not available, the evaluated dynamic profile parameters are written to the TSO terminal in line mode.

## **CMPRMIN - Dynamic Profile Parameter Input**

If available, this data set is read during session initialization to get dynamic profile parameters. Only the first 72 positions of each record are used to build a dynamic profile parameter string.

Any other profile parameters which are passed directly for the start of the Natural nucleus, for example, by the TSO `CALL` command, are concatenated at the end of the parameter string which is build from the input of `CMPRMIN`; that is, these can be used to overwrite the parameters from `CMPRMIN`.

## **CMPRTnn - Additional Reports 01-31**

These data sets can be used by Natural print file statements like `WRITE (nn)`. If no DCB information (for example, `RECFM`, `LRECL`, `BLKSIZE`) is available, the defaults are defined by the profile parameter `PRINT` or by the macro `NTPRINT` in the Natural parameter module. The print file data set names can be overwritten by subparameter `DEST`.

## **CMTRACE - External Trace Output**

If the profile parameter `ETRACE` is set to `ON`, or if the equivalent terminal command `%TRE+` was issued, any Natural trace output during the session is written to the `CMTRACE` data set. To define the Natural components that shall be traced, the profile parameter `TRACE` is required.

If data set `CMTRACE` is not available, it will be allocated dynamically as

```
//CMTRACE DD SYSOUT=*
```

when the first trace record is to be written.

## NATRJE - Job Submit Output

This data set is used for the Natural job submitting utility. If it is not defined, it will be allocated dynamically as

```
//NATRJE DD SYSOUT=(A,INTRDR)
```

when the first job is submitted.

## STEPLIB - Load Library for External Modules

STEPLIB is the default load library name for loading external modules, for example, the shared nucleus (profile parameter NUCNAME), a separate Adabas link routine module (profile parameter ADANAME), the session back-end program (profile parameter PROGRAM) and any external subprograms not linked to the Natural parameter module.

The load library name can be overwritten by profile parameter LIBNAM. The specified load library name must be defined in the TSO job control or by an ALLOC statement, for example, in the CLIST which starts the Natural session.

## CMWKFnn - Work Files 01-32

These data sets can be used by Natural work file statements like READ WORK FILE *nn* and WRITE WORK *nn*. If no DCB information (RECFM, LRECL, BLKSIZE, etc.) is available in the JCL or in the VTOC entry for the data set, the defaults are defined by the WORK profile parameter or by the NETWORK macro in the Natural parameter module. The work file data set names can be overwritten by subparameter DEST.

## Issuing TSO Commands from Natural under TSO

You can use the Natural example program TSO in library SYSEXTP to issue TSO commands; for example:

```
TSO LISTALC STATUS
```

If you enter TSO without parameters, a menu prompts you for a TSO command. To exit from the menu, enter a period (.) in the first position, or press PF3.



# VII

## Natural under TIAM

---



# 44 Natural under TIAM

---

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This document describes the functionality of the Natural TIAM interface (product code NRT) and the operation and individual components of Natural in a TIAM environment.

**Related Documents:**

- *Natural Nucleus Components* in the *Installation* documentation.
- *Installing Natural TIAM Interface on BS2000* in the *Installation* documentation.
- *Natural under BS2000* in the *Operations* documentation.

## Structure of the Natural TIAM Interface

---

The Natural TIAM interface consists of two components:

- the non-reentrant front-end part
- the reentrant part NATRENT (default)

Both components are elements of the macro NAMTIAM and are generated with two separate assembly runs; see also [Parameters in Macro NAMTIAM](#), parameter CODE.

The *front-end part* is generally linked with the Adabas interface module ADALNK to form the initialization routine which is run once only during the establishment of a Natural under TIAM session. During the initialization phase, based on the operand values of the corresponding parameters, various functions, for example, the establishment/connection to the Natural buffer pool, loading or linking of the Natural nucleus, establishing the physical terminal buffer, are executed. The front-end part must be loaded for each user (task).

The *reentrant part* NATRENT is linked as a modular element to the Natural nucleus and contains various entry points for TP system dependent routines (memory management, terminal communication, etc.). If a shared Natural nucleus is to be used, the generated NATRENT module must be linked to the front-end part.

The Natural nucleus is completely environment-independent (shared code) and must be loaded only once for all users.

## Parameters in Macro NAMTIAM

The macro `NAMTIAM` has to be generated twice: for the front-end part of the Natural TIAM Interface and for the reentrant part. For which part it is generated is determined by the parameter `CODE` in the `NAMTIAM` macro.

For the generation of the front-end part and the reentrant part, a label can be provided in the macro call to `NAMTIAM`. This label defines the CSECT name, under which the module is stored in the module library. If no label is specified, the name for the front-end part is `NATFRONT` and the name for the reentrant part is `NATRENT`.

### Example of NAMTIAM Macro for Front-End Part:

```
NATTESTF NAMTIAM CODE=FRONT,NUCNAME=NB2RENT,PARMOD=31
```

In this example, the CSECT name of the front-end part is defined as `NATTESTF`.

### Example of NAMTIAM Macro for Reentrant Part:

```
NATTESTR NAMTIAM CODE=RENT,CLRKEY=K4,PARMOD=31
```

In this example, the CSECT name of the reentrant part is defined as `NATTESTR`.

### Parameters:

The individual parameters which can be specified in macro `NAMTIAM` are explained below:

`ADACOM` | `ADDBUFF` | `APPLNAM` | `ATTKEY` | `CLRKEY` | `CODE` | `CURPRO` | `DELETE` | `DYNPAR` | `HCASK` | `ILCS` | `LF` | `LINK` | `LINK2/LINK3/LINK4` | `NUCNAME` | `PARMOD` | `PFK` | `REFRKEY` | `REQMLOC` | `SYSDTA` | `TIMESTMP` | `TRACE` | `TTYLS` | `TTYPS` | `T975X` | `USERID` |

### ADACOM - Usage of Adabas Link Module

This parameter applies to the generation of the Natural environment-dependent nucleus (see in the *Installation* documentation). It determines which Adabas link module is to be used. Possible values are:

Value:	Explanation:
ADAUSER	The module ADAUSER is linked to the environment-dependent nucleus.
ADABAS	The module ADAUSER is linked to the environment-dependent nucleus.
ADALNK	The module ADALNK is linked to the environment-dependent nucleus or the modules ADALNK and SSFB2C are linked to the environment-dependent nucleus.  This is the default value.

In any case a resolve to the Adabas module library has to be given in the linkage step for the environment-dependent nucleus.

### ADDBUFF - Additional Number of Pages

This parameter applies to the generation of the front-end part. It determines the additional number of pages for the terminal I/O buffer. Possible values are:

Value	Explanation
1 to 8 or no operand	Additional number of pages in 4 KB units.
no operand	By default, no operand is specified.

### APPLNAM - Application Name

This parameter applies to the generation of the front-end part. Possible values are:

Value	Explanation
<i>name</i>	The name (maximum 8 characters) of the Natural TIAM application. This name is part of the serialization ID when the Natural TIAM task is initialized.
NATTIAM	This is the default value.

### ATTKEY - Interrupt Mode

This parameter applies to the generation of the reentrant part. Possible values are:

Value	Explanation
ON	Pressing the K2 key on your terminal is intercepted by an STXIT routine. Natural creates an ATTENTION INTERRUPT and returns a NAT1016 error message.
OFF	Pressing the K2 key leads to a normal BS2000 interrupt. This is the default value.

### CLRKEY - Alternate Clear Key

This parameter applies to the generation of the reentrant part.

This parameter can be used to define an alternate CLEARKEY in addition to LSP and DUE1. Possible values are:

Value	Explanation
K1 to K4, F1 to F4, DUE2	Name of alternate CLEARKEY.
K4	This is the default value.

### CODE - Generation Mode

This parameter applies to the generation of both the front-end and reentrant parts.

It determines which part of the Natural TIAM Interface is to be generated. Possible values are:

Value	Explanation
FRONT	Indicates the generation/assembly of the front-end part. This is the default value.
RENT	Indicates the generation/assembly of the reentrant part.

### CURPRO - Cursor Positioning on Protected Fields

This parameter applies to the generation of the non-reentrant part.

It controls whether the cursor can be positioned to a protected field. Possible values are:

Value	Explanation
ON	The cursor <i>cannot</i> be positioned to a protected field. This is the default value.
OFF	The cursor can also be placed in a protected field (for example, for field-specific help functions).

### DELETE - Deletion of Dynamically Loaded Programs

This parameter applies to the generation of the reentrant part. Possible values are:

Value	Explanation
ON	The setting of the profile parameter DELETE in the Natural parameter module determines whether dynamically loaded non-Natural programs are unloaded at the end of the Natural program in which they are loaded or whether they are unloaded when command mode is entered. This is the default value.
OFF	A dynamically loaded non-Natural program once loaded is kept for the duration of the whole Natural session.

### DYNPAR - Reading of Dynamic Parameters

This parameter applies to the generation of the non-reentrant part. Possible values are:

Value	Explanation
DIALOG	The dynamic parameters are read from terminal input.
YES	The dynamic parameters are read from terminal input. YES has the same effect as DIALOG; it is kept for compatibility reasons.
YES, LC or DIALOG, LC	Same as DIALOG or YES. However, the parameter string is not translated to upper case.
SYSDTA	The dynamic parameters are read from SYSDTA.
SYSIPT	The dynamic parameters are read from SYSIPT.
FILE	The dynamic parameters are read from a sequential file. The input of this SAM file is interpreted as one single text string, which means that the individual entries must be separated from each other by a comma, even at the end of a line. Such a parameter file must be defined with a FILE command by using the LINK parameter CMPRMIN.  See also the example given below.
NO	No dynamic parameters are read from terminal input.  This is the default value.

Example for DYNPAR=FILE:

```
/FILE NAT.PARAMS, LINK=CMPRMIN
```

### HCASK - Hardcopy Output Device Specification

This parameter applies to the generation of the reentrant part.

It determines whether a user is asked to specify an output device each time he or she produces a hardcopy (with terminal command %H). Possible values are:

Value	Explanation
ON	The user is asked to specify a device for each hardcopy.  This is the default value.
OFF	The device used for the previous hardcopy is used again.

## ILCS - Invoking 3GL Subprograms

This parameter applies to the generation of the reentrant part. Possible values are:

Value	Explanation
CRTE	3GL subprograms are invoked with common runtime environment convention. To be able to do so, the ILCS initialization routine <code>ITOSL#</code> must be linked to the Natural environment-dependent nucleus (see the <i>Installation</i> documentation), as shown below:  <pre>INCLUDE ITOSL#,SYSLNK.CRTE.010 RESOLVE,SYSLNK.CRTE.010</pre>
YES	3GL subprograms are invoked with enhanced ILCS linkage convention. To be able to do so, the ILCS initialization routine <code>ITOINITS</code> must be linked to the Natural environment-dependent nucleus (see the <i>Installation</i> documentation), as shown below:  <pre>INCLUDE ITOINITS,SYSLNK.ILCS RESOLVE,SYSLNK.ILCS</pre>
NO	Standard processing applies.  This is the default value.

## LF - Line Advance Control Character

This parameter applies to the generation of the non-reentrant part.

With this parameter you specify the control character to be used for line advance when printing on the local printer. Possible values are:

Value	Explanation
X 'zz'	Control character.
X '25'	This is the default value.

## LINK - Linking Programs and Modules

This parameter applies to the generation of the non-reentrant part. Possible values are:

Value	Explanation
<i>name</i> ( <i>name</i> , <i>name</i> ,...)	The <i>name(s)</i> of programs and modules that are called from Natural programs and linked with the non-reentrant part must be specified with this parameter. See below.

No default value is provided.

Conversely, the programs and modules whose names are specified must be linked with the non-reentrant part, otherwise the application is put into status `SYSTEMERROR` and all users are rejected with an error message.

A `TABLE` macro call is performed for the specified programs and modules, which enters their load addresses into the dynamic loader's link table. It is therefore not necessary to dynamically load these programs when they are called by Natural programs.

**Example:**

```
LINK=PROG1
LINK=(PROG1,PROG2,MODUL111)
```

### LINK2/LINK3/LINK4 - LINK Parameter Operand Extensions

These parameters apply for the generation of the non-reentrant part.

The parameters `LINK2`, `LINK3` and `LINK4` are an extension of the `LINK` parameter. Since an operand definition cannot be longer than 127 characters (including parentheses), these parameters are provided for cases where the operand of parameter `LINK` would be too long. The syntax is analogous to that of `LINK`. Possible values are:

Value	Explanation
<i>name</i> ( <i>name</i> , <i>name</i> , ...)	The name(s) of programs and modules that are called from Natural programs and linked with the non-reentrant part must be specified with this parameter.

No default value is provided.

**Examples:**

```
NAMTIAM LINK=(PROG1,PROG2,...),
          LINK2=(PROG54,...)
```

```
NAMTIAM LINK=(PROG1,PROG2,PROG3,PROG4)
```

### NUCNAME - Name of Reentrant Natural Module

This parameter applies to the generation of the non-reentrant part.

With this parameter you specify the name of the bounded, reentrant Natural module. You must use this name for the Natural pool and load information in macro `ADDON` (`BS2STUB` assembles macro `ADDON`). Possible values are:

Value	Explanation
<i>name</i>	The name of the bounded, reentrant Natural module.
NB2RENT	This is the default value.

### PARMOD - Application Address Mode and Location

This parameter applies to the generation of both the non-reentrant part and the reentrant part.

The first part of this parameter *nn* is used to define an addressing mode (24-bit or 31-bit mode) for the Natural TIAM application.

The second part of this parameter *loc* is used to define the front part location of the Natural TIAM application. If you load the Natural environment-dependent nucleus (see the *Installation* document-ation), this must be defined in the environment-dependent nucleus link procedure as follows:

```
LOADPT=*XS
```

```
LOADPT=X 'address'
```

Possible values are:

Value	Explanation
<i>nn</i>	24/31
<i>loc</i>	BELOW/ABOVE
(31, ABOVE)	This is the default value.

#### Example:

```
/EXEC TSOLINK
PROG NATvrs, FILENAM=NATvrs, LOADPT=*XS, ...
TRAITS RMODE=ANY, AMODE=31
INCLUDE.../*
PARMOD=(nn, loc) MUST BE IDENTICAL IN THE NON-REENTRANT AND REENTRANT PART
```

where *vrs* represents the relevant product version.

### PFK - Function Key Mode

This parameter applies to the generation of the non-reentrant part. It is used to set one of the following function-key modes:

Value	Explanation
(KN, y)	Either literals %K1 to %K20 and send-key code D or send-key codes F1 to F20 are loaded to the function keys; this depends on the device type.  Where y can be either L or N: - "L" means that the function keys are loaded; N means that the corresponding mode is activated, but function keys will not be loaded.
(K0, y)	The literals 01 to 20 and send-key code F5 are loaded to the function keys.
(KS, y)	The literals A to T and send-key code F5 are loaded to the function keys; in addition, with every output message a dummy field is generated at the last two positions of the screen. This dummy field is used to receive and pass the key value.
OFF	No function key mode is generated.
(KS, L)	This is the default value.

### REFRKEY - Refresh Key

This parameter applies to the generation of the reentrant part.

It can be used to define a function key. If this function key is pressed, the last full Natural screen is refreshed. Thus it is possible to continue the dialog with Natural after the screen has been overwritten by messages from the operator or the operating system. Possible values are:

Value	Explanation
K1 to K14	Function key designation.
NO	No function key defined.
K14 (keys ESC + :)	This is the default value.

The send-key code is not passed to the Natural application. The interface sets the Natural key code to ENTER.

The key defined with the REFRKEY parameter must be different from the one defined with the CLRKEY parameter.

## REQMLOC

This parameter applies to the generation of both the non-reentrant part and the reentrant part in 31-bit mode (`PARMOD=31`).

It determines where the requested Natural work areas are to be allocated via request memory by the system. Possible values are:

Value	Explanation
BELOW	All areas are requested below 16 MB.
ABOVE	All areas are requested above 16 MB.
RES	All areas are requested depending on the location of the reentrant part.  This is the default value.

The `REQMLOC` parameter corresponds to the `LOC` parameter of the BS2000 system macro `REQM`.

## SYSDTA

This parameter applies to the generation of the front-end part. Possible values are:

Value	Explanation
PRIMARY	After reading of dynamic Natural parameters from SYSDTA, SYSDTA is set to SYSFILE SYSDTA=( PRIMARY ).  This is the default value.
SYSCMD	After reading of dynamic Natural parameters from SYSDTA, SYSDTA is set to SYSFILE SYSDTA=( SYSCMD ).

## TIMESTMP

This parameter applies to the generation of the non-reentrant part.

It determines the timebase for all system variables and timestamps derived from the machine time.

Possible values:

Value	Explanation
TIMESTMP=UTC	Timebase is UTC (former GMT).  This is the default.
TIMESTMP=LOCAL	Timebase is the local machine time

### TRACE - Trace File Number and Print Record Length

This parameter applies to the generation of the reentrant part.

With this parameter, you specify the number of a trace file and the maximal length of a trace print record. Possible values are:

Value		Explanation
(nn ,ll)	nn:	01...99 nn is the number for the SYSLSTnn trace file.
	ll:	71...132 ll is the maximal length in characters of a trace print record.
(99,71)	This is the default value.	

If any external Natural trace function is active, the trace records will be written to SYSLSTnn. In this case, the Natural TIAM driver creates the following trace file:

**Example:**

```
NATURAL.TRACE.TIAM.TTTT,SPACE=(30,3)
SYSFILE SYSLSTnn=NATURAL.TRACE.TIAM.TTTT
/* TTTT is the task sequence number
```

Before the Natural TIAM session is terminated, the trace file will be closed as follows:

```
SYSFILE SYSLSTnn=(PRIMARY)
```

### TTYLS - Line Length for Telex Machine

This parameter applies to the generation of the non-reentrant part.

With this parameter you can adjust Natural's physical line length to different paper formats used with a telex machine. Possible values are:

Value	Explanation
nn	nn specifies the physical line size for TTY devices.
80	This is the default value.

### TTYPS - Page Size for Telex Machine

This parameter applies to the generation of the non-reentrant part.

With this parameter you can adjust Natural's physical page size to different paper formats used with a telex machine. Possible values are:

Value	Explanation
<i>nn</i>	<i>nn</i> specifies the physical page size (number of lines) for TTY devices.
24	This is the default value.

### T975X - Device-Type-Specific Message Optimization

This parameter applies to the generation of the non-reentrant part.

It is used to determine for which device types messages are to be optimized when using data stations which were generated in PDN as 9750. Possible values are:

Value	Explanation
9750, 9755, 9756 or 9763	Device type.
9750	This is the default value.

### USERID - Natural User ID

This parameter applies to the generation of the non-reentrant part. Possible values are:

Value	Explanation
SYSTEM or YES	The Natural user ID is created by using the BS2000 user ID.
USER or NO	The Natural user ID is created by using the job name; that is, the / .JOBNAME of the LOGON command. If no BS2000 job name has been specified with the LOGON command, the Natural user ID is created as with USERID=SYSTEM or USERID=YES.  This is the default value.

## Common Memory Pools under TIAM

---

You use the macro `ADDON` (which assembles module `BS2STUB`) either to generate the local common memory pools, or to define attachment to the global common memory pools.

The programs `CMPSTART` and `CMPEND` start and stop *global* common memory pools. They are described in the section *Global Common Memory Pools* in the *Natural Operations* documentation.

A Natural TIAM application needs the following common memory pools:

- **Natural load pool**  
The linked reentrant part of Natural is loaded into this common memory pool.
- **Natural buffer pool**  
The executable Natural programs and the Natural global data areas are loaded into this common memory pool. Those compiled Natural programs whose objects are reentrant are executed from this memory pool.
- **Natural/Adabas nucleus communication memory pool**  
Natural connects to an additional common memory pool which is established by Adabas during startup.

The sum of the memory assigned to common memory pools, as well as the local area of the Natural environment-dependent nucleus (see the *Installation* documentation), must completely fit into the virtual user address space.

If the Adabas pool exceeds the user address space, error message 148 is produced during the `OP` command execution. At the beginning of the session, Natural issues the error message `NAT8148` and, in the following session termination, the message `NAT9989` (incorrect system file).

## Environment-Independent Nucleus

---

For TIAM applications, it is possible to use a common environment-independent nucleus. The rules that apply in this case are documented in the relevant section in the *Natural Installation* documentation.

# VIII

## Natural under openUTM

---

This document describes the functionality of the Natural *openUTM* Interface (product code NUT) and the operation and individual components of Natural in an *openUTM* environment.

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**Embedding Natural in an *openUTM* Application**

**Common Memory Pools**

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**Generating KDCROOT**

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**NATUTM Macro Parameters**

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[Utility Programs for Use with Natural under \*openUTM\*](#)  
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[openUTM TACCLASS Concept \(Priority Control\)](#)  
[Generating a Natural \*openUTM\* Application](#)  
[Optimizing Natural \*openUTM\* Applications](#)  
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**Related Documents:**

- *Installing Natural openUTM Interface on BS2000* in the *Installation for BS2000* documentation.
- *Natural under openUTM Error Messages* in the *Messages and Codes* documentation.
- *Error Messages from the Natural Swap Pool Manager Valid under CICS and openUTM* in the *Messages and Codes* documentation.
- *Natural under BS2000* in the *Natural Operations* documentation.
- *Statements for Internet and XML Access* in the *Programming Guide*

**Notation** *vrs* or *vr*

When used in this document, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

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## Structure of the Natural openUTM Interface

---

The Natural *openUTM* Interface consists of the macros NATUTM, BS2STUB and NURENT and of several utility programs, which enable special requirements to be accommodated.

- Non-Reentrant Part - Macro NATUTM
- Reentrant Part - Macro NURENT

### Non-Reentrant Part - Macro NATUTM

The macro NATUTM is used to generate the non-reentrant part of the Natural *openUTM* Interface to suit the particular application based on appropriate operand definitions for the parameters. The default values of the parameters are chosen so that, in general, they can be used without alteration for an initial generation.

The front-end part is present once per *openUTM* task and consists principally of the following components:

- KDCROOT of *openUTM*,
- assembled macro NATUTM,
- assembled macro BS2STUB,
- format exit module FREXIT,
- Adabas interface module.

### Reentrant Part - Macro NURENT

The reentrant part of the Natural *openUTM* Interface is generated by assembling the macro NURENT. This is linked with the reentrant part of the Natural *openUTM* application. If a shared Natural nucleus is to be used, the generated NURENT module must be linked to the front-end part.

The reentrant part of the Natural *openUTM* application consists of the following components:

- NATINV (address module) (must be included as the first module),
- Natural nucleus,
- Natural buffer pool manager,
- NURENT (CSECT name of the assembled macro NURENT),
- NATSWPMG (Natural swap pool manager),
- Natural parameter module,
- NATLAST (end definition) (must be included as the last module).

The reentrant part of the Natural *openUTM* Interface is only present once in a Natural *openUTM* application (reentrant) if it is loaded into class 4 storage or into a *common memory pool* in class 6 storage. The latter is recommended.

A further possibility is to link the reentrant part with the non-reentrant front-end part of the Natural *openUTM* application.

The Natural and *openUTM* macro libraries are required when assembling NATUTM, NURENT and all utility programs.

## Formatting Messages - FREXIT

- [Format Exit Module FREXIT](#)
- [FREXIT Macro](#)

### Format Exit Module FREXIT

Natural uses its own formatting routines when sending messages to the VDU (*openUTM* format type “minus”). Messages are processed by the format exit module FREXIT (transfer from logical to physical I/O domain and vice versa, producing RESTART and LOGOFF messages, etc.).

The module FREXIT must be linked with the front-end part of the Natural *openUTM* application and it must be defined as the format exit module when generating KDCROOT or KDCDEF.

#### Example:

```
PROGRAM FREXIT,COMP=ASSEMB
EXIT PROGRAM=FREEEXIT,USAGE=FORMAT
```

The program FREXIT supports the format name -END for the LOGOFF message. See the description of the parameter LOFFMAP of the macro NATUTM. No more *openUTM* administration commands (KDCINF, KDCSHUT N, etc.) can be entered after the format name -END has been used and the LOGOFF message has been output. The LOGOFF message is output in formatted mode; however, *openUTM* expects administration commands in line mode and therefore any input results in a syntax error. After this error message has been received, all valid administration commands can be input with the administration ID. The messages for asynchronous messages, RESTART and LOGOFF can be changed to suit specific requirements by changing the appropriate text constants in the program FREXIT.

The program FREXIT has a user exit INPTEX that can be satisfied by the utility program INPTEX. See the descriptions of the programs NATDUE and INPTEX in the section *Utility Programs*.

Another user exit in program FREXIT is TRMIOEX, which can be used for input/output message control.

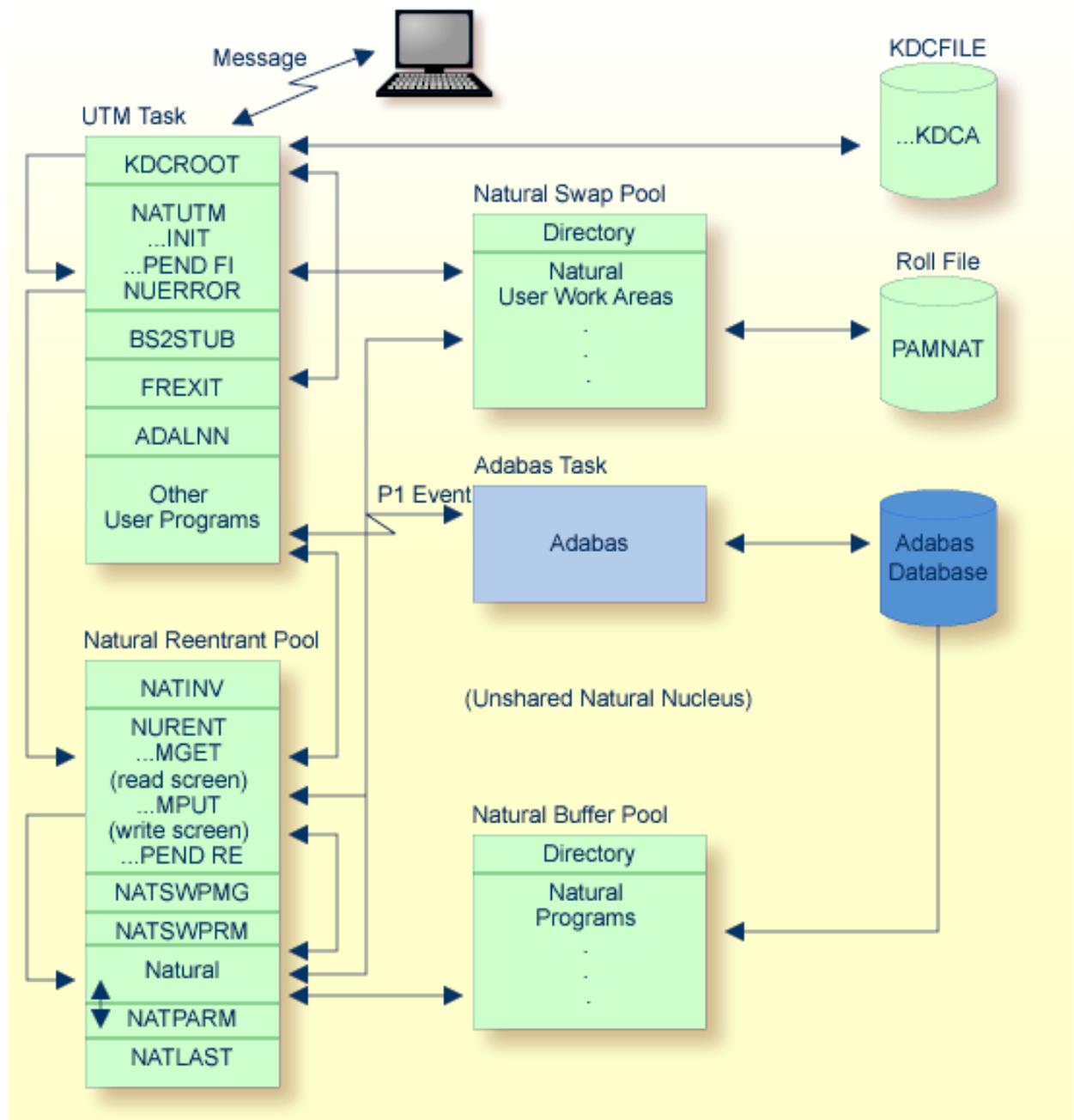
## **FREEEXIT Macro**

The macro `FREEEXIT` contains the following parameters:

<code>AMSG=ASAP</code>	If there are any “free-running” (asynchronous) messages, a further dialog with Natural is only possible if these messages have previously been read with the command <code>KDCOUT</code> .
<code>AMSG=WAIT</code>	(Default) A further dialog with Natural is possible even if any “free-running” messages have not yet been read with the command <code>KDCOUT</code> .
<code>KDCDISP=YES</code>	(Default) <code>KDCDISP</code> is supported by a restart message with an automatic <code>ENTER</code> . The last screen output will be refreshed.
<code>KDCDISP=NO</code>	<code>KDCDISP</code> is supported by a restart message with a following refresh screen.

If you want to change a default operand of macro `FREEEXIT`, you must reassemble `FREEEXIT`.

## Embedding Natural in an openUTM Application



## Common Memory Pools

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The following topics are covered:

- [Natural Buffer Pool under openUTM](#)
- [Natural Swap Pool under openUTM](#)
- [Loading Natural in a Common Memory Pool - Natural Load Pool](#)
- [Natural Monitor Pool](#)

### Natural Buffer Pool under openUTM

Natural requires a common area into which Natural programs can be read from the Adabas database and where they are also executed. This common memory pool is the Natural *buffer pool*.

You use the parameters of macro `ADDON` (which assembles module `BS2STUB`) either to define a local Natural buffer pool, or to define the connection to a global Natural buffer pool. For more information, see *ADDON Macro* in the *Natural Operations* documentation.

You use the parameters of module `CMPSTART` to define a global Natural buffer pool. For more information on this module, see *CMPSTART Program* in the *Natural Operations* documentation.

To display statistical information about the buffer pool, use the Natural utility *SYSBPM*; see the *Natural Utilities* documentation.

### Natural Swap Pool under openUTM

A Natural user work area is required for each online Natural user. This user work area must be in the computer's main store whenever the user initiates any form of dialog transaction. To reduce the frequency with which the user work area is rolled out to the swap file and rolled in again, it is possible to set up a Natural Swap Pool. For details on the swap pool, please refer to *Natural Swap Pool* in the *Natural Operations* documentation.

You use the parameters of macro `ADDON` (which assembles the module `BS2STUB`) either to define a local Natural swap pool, or to define the connection to a global Natural swap pool. For more information, see *ADDON Macro* in the *Natural Operations* documentation.

You use the parameters of module `CMPSTART` to define a global Natural swap pool. For more information, see *CMPSTART Program* in the *Natural Operations* documentation.

## Loading Natural in a Common Memory Pool - Natural Load Pool

The reentrant part of the Natural *openUTM* application can be loaded in class 4 storage or linked with the front-end part of the Natural *openUTM* application. Alternatively, it can be loaded in a common memory pool in class 6 storage. This last method is recommended. The amount of storage required in the common memory pool depends upon the size of the linked reentrant part of the Natural *openUTM* application; this can be read from the linker listing. The parameter `NUCNAME` of macro `NATUTM` is used if Natural is to be loaded into a common memory pool in class 6 storage. This parameter specifies the name of the linked, reentrant Natural nucleus. This is also the name of the Natural load pool. See also [Parameters of Macro NATUTM](#).

You use the parameters of macro `ADDON` (which assembles module `BS2STUB`) either to define a local Natural load pool, or to define the connection to a global Natural load pool (shared Natural nucleus). For more information, see *ADDON Macro* in the *Natural Operations* documentation.

You use the parameters of module `CMPSTART` to define a global Natural load pool (shared Natural nucleus). For more information, see *CMPSTART Program* in the *Natural Operations* documentation.

## Natural Monitor Pool

The Natural Monitor utility requires a common memory pool for data storage. This common memory pool is allocated when the Monitor utility is activated, and released when the Monitor utility is deactivated.

You use the parameters of macro `ADDON` (which assembles module `BS2STUB`) either to define a local Natural monitor pool, or to define the connection to a global Natural monitor pool. For more information, see *ADDON Macro* in the *Natural Operations* documentation.

You use the parameters of module `CMPSTART` to define a global Natural monitor pool. For more information, see *CMPSTART Program* in the *Natural Operations* documentation.

For details on the Monitor utility, see *SYSTP Utility* in the *Natural Utilities* documentation.

## Other Storage Areas

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- [Natural User Thread](#)
- [Natural User Work Area Asynchronous Write Buffer](#)
- [Natural User Area for Asynchronous Transactions](#)

- [Natural Roll File - LINK=PAMNAT](#)

## Natural User Thread

For each *openUTM* task a storage area with a size of `MAXSIZE` is generated. This area contains the Natural user area in decompressed form.

## Natural User Work Area Asynchronous Write Buffer

The Natural user work area can be written out either asynchronously (“write without wait”) or synchronously (“write with wait”).

If the asynchronous option is used (this is the default option), a write buffer having the size of defined operand for parameter `ROLLTSZ` is generated for each *openUTM* task. Using this technique, the compressed user work area is copied from the swap pool into the write buffer, the asynchronous write is started and processing can continue immediately. This option gives better performance, but at the cost of increased storage.

If roll-outs are to be performed synchronously, the parameter `ROLLACC` must have the value `UPAM-SY`. In this case, it is not necessary to allocate a write buffer. Processing is suspended until the user work area has successfully been written to the swap file.

## Natural User Area for Asynchronous Transactions

A storage area of `MAXSIZE` is allocated for each asynchronous transaction in a Natural *openUTM* application (Natural user work area for this transaction). It is released at the end of the transaction. The Natural swap pool is not used to store the user work area associated with asynchronous transactions. Every Natural program that runs asynchronously must end with a `TERMINATE` statement; that is, the *openUTM* DC transaction is ended with `PEND 'FI(NISH)'`. This applies to asynchronous transactions both within an application and between two Natural *openUTM* applications; see also [Asynchronous Transaction Processing under openUTM](#).

## Natural Roll File - LINK=PAMNAT

A PAM file is required for swapping the Natural user work areas. Writing to and reading from this file is done by physical chained PAM-I/O. However, this is only possible as long as the swap file does not cross an extent boundary. This can be checked using `SPPCNTRL`.

The `LINK` name of the Natural swap file is `PAMNAT`. The size of the roll file can be computed as follows:

$$NP = ([ (MS+4+31) / 32 ] * 32 * NT + 4) / 2$$

where:

NP	Size of data set in PAM pages
MS	Parameter <code>ROLLTSZ</code> in Kbytes, rounded up to next even number
NT	Number of terminals online

### Example:

`ROLLTSZ` = 80 Kbytes (per user), number of terminals online = 40

$$\begin{aligned}
 \text{Size of data set} &= ( [ ( 80 + 4 + 31 ) / 32 ] * 32 * 40 + 4 ) / 2 \\
 &= ( [ 115 / 32 ] * 32 * 40 + 4 ) / 2 \\
 &= ( [ 3.59375 ] * 32 * 40 + 4 ) / 2 \\
 &= ( 3 * 32 * 40 + 4 ) / 2 \\
 &= 3844 / 2 \\
 &= 1922 \text{ PAM pages}
 \end{aligned}$$

FILE statement:

```
/FILE NATUTM.SWAPFILE, LINK=PAMNAT, SPACE=(1922,96)
```

When a local swap pool is used, each Natural *openUTM* application requires its own Natural swap file. When a user logs on to the application, the Natural *openUTM* Interface checks whether there is sufficient space available for the new user in the Natural roll file. If there is not enough space, error message NUS0033 is output.

When a global swap pool is used, all Natural *openUTM* applications which are connected to the same global swap pool must use the same Natural roll file.

## Generating KDCROOT

The following Natural-specific definitions must be entered when generating KDCROOT for a Natural *openUTM* application:

```

MAX KB=400, SPAB=8192, NB=5120, TRMSG LTH=5120 (see Note 1)
PROGRAM NUSTART, COMP=ASSEMB (see Note 2)
PROGRAM NUERROR, COMP=ASSEMB (see Note 2)
TAC NAT, PROGRAM=NUSTART, EXIT=NUERROR (see Note 2)
EXIT PROGRAM=FREEIT, USAGE=FORMAT (see Note 3)
PROGRAM FREEIT, COMP=ASSEMB (see Note 3) ←

```

Note	
1	<p>The area needed for the <i>openUTM</i> KB has a minimum length of 400 bytes. The necessary KB length for operand <math>KB=nnn</math> in the <code>MAX</code> parameter of <code>KDCDEF</code> must be calculated as follows:</p> <p>Fixed KB length is 400 bytes            + length of KB user extension (parameter <code>KBUSEXT</code>)            + length of dynamic parameter save area (parameter <code>SVDYPRM</code>)            + (only if <code>MULTI-PASS</code> is used) length of session key areas, which has to be calculated as follows: <math>n * 72</math>, where <math>n</math> is the number of parallel session minus 1</p> <p>The <i>openUTM</i> I/O areas <code>NB</code> and <code>TRMSLGTH</code> need a length of 5120 bytes.</p>
2	<p>In a Natural <i>openUTM</i> application there is as a rule only one user-specific <i>openUTM</i> partial program.</p> <p>This program is the front-end part of the Natural <i>openUTM</i> Interface, which must be defined in the adequate parameters of <code>KDCDEF</code> under the name specified in the operand of the parameter <code>CSECT</code> of macro <code>NATUTM</code> (default = <code>NUSTART</code>).</p> <p>Any number of <i>openUTM</i> transaction codes can be assigned, providing the naming rule is observed.</p> <p>The name of the DC transaction exit routine <code>NUERROR</code> must be defined for the front-end part of the Natural <i>openUTM</i> Interface and for each other <i>openUTM</i> partial program.</p>
3	<p>The format exit module <code>FREXIT</code> must be defined with the parameters <code>EXIT</code> and <code>PROGRAM</code>.</p>

All other definitions relating to the generation of `KDCROOT` are either specific to *openUTM* or else they are dependent upon the values defined in the operands of the appropriate **parameters of macro `NATUTM`**.

## Defining the openUTM Resources - KDCDEF

The following Natural-specific points must be observed when defining the *openUTM* resources:

- [Special Definition for Type 9755/9756 Terminals](#)
- [Treatment of K Keys and F Keys](#)
- [Support of 3270-Type Terminals](#)

- Support of TTY Terminals

### Special Definition for Type 9755/9756 Terminals

The `TERMN` operand of the `PTERM` command must be set to the value `X1` or `FG` for 9755-type terminals and to the value `X2` for 9756-type terminals. These are special values and not described in the appropriate table in the *openUTM* documentation.

For all other types of terminals, the `TERMN` operand must be set to the value shown in the tables.

#### Example:

```
PTERM ss19,lterm=ltdf1900,pronam=vr,ptype=t9755,TERMN=X1
```

### Treatment of K Keys and F Keys

The Natural *openUTM* Interface supports the function keys `K1`, `K2`, `K3`, `K4`, `F1`, `F2`, `F3`, `F4` and `F5` (for P keys). The function key which has been pressed can be identified by means of the *openUTM* return code, which must be defined using the `SFUNC` statement of `KDCDEF`:

```
SFUNC K1,RET=26Z
SFUNC K2,RET=27Z
SFUNC K3,RET=28Z
SFUNC K4,RET=29Z
SFUNC F1,RET=21Z
SFUNC F2,RET=22Z
SFUNC F3,RET=23Z
SFUNC F4,RET=24Z
SFUNC F5,RET=25Z
SFUNC nn,RET=nnZ ←
```

(for the `PRKEY`, see the parameter `PRKEY`)

Using other function keys or using valid function keys that have not been defined in `KDCDEF` results in an error message.

### Support of 3270-Type Terminals

In an appropriate system configuration, 3270-type terminals are supported by the Natural *openUTM* Interface.

This means that terminal types of the 975*n* series (974*n*, 975*n* and 976*n*) as well as terminal types of 3270 devices can be connected to a Natural *openUTM* application. Natural adjusts screen output to the specific terminal type used. 3270-type terminals have to be defined as such to `KDCDEF` in the `PTERM` command (see the *openUTM* documentation).

For the support of function keys, the `SFUNC` statements of `KDCDEF` have to be defined as follows:

975 $n$ -Type Key	3270-Type Key	openUTM Return Code
F1	PF1	21Z
F2	PF2	22Z
F3	PF3	23Z
F4	PF4	24Z
F5	PF5	25Z
K1	PA1	26Z
K2	PA2	27Z
K3	PF6 + PF13	28Z
K4	PF7 + PF14	29Z
K5	PF8 + PF15	30Z
K6	PF9 + PF16	31Z
K7	PF10 + PF17	32Z
K8	PF11 + PF18	33Z
K9	PF12 + PF19	34Z
K10	PF20	35Z
K11	PF21	36Z
K12	PF22	37Z
K13	PF23	38Z
K14	PF24	39Z

### Support of TTY Terminals

For terminals which are to be used in TTY mode, the `TERMN` operand of the `PTERM` command must be set to `TERMN=X9`.

The following restrictions apply to TTY mode:

- Asynchronous transaction processing is not supported.
- MULTI-PASS is not supported.

## openUTM DC-Transaction Exit Routine NUERROR

---

An *openUTM* DC-transaction exit routine is defined in the front-end part of the Natural *openUTM* Interface. This routine is called at the beginning of a DC transaction, when a DC transaction is re-started, at normal termination and at abnormal termination (PEND ER). The user exit [UVGEXIT](#) can be used in any of these circumstances.

In the case of abnormal termination, the affected user is deleted from the internal terminal control table, the Natural recovery procedures are executed and the user's user area is released from the swap pool directory if necessary.

The DC-transaction exit routine `NUERROR` must be defined in the adequate parameters of `KDCDEF` for the front-end part of the Natural *openUTM* Interface (generation of `KDCROOT`); see also [Generating KDCROOT](#).

## openUTM Startup Function

---

If the user exit [STARTEX](#) (default value of parameter [STRTALL](#) ) is to be used, `EXIT PROGRAM=NUSTART ,USAGE=START` must be defined in the `KDCDEF` parameter for the front-end part of the Natural *openUTM* Interface.

One of the effects of this is that the task initialization routines (allocation of common memory pools, loading Natural, etc.) are activated immediately following the start of each *openUTM* task. Errors that occur are output on the console and all users are sent an appropriate message; if [SYSLST=YES](#), errors are also output to `SYSLST`.

If the *openUTM* startup function is not used, the *openUTM* task(s) are not initialized until they are activated when a user logs on. If an error occurs under these circumstances, the error message is sent to the terminal that caused the error. All other users are given an appropriate message when they try to log on to the application.

## openUTM Shutdown Function

---

If you want to use the shutdown function of *openUTM* to obtain statistics about the Natural swap pool and Natural user threads, you have to use the user exits `SHUTEX1` and/or `SHUTEX2` (default values of parameters [SHUTALL](#) and [SHUTLST](#)). The statistics collected by the Natural *openUTM* Interface are then output when the last *openUTM* task terminates.

You activate the user exits by defining the following in the `KDCDEF` parameter (`KDCROOT`) for the front-end part of the Natural *openUTM* Interface:

```
EXIT PROGRAM=NUSTART,USAGE=SHUT
```

If the *openUTM* shutdown function is not used, the user exits defined with `SHUTALL` and `SHUTLST` cannot be used and the statistics are not available.

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## Natural under openUTM - Part 2

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- NURENT Macro Parameters ..... 377

This part of the Natural *openUTM* Interface documentation deals with the macro parameters.

## NATUTM Macro Parameters

---

The following parameters are available:

ADACALL | ADACOM | ADAPRI | ADAUTM | APPLNAM | APRISTD | ASAPPLI | ASYNTAC | BADTAC | CDYNAM | CLRKEY | CURPRO | ICONTRL | INITPRG | KB | KBSAVE | KBUSEXT | LFH | LINK | LINK2/LINK3/LINK4 | LOFFMAP | NATMON | NUAADDR | NUCNAME | PARMOD | PENDPR | PFK | PRKEY | REFRKEY | ROLLACC | ROLLTSZ | RSTCNT | RSTWARM | SCRNOPT | SHUTALL | SHUTLST | SPOOL | STRTALL | STRTFST | SVDYPRM | SWAMODE | SWDPAGE | SWPUSID | SYAPPLI | SYNTAC | SYSLST | TACEND | TCLA1 | TCLA2, TCLA3, TCLA4 | TCLS1 | TCLS2, TCLS3, TCLS4 | TERMTAB | TID | TimestMP | TRACE | TTYLS | TTYPS | ULANG

### ADACALL - Access to Adabas

This parameter defines an entry in the Natural *openUTM* Interface for the subroutine ADACALL. This subroutine must be called each time a non-Natural program accesses Adabas. ADACALL generates a valid Adabas user ID and subsequently invokes the Adabas interface module ADALNN. Possible values are:

Value:	Explanation:
<i>name</i>	<i>name</i> of the entry.
NO	Subroutine ADACALL is not generated. This is the default value.

### ADACOM - Adabas Link Module Usage

This parameter determines which Adabas link module is to be used. Possible values are:

Value:	Explanation:
ADABAS	The module ADAUSER is linked to the environment-dependent nucleus.
ADALNK	The modules ADALNK and SSFB2C are linked to the environment-dependent nucleus.
ADALNN	The modules ADALNK and SSFB2C are linked to the environment-dependent nucleus.
, (comma)	The module ADALNK is linked to the environment-dependent nucleus. This is the default value.

In any case a resolve to the Adabas module library has to be given in the linkage step for the environment-dependent nucleus.

## ADAPRI - Activation of Adabas Priority Control for openUTM Application

See *Adabas Priority Control* for details. Possible values are:

Value:	Explanation:
YES	Activates Adabas priority control for a Natural <i>openUTM</i> application.
NO	The Adabas priority for all <i>openUTM</i> transactions is the same.  This is the default value.

## ADAUTM - Synchronization of Async openUTM/Adabas Transactions

This parameter enables you to realize synchronized processing and coordinated restart of asynchronous transactions between *openUTM* and Adabas. This requires that the module ADAUTM is available; this module must be linked to the Natural environment-dependent nucleus (see the *Installation* documentation). Possible values are:

Value:	Explanation:
YES	Synchronized processing and coordinated restart of asynchronous transactions between <i>openUTM</i> and Adabas are enabled.  <b>Caution:</b> If ADAUTM=YES is specified, the ADACALL parameter must <i>not</i> be set to ADABAS.
NO	This is the default value.  <b>Caution:</b> Do not change the default value of this parameter without prior consultation of Software AG support.

## APPLNAM - Name of Natural openUTM Application

With this parameter, you specify the name of the Natural *openUTM* application. The value of this parameter must be identical with the value of parameter APPLNAME in KDCDEF. This name is used to create a name for a task-specific SYSLST file (see also SYSLST parameter below). Possible values are:

Value:	Explanation:
<i>name</i>	Up to 8 characters long.  No default value is provided.

The specified name is also used to construct a serialization marker for the initialization routine in the Natural *openUTM* Interface; an S is inserted in the first free character position (for example, if APPLNAM=NATUTM, the name of the serialization marker is NATUTMS).

Furthermore, this name is used to create an Adabas user ID if TID=N is specified.

A defined character position of the operand of `APPLNAM` can be used for constructing the Adabas user ID; see parameter `TID`.

### APRISTD - Adabas Priority for Standard openUTM TAC

This parameter can be used to define the Adabas priority *nnn* for the standard *openUTM* TAC (default NAT). Possible values are:

Value:	Explanation:
<i>nnn</i>	Adabas priority <i>nnn</i> for the standard <i>openUTM</i> TAC (default NAT).
144	This is the default value.

The `APRISTD` parameter is only in effect if the `ADAPRI` parameter is set to YES. For individual TACs, individual priorities can be defined with the parameters `TCLSn` and `TCLAN`; see also *Adabas Priority Control*.

### ASAPPLI - Name of Logical openUTM Communications Partner

This parameter specifies the name of the logical *openUTM* communications partner (as defined in `KDCDEF`) of the asynchronous *openUTM* application. This name is only relevant in the case of asynchronous transaction processing between two *openUTM* applications. Possible values are:

Value:	Explanation:
<i>name</i>	<i>name</i> specifies the name of the logical <i>openUTM</i> communications partner.  <b>Caution:</b> If <code>ASAPPLI=<i>name</i></code> is specified, the operand of the parameter <code>SYAPPLI</code> must also be defined.
NO	This is the default value.

### ASYNTAC - openUTM Transaction Code for Asynchronous openUTM Task or Application

With this parameter you define the *openUTM* transaction code (TAC) for the *openUTM* task or application that runs asynchronously. Possible values are:

Value:	Explanation:
<i>tac</i>	<i>openUTM</i> TAC for the <i>openUTM</i> task or application that runs asynchronously.
NATAS	This is the default value.

The specified *openUTM* TAC must be distinct from the “standard” Natural TAC and also from the TAC used for the synchronous *openUTM* application (if asynchronous transaction processing is used between two *openUTM* applications).

The first five characters determine the unique identifier for asynchronous *openUTM* TACs.

## BADTAC - Activation of openUTM Function BADTACS

This parameter enables you to activate the *openUTM* function BADTACS, which means that in the assembled program of macro NATUTM, the startup program AUTOTAC is generated for undefined *openUTM* transaction codes. Possible values are:

Value:	Explanation:
YES	Activates the <i>openUTM</i> function BADTACS.
NO	This is the default value.



**Note:** BADTAC=YES requires that the following additional definitions must be supplied when defining KDCDEF and generating KDCROOT:

### KDCDEF:

```
PROGRAM AUTOTAC,COMP=ASSEMB
TAC KDCBADTC,CALL=FIRST,PROGRAM=AUTOTAC,EXIT=NUERROR,TYPE=D
TAC AUTOCONN,TYPE=D,PROGRAM=NATUTM,EXIT=NUERROR,CALL=BOTH
```

## CDYNAM - Maximum Number of Modules to be Dynamically Loaded

This parameter specifies the maximum number of modules to be dynamically loaded (for example, COBOL or Assembler subroutines) and/or the number of modules which have been linked to the Natural environment-dependent nucleus (see the *Installation* documentation) and declared with parameters [LINK](#) to [LINK4](#). Possible values are:

Value:	Explanation:
<i>nn</i>	<i>nn</i> defines the number of programs.
15	This is the default value.



**Note:** The programs to be dynamically loaded must be either in the load library specified in the Natural parameter module or in the BLSLIB library or libraries specified in the start job.

## CLRKEY - Activation/Deactivation of CLEAR Key

This parameter activates or deactivates the CLEAR key. Possible values are:

Value:	Explanation:
ON	Activates the CLEAR key (keys LSP and ENTER).  This is the default value.
OFF	Deactivates the CLEAR key, which means that after pressing CLEAR, the entire last Natural screen is displayed again.

### CURPRO - Cursor Positioning to Protected Field

This parameter controls whether the cursor can be positioned to a protected field. Possible values are:

Value:	Explanation:
ON	The cursor <i>cannot</i> be positioned to a protected field.  This is the default value.
OFF	The cursor can also be placed in a protected field (for example, for field-specific help functions).

### ICONTRL - openUTM Input Exit for Messages in Minus Format

This parameter allows you to generate an *openUTM* input exit for messages in minus (-) format; that is, messages from a Natural screen. Such an input exit controls the allowed (or not-allowed) user KDC commands. Possible values are:

Value:	Explanation:
(YES, KDC xxxx (, KDC xxxx , ...)) (YES)	Any KDC command not allowed must be defined with this parameter by specifying YES and the name of the KDC command. See examples below.
(NO)	This is the default value.

#### Examples:

ICONTRL=(NO)	This example does not generate an input exit and allows all <i>openUTM</i> commands.
ICONTRL=(YES)	This example generates an input exit with the name ICONTRL and prohibits usage of all <i>openUTM</i> commands.
ICONTRL=(YES, KDCOUT, KDCOFF)	This example generates an input exit with the name ICONTRL and prohibits usage of the commands KDCOUT and KDCOFF.

If YES is specified as first operand, the generated input exit must be defined in KDCDEF and KDCROOT as follows:

```
EXIT PROGRAM=ICONTRL,USAGE=(INPUT,USERFORM)
PROGRAM ICONTRL,COMP=ASSEMB
```

### INITPRG - Value for Natural Variable \*INIT-PROGRAM

This parameter defines the value for the Natural variable \*INIT-PROGRAM. Possible values are:

Value:	Explanation:
APPLNAM	The Natural variable *INIT-PROGRAM contains the value of the parameter APPLNAM. This is the default value.
KCTACVG	The Natural variable *INIT-PROGRAM contains the value of the <i>openUTM</i> KB field KCTACVG ( <i>openUTM</i> start TAC).

### KB - Pass KB Address as First Parameter

This parameter specifies whether the address of the *openUTM* communication area KB (*Kommunikationsbereich*) is passed as the first parameter address each time Natural calls a non-Natural program. This has been taken account of in the subroutines and utility programs of the Natural *openUTM* Interface. Possible values are:

Value:	Explanation:
YES	The address of the <i>openUTM</i> communication area (KB) is passed as the first parameter address each time Natural calls a non-Natural program.
NO	This is the default value.

### KBSAVE - Saving of openUTM KB via SPUT

This parameter specifies whether the *openUTM* KB will be saved via SPUT or not. Possible values are:

Value:	Explanation:
YES	The <i>openUTM</i> KB will be saved via SPUT, starting from the end of the KB header plus twelve bytes. This information will be saved in the LSSB before a PEND PR is executed for a user-specific partial <i>openUTM</i> program.
NO	The <i>openUTM</i> KB will not be saved. This is the default value.

To be able to use this parameter, you must set the following KDCDEF definition:

MAX LSSBS=1

If the user-specific partial *openUTM* program resumes, the original communication area will be refreshed via *SGET*. This allows the partial *openUTM* program to use the KB from the end of the *openUTM* communication area header plus twelve bytes. Therefore, the program must not destroy these twelve bytes. If a KB user extension is defined, this area will not be saved.

### KBUSEXT - Length of openUTM KB User Extension

This parameter specifies the length of a *openUTM* KB user extension. Possible values are:

Value:	Explanation:
<i>nnnnn</i>	<i>nnnnn</i> specifies the length of a <i>openUTM</i> KB user extension. The maximum length allowed is 30720 bytes.
0	This is the default value.

Length and address of a user extension are stored in the KB:

USEREXTL DS	H	<i>length in bytes</i>
USEREXTA DS	F	<i>address</i>

For more information, see the *DSECT* macro *CMBS2TP*.

### LFH - Use of Adabas LFH

This parameter specifies that the Adabas large file handler (LFH) is to be used. Possible values are:

Value:	Explanation:
YES	Specifies that you are using the Adabas LFH.
NO	This is the default value.

If you specify *YES*, you also must define the buffer size for the Adabas LFH in the Natural parameter module (parameter *VSIZE* ).

## LINK - Programs and Modules Called from Natural

This parameter enables you to specify the names of programs and modules that are called from Natural programs and linked with the non-reentrant part. Possible values are:

Value:	Explanation:
<i>name</i> ( <i>name</i> , <i>name</i> ,...)	The <i>names</i> of programs and modules that are called from Natural programs and linked with the non-reentrant part must be specified in the operand of this parameter.  Conversely, the programs and modules whose names are specified must be linked with the non-reentrant part, otherwise the application is put into status SYSTEMERROR and all users are rejected with an error message.

A TABLE macro call is performed for the specified programs and modules, which enters their load addresses into the dynamic loader's link table. It is therefore not necessary to dynamically load these programs when they are called by Natural programs.

Example:

```
LINK=PROG1
LINK=(PROG1,PROG2,MODUL111)
```

## LINK2/LINK3/LINK4 - Extensions of Parameter LINK

These parameters are an extension of the parameter [LINK](#). Possible values are:

Value:	Explanation:
<i>name</i> ( <i>name</i> , <i>name</i> ,...)	The syntax is in analogy to that of LINK. See examples below.

No default value is provided.

Since an operand definition must not be longer than 127 characters (including parentheses), the parameters LINK2 to LINK4 are provided for cases where the operand of parameter [LINK](#) would be too long.

Examples:

```
NATUTM LINK=(PROG1,PROG2,...),
        LINK2=(PROG54,...)
NATUTM LINK=(PROG1,PROG2,PROG3,PROG4)
```

### LOFFMAP - Format Name for Logoff Message

With this parameter, a format name for the logoff message can be specified. Possible values are:

Value:	Explanation:
' - END '	<p>The message defined in the format exit module <code>FREXIT</code> is output:</p> <pre>NAT9994 - YOUR SESSION WAS SUCCESSFULLY FINISHED. PLEASE GIVE "KDCOFF" (LEAVE THE APPLICATION) OR "UTM-TAC".</pre> <p>The message is output in the language specified by parameter <code>ULANG</code>; if required, it can be modified in the program <code>FREXIT</code>.</p> <p>This is the default value.</p>
' '	<p>The following message is output in line mode:</p> <pre>NAT9994 - Natural TERMINATED NORMALLY</pre>
' name '	<p>The user-defined message is output.</p> <p>The message is defined with in minus (-) format in <code>FREXIT</code> or in asterisk (*) format with <code>IFG</code> and <code>FHS</code>.</p>
' KDCOFF '	<p>An automatic <code>KDCOFF</code> is performed for the user when a <code>FIN</code> system command or <code>TERMINATE</code> statement is executed.</p>

In any case, the operand specified with the `LOFFMAP` parameter is used as the format name for `openUTM`. The operand is therefore restricted to a maximum of 8 characters.

### NATMON - Automatic Activation of Natural Monitor during Application Startup

This parameter specifies whether the Natural monitor is activated automatically during application startup or not. Possible values are:

Value:	Explanation:
ON	The Natural monitor is activated automatically during application startup.
OFF	<p>The Natural monitor is not activated automatically during application startup.</p> <p>This is the default value.</p>

## NUAADDR - Natural User Thread Address

With this parameter, you specify a Natural user thread address. The following happens if you specify a particular value:

Value:	Explanation:
, (comma)	Comma means no value. The Natural user thread will be allocated in the next free address below the 16-MB line.  This is the default value.
XXXXX	The Natural user thread will be allocated on the hexadecimal address in the class 6 memory below the 16-MB line. This address must be aligned to the 4-KB segment limit. The result of address plus Natural user thread's length in bytes (MAXSIZE) must not be greater than address H'DF0000'. The highest possible address is H'DEFFFF'.
ABOVE	The Natural user thread will be allocated above the 16-MB line.
(ABOVE, NNNNN)	The Natural user thread will be allocated above the 16-MB line where NNNNN denotes the decimal number of megabytes above the 16-MB line.

### Examples:

NUAADDR=ABOVE	The Natural user thread will be allocated in the next free address above the 16-MB line.
NUAADDR=(ABOVE, 258)	The hexadecimal address of the Natural user thread is H'10200000' (above the 16-MB line).
NUAADDR=6E000I	The hexadecimal address of the Natural user thread is H'6E000' (below the 16-MB line).

When the Natural user thread is allocated above the 16-MB line, the asynchronous write buffer and the thread for asynchronous transactions will also be allocated above the 16-MB line. In this case, the 31-bit address mode will not be switched back to 24-bit address mode before a 3GL program is called. This means the called 3GL program must be able to run in 31-bit address mode.

## NUCNAME - Name of Bounded Reentrant Natural Module

This parameter specifies the name of the bounded, reentrant Natural module. Possible values are:

Value:	Explanation:
<i>name</i>	The name of the bounded, reentrant Natural module.

No default value is provided.

You must use the name of the bounded, reentrant Natural module for the Natural pool and load information in macro `ADDON` (macro `ADDON` assembles `BS2STUB`) and for program `CMPSTART` when a shared nucleus is to be used.

## PARMOD - Application Address Mode and Location

This parameter applies to the generation of both the non-reentrant part and the reentrant part. Possible values are:

Value:	Explanation:		
<i>nn, loc</i>	<i>nn</i>	24/31	The first value of this parameter ( <i>nn</i> ) is used to define an addressing mode (24-bit or 31-bit mode) for the Natural <i>openUTM</i> application.
	<i>loc</i>	BELOW/ABOVE	The second value of this parameter ( <i>loc</i> ) is used to define the partial program location of the Natural <i>openUTM</i> application.
(31, ABOVE)	This is the default value.		

If you load the environment-dependent nucleus (see the *Installation* documentation) of the application above 16 MB, this must be defined in the link procedure of the environment-dependent nucleus as follows:

```
LOADPT=*XS
```

or

```
LOADPT=X'address'
```

### Example:

```
/EXEC TSOLINK
PROG NATvrs, FILENAM=NATvrs, LOADPT=*XS, ...
TRAITS RMODE=ANY, AMODE=31
INCLUDE ...
/* PARMOD=(nn, loc) MUST ALSO BE DEFINED FOR ASSEMBLING MACRO NURENT, WHICH
/* BELONGS TO THE REENTRANT PART OF NATURAL openUTM; OPERANDS MUST BE IDENTICAL FOR
/* THE NON-REENTRANT AND REENTRANT PARTS.
```

where *vrs* represents the current product version.

## PENDPR - Define openUTM TAC for PEND PR

This parameter defines a *openUTM* TAC for a *PEND PR*. Possible values are:

Value:	Explanation:
' zzzzzzzz'	zzzzzzzz (maximum 8 characters) defines the <i>openUTM</i> TAC.
' '	This is the default value (no TAC for PENDING PR).

When PENDINGPR=' zzzzzzzz' is specified, a PENDING PR(OGRAM) is executed instead of a PENDING FINISH) when the FIN system command is entered or a TERMINATE statement is executed or the PENDING PR function key is pressed. The *openUTM* partial program that has been associated with the specified *openUTM* TAC is started after the PENDING PR.

### PFK - Function Key Modes

This parameter is used to set one of the following function-key modes:

Value:	Explanation:
(KN, y)	The literals %K1 to %K20 and send-key code DÜ are loaded to the function keys.
(K0, y)	The literals 01 to 20 and send-key code F5 are loaded to the function keys.
(KS, y)	The literals A to T and send-key code F5 are loaded to the function keys; in addition, with every output message a dummy field is generated at the last two positions of the screen, which is used to receive and pass the key value.
OFF	No function key mode is generated.
KS, L	This is the default value.

Where *y* can be:

L	function keys are loaded
N	function keys are not loaded

### PRKEY - openUTM Return Code for Function Key

This parameter is used to define an *openUTM* return code for a function key (F1 to F5 or K1 to K14). Possible values are:

Value:	Explanation:
<i>nnZ</i>	Possible values are 20Z to 39Z.
35Z	Default value for K10 (keys ESC + >).

Whenever a function key defined with this parameter is activated in the Natural dialog, the Natural session is suspended and if an *openUTM* TAC for another *openUTM* partial program is available, a PENDING PR(OGRAM) is executed.

This *openUTM* TAC can be defined in several ways:

- with the Natural profile parameter PROGRAM=*tac*,

- with the parameter `PENDPR=tac`,
- with the utility program `TACSWTCH`.

On return from the called *openUTM* partial program via the `PEND PR(OGRAM)` to the Natural *openUTM* Interface, the Natural session is continued at the point where it has been suspended.

The same return code as specified with the `PRKEY` parameter must also be defined with an `SFUNC` statement in `KDCDEF`.

### REFRKEY - Definition of openUTM Function Key

This parameter can be used to define an *openUTM* function key. Possible values are:

<code>REFRKEY=nnZ</code>	Possible values for <i>nn</i> are in the range from 26 to 39 (K1 to K14).
<code>REFRKEY=NO</code>	No <i>openUTM</i> function key defined.
<code>REFRKEY=39Z</code>	Default value for K14 (keys ESC + :).

If the defined function key is pressed, the last full Natural screen is refreshed. Thus it is possible to continue the dialog with Natural after the screen has been overwritten by messages from the operator or the operating system. The send key code is not passed to the Natural application. The interface sets the Natural key code to `ENTER`.

### ROLLACC - Access Method for Natural Roll File

This parameter defines the access method for the Natural roll file. Possible values are:

Value:	Explanation:
<code>UPAM-SY</code>	The access method for the Natural roll file is <code>UPAM</code> with synchronous roll file I/Os. This access method is not allowed with global swap pools.
<code>UPAM-AS</code>	The access method for the Natural roll file is <code>UPAM</code> with P1-eventing for asynchronous writes.  This is the default value.
<code>(UPAM-AS, PAMWAIT)</code>	The Natural <i>openUTM</i> Interface waits with a <code>VPASS SVC</code> from the completed asynchronous write before a <code>PEND RE</code> is executed. This option is needed because a <i>openUTM</i> task which is inactive (P2 wait) cannot be posted via P1-eventing. Instead, the user session must be terminated with the error message <code>Timeout for asynchronous write</code> .
<code>FASTPAM</code>	The access method for the Natural roll file is <code>FASTPAM</code> with Forward Eventing for asynchronous writes (high performance). See prerequisites described below.

## Prerequisites for ROLLACC=FASTPAM

To use the FASTPAM option, the following prerequisites apply:

- Parameter `TERMTAB` must be defined as `SWP`.
- The class II definition in the batch job for starting the resident FASTPAM environment and the FASTPAM I/O pool must be:

```
/EXEC NATUTM,CLASSII=(nnn, yy)
```

- The FASTPAM authorization in the user catalog must be:

```
/SHOW-USER-ATTRIBUTES
          FIELD:DMS-TUNING-RESOURCES=*EXCLUSIVE
/*OR ALTERNATIVELY:
/MODIFY-USER
          FIELD: DMS-TUNING-RESOURCES=EXCLUSIVE-USE>
```

- The BIAS for the BS2000 operating system must be defined as follows:

```
/MODIFY-SYSTEM-BIAS MAX-RESIDENT-PAGES=nnn
```

To calculate the necessary number of resident core pages, use the following formula (ignore all rest values):

```
ROLLTSZ + 3 / 4 * 2 = N1 (FASTPAM I/O areas)
ROLLTSZ + 31 / 32 * 36 + 4095 / 4096 * 2 = N2 (FASTPAM access lists)
```

$N1 + N2 =$  number of resident pages for one Natural *openUTM* task

## ROLLTSZ - Maximum Roll Thread Size

This parameter determines the maximum roll thread size *nnn* (in KB); that is, the maximum size of a compressed user thread on the Natural roll file. Possible values are:

Value:	Explanation:
<i>nnn</i>	<i>nnn</i> must be a multiple of 4 (roll file block size).
160	This is the default value.

If `ROLLACC=UPAM-AS`, valid values for `ROLLTSZ` are 4 to 1600 (KB).

If `ROLLACC=UPAM-SY` or `ROLLACC=FASTPAM`, valid values for `ROLLTSZ` are 4 to 3200 (KB).

To calculate the size of the Natural roll file, use the following formula:

$ROLLTSZ / 2 * \text{maximum number of users} = nnn$

*nnn* is the number of PAM pages for the Natural roll file.

As user threads are generally written to the roll file in compressed form, an optimum roll thread size contributes considerably to saving disc storage.

The optimum value for *nnn* can be ascertained with the Natural Swap Pool Statistics; see the [SYSLST](#) parameter.

### RSTCNT - Control of Restart Situations

This parameter can be used to control restart situations in which the “lifetime” of a user results from an old Natural *openUTM* session. Possible values are:

Value:	Explanation:
YES	In such a restart situation a message is displayed to the user and the <i>openUTM</i> task is finished with <code>PEND FI(NISH)</code> ; the user must restart his/her <i>openUTM</i> task by entering the <i>openUTM</i> TAC.
NO	In such a restart situation the Natural session is newly initialized without a message being displayed.  This is the default value.

### RSTWARM - Control of Restart Situations

This parameter can be used to control restart situations. Possible values are:

Value:	Explanation:
YES	There will be a warm start of a Natural session if there is an <i>openUTM</i> restart situation. The last terminal screen will be displayed, prerequisite for this function is a global Natural swap pool.  This is the default value.
NO	There will be a restart of a Natural session if there is an <i>openUTM</i> restart situation.

### SCRNOPT - Terminal Types with Deactivated Natural Screen Optimization

This parameter can be used to define (one or two) terminal types for which Natural screen optimization is to be de-activated. Possible values are:

Value:	Explanation:
(yy=zz)	yy must be a valid terminal name TERMN as defined in KDCDEF.  zz is a synonym for yy.  For terminal types defined in KDCDEF with TERMN= zz, screen optimization is then de-activated.
(yy=zz ,yy=zz)	Same as above, but two terminals defined.
NO	Screen optimization is active for all terminal types.  This is the default value.

**Example:**

```
SCRNOPT=(FL=Z9)
```

where:

FL	is a valid TERMN name for IBM 3270-type terminals
Z9	is a synonym for 3270-type terminals

This example would deactivate screen optimization for those 3270-type terminals which are defined as TERMN=Z9 in KDCDEF.

**SHUTALL - Name of User Exit**

With this parameter, you can specify the name of a user exit. Possible values are:

Value:	Explanation:
<i>name</i>	Specifies the name of a user exit.
SHUTEX1	This is the default value.

This user exit is invoked by the Natural *openUTM* Interface whenever an *openUTM* task is terminated with KDCSHUT, provided that the *openUTM* SHUTDOWN function has been defined in KDCDEF.

**SHUTLST - Name of User Exit**

With this parameter, you can specify the name of a user exit. Possible values are:

Value:	Explanation:
<i>name</i>	Specifies the name of a user exit.
SHUTEX2	This is the default value.

This user exit is invoked by the Natural under *openUTM* when the last *openUTM* task is terminated with `KDCSHUT`, provided that the *openUTM* `SHUTDOWN` function has been defined in `KDCROOT`.

### SPOOL - Automatic Start and Termination of Printer Task

This parameter enables you to specify a spooling system. Possible values are:

Value:	Explanation:
<code>(NATSPPOOL, 'enter-parms ', n)</code>	For use with NATSPPOOL (Natural Advanced Facilities), see <a href="#">Using NATSPPOOL</a> .
REPRO-2000	For use with a remote spooling system, see <a href="#">Using REPRO-2000 Remote Spooling System</a> .
RMSPPOOL	For use with your own user exit program, see <a href="#">Using RMSPPOOL User Exit</a> .

No default value is provided

The following topics are covered below:

- [Using NATSPPOOL](#)
- [NATSPPOOL Processing Logic](#)
- [Using REPRO-2000 Remote Spooling System](#)
- [Using RMSPPOOL User Exit](#)

### Using NATSPPOOL

When using NATSPPOOL (Natural Advanced Facilities), the `SPOOL` parameter can be used to indicate that the printer task(s) required by NATSPPOOL are to be started up automatically by means of `ENTER` calls whenever the Natural *openUTM* application is started, and terminated whenever the application is shut down. In this case, the operands of the parameter must be:

```
SPOOL=(NATSPPOOL, 'enter-parm', n)
```

where:

' <i>enter-parms</i> '	are the parameters for the ENTER call (in apostrophes)
<i>n</i>	is the number of printer tasks to be started (in the range 1 to 30)

**Example:**

The following ENTER job is to be automatically started and terminated. The file name is AF.E.PRINT:

```
/LOGON
/OPTION MSG=FHL
/SYSFILE FILE=SYSLST
/EXEC NAFPTTSK
/LOGOFF
```

Operand definition for the parameter SPOOL:

```
SPOOL=(NATSPPOOL, 'AF.E.PRINT, TIME=999', 2)
```

In this example, NATSPPOOL is the name of the Natural spooling system; AF.E.PRINT is the file name of the ENTER job to be started and terminated; TIME=999 is an additional, optional parameter for the ENTER call (see the description of the BS2000 ENTER macro); and 2 means that two NATSPPOOL printer tasks are to be started/terminated.

The second suboperand can contain any valid operands (enclosed in apostrophes) for the ENTER macro call.

The operand of parameter SPOOL in macro NURENT must be NATSPPOOL.

**NATSPPOOL Processing Logic**

The specified number of NATSPPOOL printer tasks according to the operand definition in the parameter SPOOL is started when the application is started up. Interprocess communication is then used to check that at least one printer task is running. If this condition is not satisfied, the application is set to status SYSTEMERROR, an error message is output on the console and users who attempt to logon are rejected with the message:

```
NUI0036 - SYSTEMERROR ... PLEASE GIVE KDCOFF
```

For more information on this system error, see error message NUI0036.

### Using REPRO-2000 Remote Spooling System

If a remote spooling system is used (for example, TD-SPOOL or REPRO-2000), set `SPOOL=REPRO-2000` in the macros `NATUTM` and `NURENT`. This function is not supported by Software AG.

The logic used by Natural offline reports must be considered when implementing the interface module for a remote spooling system (see macro `NURENT`, label `CMWHC`). When an offline report is activated, Natural transfers output a record at a time. The logic for sending and accepting print records, the layout of the print record, etc., are in macro `NURENT`, subroutine `CMWHC`.

### Using RMSPOOL User Exit

If you use your own user exit program named `RMSPOOL` as remote spooling interface, set `SPOOL=RMSPOOL` in the macros `NATUTM` and `NURENT`. See [User Exits](#) for details on the user exit `RMSPOOL`.

### STRTALL - Name of User Exit for All openUTM Tasks

With this parameter, you can specify the name of a user exit. This user exit is invoked by Natural under `openUTM` whenever a `openUTM` task is started. Possible values are:

Value:	Explanation:
<i>name</i>	Specifies the name of a user exit.
STARTEX	This is the default value.

### STRTFST - Name of User Exit for First openUTM Task

With this parameter, you can specify the name of a user exit. This user exit is invoked by Natural under `openUTM` when the first `openUTM` task is started, provided that the `openUTM` `STARTUP` function has been defined in `KDCDEF`. Possible values are:

Value:	Explanation:
<i>name</i>	Specifies the name of a user exit.
STAPPLX	This is the default value.

### SVDYPRM - Save Area Length for Dynamic Natural Parameters

This parameter determines the length in bytes of a save area for dynamic Natural parameters in the `openUTM` KB. These parameters are used when a Natural `openUTM` session is restarted. Possible values are:

Value:	Explanation:
<i>nnnn</i>	Specifies the length in bytes of a save area for dynamic Natural parameters in the <i>openUTM</i> KB. Possible values are 0/8 . . . 2048 (bytes).
0	This is the default value.

### SWAMODE - Switching from 31 to 24-Bit Address Mode

This parameter determines whether a 31-bit address mode is switched to 24-bit mode or not before a `PEND PR` is executed. What you must set depends on whether the partial *openUTM* program can run in 31-bit address mode (NO) or not (YES). Possible values are:

Value:	Explanation:
YES	31-bit address mode is switched to 24-bit mode.
NO	This is the default value.

### SWDPAGE - Pageability of Swap Pool Main Directory

This parameter determines whether the swap pool main directory is pageable or not. Possible values are:

Value:	Explanation:
NO	Specifies that the swap pool main directory is not pageable.
YES	This is the default value.

A swap pool directory that is not pageable improves performance considerably. In that case, the BS2000 macro `CSTAT` will be used to declare the swap pool directory as not pageable. To be able to specify `SWDPAGE=NO`, you must define the maximum and minimum of resident core pages in the startup job.

#### Example:

```
/EXEC E.NAT vrs, CLASSII=(4,2)
```

where *vrs* represents the current product version.

For more information, see the description of BS2000 macro `CSTAT` or the description of BS2000 command `EXECUTE`, operand `CLASSII` or, when `SDF` is used, the description of BS2000 command `START-PROGRAM`, operand `RESIDENT-PAGES=PARAMETERS . . .`

If the call to macro `CSTAT` fails, the application is still able to run.

## SWPUSID - Swap Pool User Identification

This parameter determines the swap pool user identification. Possible values are:

Value:	Explanation:
KCLOGTER	This is the <i>openUTM</i> KB's logical terminal name. This is the default value.
KCBENID	This is the <i>openUTM</i> KB's user name.
INTERNID	This is the internal terminal ID (serial number).

### Warning:

The value `KCBENID` must not be specified if either or both of the following conditions in the `KDCDEF` of the Natural *openUTM* application apply:

1. `SIGNON` with parameter `MULTI-SIGNON=YES` is set;
2. `UPIC` or terminal server clients are defined in an `LTERM` pool (`TPOOL`) with `CONNECT-MODE=MULTI` set.

In both cases, `KCBENID` might not be unique and thus not suitable as swap pool user identification.

## SYAPPLI - Name of Logical openUTM Communications Partner

With this parameter, you can specify the name of the logical *openUTM* communications partner (as defined in `KDCDEF`) of the synchronous *openUTM* application. Possible values are:

Value:	Explanation:
<i>name</i>	The operand of the parameter <code>ASAPPLI</code> must also be defined.
NO	This is the default value.

The operand is only significant in the case of asynchronous transaction processing between two *openUTM* applications.

## SYNTAC - openUTM TAC for Sending Messages from Async to Sync openUTM Applications

This parameter defines the *openUTM* transaction code used to send free messages for a terminal from the asynchronous to the synchronous *openUTM* application. Possible values are:

Value:	Explanation:
<i>tac</i>	Specifies the <i>openUTM</i> transaction code.
NATSY	This is the default value (synchronous TAC).

The *openUTM* TAC specified in this parameter must be distinct from the “standard” Natural TAC and also from the TAC used for the asynchronous *openUTM* application.

### SYSLST - SYSLIST File Generation for openUTM Task

This parameter defines whether a SYSLST file is generated for each *openUTM* task or not. The SYSLST file contains statistics data and error information (if a *openUTM* task ends abnormally). Possible values are:

Value:	Explanation:
YES	A SYSLST file is generated for each <i>openUTM</i> task. This is the default value.
NO	No SYSLST file is generated.

The name of a SYSLST file is `LST.name.tsn`, which is generated from the following components:

LST	prefix
<i>name</i>	the value of parameter <code>APPLNAM</code>
<i>tsn</i>	the 4-digit task sequence number of the <i>openUTM</i> task

### TACEND - Action at PEND

This parameter defines the action to be taken in conjunction with the *openUTM* operation key `PEND`. Possible values are:

Value:	Explanation:
KP	Each dialog step is terminated with a <code>PEND KP (KEEP)</code> . The <i>openUTM</i> KB is written to the page pool of <code>KDCFILE</code> only if no additional space in <i>openUTM</i> cache storage is available. It is to be noted that no synchronized processing between <i>openUTM</i> (s) and Adabas can be performed.
RE	Each dialog step is terminated with a <code>PEND RE (RETURN)</code> ; that is, the end of an <i>openUTM</i> transaction. The <i>openUTM</i> KBs in the page pool of <code>KDCFILE</code> are saved with each dialog step. This processing mode is required when a synchronized processing between <i>openUTM</i> (s) and Adabas is to take place.  This is the default value.

### TCLA1 - openUTM TACs for Async Transaction w. Priority Level 1

This parameter allocates *openUTM* TACs for asynchronous transactions with priority level 1 using the *openUTM* TACCLASS concept. A TAC table is constructed that can be accessed from Natural programs by means of the subroutine NATTAC, passing a priority level as parameter; see [openUTM TACCLASS Concept \(Priority Control\)](#).

Possible values are:

Value:	Explanation:
<i>tac</i> ( <i>tac</i> , <i>nn</i> )	<i>nn</i> can be specified to control Adabas priority for the corresponding <i>openUTM</i> TAC (TACCLASS); see <a href="#">Adabas Priority Control</a> .
-	Specifying TCLA1=- (note that the dash is not enclosed in apostrophes) denotes that no <i>openUTM</i> TAC is to be allocated.
(- , 0)	
(NATAS1 , 64)	This is the default value.

### TCLA2, TCLA3, TCLA4 - openUTM TACs for Async Transaction w. Priority Levels 2, 3, 4

These parameters allocate *openUTM* TACs for asynchronous transactions with priority levels 2, 3 and 4 using the *openUTM* TACCLASS concept. Their values are used analogous to TCLA1 (see above). Possible values are:

Value:	Explanation:
TCLA <i>n</i> = <i>tac</i> TCLA <i>n</i> =( <i>tac</i> , <i>nn</i> )	Analogous to TCLA1, but for priority levels <i>n</i> =2 , 3 , 4.
TCLA <i>n</i> =-	
TCLA2=(NATAS2 , 48) TCLA3=(NATAS3 , 32) TCLA4=(NATAS4 , 16)	These are the default values.

### TCLS1 - openUTM TACs for Async Transaction w. Priority Level 1

This parameter allocates *openUTM* TACs for synchronous transactions with priority level 1 using the *openUTM* TACCLASS concept. A TAC table is constructed that can be accessed from Natural programs by means of the subroutine NATTAC, passing a priority level as parameter; see [openUTM TACCLASS Concept \(Priority Control\)](#).

Possible values are:

Value:	Explanation:
<i>tac</i> ( <i>tac</i> , <i>nn</i> ) - (-, 0)	<i>nn</i> can be specified to control Adabas priority for the corresponding <i>openUTM</i> TAC (TACCLASS); see <a href="#">Adabas Priority Control</a> .  Specifying TCLS1=- (note that the dash is not enclosed in apostrophes) denotes that no <i>openUTM</i> TAC is to be allocated.
(NAT1, 128)	This is the default value.

### TCLS2, TCLS3, TCLS4 - openUTM TACs for Async Transaction w. Priority Levels 2, 3, 4

These parameters allocate *openUTM* TACs for asynchronous transactions with priority levels 2, 3 and 4 using the *openUTM* TACCLASS concept. Their values are used analogous to TCLS1 (see [above](#)).

Possible values are:

Value:	Explanation:
TCLS <i>n</i> = <i>tac</i> TCLS <i>n</i> =( <i>tac</i> , <i>nn</i> )  TCLS <i>n</i> =-	Analogous to <a href="#">TCLS1</a> , but for priority levels <i>n</i> =2, 3, 4.
TCLS2=(NAT2, 112) TCLS3=(NAT3, 96) TCLS4=(NAT4, 80)	These are the default values.

### TERMTAB - Terminal Control Table for Natural Roll File Management

This parameter defines the terminal control table needed to manage the Natural roll file. Possible values are:

Value:	Explanation:
(SWP, TERMNAME, CHECKPNT) (SWP, INTERNID, CHECKPNT) (SWP, TERMNAME) (SWP, INTERNID) (N, TERMNAME) (N, INTERNID)	20 bytes long 12 bytes 10 bytes 2 bytes 10 bytes 2 bytes  See <a href="#">Explanation of Operands</a> below.
(SWP, TERMNAME)	This is the default value.

The terminal control table is allocated either in the Natural swap pool or in the Natural roll file. It contains a header (48 bytes) and an entry for each active user or active session. Its size depends on the size of the Natural roll file, on the value of the parameter [ROLLTSZ](#) and on the length of its own entries.

The Natural *openUTM* Interface computes the length of the terminal control table as follows:

$\text{Roll file pages} / (\text{ROLLTSZ} / 2) = N$

$N * \text{terminal control table entry length} + 48 = \text{length of the terminal control table}$

### Explanation of Operands

Operand	Meaning
SWP	The terminal control table is allocated in the Natural swap pool.
TERMNAME	The logical terminal name will be used to identify an entry in the terminal control table.
INTERNID	The internal terminal ID (serial number) will be used to identify an entry in the terminal control table. INTERNID is two bytes long.
CHECKPNT	Is only allowed when the terminal control table is allocated in the Natural swap pool. It is necessary if terminals are defined with <code>RESTART=NO</code> or if a terminal pool is defined in <code>KDCDEF</code> . The terminal control table entry contains a checkpoint (timestamp) for the last Natural user thread that has been rolled out. A user thread in the Natural roll file should not be overwritten by a thread with a timestamp lower than the timestamp in the terminal control table entry.  CHECKPNT is 10 bytes long.
N	The number of PAM pages for the terminal control table in the Natural roll file. Possible values of this operand are 1 to 16 (PAM pages). For each terminal, 10 bytes are needed in the terminal control table. For each session, two bytes are needed.

### Examples:

`TERMTAB=(2, TERMNAME)`

The maximal number of entries in the terminal control table:  $2 * 2048 - 48 / 10 = 404$

`TERMTAB=(1, INTERNID)`

The maximum number of entries in the terminal control table:  $1 * 2048 - 48 / 2 = 1000$

### TID - Adabas User ID Construction Method

This parameter specifies the method to be used to construct the “unique” Adabas user ID. Possible values are:

Value:	Explanation:
$n$	The Adabas user ID is constructed from the defined ( $n$ ) character of the operand of the parameter <code>APPLNAM</code> (default value: N) and the last two characters of the user's first <code>SWAPPAMKEY</code> . $n$ must be a number in the range of 1 to 8.  <b>Caution:</b> If you specify <code>TID= n</code> , the “defined character” of the value specified with the parameter <code>APPLNAM</code> must be different from that of other Natural <i>openUTM</i> applications if these use the same Adabas; otherwise, the uniqueness of the Adabas user IDs - and thus data consistency - cannot be guaranteed.
$(T, n)$	A unique 4-byte user ID is constructed by taking characters $n$ to $(\max. n + 3)$ of the logical <i>openUTM</i> terminal name ( <code>KCLOGTER</code> ). $n$ must be a number in the range 1 - 8. The resulting character string must consist of valid characters (0 - 9 and A - F) and must be unique. See example below.
$(U, n)$	The characters are taken from the <i>openUTM</i> user ID ( <code>KCBENID</code> ), starting at the position specified by the second subparameter. The resulting character string must consist of valid characters and must be unique.
$(TID=1)$	The Adabas user ID consists of the first digit from the operand of parameter <code>APPLNAM</code> and of the two-byte entry number in the terminal control table.  This is the default value.

**Example:**

```
TID=(T,4)
```

	KCLOGTER	Adabas User ID
1st terminal	LTU9A110	X'00009A11'
2nd terminal	LTU9F110	X'00009F11'
3rd terminal	LTU9F120	X'00009F12'

If “mixed” Adabas calls occur within one Natural *openUTM* application (that is, calls from both Natural and non-Natural programs), the Adabas user ID can be found using the `ENTRY CMTRMID` in macro `NATUTM`. The current Adabas user ID (4 bytes) can be found at address `CMTRMID`; see also the parameter `ADACALL`.

**Example:**

```
EXTRN CMTRMID
.
.
L R1,CMTRMID
MVC ADAID(4),0(R1)
```

For the Adabas user ID, the full terminal name (`KCLOGTER`) will be used when `TID=(T, n)` or the full user ID (`KCBENID`) will be used when `TID=(U, n)`. Default is `TID=((T,1))`.

## TIMESTAMP

With this parameter, you specify the timebase for all system variables and timestamps derived from the machine time.

Possible values:

Value	Explanation
TIMESTAMP=UTC	Timebase is UTC (former GMT). This is the default.
TIMESTAMP=LOCAL	Timebase is the local machine time

## TRACE - Trace File Number and Trace Print Record Length

With this parameter, you specify the number of a trace file and the maximal length of a trace print record. Possible values are:

Value:	Explanation:
( <i>nn</i> , <i>ll</i> )	<i>nn</i> is the number for the SYSLST <i>nn</i> trace file. Possible range: 01 - 99. <i>ll</i> is the maximal length in characters of a trace print record. Possible range: 71 - 132.
(99, 71)	This is the default value.

If any external Natural trace function is active, the trace records will be written to SYSLST *nn*. In this case, the Natural *openUTM* driver creates the following trace file:

### Example:

```
appName.Natural.TRACE,SPACE=(90,60)
SYSFILE SYSLSTnn=appName.Natural.TRACE
/* appName is the application name
```

This file will be used by all tasks of the Natural *openUTM* application. Before the Natural *openUTM* application is terminated, the trace file will be closed as follows:

```
SYSFILE SYSLSTnn=(PRIMARY)
```

To activate the Natural trace functions, see the parameters `ETRACE` and `ITRACE` of the Natural parameter module.

### TTYLS - Physical Line Size for TTY Devices

With this parameter you can adjust Natural's physical line length to different paper formats used with a telex machine. Possible values are:

Value:	Explanation:
<i>nn</i>	<i>nn</i> specifies the physical line size for TTY devices.
80	This is the default value.

### TTYPS - Physical Page Size for TTY Devices

With this parameter you can adjust Natural's physical page size to different paper formats used with a telex machine. Possible values are:

Value:	Explanation:
<i>nn</i>	<i>nn</i> specifies the physical page size (number of lines) for TTY devices.
24	This is the default value.

### ULANG - Session Language Indicator

This parameter determines the language of the restart message, the logoff message, and the “free-running messages”. Possible values are:

Value:	Explanation:
D	Danish
E	English (This is the default value)
F	French
G	German
I	Italian
N	Dutch
S	Spanish

## NATUTM Macro Entries

---

- [CMKBADR - Current Address of openUTM KB](#)
- [User Area in the Swap Pool Directory](#)

### CMKBADR - Current Address of openUTM KB

The entry `CMKBADR` holds the current address of the *openUTM* communication area KB (*Kommunikationsbereich*).

The communication area can be accessed as shown in the following example, which illustrates an Assembler program that could be called from a Natural program.

#### Example:

```
EXAMPLE CSECT
  STM 14,12,12(13)
  USING EXAMPLE,15
  L 2,VCONST          LOAD ADDRESS OF KB-ADDRESS
  L 3,0(,2)          LOAD ADDRESS OF KB
  .
  .
  LM 14,12,12(13)
  BR 14
VCONST DC V(CMKBADR)  ENTRY ADDRESS
  END
```

In this case, the program name `EXAMPLE` must be defined with the parameter `LINK` or `LINK2` of macro `NATUTM`, and the program itself must be linked to the Natural environment-dependent nucleus (see the *Installation* documentation).

### User Area in the Swap Pool Directory

One fullword is available for user-defined purposes in the Natural swap pool directory - see label `USERWRD` in `DSECT MEMPOOL` of macro `NAMSWDIR`. This word can be used for synchronization, for example, for switching accounting on and off, whilst the Natural *openUTM* application is running.

The following example shows how this area can be addressed.

**Example:**

```

PROG      WXTRN CMKBADR      ENTRY IN MACRO NATUTM
          CSECT
          STM  14,12,12(13)  SAVE REGISTERS
          USING PROG,15      BASE OF PROGRAM
          USING KB,4         BASE OF UTM KB
          USING MAINDIR,5    BASE OF SWAP POOL DIRECTORY
          L    3,KBADR       LOAD ADDRESS OF KB ADDRESS
          L    4,0(,3)       LOAD ADDRESS UTM KB
          L    5,ASWPDIR     ADDRESS SWAP POOL DIRECTORY
          OI   USERWRD+3,1   SET THE LOW ORDER BIT OF FIELD
*
          LM  14,12,12(13)  RELOAD REGISTERS
          BR  14             RETURN
KBADR     DC  A(CMKBADR)    ENTRY IN MACRO NATUTM
          NAMSWDIR          MACRO CALL FOR SWAP POOL DSECT
MAINDIR   DSECT
          .
          .
USERWRD   DS    F          DIRECTORY USER AREA
          .
          CMKBNEX           MACRO CALL FOR UTM KB DSECT
KB        DSECT
          .
          .
ADRSWAP   DS    F          ADDRESS OF Natural SWAP POOL
          .
          END

```

When working in this area, the user must take care not to overwrite any other data in the swap pool directory. Mistakes could lead to abnormal termination of the *openUTM* task.

## NURENT Macro Parameters

---

The following parameters are available:

ACCNT | ATTKEY | AUTOLINK | CALLM31 | CLR3270 | EXTAPPL | FPUT | ILCS | K2 | PARMOD | SCRNRTRC  
 | SPOOL | UINPEX | UOUTEX

### ACCNT - Call Logic for User Account Routine

This parameter is used to define the logic for call of the user account routine (user exit `ACCEXIT`). Possible values are:

Value:	Explanation:
APPL	ACCEXIT is called at change of application (new Natural logon ID). This is the default value.
DIAL	ACCEXIT is called after every dialog step.

### ATTKEY - Attention Interrupt Key

This parameter is used to define an attention interrupt key. Such a key definition only makes sense for output in non-conversational mode. Possible values are:

Value:	Explanation:
<i>nnZ</i>	<i>nnZ</i> can be in the range of 26Z to 39Z.
ATTKEY=	Default value: no value

### AUTOLINK - Use of AUTOLINK Function

This parameter specifies whether the `AUTOLINK` function of the dynamic binder/loader for loading of 3GL programs is activated or not. Possible values are:

Value:	Explanation:
YES	The <code>AUTOLINK</code> function is activated. This is the default value.
NO	The <code>AUTOLINK</code> function is deactivated.

### CALLM31 - Switching from 31 to 24-Bit Address Mode

This parameter is only relevant if Natural is generated for the 31-bit addressing mode and the front part is loaded below (`PARMOD=31`, see [below](#) ).

Value:	Explanation:
YES	A call from a Natural program to a 3GL program will be executed in 31-bit addressing mode.
NO	Call in 24-bit mode. The addressing mode is switched from 31-bit to 24-bit before a 3GL program will be called from a Natural program. This is the default value.

Exceptions:

- The 3GL program is loaded above the 16-MB line.
- The address of the parameter list is above the 16-MB line.

### CLR3270= xxx - Definition of CLEAR Key

This parameter defines the CLEAR key in the AID character table V (AID3270) for 3270-type devices (IBM).

Value:	Explanation:
xxx	xxx defines the CLEAR key.
PA1	By default, PA1 is the CLEAR key.

### EXTAPPL - openUTM TERMN Name of External DCAM or PDN Applications

This parameter defines the *openUTM* TERMN name (see the parameter PTERM of *openUTM* KDCDEF) of external DCAM or PDN applications. For these TERMN names, the MGET return code 05Z (format changed) is ignored. Possible values are:

Value:	Explanation:
xx	xx and yy define the <i>openUTM</i> TERMN name.
(xx, yy)	

No default value is provided.

### FPUT - Operation Supplement for Printing via KDCS-Call FPUT

This parameter defines the operation supplement for printing via KDCS-Call FPUT to a printer which is defined in the *openUTM* KDCDEF.

Value:	Explanation:
NE	Total print message.
NT	Part of a print message.

### ILCS - Support of CRTE or ILCS

This parameter specifies whether the common runtime environment for calls (CRTE) or the ILCS interface for calls of 3GL programs will be supported. Possible values are:

Value:	Explanation:
CRTE	<p>The common runtime environment for calls of 3GL programs will be supported.</p> <p>Prerequisite: The program <code>ITOSL#</code> must be included in the front part.</p> <pre>INCLUDE ITOSL#,SYSLNK.CRTE.010 RESOLVE,SYSLNK.CRTE.010</pre>
YES	<p>Only the ILCS interface for calls of 3GL programs will be supported.</p> <p>Prerequisite: The program <code>ITOINITS</code> must be included in the front part.</p> <pre>INCLUDE ITOINITS,SYSLNK.ILCS RESOLVE,SYSLNK.ILCS</pre>
NO	<p>CRTE or ILCS are not supported.</p> <p>This is the default value.</p>

### K2 - openUTM Return Code for K2 Key

This parameter specifies the *openUTM* return code for the k2 key (for Natural PA2)

Value:	Explanation:
<i>nnn</i>	<i>nnn</i> must be in the range of 26Z to 39Z.
27Z	This is the default value.

### PARMOD - Application Address Mode and Location

This parameter applies to the generation of both the non-reentrant part and the reentrant part. Possible values are:

Value:	Explanation:		
<i>(nn, loc)</i>	<i>nn</i>	24/31	The first part of this parameter ( <i>nn</i> ) is used to define an addressing mode (24-bit or 31-bit mode) for the Natural <i>openUTM</i> application.
	<i>loc</i>	BELOW/ABOVE	The second part of this parameter ( <i>loc</i> ) is used to define the partial program location of the Natural <i>openUTM</i> application.
<i>(31, ABOVE)</i>	This is the default value.		

PARMOD=(*nn*, *loc*) must also be defined for assembling macro NATUTM. Operands must be identical for the non-reentrant part and the reentrant part.

### SCRNTRC - Tracing of Screen I/Os

This parameter is used for debugging screen I/O to find out the reason for certain error situations. If this parameter is set to ON/(ON, *nn*), a special debug buffer for each user will be allocated (default buffer size is 3 KB). Possible values are:

Value:	Explanation:
ON	A debug buffer for each user is allocated with a default buffer size of 3 KB.
(ON, <i>nn</i> )	A debug buffer for each user is allocated where <i>nn</i> is used to define a specific screen debug buffer size other than the default value of 3 KB.
OFF	This is the default value.

 **Caution:** You should only set this parameter to ON/(ON, *nn*) after having consulted with Software AG Technical Support.

### SPOOL - Hardcopy Destination

This parameter enables you to specify a spooling system. The value for this parameter must correspond to the value for the SPOOL parameter in macro NATUTM. Possible values are:

Value:	Explanation:
NATSPOOL	Hardcopy will be printed via NAF (Natural Advanced Facilities), see <a href="#">Using NATSPOOL</a> .
REPRO-2000	For use with a remote spooling system, see <a href="#">Using REPRO-2000 Remote Spooling System</a> .
RMSPPOOL	For use with your own user exit program, see <a href="#">Using RMSPPOOL User Exit</a> .
<i>No value</i>	Hardcopy will be printed via openUTM (FPUT). This is the default.

### UINPEX - Name of User Exit

With this parameter, you can specify the name of a user exit. This user exit is invoked by Natural under openUTM after a terminal message has been sent; see also [User Exits](#). Possible values are:

Value:	Explanation:
<i>name</i>	<i>name</i> specifies the name of a user exit
INPSCR	By default, user exit INPSCR is used.

## UOUTEX - Name of User Exit

With this parameter, you can specify the name of a user exit. This user exit is invoked by Natural under *openUTM* before a terminal message is to be sent; see also *User Exits*.

Value:	Explanation:
<i>name</i>	<i>name</i> specifies the name of a user exit
OUTSCR	User exit OUTSCR is used. This is the default value.

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## Natural under openUTM - Part 3

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**Notation** *vrs* or *vr*

When used in this document, the notation *vrs* or *vr* represents the relevant product version (see also *Version* in the *Glossary*).

## User Exits

---

Several user exits are provided in the Natural *openUTM* Interface. These are described below.

To use any of these exits, the corresponding user program must be linked with the Natural environment-dependent nucleus (see the *Installation* documentation). The user exit RP2PRNT is an exception.

User exit routines are called with the customary register conventions.

ACCEXIT | ACCINIT | INPTEX | RP2PRNT | RMSPPOOL | SHUTALL | SHUTLST | STRTALL | STRTFST | TRMIOEX | UINPEX | UOUTEX | UVGEXIT | WHCEXT

### ACCEXIT - Macro NATUTM

The user exit ACCEXIT can be used to retrieve accounting information. Depending on the value of the parameter ACCNT in macro NURENT, this user exit is activated either at the end of each dialog step or at each change of application (new Natural logon ID); see also *Accounting for Natural openUTM Applications*.

### ACCINIT - Macro NATUTM

The user exit ACCINIT can be used to gather accounting information. It is activated at the beginning of each dialog step; see also *Accounting for Natural openUTM Applications*.

### INPTEX - Program FREXIT

The user exit INPTEX is activated whenever an input message is read. See also the description of the program INPTEX in the section *Utility Programs for Use with Natural under openUTM*.

## RP2PRNT - Macro NURENT

The user exit RP2PRNT is intended as an interface to other manufacturers' spooling systems. The user exit routine (spooling program) must be reentrant and linked with the reentrant part of the Natural *openUTM* application. See also *Other Spooling Systems* and the description of the parameter SPOOL in the section *Parameters of Macro NATUTM*.

## RMSPPOOL - Macros NATUTM and NURENT

If you wish to write your own spooling interface program, call it RMSPPOOL. The program RMSPPOOL can be linked to the non-reentrant part or to the reentrant part of the Natural *openUTM* application. If it is to be linked to the reentrant part, the program itself must be written so as to be reentrant.

 **Important:** If program RMSPPOOL is to be used, the SPOOL parameter in the macros NATUTM and NURENT must be set to SPOOL=RMSPPOOL.

The Natural *openUTM* Interface passes the following parameters to program RMSPPOOL:

Address (Format/Length)	Contents	
1st Address (A2)	Function code. Possible function codes are:	
	OP	The print file has to be opened, and the first print record is passed.
	PR	Any subsequent print record is passed.
	CL	The print file has to be closed.
2nd Address	Print record (data to be printed).  The first byte of the print record contains the line/form feed character. (If function code CL, this is a dummy address.)	
3rd Address (B2)	Length of print record (including feed character).  (If function code CL, this is a dummy address.)	
4th Address (A8)	Printer name.	
5th Address	Print buffer.  This buffer can be used as work area by RMSPPOOL (also if RMSPPOOL is reentrant) for any purpose. The buffer is available for exclusive use by RMSPPOOL between dialog input and dialog output.	
6th Address (B2)	Length of print buffer.	
7th Address (A8)	Current user ID (as in the system variable *USER).	
8th Address (A8)	Current terminal ID (as in the system variable *INIT - ID).	
9th Address (A8)	Current Natural library name (as in the system variable *LIBRARY - ID).	
10th Address (A8)	Current Natural program name (as in the system variable *PROGRAM).	

Address (Format/Length)	Contents
11th Address (A4/B4)	<p>Return code.</p> <p>When RMSP00L is invoked, the Natural <i>openUTM</i> Interface sets this field to binary 0. Upon return of control from RMSP00L, any value other than binary 0 is interpreted as error code and (if displayable) is displayed to the user on the terminal screen and also output to SYSLST.</p>

### SHUTALL - Macro NATUTM

The user exit specified with the [SHUTALL](#) parameter in macro NATUTM is activated whenever a *openUTM* task is terminated (KDCSHUT*n*). By default, this user exit is SHUTEX1.

If the user exit specified with SHUTALL is to be used, the parameter USAGE=SHUT in KDCDEF for the Natural *openUTM* Interface must have been set when generating KDCROOT.

### SHUTLST - Macro NATUTM

The user exit specified with the [SHUTLST](#) parameter in macro NATUTM is activated when the *last* *openUTM* task is terminated (KDCSHUT*n*). By default, this user exit is SHUTEX2.

If the user exit specified with SHUTLST is to be used, the parameter USAGE=SHUT in KDCDEF for the Natural *openUTM* Interface must have been set when generating KDCROOT.

### STRTALL - Macro NATUTM

The user exit specified with the [STRTALL](#) parameter in macro NATUTM is activated whenever an *openUTM* task is started. By default, this user exit is STARTEX.

### STRTFST - Macro NATUTM

The user exit specified with the [STRTFST](#) parameter in macro NATUTM is activated when the *first* *openUTM* task is started. By default, this user exit is STAPPLX.

### TRMIOEX - Program FREXIT

The user exit TRMIOEX is activated with each formatted input or output message.

### UINPEX - Macro NURENT

The user exit specified with the **UINPEX** parameter in macro **NURENT** is activated *after* a terminal message has been sent. By default, this user exit is **INPSCR**.

Natural under *openUTM* passes the following parameters to the user exit:

Address (Format/Length)	Contents
1st Address	Address input buffer.
2nd Address (B2)	Address message length.

### UOUTEX - Macro NURENT

The user exit specified with the **UOUTEX** parameter in macro **NURENT** is activated *before* a terminal message is to be sent. By default, this user exit is **OUTSCR**.

Natural under *openUTM* passes the following parameters to the user exit:

Address (Format/Length)	Contents
1st Address	Address output buffer.
2nd Address (B2)	Address message length.

### UVGEXIT - Macro NATUTM

The user exit **UVGEXIT** is activated at the start, restart and end (normal or abnormal) of an *openUTM* DC transaction. The current task ID (*Vorgangskennzeichen*, **KCKNZVG**) is passed to the user exit routine.

### WHCEXT - Macro NURENT

The user exit **WHCEXT** can be used to modify an output which is to be printed before it is passed by **FPUT** to *openUTM*. When **WHCEXT** is called, Register 9 contains the address of the output to be printed and Register 13 the address of the save area.

**WHCEXT** must be reentrant and it must be linked to the reentrant part of the Natural *openUTM* application. For further information, please refer to the source listing of the assembled macro **NURENT** (Label '**NUWHC**').

## Asynchronous Transaction Processing under openUTM

To start an asynchronous transaction, the service routine NATASYN in the Natural *openUTM* Interface has to be called.

The start of an asynchronous transaction in a Natural program is done by passing dynamic parameters according to the following pattern:

```

...
COMPRESS dynamic parameters INTO field
CALL 'NATASYN'[parameter area
SET CONTROL 'H'
WRITE NOTITLE NOHDR field
[WRITE ...]
INPUT 'text' ifield (A1)
END
    
```

If the length of the dynamic parameters exceeds 250 bytes (that is, if more than one WRITE statement is required), a *parameter area* has to be passed with the CALL 'NATASYN' statement.

The parameter area is also required if the asynchronous transaction is to be started with *openUTM* DPUT; that is, at a specific time. The aggregate length of the dynamic parameters must not exceed 3750 bytes. The *parameter area* for the CALL 'NATASYN' has the following structure:

Bytes	Contents	
01-02	Number of WRITE statements.	
03	DPUT time indicator:	
	R	a relative time,
	A	an absolute time
	<i>blank</i>	FPUT
04-06	Day of the year.	
07-08	Hours.	
09-10	Minutes.	
11-12	Seconds.	

For the contents of Bytes 03 - 12, the same rules apply as described for DPUT calls in the respective *openUTM* documentation. Natural programming examples can be found in the Natural library SYSEXTP (programs STARTAS1, ASYNMULT, STARTAS, READAUTO, AWINDOW1, AWINDOW2).

For asynchronous transaction processing, KDCROOT, KDCDEF and the *openUTM* startup job must be modified as necessary (see the *openUTM* documentation).

All *openUTM* TACs for asynchronous transactions must begin with the character sequence which is defined as a unique identifier for asynchronous TACs in parameter `ASYNTAC` of macro `NATUTM`. Conversely, the first five characters of *openUTM* TACs for synchronous transactions must *not* be this character string.

Mixed transaction processing (that is, both within a single *openUTM* application and between two *openUTM* applications) is not possible.

### Asynchronous Processing within a Natural openUTM Application

If transactions are to be processed asynchronously within a Natural *openUTM* application, the operands of the parameters `SYAPPLI` and `ASAPPLI` of macro `NATUTM` must be set to `NO` (this is the default value).

#### Example:

This is an example of a Natural program that initializes an asynchronous transaction within a Natural *openUTM* application.

```
* STARTAS - EXAMPLE OF THE INITIALIZATION FOR ASYNCHRONOUS
*          TRANSACTION WORKING WITHIN ONE UTM APPLICATION
*          PARS ARE SEPARATED BY ', '
*          SUBLIST IN STACK IS SEPARATED BY ';'
FORMAT LS=145
RESET PARM1(A144) PRDEST(A8) LTDEST(A8)
MOVE 'PRINTER1' TO PRDEST           /* --> Note 1
MOVE *INIT-ID TO LTDEST             /* --> Note 2
COMPRESS 'SENDER=' PRDEST ',OUTDEST=' LTDEST ', '
'MENU=F,STACK=(LOGON APPL1;READAUTO)'
INTO PARM1 LEAVING NO               /* --> Note 3
CALL 'NATASYN'                      /* --> Note 4
SET CONTROL 'H'                     /* --> Note 5
WRITE NOTITLE NOHDR PARM1           /* --> Note 6
INPUT 'ASYNTASK INVOKED - HOPEFULLY' IFELD(A1) /* --> Note 7
END
```

Note	
1	The name (dummy) of a printer is moved into field <code>PRDEST</code> .
2	The logical name of the <i>openUTM</i> terminal is moved into field <code>LTDEST</code> .
3	The message that is to be sent and processed by Natural is assembled, with the following information: <ul style="list-style-type: none"> <li>■ the printer name (in this example, an arbitrary 8-character name),</li> <li>■ the logical name (<code>KCLOGTER</code>) of the terminal to which the message is to be sent,</li> <li>■ suppression of the main menu (this must be specified),</li> <li>■ the application name (Natural logon ID),</li> </ul>

Note	
	<ul style="list-style-type: none"> <li>■ the name of the program to be started and to be run in an asynchronous <i>openUTM</i> transaction (READAUTO in the example).</li> </ul>
4	When the subroutine NATASYN (in macro NATUTM) is called, a marker is set to indicate that an asynchronous transaction is to be initialized. The subroutine NATASYN conforms to the conventions for calling non-Natural programs.
5	The Natural offline report is activated.
6	The message (PARM1) is output by FPUT as an asynchronous transaction.
7	The Natural offline report is “switched off” by means of an INPUT statement that must have at least one input field.

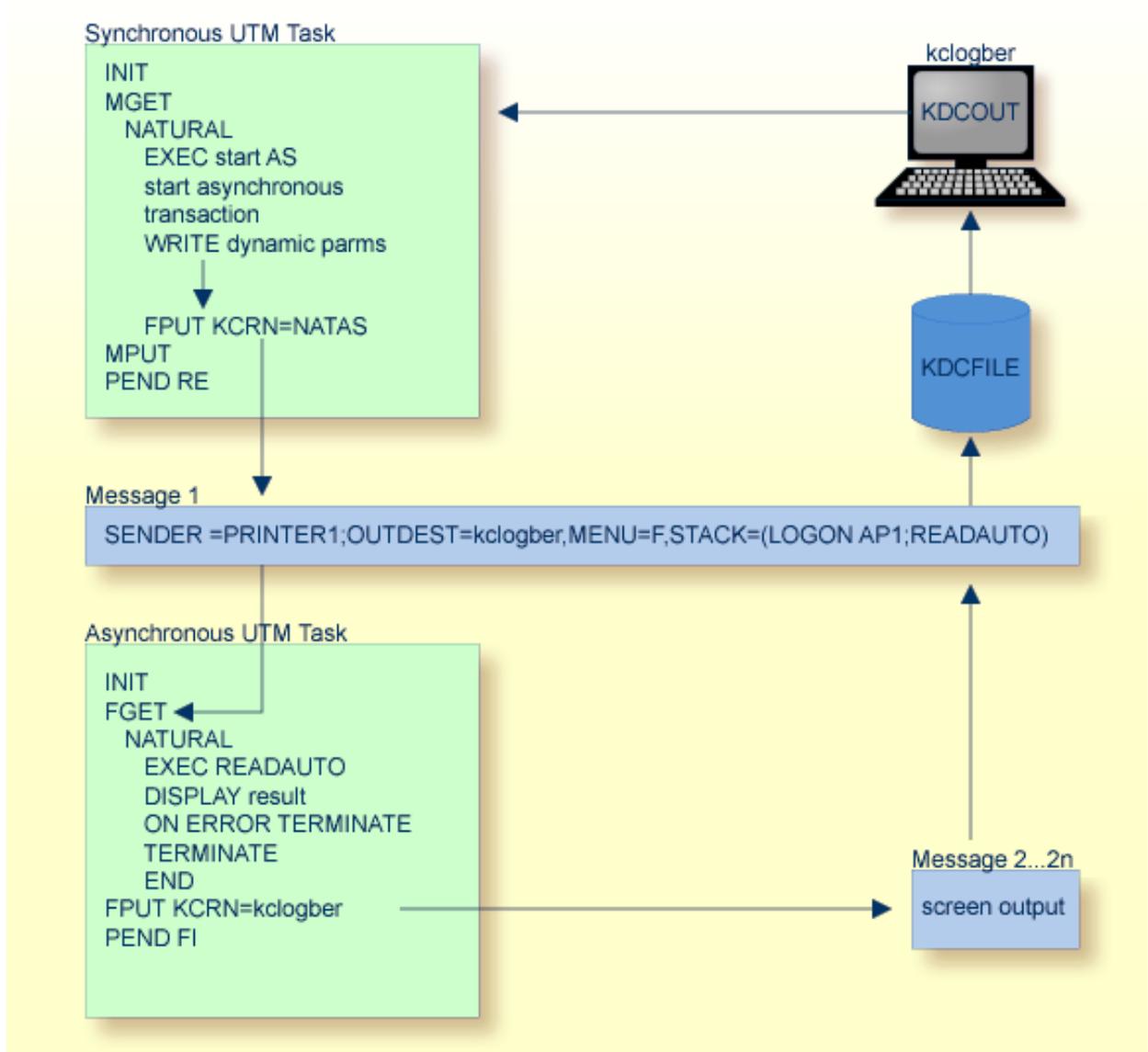
An example of the program that is to be executed asynchronously:

```

* READAUTO - EXAMPLE FOR ASYNCHRONOUS TRANSACTION WORKING
READ (75) AUTOMOBILES BY MAKE
WRITE MAKE MODEL HORSEPOWER YEAR
LOOP
ON ERROR DO                                /* --> Note 1
  ERRNO(A4) = *ERROR
  WRITE '*****'
      /'ERROR NO.: ' ERRNO ' IN ASYNCHRONOUS PROGRAM ' *PROGRAM
      /'*****'
  TERMINATE
DOEND
TERMINATE                                /* --> Note 2
END
    
```

Note	
1	An ON ERROR routine must be defined in each program that is to be executed asynchronously. The routine must end with a TERMINATE statement.
2	Each program that is to be executed asynchronously must end with a TERMINATE statement.

**Logic of an Asynchronous Transaction within one Natural openUTM Application:**



**Asynchronous Processing between two Natural openUTM Applications**

When processing transactions asynchronously between two Natural *openUTM* applications, the logical *openUTM* terminal name (LTERM name) of the synchronous application must be defined with the parameter *SYAPPLI* of macro *NATUTM*, and the logical *openUTM* terminal name (LTERM name) of the asynchronous application must be defined with the parameter *ASAPPLI* of macro *NATUTM*.

**Caution:** *KDCROOT* and *KDCDEF* must be generated as appropriate for both applications.

**Example:**

```
NUSTART NATUTM SYAPPLI=LNATUTM,ASAPPLI=LNATASY,...
ASYNDRV NATUTM SYAPPLI=LNATUTM,ASAPPLI=LNATASY,...
```

**Example of Synchronous Application:**

```
OPTION GEN=ALL,ROOTSRC=INPUT.KDCROOT.KDCNATS
ROOT.KDCNATS
MAX KB=400,SPAB=8192,NB=5120,TRMSGLTH=520
MAX APPLINAME=NATUTM,APPLIMODE=S,KDCFILE=(NATUTM,S)
MAX TASKS=10,ASYNTASKS=5
.
.
EXIT PROGRAM=NUSTART,USAGE=START
EXIT PROGRAM=NUSTART,USAGE=SHUT
EXIT PROGRAM=FREEIT,USAGE=FORMAT
.
.
DEFAULT PROGRAM COMP=ASSEMB
PROGRAM NUSTART
PROGRAM FREEIT
PROGRAM NUERROR
.
.
DEFAULT TAC TYPE=D,PROGRAM=NUSTART,EXIT=NUERROR,CALL=BOTH,...
TAC NAT,ADMIN=NO,TIME=0
TAC NAT1,ADMIN=NO,TIME=0
.
.
DEFAULT TAC TYPE=A,PROGRAM=NUSTART,EXIT=NUERROR,CALL=FIRST,...
TAC NATSY
TAC NATAS
.
.
PTERM NATASY,PRONAM=HOST,PTYPE=APPLI,TERMN=A1,LTERM=LNATASI
DEFAULT PTERM PRONAM=PCDF,PTYPE=T9750,TERMN=FE,CONNECT=N,STATUS=ON
PTERM DFDSS001,LTERM=DF97501
PTERM DFDSS002,LTERM=DF97502
.
.
LTERM LNATASY
DEFAULT LTERM USAGE=D,STATUS=ON,ANNOAMSG=Y,RESTART=YES
LTERM DF97501
LTERM DF97502
.
.
SFUNC F1,RET=21Z
.
.
END
```

**Example of Asynchronous Application:**

```

OPTION GEN=ALL,ROOTSRC=INPUT.KDCROOT.KDCNATA
ROOT.KDCNATA
MAX KB=400,SPAB=8192,NB=5120,TRMSGLTH=520
MAX APPLINAME=NATASY,APPLIMODE=S,KDCFILE=(NATASY,S)
MAX TASKS=10,ASYNTASKS=5
.
.
EXIT PROGRAM=ASYNDRV,USAGE=START
EXIT PROGRAM=ASYNDRV,USAGE=SHUT
EXIT PROGRAM=FREXIT,USAGE=FORMAT
.
.
DEFAULT PROGRAM COMP=ASSEMB
PROGRAM ASYNDRV
PROGRAM FREXIT
PROGRAM NUERROR
.
.
DEFAULT TAC TYPE=D,PROGRAM=ASYNDRV,EXIT=NUERROR,CALL=BOTH,...
TAC NAT,ADMIN=NO,TIME=0
TAC NAT1,ADMIN=NO,TIME=0
.
.
DEFAULT TAC TYPE=A,PROGRAM=ASYNDRV,EXIT=NUERROR,CALL=FIRST,...
TAC NATSY
TAC NATAS
.
.
PTERM NATUTM,PRONAM=HOST,PTYPE=APPLI,TERMN=A1,LTERM=LNATUTM
DEFAULT PTERM PRONAM=PCDF,PTYPE=T9750,TRMN=FE,CONNECT=N,STATUS=ON
PTERM DFDSS001,LTERM=97501
PTERM DFDSS002,LTERM=97502
.
.
LTERM LNATUM
DEFAULT LTERM USAGE=D,STATUS=ON,ANNOAMSG=Y,RESTART=YES
LTERM DF97501
LTERM DF97502
.
.
SFUNC F1,RET=21Z
.
.
END

```

Please see also the *openUTM* documentation. If the asynchronous application is primarily intended for processing asynchronous transactions, storage can be saved by generating this application with a small (local) Natural swap pool of about 64 KB.



**Important:** The TAC that was defined with the parameter **SYNTAC** (the default value is NATSY) must always be defined for KDCDEF with TYPE=A; this is an exception to the rules for naming openUTM TACs. If, in addition, the synchronous application uses the openUTM TACCLASS concept, an asynchronous TAC class must also be allocated to this TAC

**Example of a Natural Program to Initialize an Asynchronous Transaction between two Natural openUTM Applications:**

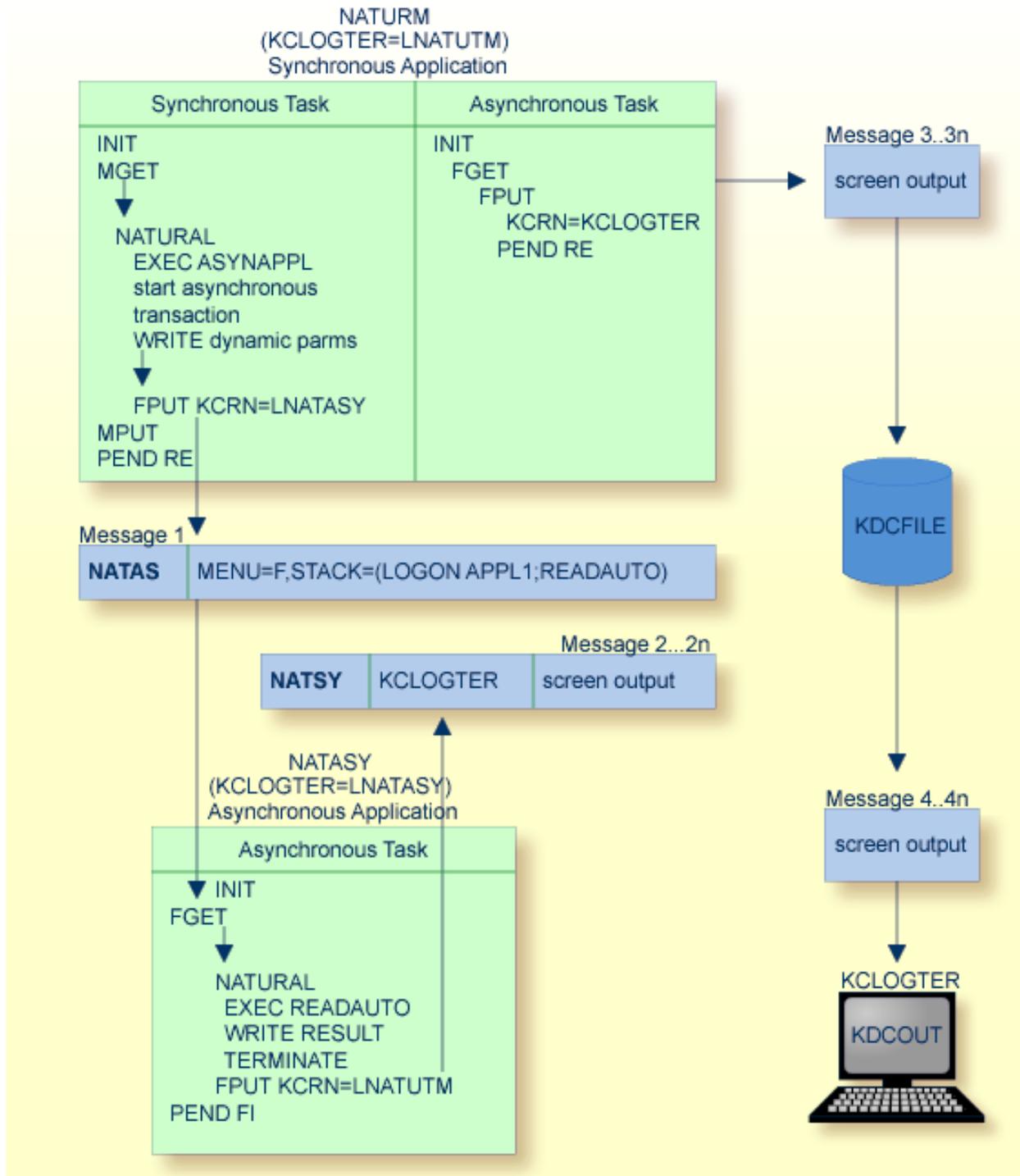
```
* ASYNAPPL - EXAMPLE OF INITIALIZATION FOR ASYNCHRONOUS
*           TRANSACTION WORKING BETWEEN TWO UTM APPLICATIONS
FORMAT LS=145
RESET PARM1(A144) PRDEST(A8) LTDEST(A8) ASYNTAC(A8)
MOVE 'PRINTER1' TO PRDEST           /* --> Note 1
MOVE *INIT-ID   TO LTDEST           /* --> Note 2
MOVE 'NATSY'   TO ASYNTAC          /* --> Note 3
COMPRESS 'NATAS' ' SENDER=' PRDEST ',OUTDEST=' LTDEST
        ',ASYNNAME=' ASYNTAC ', '
        'MENU=F,STACK=(LOGON APPL1;READAUTO)'
        INTO PARM1 LEAVING NO       /* --> Note 4
CALL 'NATASYN'                      /* --> Note 5
SET CONTROL 'H'                      /* --> Note 6
WRITE NOTITLE NOHDR PARM1           /* --> Note 7
INPUT 'ASYNTASK INVOKED - HOPEFULLY' IFELD(A1) /* --> Note 8
END
```

Notes	
1	The name of a printer (simulation) is moved into the field PRDEST.
2	The logical name of the openUTM terminal (KCLOGTER) is moved into the field LTDEST.
3	The standard TAC for sending “free-running” messages from the asynchronous application to the synchronous application is put in the field ASYNTAC. See also the description of the parameter SYNTAC of macro NATUTM.
4	The message that is to be sent and processed by Natural is assembled, with the following information: <ul style="list-style-type: none"> <li>■ transaction code for the asynchronous transaction (NATAS),</li> <li>■ printer name (in this example, an arbitrary 8-character string),</li> <li>■ the logical name (KCLOGTER) of the terminal to which the message is to be sent,</li> <li>■ the name of the standard TAC for sending free-running messages from the asynchronous application to the synchronous application,</li> <li>■ main menu suppression (this must be specified),</li> <li>■ the name of the application (Natural logon ID),</li> <li>■ the name of the Natural program to be started and to be run in the asynchronous transaction/application (in this example, READAUTO).</li> </ul>
5	When subroutine NATASYN (in macro NATUTM) is called, a marker for the initialization of an asynchronous transaction is set. The subroutine conforms to the conventions for calling non-Natural programs.

Notes	
6	The Natural offline report is activated.
7	The message (PARM1) is output with FPUT as an asynchronous transaction.
8	The Natural offline report is “switched off” by means of an INPUT statement with at least one input field.

The program to be executed asynchronously (READAUTO) must conform to the conventions that apply to asynchronous transaction processing within one Natural *openUTM* application.

Logic of Asynchronous Transaction between two Natural openUTM Applications:



## Printing under openUTM

- Using Local Non-Spooled Printers
- Using NATSPOOL (Natural Advanced Facilities)
- Other Spooling Systems

### Using Local Non-Spooled Printers

A Natural program that wishes to use local printers without spooling (that is, with FPUT via *openUTM*), should proceed as shown in the following example.

#### Example:

```
* TESTPRNT - TEST FOR THE Natural OFFLINE REPORT
RESET PARAM(A9)
REDEFINE PARAM (PARAM1(A1) PARAM2(A8))
MOVE 'H' TO PARAM1 /* --> Note 1
MOVE 'PRINTER1' TO PARAM2 /* --> Note 2
SET CONTROL PARAM /* --> Note 3
READ (50) AUTOMOBILES BY MAKE
WRITE NOTITLE NOHDR MAKE MODEL HORSEPOWER YEAR /* --> Note 4
LOOP
EJECT
INPUT 'PRINT ORDER WAS EXECUTED' IFELD(A1) /* --> Note 5
END
```

Notes	
1	The Natural offline report is activated by putting an H in the first position of the field PARAM.
2	The logical <i>openUTM</i> printer name is defined starting at the second position of the field PARAM.
3	The SET CONTROL statement, together with the content of the field PARAM, activates the Natural offline report and specifies the name of the printer. To ensure compatibility for existing programs written using Natural Version 1, the programs CMLIST and NATPRNT continue to be available; see <a href="#">Utility Programs for Use with Natural under openUTM</a> .
4	The print records are passed to <i>openUTM</i> from the Natural <i>openUTM</i> Interface using FPUT.
5	The INPUT statement (which must have at least one input field) deactivates the Natural offline report.

All the necessary steps for using local printers must have been taken when generating *openUTM*; for further details, please refer to the *openUTM* documentation. The appropriate *openUTM* administration commands can be used to verify that a connection to the defined printers exists.

## Using NATSPOOL (Natural Advanced Facilities)

The parameter `SPOOL` of macro `NATUTM` is provided for using `NATSPOOL` under `openUTM`. Further details are given in the section *Parameters of Macro NATUTM*. Please refer also to the BS2000-specific installation information in the *Natural Advanced Facilities* documentation.

If in an asynchronous `openUTM` transaction printing is to be done with `NATSPOOL`, the `TERMINATE` statement must be preceded by an `END OF TRANSACTION` statement.

## Other Spooling Systems

The User Exit `RP2PRNT` is provided for interfacing to other spooling systems. This user exit is activated if `REPRO-2000` is specified with the parameter `SPOOL` in macro `NURENT`. (This value should be used for all spooling systems.)

Since it must be linked with the reentrant part of the Natural `openUTM` application, the user exit routine `RP2PRNT` must be reentrant.

The logic of the transfer of print records from Natural, buffer processing, etc., can be seen in macro `NURENT` (labels `CMWTERM` and `CMWHC`) and the appropriate routines in macro `NATUTM`.

As an alternative, it is possible to use the User Exit `RMSPPOOL`; see section *User Exits* above.

Software AG does not provide support for this interface to other spooling systems except as described in the preceding paragraphs.

## Calling Non-Natural Programs

---

Non-Natural programs are called using the standard register conventions for inter-program communication. If the program to be called is reentrant (uses shared code), it can be defined with the profile parameter `CSTATIC` in the Natural parameter module (macro `NTPRM`) and linked to the reentrant part of the `openUTM` application. Otherwise, one of the following procedures can be used:

- The programs can be dynamically loaded at runtime. To do this, the programs must be in the library defined with the profile parameter `LIBNAM` in the Natural parameter module or in the `BLSLIB` libraries specified in the `openUTM` start job;
- The programs can be linked to the Natural environment-dependent nucleus (see the *Installation* documentation). To do this, the names of the programs must be defined in the operand of the parameter `LINK`, `LINK2`, `LINK3` or `LINK4` of macro `NATUTM`. This procedure is always necessary for programs that contain an `EXTRN` reference to an `ENTRY` that is already present in the Natural environment-dependent nucleus. The Natural `openUTM` Interface executes a `TABLE` macro call for the programs that have been defined in this way. This makes an entry in the dynamic loader's

LINK table, indicating that it is not necessary to dynamically load the programs when they are called by the Natural program.

In both cases, the maximum number of called non-Natural programs must be defined with the parameter `CDYNAM` of macro `NATUTM`; see *Parameters of Macro NATUTM*.



**Note:** If parameter `KB` in macro `NATUTM` is set to `YES`, Natural always passes the address of the *openUTM* communication area `KB` (*Kommunikationsbereich*) as the first parameter address. This does not apply to programs which are defined with profile parameter `CSTATIC`.

## Calling openUTM Chained Partial Programs

Several methods are provided for ending a Natural session (`FIN` or `TERMINATE`) with a `PEND PR(OGRAM)` instead of a `PEND FI(NISH)`, so that another *openUTM* partial program is called:

- The *openUTM* TAC for the *openUTM* partial program that is to be called can be passed using the Natural dynamic parameter `PROGRAM` at the start of the Natural session, for example:

```
STACK=(LOGON APPL1;MENU),PROGRAM=NAT10
```

- The *openUTM* TAC for the *openUTM* partial program that is to be called can be defined in the operand of the parameter `PENDPR` of macro `NATUTM`, for example:

```
NATUTM PENDPR='NAT10'
```

- The utility program `TACSWTCH` can be used.

In all cases, the Natural *openUTM* Interface would execute a `PEND PR(OGRAM)` with the *openUTM* TAC `NAT10` at the end of the Natural session, which means that the *openUTM* partial program associated with this TAC would be started.

Another way to execute a `PEND PR(OGRAM)` is by activating the function key defined for this purpose, which suspends, but not terminates, the Natural session. On return from the *openUTM* partial program with `PEND PR(OGRAM)`, the Natural session can be continued from the point at which it has been suspended; see also the parameter `PRKEY`. If the function key for `PEND PR(OGRAM)` is activated without a *openUTM* TAC for another *openUTM* partial program being defined, an appropriate error message is displayed.



**Note:** The programs `NUEXAMPL`, `UTMNAV` and `UTMCOB` show examples of the logic necessary in an *openUTM* partial program that wishes to communicate with the Natural *openUTM* Interface (and therefore with Natural itself) - see the descriptions of programs `UTMCOB` and `UTMNAV` in the section *Software Exchange*.

## Calling Adabas from Non-Natural Programs in a Natural openUTM Application

---

If a Natural program calls a non-Natural program that also includes Adabas calls, the appropriate field in the Adabas control block must be supplied with the current Adabas user ID. In this case, generate the `CSECT ADACALL` in the Natural *openUTM* Interface.

`ADACALL` contains an entry which is defined with the parameter `ADACALL` in macro `NATUTM` (the default value of this parameter is `ADABAS`).

This entry is activated for every `CALL [ADABAS] USING . . .`. The current Adabas user ID is passed to the field `ADDITIONS2` of the Adabas command block, and subsequent processing of the Adabas call is passed to the Adabas interface module `ADALNN`; see also the parameter `ADACALL`.

## Terminating an openUTM Task Abnormally

---

The Natural session (and thereby also the *openUTM* task) can be abnormally terminated by entering the `CANCEL` parameter's value of the Natural parameter module (default is `*CANCEL` in upper-case letters).

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## Natural under openUTM - Part 4

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## Accounting for Natural openUTM Applications

To better control the use of resources by Natural *openUTM* applications, accounting records are made available by the user exits ACCINIT and ACCEXIT.

- The user exit ACCINIT is activated by the Natural *openUTM* Interface at the beginning of each dialog step.
- The user exit ACCEXIT is activated by the Natural *openUTM* Interface depending on the parameter ACCNT in macro NURENT:

ACCNT=DIAL	The user exit ACCEXIT is activated at the end of each dialog step.
ACCNT=APPL	The user exit ACCEXIT is activated at each change of application (new Natural logon ID).

In both cases, an accounting record is also provided at the end of the session (FIN system command or TERMINATE statement).

### Structure of the Accounting Record

0 - 7	Logical <i>openUTM</i> terminal name	DS	CL8
8 - 15	User ID	DS	CL8
16 - 23	Current Natural application name	DS	CL8
24 - 27	Number of Adabas calls	DS	F
28 - 31	Accumulated message length	DS	F
32 - 35	Elapsed time in Natural including subroutines (milliseconds)	DS	F
36 - 37	Number of pages printed	DS	H
38 - 39	Number of terminal I/O transfers	DS	H
40 - 49	(user area)	DS	CL10
50 - 51	unused	DS	CL2
52 - 55	Adabas command time (milliseconds)	DS	F
56 - 63	Name of last transaction program	DS	CL8

The user area of the accounting record can (if required) be used for additional application-specific accounting information. The accounting area is in the user-specific *openUTM* communication area KB (*Kommunikationsbereich*).

The current address of the *openUTM* KBs can be found with the entry CMKBADR of macro NATUTM as necessary; otherwise, the operand of the parameter KB of macro NATUTM must be set to YES. In this case, Natural passes the address of the communication area as the first parameter of every subroutine call.

The user exit routine `ACCEXIT` can store the accounting records in an Adabas file, in a shared sequential PAM data set or in a task-specific SAM data set. The program `ACCEXIT` shows an example of the method for storing accounting records; see [Software Exchange](#).

## Utility Programs for Use with Natural under openUTM

Several utility programs are provided for use with Natural under *openUTM*.

The following rules apply to their usage:

- The Natural and *openUTM* macro libraries must be used when assembling these utilities.
- When a particular program is to be used:
  - its name must be specified with the parameter `LINK` or `LINK2` of macro `NATUTM`
  - and the program itself must be linked to the Natural environment-dependent nucleus (see the *Installation* documentation).

A short-form description of these utility programs is given below.

`NATDUE` | `INPTX` | `NATPRNT` | `UTMTAC` | `TACSWTCH`

A detailed description, including the interface, valid parameter values and a summary of the logic, can be found in each program's maintenance log.

### Utility Program NATDUE

The program `NATDUE` can be used to find out within a Natural program whether the user has entered data in the current dialog step or whether merely `EM/DÜ` or `DÜ` was pressed.

The utility program `INPTX` must be used if `NATDUE` is to be called. The program `INPTX` satisfies the user exit `INPTX` in the format exit module `FREXIT` and checks at each dialog step whether data were entered. According to the result of this test, a flag that is subsequently interrogated by the program `NATDUE` is set in the communication area `KB` (*Kommunikationsbereich*).

### Example of a Natural Program that Calls NATDUE:

```
* PROG1 - EXAMPLE FOR CALLING THE SUBROUTINE 'NATDUE'
RESET P1(A1) ...
...
INPUT USING MAP ...
CALL 'NATDUE' P1
IF P1 = 'Y' DO ...      /* INPUT FROM USER
IF P1 = 'N' DO ...      /* NO INPUT FROM USER
IF P1 = 'E' DO ...      /* ERROR
...
END
```

## Utility Program INPTEX

The utility program `INPTEX` satisfies the user exit of the same name in the format exit `FREXIT`.



**Important:** `INPTEX` must be linked to the Natural environment-dependent nucleus (see the *Installation* documentation).



**Caution:** Any modifications that can be made to this program, for example, ignoring data entered in a particular line on the terminal screen, are made at the user's risk.

The function of this program is to check each input message for the presence of input from the terminal, or whether merely `EM/DÜ` or `DÜ` was pressed.

It is not necessary to define the program name `INPTEX` with the parameter `LINK` or `LINK2` of macro `NATUTM`.

## Utility Program NATPRNT

The program `NATPRNT` provides the following special service functions for operating local printers:

- accepting the logical name of the target printer;
- verifying the printer name against a list of valid printer names;
- setting a marker for building variable length print records.

## Utility Program UTMTAC

The program `UTMTAC`, which can be called from a Natural program, yields the current *openUTM* TAC. This makes it possible for a central Natural program to perform *openUTM* TAC-controlled “navigation” within a Natural *openUTM* application.

## Utility Program TACSWTCH

The utility program `TACSWTCH` is a macro which can be used to dynamically assign an *openUTM* TAC for a `PEND PR(OGRAM)` from within a Natural program. The specified *openUTM* TAC is checked against the generated *openUTM* table and saved accordingly. Also, information can be passed to the `PEND PR(OGRAM)`. To use this utility, proceed as follows:

1. Define the valid *openUTM* TACs and assemble the `TACSWTCH` macro:
2. For Example: `TACSWTCH TAC=(tac1,tac2,tac3,...tacn)` These TACs have to be defined in `KDCDEF` as well, and for the generation of `KDCROOT` they have to be assigned to the corresponding *openUTM* partial programs.
3. Define the program `TACSWTCH` with the parameters `LINK` to `LINK4` in macro `NATUTM`.
4. Link program `TACSWTCH` to the Natural environment-dependent nucleus (see the *Installation* documentation).



Value	Explanation
PUTP	Data will be moved from the adequate data area of the calling Natural program to the print buffer.
PUTU	Data will be moved from the adequate data area of the calling Natural program to the KB user extension.

The first two bytes (format: binary) in the data area of the Natural program must contain the data length (including these first two bytes). The data will be moved including the first two bytes.

**Example for PUTP and GETP:**

```

DEFINE DATA LOCAL
01 P1(A8)                /* FUNCTION CODE/UTM TAC
01 P2(A252)              /* FIRST PART OF DATA AREA
01 REDEFINE P2
    02 P21(B2)           /* DATA LENGTH INCLUDING FIRST TWO BYTES
    02 P22(A250)
01 A1(A250)              /* SECOND PART OF DATA AREA
01 P3(N1)                /* RETURN CODE
END-DEFINE
...                      /* PROGRAM LOGIC
MOVE 'PUTP' TO P1        /* MOVE FUNCTION CODE FOR TACSWTCH
MOVE 502 TO P21          /* MOVE TOTAL LENGTH OF DATA
CALL 'TACSWTCH' P1 P2 P3 /* PUT DATA INTO PRINT BUFFER
IF P2 NE 0               /* RETURN CODE CONTROLLING
    DO...                /* ERROR LOGIC
MOVE 'NAT1' TO P1        /* MOVE ADEQUATE UTM TAC
MOVE 'G' TO P3           /* EXECUTE PEND PR WITH TAC NAT1
CALL 'TACSWTCH' P1 P3
IF P3 NE 0               /* RETURN CODE CONTROLLING
    DO...                /* ERROR LOGIC
INPUT ' '                /* DUMMY MESSAGE FOR DRIVER CONTROL
    
```

Now the Natural *openUTM* driver gets control and runs with the following logic:

1. It ignores the dummy message (INPUT ' ').
2. MPUT with LENGTH=0 and PEND PR with TAC 'NAT1' for the *openUTM* partial program.
3. The *openUTM* partial program gets the Natural program data through the print buffer. The print buffer is located in the *openUTM* SPAB and the address of the print buffer is defined in the field 'KBAPBUFF', which is located in the *openUTM* KB:
  - It moves data for the Natural program into the print buffer (the first two bytes must contain the data length in binary format, including the two-byte length field).
  - It executes an MPUT with LENGTH=0 and a PEND PR with the TAC defined for the Natural *openUTM* driver.
4. The Natural *openUTM* driver gets control (INIT/MGET).
5. It simulates ONLY ENTER for Natural.

6. It resumes with Natural as follows:

```

MOVE 'RESET' TO P1          /* MOVE FUNCTION CODE FOR TACSWTCH
CALL 'TACSWTCH' P1 P3      /* RESET PEND PR TAC (NAT1)
IF P3 NE 0                 /* RETURN CODE CONTROLLING
    DO...                  /* ERROR LOGIC
MOVE 'GETP' TO P1          /* MOVE FUNCTION CODE FOR TACSWTCH
CALL 'TACSWTCH' P1 P2 P3  /* GET DATA FROM PRINT BUFFER
IF P3 NE 0                 /* RETURN CODE CONTROLLING
    DO...                  /* ERROR LOGIC
...                         /* PROGRAM LOGIC
END

```

If the parameter **KBSAVE** of macro NATUTM is set to YES, the called *openUTM* partial program may use the *openUTM* KB (from the end of the header plus first twelve bytes). In this case, the *openUTM* KB will be saved (beginning from KB header plus first twelve bytes) with SPUT and will be refreshed with SGET.

When defining *openUTM* transaction codes for the transaction logic between Natural and other *openUTM* partial programs, the following rule applies:

For a PEND PR from another *openUTM* partial program to the Natural *openUTM* driver, the preceding start TAC may never be used. The fact that the Natural *openUTM* driver was called by a PEND PR can only be recognized if the contents of the preceding start TAC in field KCTACVG are different from the current TAC in field KCTACAL. (Normally, field KCTACVG contains the TAC with which the user has entered the application.)

## Software Exchange

Software AG's customers have developed programs that meet certain specific needs found in their Natural *openUTM* applications. These programs are made available to all interested users via the "Software Exchange". This also applies to programs developed by Software AG that demonstrate example solutions to particular problems.

These programs, which are available free of charge, are not maintained by Software AG. The complete documentation of each program is usually included in the maintenance log of the source listing.

A short-form description of each program is given below:

[XAMDUSA](#) | [UTMCOB](#) | [UTMNAV](#) | [NUEXAMPL](#) | [ACCEXIT](#) | [TABMOD](#)

## Program XAMDUSA

This program saves and restores the current user-specific `WORKING-STORAGE SECTION` of the calling COBOL program.

This enables user-specific data areas, for example tables, to be accessible over many dialog steps and without regard to the *openUTM* task in which the user is currently running. The data are saved in a PAM file using logical/physical chained PAM-I/O.

## Program UTMCOB

Program `UTMCOB` is an example of a user-specific *openUTM* partial program within a Natural *openUTM* application. It shows the fundamental logical structure of a program that, as a *openUTM* partial program:

- Can be activated by the user by associated *openUTM* TACs.
- Activates the Natural *openUTM* Interface and hence the Natural application by means of `PEND PR(OGRAM)` with dynamic Natural parameters.
- Can be activated from the Natural *openUTM* Interface by means of `PEND PR(OGRAM)`.

See also [Calling openUTM Chained Partial Programs](#).

## Program UTMNAV

Program `UTMNAV` is another example of a user-specific *openUTM* partial program within a Natural *openUTM* application:

- It can be activated by the user or with `PEND PR(OGRAM)` by the associated *openUTM* TAC.
- It interprets passed messages as dynamic Natural parameters.
- It provides screen output of information on the program logic.
- Previously received screen input (Natural dynamic parameters) is sent with `MPUT` and passed to the Natural *openUTM* Interface with `PEND PR(OGRAM)`.

Program `UTMNAV` contains an example of how the *openUTM* KB can be used as a “common” user area.

### Program NUEXAMPL

Program NUEXAMPL is an example of a user-specific *openUTM* partial program which can exchange data with a Natural program. The program logic of NUEXAMPL and of the calling Natural program is described in the maintenance log of NUEXAMPL.

### Program ACCEXIT

Program ACCEXIT is an example of a program that saves accounting data on a shared ISAM data set. The user exits ACCEXIT and SHUTEX2 of the Natural *openUTM* Interface are used. See also [Accounting for Natural openUTM Applications](#).

### Program TABMOD

The program TABMOD, which can be called from a Natural program, performs the following functions:

- load data records, for example a table, into a common memory pool using a unique key when an application is started and whilst an application is running;
- transfer data records according to the requirements of the calling Natural program.

This makes it possible to load frequently-needed data into storage once only and then keep them resident.

TABMOD is available as a macro in the library NUT $nnn$ .MAC. It contains all information necessary for its installation and usage.

## openUTM TACCLASS Concept - Priority Control

---

Natural programs can allocate *openUTM* TAC classes to optimize resource control using the *openUTM* TACCLASS concept in a Natural *openUTM* application.

The following procedure should be followed when generating the Natural *openUTM* application and creating the Natural program:

## Step 1: Specify openUTM TACs and TAC Classes in the KDCDEF and KDCROOT Definitions

### Example:

```

OPTION GEN=ALL,ROOTSRC=INPUT.KDCROOT.KDCNATP
ROOT KDCNATP
MAX APPLINAME=NATUTM,APPLIMODE=S,KDCFILE=(NATUTM,S)
MAX KB=400,SPAB=8192,NB=5120,TRMSGLTH=5120
MAX TASKS=10
MAX ASYNTASKS=3
...
EXIT PROGRAM=NUSTART,USAGE=START
EXIT PROGRAM=NUSTART,USAGE=SHUT
EXIT PROGRAM=FREXIT,USAGE=FORMAT
...
DEFAULT PROGRAM COMP=ASSEMB
PROGRAM NUSTART
PROGRAM FREXIT
PROGRAM NUERROR
PROGRAM KDCADM,COMP=SPL4
...
DEFAULT TAC TYPE=D,PROGRAM=NUSTART,EXIT=NUERROR,CALL=BOTH,...
TAC NAT,TIME=(3600000,5400),TACCLASS=1,...
TAC NAT1,TIME=(3600000,5400),TACCLASS=2,...
...
DEFAULT TAC TYPE=A,PROGRAM=NUSTART,EXIT=NUERROR,CALL=FIRST,...
TAC NATAS,TACCLASS=9
TAC NATAS1,TACCLASS=10
...
TACCLASS 1,TASKS=3
TACCLASS 2,TASKS=1
TACCLASS 9,TASKS=2
TACCLASS 10,TASKS=1
...
END
    
```

See also the *openUTM* documentation *openUTM Generierung und Administration (openUTM Generation and Administration)*.

### Notes on the openUTM TACs Defined

<b>openUTM TAC</b>	<b>Explanation</b>
NAT	This is the <i>openUTM</i> TAC for less resource-intensive synchronous transactions; that is, transactions of short duration.
NAT1	This is the <i>openUTM</i> TAC for more resource-intensive synchronous transactions; that is, transactions of longer duration.
NATAS	This is the <i>openUTM</i> TAC for less resource-intensive asynchronous transactions.
NATAS1	This is the <i>openUTM</i> TAC for more resource-intensive asynchronous transactions.

## Step 2: The Structure of the openUTM Start Job

The name of the job is EN.NATUTM.

### Example:

```
/.NATUTM LOGON Natural,E,,TIME=10000
/SYSFILE SYSOUT=PROT.UTMSTAT
/FILE NATUTM.KDCA,LINK=KDCFILE
/ERASE NATUTM.PRINTCONTROL
/STEP
/FILE LOG.NATUTM,LINK=SYSLOG
/FILE NATUTM.SWAPFILE,LINK=PAMNAT,SHARUPD=Y
/SYSFILE TASKLIB=NAT210.MOD
/.REPEAT EXEC NATUTM.E
.UTM START FILEBASE=NATUTM
START TASKS=7
START ASYNTASKS=3
START STARTNAME=EN.NATUTM
.UTM END
/SKIP .REPEAT
/STEP
/SYSFILE SYSOUT=(PRIMARY)
/STEP
/SYSFILE SYSLST=(PRIMARY)
/CAT NATUTM.PRINTCONTROL,SHARE=YES
/PRINT LST.NATUTM.,SPACE=E
/ERASE LST.NATUTM.
/STEP
/LOGOFF NOSPOOL
```

## Step 3: Change the TAC Class of Synchr. Transactions by a Natural Program

The TAC-class of synchronous *openUTM* transactions can be changed by a Natural program with the statements:

```
CALL 'NATTAC' operand1[operand2] [operand3]INPUT 'TACCLASS
```

where:

<i>operand1</i>	Must contain the value $S=n$ , where $S$ denotes "synchronous" and $n$ is an integer value (0 - 4) that denotes the priority level of the transaction in subroutine NATTAC's table of transaction codes for synchronous TACs.
	If $n$ is 0, the table of transaction codes is not used. The TAC to be used is passed explicitly in <i>operand2</i> when NATTAC is called.
	If $n$ is a value in the range 1 - 4, the priority level of the desired TAC is taken from the appropriate parameter <a href="#">TCLS1</a> to <a href="#">TCLS4</a> (for synchronous transactions) or <a href="#">TCLA1</a> to <a href="#">TCLA4</a> (for asynchronous transactions).

	If the subroutine NATTAC detects an error in <i>operand1</i> , it returns immediately to the calling program with an error code in <i>operand1</i> :
E01	The first two characters of <i>operand1</i> were neither S= nor A=.
E02	The third character of <i>operand1</i> was <0 or >4.
E03	No <i>openUTM</i> TAC was defined for the specified priority level when the Natural <i>openUTM</i> application was generated, which means that the corresponding parameter (TCLS <i>n</i> or TCLA <i>n</i> ) has the value - .
<i>operand2</i>	Optional. Must contain the <i>openUTM</i> TAC for the desired TAC class if the third character of <i>operand1</i> is 0.
<i>operand3</i>	Optional. Must contain the value Y if the current user's subsequent dialog is to be executed with the <i>openUTM</i> TAC defined in <i>operand1</i> or <i>operand2</i> . If <i>operand3</i> is omitted when NATTAC is called, or if <i>operand3</i> has some value other than Y, the START transaction code for the current user is used again with the first terminal output (standard function). If <i>operand3</i> has the value Y when NATTAC is called, further processing for the current user takes place with the <i>openUTM</i> TAC specified in <i>operand1</i> (implicit) or <i>operand2</i> (explicit) .

The statement INPUT 'TACCLASS' does not perform any terminal I/O; its function is merely to control the TACCLASS allocation.

Alternatively, a Natural program can call the Natural subprogram NATTAC with a CALLNAT statement. For this, the INPUT 'NATTAC' statement is omitted; the operands are the same as for the CALL statement (see above):

```
CALLNAT 'NATTAC' operand1[operand2] [operand3]
```

This procedure can be used with synchronous as well as asynchronous transactions. NATTAC is contained in the library SYSTEM.

**Example 1:**

A Natural program that allocates an *openUTM* TAC explicitly to assign a new TAC class and then changes over to the START *openUTM* TAC.

```
* TACCLASS - EXAMPLE FOR A TACCLASS SWITCH
RESET CONTROL(A3) NEWTAC(A8) NR(N3)
REDEFINE CONTROL (ERRFLD(A1))
INPUT 'TEST FOR A TACCLASS SWITCH - NEW TAC: NAT1' IFELD(A1)
MOVE 'S=0' TO CONTROL /* SYNCHR. TAC, EXPLICIT --> Note 1
MOVE 'NAT1' TO NEWTAC /* SET NEW TAC --> Note 2
CALL 'NATTAC' CONTROL NEWTAC /* INVOKE TAC SWITCH --> Note 3
IF ERRFLD = 'E' DO /* ERROR CHECK --> Note 4
    DISPLAY 'ERROR' CONTROL 'FROM NATTAC'
    TERMINATE
DOEND
INPUT 'TACCLASS' /* ACTIVATE NEW TAC --> Note 5
```

```

READ (50) AUTOMOBILES BY MAKE      /* NOW IN NEW TACCLASS  --> Note 6
ADD 1 TO NR
WRITE NOTITLE NOHDR NR MAKE MODEL /* START TAC IS USED    --> Note 7
LOOP
ON ERROR DISPLAY 'ERROR IN PROGRAM TACCLASS'
END

```

Note	
1	The value S=0 indicates that it is a synchronous transaction and that the TAC is passed explicitly in the second parameter of the CALL 'NATTAC', which means that the TAC table is not used.
2	The new TAC (NAT1) is set up for the call to NATTAC.
3	The change of TAC class is initialized by calling NATTAC.
4	An error check is performed after returning from subroutine NATTAC.
5	A pseudo-MPUT and a PEND PA are executed with the new TAC.
6	The program is now running in the TAC class for NAT1.
7	When the first terminal output starts, the START <i>openUTM</i> TAC takes effect again.

In this example, the `AUTOMOBILE` file is read using the *openUTM* TAC NAT1. When the first terminal output begins, the START *openUTM* TAC (NAT) takes effect again.

### Internal Processing Logic:

When NATTAC is called, a flag is set in the *openUTM* communication area (*Kommunikationsbereich*) indicating that a change of TACCLASS is pending.

The *openUTM* TAC passed by the program is also stored in the user-specific communication area. The operation `INPUT 'TACCLASS'` causes terminal output from Natural, which causes the *openUTM* Interface to issue an MPUT and a PEND 'PA' with the new *openUTM* TAC (the message is received by the Natural *openUTM* Interface itself). When the message is received (in the new TAC class), the presence of the TACCLASS change flag causes the interface to simulate an ETX/DÜ in its input area. Further processing runs in the new TAC class.

Depending upon the value of the operand in the previous call of NATTAC, the first message sent to the terminal can cause an MPUT and a PEND 'PR' with the user's START *openUTM* TAC; that is, a further TACCLASS change may take place.

### Example 2:

A Natural program that allocates a *openUTM* TAC explicitly to assign a new TAC class without changing over to the START *openUTM* TAC.

```

* TACCLAS1 - EXAMPLE FOR A TACCLASS SWITCH
RESET CONTROL(A3) NEWTAC(A8) SWOFF(A1)
INPUT 'TEST FOR A TACCLASS SWITCH - NEW TAC: NAT1' IFELD(A1)
MOVE 'S=0' TO CONTROL /* SYNCHR. TAC, EXPLICIT
MOVE 'NAT1' TO NEWTAC /* SET NEW TAC
MOVE 'Y' TO SWOFF /* NO RESET TO START TAC
CALL 'NATTAC' CONTROL NEWTAC SWOFF /* INVOKE TAC SWITCH
INPUT 'TACCLASS' /* ACTIVATE NEW TAC
FETCH 'TACCLAS2' /* NOW IN NEW TACCLASS
END
* TACCLAS2 - THIS PROGRAM IS FETCHED FROM PROGRAM TACCLAS1
RESET NR(N3)
READ (25) AUTOMOBILES BY MAKE /* TACCLASS IS NAT1
ADD 1 TO NR
WRITE NOTITLE NOHDR NR MAKE MODEL HORSEPOWER YEAR
LOOP
FETCH 'MAINMENU' /* TACCLASS = NAT1
END

```

In this example, processing is assigned to a new TAC class with TAC NAT1. Switching to the user's START *openUTM* TAC is avoided by the presence of the third parameter (SWOFF) in the call to NATTAC with value Y.

It is also possible to perform several TACCLASS changes within one Natural program.

### Example 3:

A Natural program that performs two explicit and one implicit TACCLASS changes.

```

*TACMULT - EXAMPLE FOR TWO TACCLASS SWITCHES IN ONE PROGRAM
RESET CONTROL(A3) NEWTAC(A8) SWOFF(A1) NR(N4)
INPUT 'TEST FOR 2 TACCLASS SWITCHES' IFELD(A1)
MOVE 'S=0' TO CONTROL /* SYNCHR. TAC, EXPLICIT
MOVE 'NAT1' TO NEWTAC /* SET NEW TAC
MOVE 'Y' TO SWOFF /* NO RESET TO START TAC
CALL 'NATTAC' CONTROL NEWTAC SWOFF /* INVOKE TAC SWITCH
INPUT 'TACCLASS' /* ACTIVATE NEW TAC
READ (50) AUTOMOBILES BY MAKE /* NOW IN NEW TACCLASS
ADD 1 TO NR
WRITE NR MAKE MODEL YEAR
LOOP
EJECT /* ACTIVATE NEW OUTPUT *****
MOVE 'S=0' TO CONTROL /* SYNCHR. TAC, EXPLICIT
MOVE 'NAT2' TO NEWTAC /* SET NEW TAC
CALL 'NATTAC' CONTROL NEWTAC /* INVOKE TAC SWITCH
INPUT 'TACCLASS' /* ACTIVATE NEW TAC
READ (100) AUTOMOBILES BY MAKE /* NOW IN NEW TACCLASS
WRITE MAKE MODEL YEAR /* NOW START TAC IS USED
LOOP

```

```
ON ERROR DISPLAY 'ERROR IN PROGRAM TACMULT'
END
```

The *openUTM* TAC NAT2 has not been considered in the preceding examples; it must be defined in KDCROOT and KDCDEF.

If an explicit TACCLASS change is to take place after a WRITE, PRINT or DISPLAY statement, an EJECT must be issued before assigning the new TAC. This operation performs an unconditional output to the terminal before executing the INPUT 'TACCLASS'. Instead of the EJECT, the following statements can be used:

```
STACK TOP DATA 'A'
INPUT A(A1)
```

This sequence also performs an unconditional output to the terminal before executing the INPUT 'TACCLASS'.

#### Example 4:

A Natural program that allocates an *openUTM* TAC implicitly to assign a new TAC class and then changes over to the START *openUTM* TAC. This example uses the TAC table for synchronous transactions in the subroutine NATTAC.

```
* TACIMP1 - EXAMPLE FOR AN IMPLICIT TACCLASS SWITCH
RESET CONTROL(A3) NR(N3)
REDEFINE CONTROL (ERRFLD(A1))
INPUT 'TEST FOR AN IMPLICIT TACCLASS SWITCH' IFELD(A1)
MOVE 'S=1' TO CONTROL /* USE 1ST TAC IN TABLE --> Note
CALL 'NATTAC' CONTROL /* INVOKE TAC SWITCH
IF ERRFLD = 'E' DO /* ERROR CHECK
    DISPLAY 'ERROR' CONTROL 'FROM NATTAC'
    TERMINATE
    DOEND
INPUT 'TACCLASS' /* ACTIVATE NEW TAC
READ (100) AUTOMOBILES BY MAKE /* NOW IN NEW TACCLASS
ADD 1 TO NR
WRITE NOTITLE NOHDR NR MAKE MODEL /* START TAC IS USED
LOOP
ON ERROR DISPLAY 'ERROR IN PROGRAM TACIMP1'
END
```

Note: The value S=1 indicates that it is a synchronous transaction and that the TAC is to be taken from the first entry in the TAC table. This is the TAC that was defined as the value of the operand of the parameter TCLS1 (default value: NAT1). The third character of the first parameter in the CALL 'NATTAC' indicates which of the four parameters TCLS1 to TCLS4 applies.

**Example 5:**

A Natural program that allocates an *openUTM* TAC implicitly to assign a new TAC class but does not change over to the *START openUTM* TAC. This example uses the TAC table for synchronous transactions in the subroutine *NATTAC*, and processing continues with this TAC.

```
* TACIMP2 - EXAMPLE FOR AN IMPLICIT TACCLASS SWITCH
RESET CONTROL (A3) SWOFF(A1) NR(N3)
REDEFINE CONTROL (ERRFLD(A1))
MOVE 'S=4' TO CONTROL                /* USE 4TH TAC IN TABLE --> Note
MOVE 'Y' TO SWOFF                    /* NO RESET TO START TAC
CALL 'NATTAC' CONTROL SWOFF          /* INVOKE TAC SWITCH
IF ERRFLD = 'E' DO                   /* ERROR CHECK
    DISPLAY 'ERROR' CONTROL 'FROM NATTAC'
    TERMINATE
DOEND
INPUT 'TACCLASS'                     /* ACTIVATE NEW TAC
READ (100) AUTOMOBILES BY MAKE       /* NOW IN NEW TACCLASS
ADD 1 TO NR
WRITE NR MAKE MODEL YEAR
LOOP
ON ERROR DISPLAY 'ERROR IN PROGRAM TACIMP2'
END
```

**Note:** The value *S=4* indicates that it is a synchronous transaction and that the TAC is to be taken from the fourth entry in the TAC table. This is the TAC that was defined as the value of the operand of the parameter *TCLS4* (default value: *NAT4*). The TAC *NAT4* is not defined in the examples of *KDCROOT* and *KDCDEF*; in practice, the user must supply suitable definitions.

Using the TAC table has the advantage that the *openUTM* TAC does not have to be coded explicitly in the Natural program. The Natural programs contain merely the relative priority “weights” of the transactions to be executed. The system administrator can allocate and change the names of the *openUTM* TACs without having to change the Natural programs.

For testing Natural programs with *TACCLASS* change for synchronous transactions, please note the following: To verify correct operation of the *TACCLASS* change, the Natural program can be tested without the statement(s) *CALL 'NATTAC' operand1 (operand2) (operand3)*. If the *INPUT 'TACCLASS'* statement produces only the output '*TACCLASS*' on the terminal, the program is correct. The operand(s) for the call to *NATTAC* must be set correctly. The *openUTM* processing terminates with Error Code *KM01* whenever an *openUTM* TAC that is not defined in *KDCROOT* and *KDCDEF* is used.

## Step 4: Allocation of TAC Classes for Asynchronous Transactions within One Natural openUTM Application

The TAC class for asynchronous transactions within a Natural *openUTM* application can be changed with the statement:

```
CALL 'NATTAC' operand1[operand2]
```

<i>operand1</i>	Must contain the value $A = n$ , where $A$ denotes “asynchronous” and $n$ is an integer in the range from 0 to 4 that denotes the priority level of the transaction in subroutine NATTAC's table of transaction codes for asynchronous TACs. The form of the operand is analogous to the form of the operand for synchronous transactions.
<i>operand2</i>	Optional. Contains the <i>openUTM</i> TAC for the required TAC class if <i>operand1</i> has the value $A=0$ .

All *openUTM* TACs for asynchronous transactions must begin with the character string which is defined as unique identifier for asynchronous TACs in parameter **ASYNTAC** of macro NATUTM. Conversely, the *openUTM* TACs for synchronous transactions must not begin with this string.

### Example 6:

A Natural program that performs initialization for asynchronous transaction processing, using the *openUTM* TAC NATAS. This is the standard TAC for asynchronous transactions. See also the description of the parameter **ASYNTAC** of macro NATUTM.

```
* STARTAS - EXAMPLE FOR ASYNCHRONOUS TRANSACTION WORKING
*           WITHIN ONE APPLICATION - USING THE STANDARD TAC
FORMAT LS=145
RESET PARM1(A144) PRDEST(A8) LTDEST(A8)
MOVE 'PRINTER1' TO PRDEST
MOVE *INITID TO LTDEST
COMPRESS 'SENDER=' PRDEST ',OUTDEST=' LTDEST ','
        'MENU=F,STACK=(LOGON APPL1;READAUTO)' INTO PARM1
        LEAVING NO
CALL 'NATASYN'
SET CONTROL 'H'
WRITE NOTITLE NOHDR PARM1
INPUT 'ASYNTASK INVOKED - HOPEFULLY' IFELD(A1)
END
```

### Example 7:

A Natural program that initializes asynchronous transaction processing and allocates the *openUTM* TAC NATAS1 for assignment to another TAC class.

```

* STASTAC - EXAMPLE FOR ASYNCHRONOUS TRANSACTION WORKING
*           WITHIN ONE APPLICATION
*           AND SWITCH TO A NEW TACCLASS
FORMAT LS=145
RESET PARM1(A144) PRDEST(A8) LTDEST(A8) CONTROL(A3) NEWTAC(A8)
REDEFINE CONTROL (ERRFLD(A1))
MOVE 'PRINTER1' TO PRDEST
MOVE *INIT-ID TO LTDEST
COMPRESS 'SENDER=' PRDEST ',OUTDEST=' LTDEST ','
        'MENU=F,STACK=(LOGON APPL1;READAUTO)' INTO PARM1
        LEAVING NO
MOVE 'A=0'     TO CONTROL           /* ASYNCHR. TAC, EXPLICIT --> NOTE
MOVE 'NATAS1' TO NEWTAC           /* SET NEW TAC
CALL 'NATTAC' CONTROL NEWTAC      /* INVOKE TAC SWITCH
IF ERRFLD = 'E' DO                /* ERROR CHECK
    DISPLAY 'ERROR' CONTROL 'FROM NATTAC'
    TERMINATE
DOEND
CALL 'NATASYN'                    /* INVOKE ASYNCHRONOUS TAC
SET CONTROL 'H'
WRITE NOTITLE NOHDR PARM1
INPUT 'ASYNTAC INVOKED - HOPEFULLY' IFELD(A1)
END

```

The value A=0 indicates that it is an asynchronous transaction and that the TAC is passed explicitly in the second parameter of the CALL 'NATTAC', which means that the TAC table is not used.

```

MOVE 'A=1' TO CONTROL
CALL 'NATTAC' CONTROL

```

The procedure for using the TAC table (see the parameters [TCLA1](#) to [TCLA4](#) in the section [Parameters of Macro NATUTM](#)) corresponds to the procedure for synchronous transactions.

An example of the program that is to be executed asynchronously (READAUTO):

```

* READAUTO - ASYNCHRONOUS Natural PROGRAM
READ (75) AUTOMOBILES BY MAKE
WRITE MAKE MODEL HORSEPOWER BODY-TYPE YEAR
LOOP
ON ERROR TERMINATE
TERMINATE
END

```

The desired *openUTM* TAC must always be allocated in the Natural program that initializes the asynchronous transaction processing (the use of the standard TAC for asynchronous transaction processing is an exception; see the description of the parameter [ASYNTAC](#) in the macro NATUTM. The program that is to be executed asynchronously then runs in the desired TAC class. Since each asynchronous Natural program must be ended with the TERMINATE statement, the *openUTM* DC transaction is also ended (PEND 'FI') when the program ends.

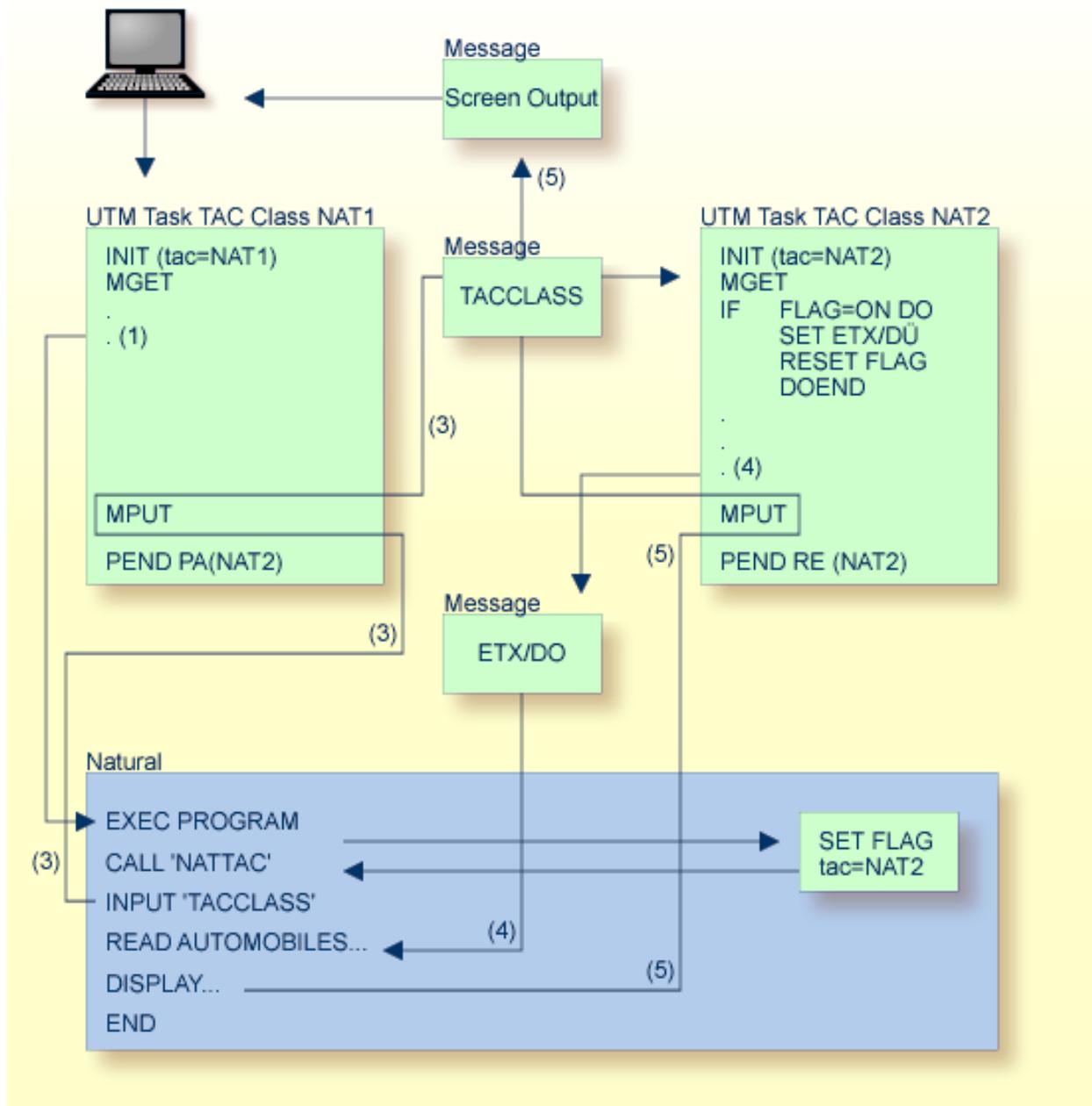
The program that initializes the asynchronous transaction processing always runs in a synchronous transaction. Thus it is feasible to perform a change of TACCLASS using the procedure for synchronous transactions. This change can take place before allocating the asynchronous TACs or after initializing the asynchronous transaction (`INPUT` statement).

### **Step 5: Assign the TAC Class for Asynchronous Transactions between Two Natural openUTM Applications**

It is not necessary to call `NATTAC` for asynchronous transaction processing between two Natural *openUTM* applications. The necessary *openUTM* TAC is allocated explicitly in the Natural program; see also [Asynchronous Transaction Processing](#).

### **openUTM TACCLASS Switch**

The following figure illustrates the logic of an *openUTM* TACCLASS switch for synchronous transactions:



## Generating a Natural openUTM Application

The following programs and macros must be assembled to generate a Natural *openUTM* application:

KDCROOT	<i>openUTM</i> interface module.
NATUTM	Front-end part of the Natural <i>openUTM</i> Interface.
BS2STUB	Common memory pool definition.
FREXIT	Format exit module (only if the default parameter is to be changed).
NURENT	Reentrant part of the Natural <i>openUTM</i> Interface.
NTPRM	Natural parameter module.
NTSWPRM	Swap pool parameter module.

This list does not include the utility programs of the Natural *openUTM* Interface.

The following example shows how to generate an application.

```

OPTION GEN=ALL,ROOTSRC=INPUT.KDCROOT.KDCNATP
ROOT KDCNATP
MAX APPLNAME=NATUTM,APPLIMODE=S,KDCFILE=(NATUTM,S)
MAX KB=400,SPAB=8192,NB=5120,TRMSGLTH=5120
MAX TASKS=10,ASYNTASKS=3
MAX GSSBS=0,KSSBS=1
MAX LOGACKWAIT=600,RESWAIT=(600,1200),TERMWAIT=(1800,0)
MAX PGPOOL=(88,80,95),CONRTIME=2,RECBUF=(400,2048)
MAX DPUTLIMIT1=(001,23,59,59),DPUTLIMIT2=(001,23,59,59)
MAX LPUTLTH=0
*+-----+
*I          EXIT DEFINITIONS:  STARTUP (CSECT NAME OF NATUTM)          I
*I                               SHUTDOWN (CSECT NAME OF NATUTM)       I
*I                               FORMAT (FREXIT)                       I
*+-----+
EXIT PROGRAM=NUSTART,USAGE=START
EXIT PROGRAM=NUSTART,USAGE=SHUT
EXIT PROGRAM=FREXIT,USAGE=FORMAT
*+-----+
*I          P R O G R A M   D E F I N I T I O N S                      I
*+-----+
DEFAULT PROGRAM COMP=ASSEMB
PROGRAM NUSTART
PROGRAM FREXIT
PROGRAM NUERROR
PROGRAM AUTOTAC
PROGRAM KDCADM,COMP=SPL4
*+-----+
*I          SYNCHRONOUS TACS FOR Natural/UTM                          I
*I          THE ERROR EXIT 'NUERROR' MUST BE DEFINED FOR EACH TAC     I

```

```

*+-----+
DEFAULT TAC TYPE=D,PROGRAM=NUSTART,EXIT=NUERROR,CALL=BOTH
TAC NAT,ADMIN=NO,TIME=0
TAC AUTOCONN
*+-----+
*I          BADTACS DEFINITION FOR Natural/UTM                      I
*I          THE ERROR EXIT 'NUERROR' MUST BE DEFINED FOR EACH TAC    I
*+-----+
TAC KDCBADTC,CALL=FIRST,PROGRAM=AUTOTAC,EXIT=NUERROR,TYPE=D
*+-----+
*I          ASYNCHRONOUS TACS FOR Natural/UTM                      I
*I          THE ERROR EXIT 'NUERROR' MUST BE DEFINED FOR EACH TAC    I
*+-----+
DEFAULT TAC TYPE=A,PROGRAM=NUSTART,EXIT=NUERROR,CALL=FIRST
TAC NATAS
TAC NATSY
*+-----+
*I          UTM ADMINISTRATOR TACS                                  I
*+-----+
DEFAULT TAC PROGRAM=KDCADM,ADMIN=Y,TYPE=D,CALL=BOTH
TAC KDCTAC
TAC KDCLOG
TAC KDCSHUT
TAC KDCAPPL
TAC KDCINF
TAC KDCUSER
TAC KDCSEND
TAC KDCDIAG
TAC KDCLTERM
TAC KDCPTERM
TAC KDCSWTCH
TAC KDCHELP
*+-----+
*I          PTERM 9750 DEFINITION                                  I
*+-----+
DEFAULT PTERM PRONAM=VR,PType=T9750,TERMN=FE,CONNECT=N
PTERM DFDSS001,LTERM=DF97501
PTERM DFDSS002,LTERM=DF97502
PTERM DFDSS003,LTERM=DF97503
*+-----+
*I          LTERM DEFINITION                                      I
*+-----+
DEFAULT LTERM USAGE=D,STATUS=ON,ANNOAMSG=YES,RESTART=YES
LTERM=DF97501
LTERM=DF97502
LTERM=DF97503
*+-----+
*I          SFUNC DEFINITION                                      I
*+-----+
SFUNC F1,RET=21Z
SFUNC F2,RET=22Z
SFUNC F3,RET=23Z

```

```

SFUNC F4,RET=24Z
SFUNC F5,RET=25Z
SFUNC K1,RET=26Z
SFUNC K2,RET=27Z
SFUNC K3,RET=28Z
SFUNC K4,RET=29Z
END

```

See also the *openUTM* documentation *UTM Generierung und Administration (openUTM Generation and Administration)*.

## Generating the Natural openUTM Interface

1. The operands of the **parameters of macro NATUTM** must be set to the correct values as required; the macro NATUTM must then be assembled.
2. Example of NATUTM Macro Call:

```

NUSTART NATUTM APPLNAM=NATUTM,          --> Note 1 -
              NUCNAME=NATvrs
,
              --> Note 2 -
              LINK=TACSWTCH             --> Note 3 -
              PARMOD=24,                --> Note 4 -
              ROLLACC=UPAM-AS,          --> Note 5 -
              ROLLTSZ=180,              --> Note 6 -
              TERMTAB=(SWP,TERMNAME),   --> Note 7 -
              UMODE=(S,G)               --> Note 8

```

where *vrs* represents the current product version number.

Notes	
1	The CSECT name of the non-reentrant part of the Natural <i>openUTM</i> Interface is specified as NUSTART (default value). The name of the Natural <i>openUTM</i> application is specified as NATUTM.
2	The name of the link-edited reentrant part of the Natural <i>open</i> Interface is specified as NAT <i>vrs</i> ; this is also the name of the common memory pool into which the reentrant part will be loaded.
3	A TABLE macro call is to be executed for program TACSWTCH. This means that this program must be linked in the front-end part of the Natural <i>openUTM</i> application.
4	The Natural <i>openUTM</i> application runs in 24-bit addressing mode.
5	The access method to the Natural roll file is specified as UPAM with P1-Eventing for asynchronous writes.
6	The maximum thread size of the Natural roll file is specified as 180 (KB).
7	The internal terminal control table is allocated in the Natural swap pool; the logical terminal name will be used for identifying the entries in the terminal control table.
8	The user dialog with Natural is to take place in “single” mode; that is, one terminal can initiate one Natural session. Messages at restart, logoff and also free-running messages (asynchronous processing) are to be output in German.

The operands of the other parameters of macro `NATUTM` are not specified since the default values apply.

3. Assemble the macro `NURENT` (the reentrant part of the Natural *openUTM* Interface). In this example, no changes are required to the parameters. The CSECT name of the assembled macro `NURENT` is `NURENT`.
4. Assemble the macro `BS2STUB` with the common memory pool definitions specified in macro `ADDON`.
5. Assemble the Natural parameter module. The sample `NTPRM` macro call must be adapted to suit the local environment.
6. Assemble the swap pool parameter module (macro `NTSWPRM`).

### Linking the Nucleus

The Natural environment-dependent nucleus and the environment-independent nucleus can be linked using the JCL supplied. This JCL should be checked and modified as required to suit the local environment (library names, etc.) before being used. Special features in the JCL are indicated by `REMARK` statements.

### Setting Up the Natural Roll File

The size of the Natural swap file must be calculated and the file must be allocated with link name `PAMNAT`.

### Start Job for a Natural openUTM Application

JCL examples for starting the Natural *openUTM* application are supplied. Before use, the JCL should be checked and modified as required (*openUTM* startup parameters, data set names, etc.).

## Optimizing Natural openUTM Applications

---

The following points should be considered if the performance of a Natural *openUTM* application is unsatisfactory:

- **Can poor performance be localized to one or more particular Natural programs?**  
If so, optimize the program(s) by redesigning. These programs can be identified by using the Natural monitor in library `SYSTP`.
- **Is the swap I/O rate too high?**  
By using the program `MENU` in library `SYSTP` you can check how efficiently the Natural swap pool is being used. The statistical information provided about the swap pool also helps to answer the following questions:

- **Is the number of logical swap pools and their slot lengths appropriate?**  
Function SW in the main menu of SYSTP offers various possibilities for controlling the Natural swap pool optimization.
- **Has the Natural swap pool been defined large enough?**  
Increasing the size of the swap pool and/or generating swap pool data space reduces the swap I/O rate considerably.
- **Is the Natural buffer pool too small?**  
Information about the size and occupancy of the Natural buffer pool can be obtained with the Natural utility SYSBPM, which is described in the Natural *Utilities* documentation.
- **Has the number of openUTM tasks been chosen correctly?**  
This is strongly dependent upon the path lengths of the individual transactions and the number of terminals connected.
- **Is it possible that particular transactions (so-called long jobs) are loading the available openUTM tasks so heavily that the shorter transactions are suffering from poor throughput as a result?**  
If this is the case, the *openUTM* TACCLASS concept and/or the asynchronous transaction processing facilities should be used.
- **Does the Natural Roll File consist of too many extents on one disk drive (physical chained I/O is not possible over extent boundaries), or is the Natural Roll File on a very heavily used disk drive?**  
If possible, allocate the Natural Roll File to one or more lightly-used disk drives, with only one extent on each.

These suggestions should be considered in the light of the total system environment, including such factors as available storage, storage paging rates, disk and channel I/O traffic loads, etc.

## Several Applications with One Common Natural

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### Related Topics:

For more information on the Natural nucleus components mentioned in this section, refer to *Environment-Independent Nucleus* and *Environment-Dependent Nucleus* in the *Installation for BS2000* documentation.

To save storage space, it can be desirable for several Natural *openUTM* applications to share the environment-independent nucleus in a common memory pool in the class 6 storage. The following steps must be taken when generating the Natural *openUTM* application:

- The global Natural load pool must be defined with the parameters of module CMPSTART, for example:

```
NAME=NATSHARE, POSI=ABOVE, ADDR=250, PFIX=YES, SIZE=2MB  
LIBR=NATvrs.USER.MOD
```

where *vrs* represents the current product version number.

For more information, see *CMPSTART Program* in the *Natural Operations* documentation.



**Notes:**

1. NATSHARE is the name of the linked environment-independent nucleus. It is also the name of the common memory pool.
2. The operand of parameter PFIX must be YES.
3. The operand of parameter ADDR must be defined.
4. The operand of parameter LIBR must contain the name of the module library from which the environment-dependent nucleus is to be loaded.
5. The reentrant part of the Natural *openUTM* Interface (the assembled module of macro NURENT) must be linked to the environment-dependent nucleus.
6. The operand of parameter NUCNAME must be defined for each assembly of macro NATUTM as the same (in this example: NUCNAME=NATSHARE).
7. The definition of the Natural load pool in the ADDON macro for the assembly of macro BS2STUB must be the same for all applications, for example:  
STUBSHAR BS2STUB PARMOD=31, PROGMOD=ANY ADDON NAME=NATSHARE, STAT=GLOBAL

For more information, see *ADDON Macro* in the *Natural Operations* documentation.

### **Lists of Shared and Application-Specific Parameter Modules**

If application-specific Natural parameter modules are to be used, they must be linked to the environment-dependent nucleus, which means that there is a parameter module in each environment-dependent nucleus. This also applies to the swap pool parameter module.

Only the addresses defined in the CSTATIC list of the parameter module of the environment-dependent nucleus are considered in the entry point table of callable 3GL programs; if any of these addresses cannot be resolved in the environment-dependent nucleus (because they refer to modules which are linked to the environment-independent nucleus), Natural tries to resolve these addresses with the CSTATIC list in the parameter module of the reentrant part. Thus it is allowed to have unresolved CSTATIC addresses when linking the environment-dependent nucleus, provided they can be resolved by the environment-independent nucleus.

As the CSTATIC list of the environment-independent nucleus is only used for those addresses which cannot be resolved by the environment-dependent nucleus, *all* CSTATIC entries to be used (whether they are in the environment-dependent nucleus or in the environment-independent

nucleus) must be defined in the `CSTATIC` list of the parameter module of the environment-dependent nucleus.

## Entering and Defining Dynamic Natural Parameters

---

The following possibilities exist for entering and defining the Natural dynamic parameters:

- entering the dynamic parameters together with the *openUTM* TAC when logging on to the application;
- passing the dynamic parameters from another *openUTM* partial program using `MPUT` and `PEND PR(OGRAM)`;
- defining the dynamic parameters in the operand of the parameter `MSPAR1`. They then apply to all users of this application and cannot be changed.

## openUTM User Restart

---

When a Natural session is started, any Natural dynamic parameters defined are saved up to a length which is defined in the operand of parameter `SVDYPRM` in macro `NATUTM`. In case of a user restart situation, these saved data are automatically reused when the Natural session is started again. This also applies when the start of the Natural session results from a `PEND PR(OGRAM)` of another *openUTM* partial program.

See also *Global (Restartable) Swap Pool* in the *Natural Operations* documentation.

## Adabas Priority Control

---

Adabas priority control has no connection with the priority control of BS2000. Unlike with BS2000 priority control, for Adabas a higher priority value means higher priority. If several requests are in the Adabas command queue at the same time, the request with the highest priority is processed first by Adabas and 1 is added to the priority of the other requests that are in the command queue at this time.

Under certain conditions, it may be useful to assign to the Adabas task a lower BS2000 priority than to the *openUTM* tasks.

The following parameters in macro `NATUTM` can be used to control Adabas priority control for *openUTM* transactions:

ADAPRI	Activation of Adabas priority control for <i>openUTM</i> transactions.
APRISTD	Assignment of standard Adabas priority for all <i>openUTM</i> transactions to which no priority is assigned individually.
TCLS <i>n</i>	Assignment of Adabas priority for individual synchronous <i>openUTM</i> transactions.
TCLA <i>n</i>	Assignment of Adabas priority for individual asynchronous <i>openUTM</i> transactions.

If Adabas priority control is activated for *openUTM* transactions (parameter ADAPRI=YES), it is also in effect for non-Natural programs which access Adabas via the subroutine ADACALL; see the parameter **ADACALL** in the macro NATUTM.

By defining different Adabas priorities for different transactions with the above parameters, and at the same time using the *openUTM* TACCLASS concept, it is possible to set up a very sophisticated system of priority control. However, when you explicitly assign Adabas priorities to *openUTM* transaction, you should take into consideration the standard priorities Adabas assigns to other processes (for example, TIAM or batch processing).

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