Critical Release Notice

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The content of this customer NTP supports the SN06 (DMS) and ISN06 (TDM) software releases.

Bookmarks used in this NTP highlight the changes between the baseline NTP and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the baseline NTP remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to new or modified content for the baseline NTP that is valid through the current release.

Red: Applies to new or modified content for NA017/ISN04 (TDM) that is valid through the current release.

Blue: Applies to new or modified content for NA018 (SN05 DMS)/ISN05 (TDM) that is valid through the current release.

Green: Applies to new or modified content for SN06 (DMS)/ISN06 (TDM) that is valid through the current release.

Attention!
Adobe® Acrobat® Reader™ 5.0 is required to view bookmarks in color.

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Standard release 01.03 for software release SN06 (DMS) and ISN06 (TDM).

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DMS-100 Family

Maintenance System

Maintenance Guide

BCS34 Standard 01.02 April 1998

NORTEL

NORTHERN TELECOM

DMS-100 Family

Maintenance System

Maintenance Guide

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Contents

About this document

When to use this document

This document is a maintenance guide for maintenance personnel who have a basic knowledge of the Digital Multiplex System (DMS) and the lines subsystem. The purpose of the Maintenance System is to provide complete maintenance by detecting, analyzing, correcting and reporting errors in DMS software and hardware.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the *next* software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the *same* software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *Product Documentation Directory*, 297-8991-001.

References in this document

The following documents are referred to in this document:

- *SuperNode Technical Specification* PLN-5001-001
- *Nonmenu Commands Reference Manual* 297-1001-820

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION Information needed to perform a task

ATTENTION

If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER Possibility of personal injury

DANGER

Risk of electrocution

Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING Possibility of equipment damage

WARNING

Damage to the backplane connector pins

Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION Possibility of service interruption or degradation

CAUTION
Possible loss of service
Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

>BSY

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

>BSY CTRL

Variables

Variables are shown in lowercase letters:

>BSY CTRL ctrl_no

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

1 Manually busy the CTRL on the inactive plane by typing

>BSY CTRL ctrl_no
and pressing the Enter key.

where

ctrl_no is the number of the CTRL (0 or 1)

Example of a MAP response:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

General

The purpose of the Maintenance System for the DMS 100 Family of Digital Multiplex Switching (DMS) systems is to provide complete maintenance by detecting, analyzing, correcting and reporting errors in DMS software and hardware.

The Maintenance System consists of a number of functional areas, each having hardware elements and software resources, which interact through internal messages to perform the tasks involved in automatic maintenance.

Each functional area, referred to as a maintenance sub-system (SS) contains the software necessary for maintaining its own hardware. The functional areas correspond to the hardware and software components of DMS which are described in *SuperNode Technical Specification*, PLN-5001-001. Each maintenance SS locates and diagnoses errors occurring within the area of responsibility assigned to it.

The maintenance sub-systems are accessible to maintenance personnel through the Maintenance and Administration Position (MAP) or other terminal devices such as TTY. The MAP provides a Man-Machine Interface (MMI) through its Visual Display Unit (VDU) screen and keyboard. The VDU screen displays DMS status information in response to requests from maintenance personnel entered manually via the VDU keyboard. Refer to *Nonmenu Commands Reference Manual*, 297-1001-820 for a detailed description of the MAP and its operating instructions.

Maintenance sub-systems

The maintenance sub-systems and their areas of responsibility are:

- **Software (SWERR) Maintenance SS** The Software maintenance SS is responsible for periodically checking the CC software to ensure that logical rules are followed (software sanity). The SWERR SS monitors the number of timeouts, the density of message flow, the amount of available system resources, and the percentage of memory used.
- **Central Control (CC) Maintenance SS** The CC maintenance SS is responsible for maintaining the hardware on the Central Processor Unit (CPU), Data Store (DS), and Program Store (PS) shelves. This includes cards, such as the data port extenders and the associated control and interface cards. Also monitors the power converters and cooling unit. DS maintenance includes the memory extension (MEX) frame if such is in use. Reports changes in CPU status (active or inactive). Maintains links up to, but not including the Central Message Controller (CMC).
- **Central Message Controller (CMC) Maintenance SS** Responsible for maintaining all hardware on the CMC shelves, plus the links to the Network Modules (NM) and Input-Output Controllers (IOC).
- **Input-Output Devices (IOD) Maintenance SS** Responsible for maintainting all hardware on the IOC shelves, including the device controller (DC) cards for the local IO devices (tape drives, TTY, VDU, etc.), the remote IO devices (via modems), and the common control cards. Also monitors the performance of the IO devices themselves and the power converter cards.
- **Network Module (NET) Maintenance SS** Responsible for maintaining all Network Modules (NM) and the links to the Peripheral Modules (PM). Also maintains the power converters, and cooling units of all NM frames.
- **Peripheral Module (PM) Maintenance SS** The PM maintenance SS is responsible for all types of peripheral modules such as Trunk Module (TM), Line Module (LM), and Digital Carrier Module (DCM). In each type of PM, the common control cards, the interface cards to the NMs, and the power converters, are maintained. Not included, are the transmission interface cards to the trunks (TM), lines (LM), or digital carrier equipment (DCE).

- **Trunks (TRKS) Maintenance SS** Responsible for maintaining the trunk interface cards in the TM and the transmission facilities to the distant office. In a DCM, the TRKS SS maintains the DCE interface cards and the transmission facilities via the digital carrier equipment to the distant office.
- **Lines (LNS) Maintenance SS** Responsible for maintaining the line interface cards in the LM and the transmission facilities to the subscriber's station equipment.
- **Traffic (TRAF) Maintenance SS** Responsible for detecting abnormal traffic and overload conditions. Generates data on traffic patterns for display on the VDU. Permits manual overload control. Applies automatic high-priority line.
- **External (EXT) Alarms Maintenance SS** Monitors the alarm circuits of any equipment outside the DMS system. Sends alarm indication to alarm hardware and VDU.

Maintenance sub-system interfaces

Each of the maintenance sub-systems just described has three kinds of interfaces with other elements of the maintenance system.

1 **Inputs.** From other maintenance sub-systems, from the I/O system and the alarm detection system.

2 **Outputs.** To other maintenance sub-systems and to the routing and reporting sub-system.

3 **Manual.** Via the VDU or TTY, as mentioned in para. l.

Input-Output (I/O) Message System The I/O Message System handles the reception and routing of internal messages between components of the DMS. All messages contain an error indicator. If no error indicator is present the message proceeds without the maintenance system being involved. If an error is present, the error indicator is routed to the maintenance SS whose area of responsibility covers the source of the error. The I/O System is a major source of error detection inputs to the maintenance sub-systems.

Alarm Detection Sub-System The alarm detection SS is a software/hardware entity which performs the following functions:

1 Receives hardware-detected alarms from within the DMS system via alarm scan points.

2 Receives software alarms via error information from the I/O system.

3 Interprets the type of alarm and its level of severity.

4 Routes alarm messages to the responsible maintenance SS for action.

5 Sends messages to the routing and reporting SS for status display update (VDU, TTY).

6 Resets alarm conditions when a problem has been resolved, or on a manual input from the VDU keyboard.

Routing and Reporting Sub-system The routing and reporting SS provides an interface between the maintenance sub-systems, the VDU and the alarm hardware (visible and audible alarm devices). The action of the routing and reporting SS is described later.

Maintenance Concept

The basic concept of the DMS Maintenance System is that each maintenance SS has the responsibility to locate and diagnose an error condition which is presented to it. The maintenance SS must determine first if the error lies within its own area of responsibility. If the error is within the responsibility of the maintenance SS, the error is diagnosed to determine what item is causing the error, and a message is sent to the routing and reporting SS. If the error is not within the maintenance SS itself, the error message is passed to the next appropriate SS which takes similar action until the error is finally located.

Man–machine interface (MMI)

Maintenance personnel can access the maintenance SS via the VDU keyboard and obtain status information as a display on the VDU screen. An additional or alternative MMI can also be provided by TTY.

Telescoping

The MAP maintenance function uses the technique of telescoping to examine the operation of the DMS. Telescoping permits ever-increasing details about system status or troubles to be obtained, starting at the maintenance sub-system level and descending to lower levels until the fault is eventually traced to a replaceable component level.

Routing and reporting sub-system

The routing and reporting SS provides an interface between the VDU, the readout and storage devices, and the maintenance sub-systems. The following lists the main functions of this sub-system:

1 Assigns priorities to messages incoming from the maintenance sub-systems, based on the type and severity of the fault.

2 Assigns output routes based on the message type and routing information contained therein.

3 Drives software and hardware alarms based on the severity of the fault information contained in the message.

4 Retrieves information from a message logging mechanism. The request for this information is usually originated by the maintenance personnel.

5 Monitors the number of instances of a specific message and then, outputs either successive instances of that message and/or a threshold message.

The routing and reporting sub-system is divided into three parts as follows:

- Routing mechanism
- Logging Mechanism
- Software/hardware Alarm

Routing mechanism

The core of the routing and reporting sub-system is the routing mechanism which interfaces with the VDU, the maintenance sub-systems, the alarm sub-system and the logging mechanism.

The main function of the routing mechanism is to receive messages from the different sub-systems and decide whether the message should be:

1 Routed immediately to one or more VDUs.

2 Stored in the logging mechanism for future retrieval.

3 Routed for status update; i.e. if a sub-system reports a change in its resource status or organization, the routing mechanism will decide which VDU requires the level of status change.

4 Routed to the alarm sub-system in order to take appropriate action based on the type and severity of the alarm message.

5 Re-routed to an alternative I/O device if the intended device is out of service.

The routing mechanism also checks the threshold of alarms which are not associated with any particular maintenance sub-system.

Logging mechanism

The logging mechanism can display and store data in any of the following forms:

1 Hardcopy on printer.

2 Storage device.

3 Memory device at a remote terminal capable of performing system correlation.

The routing mechanism determines whether the alarm message should be directed to a printer or to a storage device. Maintenance personnel can at any time request retrieval of all the information pertaining to a particular alarm. This method prevents the maintenance personnel from being flooded with irrelevant data on topics other than the problem at hand.

Software/hardware alarm

The software/hardware alarm receives the status messages from maintenance sub-systems and acts as follows, depending on the severity of the alarm:

1 Activates the proper audio and visual alarm (e.g. bell and light).

2 Updates the top level status display of the appropriate man machine terminal. This is done on a continuous update basis.

3 Resets alarm conditions whenever a problem has been cleared.

Message types

Inter-maintenance sub-system mesages

Transient errors always stay in the maintenance sub-system where they occured. It is ONLY when these errors persist that, if not resolved, they will be communicated to another maintenance sub-system via inter-maintenance sub-system messages.

There are two reasons for communication to take place between two maintenance sub-systems:

1 A sub-system is giving an error indication to another sub-system. These are termed fault messages.

2 A sub-system is notifying another sub-system that a component is no longer available for service. These are termed status messages.

The receiving sub-system is responsible for taking the appropriate action on the message. Furthermore, it is responsible for communicating information concerning its activity to the routing and reporting SS. Note that the transmitting sub-system's responsibilities concerning problems related to other sub-systems terminate as soon as it has disposed of the information.

Messages from the maintenance sub-systems to the routing and reporting sub-system

Any maintenance sub-system can find it necessary to send one of five types of messages to the routing and reporting sub-system. In the usual order of occurrence, the five types of messages are:

1 Error - an abnormal event has occurred in the sub-system.

2 Diagnostic - results from an attempt by the sub-system to test a given aspect.

3 Action - an alteration has occurred in the status or organization of the sub-system's resources.

4 Exception - a report that a threshold has been exceeded.

5 Information - a report on the instantaneous status of a sub-system.

These messages are passed to the routing and reporting sub-system in packed (i.e. internal) format. There are two kinds of messages involved:

1 Specific responses to requests from the command interpreter.

2 Unsolicited messages which are submitted to the routing and reporting sub-system without any specific destination from the sub-system's point of view.

Messages between the VDU and the routing mechanism

Input from the VDU moves through the command interpreter (CI). This process is responsible for interpreting the common language definitions of system components into internal form. This translated result and the request or command is then passed on to:

1 The relevant maintenance sub-system, or:

2 the routing mechanism, or:

3 the logging mechanism.

In case (2) above, the input either performs routing and reporting functions such as setting thresholds, or is passed on to the logging mechanism or the software-hardware alarm system. In (3) the input is used to retrieve stored information for display.

Output to the VDU always emerges from the routing and reporting sub-system. This includes responses to requests or commands from the command interpreter to the maintenance sub-system.

Output and inputs to any other devices (e.g. printer) are organized in the same way as the VDU.

Messages between remote maintenance centers and trunks maintenance SS

An external interface to the trunk maintenance SS is provided. It is through such a facility that messages will pass between DMS and remote maintenance and administration centers.

Messages between the I/O message system or alarm detection sub-system and the maintenance sub-systems

Major sources of indications to the maintenance sub-system are the messages from the I/O message system or the alarm detection sub-system. Problems detected by these two systems are routed to the relevant maintenance SS.

Messages from the CC Maintenance SS to software Maintenance SS

When anomalies in the CC Maintenance SS, relating to the software environment itself, occur the CC passes a message to the SW maintenance SS. This is the only type of communication between the SW maintenance SS and any other sub-system.

Interaction Protocol

This section defines maintenance sub-system interaction protocol and man-machine protocol.

Maintenance sub-system interaction protocol (MSIP)

MSIP is initiated by a detection of a fault (FD). When the I/O system, alarm detection SS, or any of the maintenance sub-systems, detect a fault, the maintenance sub-system in whose area the problem falls, is responsible for running a diagnostic procedure. Should the diagnosis be successful and the problem is not transient, then an error message is sent to the routing and reporting SS. Should the diagnosis fail, a diagnostic message is sent to the routing and reporting SS. The maintenance sub-system is capable of initiating an action when it can determine the cause of the failure. If so, an action message (followed possibly by a status message) is sent to the routing and reporting SS.

MSIP as initiated by a manual request (MR) from the VDU. Three types of messages can be requested by the VDU:

1 Action request (AR) - which may result in a status change and hence a status update on the VDU.

2 Status request (SR) - which is a simple request for information.

3 Diagnostic request (DR) - which is a simple request to run a diagnostic. No action is taken as a function of the result of the diagnosis when the request comes from the MAP.

Man-machine protocol

Having observed a status change on the system VDU display, maintenance personnel can request sublevel information, showing overall sub-system status. Further information is retrievable from the logging mechanism on diagnostic, error and status messages stored therein. Based on this information the fault is repaired and maintenance personnel then request that the component be returned to service. This request results in a diagnostic being run, which if successful, then performs the action of returning the repaired component to service. The associated action and status messages are also generated at this time. If the diagnostic fails, a diagnostic message is sent resulting in a repetition of the repair attempt and a re-run of the

diagnostic. The fault will continue to be displayed as an alarm on the VDU, even if the audible alarm is off, until the diagnostic is successful.

List of terms

AF

Access Fault

AR

Action Request

CC

Central Control (CPU, DS, PS)

CI

Command Interpreter

CMC

Central Message Controller

CP

Call Processing

CPU

Central Processor Unit

DC

Device Controller Cards (part of IOC)

DR

Diagnostic Request

DS

Data Store

FD

Fault Detection

IOC

Input-Output Controller

LM

Line Module

MAP

Maintenance and Administration Position

MMI

Man-Machine Interface

MR

Manual Request

MSIP

Maintenance Sub-system Interaction Protocol

NM

Network Module

NMC

Network Message Controller

ODM

Office Data Modification

PM

Peripheral Modules (LM, TM)

PS

Program Store

SR

Status Request

SS

Sub-system

TL

Trunk/Line Maintenance

TM

Trunk Module

TTY

Teletype or printer

VDU

Visual Display Unit

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