Critical Release Notice

Publication number: 297-8241-550
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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.

Publication History

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Standard release 09.02 for software release SN06 (DMS) and ISN06 (TDM).

Change of phone number from 1-800-684-2273 to 1-877-662-5669, Option 4 + 1.

297-8241-550

DMS-100 Family

Subscriber Carrier Module-100 Urban

Maintenance Manual

XPM10 Standard 09.01 August 1998

NORTEL
NORTHERN TELECOM

DMS-100 Family

Subscriber Carrier Module-100 Urban

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Publication number: 297-8241-550
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Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant.
This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user’s own expense
Allowing this equipment to be operated in such a manner as to not provide for proper answer supervision is a violation of Part 68 of FCC Rules, Docket No. 89-114, 55FR46066
This equipment is capable of providing users with access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities is a violation of the Telephone Operator Consumer Service Improvement Act of 1990 and Part 68 of the FCC Rules

Contents

About this document

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.

This document is written for all DMS-100 Family offices. More than one version of this document may exist. To determine whether you have the latest version of this document 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:

- *Alarm Clearing and Performance Monitoring Procedures*
- *Card Replacement Procedures*
- *DMS–100 Remote Carrier Urban Integration Description, Ordering, Installation and Maintenance*.
- *Input/Output System Reference Manual*
- *Office Parameters Reference Manual*
- *Operational Measurements Reference Manual*

- *Product Documentation Directory*, 297–8991–001
- *Service Order and Query System Reference Manual*
- *Translations Guide*
- *XPM Translations Guide*

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.
```

Maintenance overview

The subscriber carrier system consists of the Subscriber Carrier Module-100 Urban (SMU) and one or more remote carrier urban (RCU) modules. This document contains information to maintain the system at the maximum efficient operating level. This document contains description and procedure information for the SMU, RCU, and DS-1 links.

This chapter provides the basic maintenance plan for the SMU-RCU subsystem. This maintenance plan involves maintenance of the SMU module, RCU module and DS-1 links that connect to the SMU and RCU. This maintenance plan also involves line cards and subscriber loops.

The chapter contains the following sections. The information in this chapter assumes that all components and software processes function normally.

- Functional description. This section contains a summary of the SMU, RCU, and DS-1 links. This section provides information on the functions and the software processes supporting these functions.

  Note 1: In this document, the CM refers to the computing module (CM) of the DMS-100 SuperNode switch. As use of DMS-100 SuperNode switch increases, the term CM is more correct referring to the central processing unit (CPU) of the switch.

  Note 2: The SMU is the *enhanced* SMU (ESMU) when the following conditions are present. The SMU, the RCU and the DMS-100 switch contain the enhanced software and hardware to support one or both of the following two features. These features include the integrated services digital network (ISDN) and the Meridian business set (MBS) terminals. The SMU, RCU and the DMS-100 switch support these features for residential or business groups. This support must occur along with the current features described earlier. The SMU experiences backplane modification and several additions. These additions include one or more D-channel handler (DCH) circuit cards and an enhanced ISDN signaling pre-processor (EISP) circuit card.

- Fault conditions. This section identifies problems that can occur in components and the links that connect these components. This section also identifies the software that controls the voice and message flow.

- Automatic maintenance. This section identifies the system actions that attempt to pinpoint a fault. These system actions can attempt to automatically correct the fault to prevent manual interruption. These actions include a switch of activity (SWACT), routine exercise (REX) testing and automatic subscriber lines testing.
- Increase to manual maintenance. This section discusses manual protection switching that must occur when the SMU cannot switch a protection link to service. The SMU attempts to return this link to service after the detection of a fault on a primary link.

Functional description of the SMU

The SMU is a redundant peripheral module with two units, an active and a standby. Each unit can support call processing and system control. The units operate in *hot* standby configuration: one unit is active while the mate unit is on standby. When detection of a fault on the active unit occurs, standby control on the mate unit takes control. This unit maintains full control of the links until the correction of the failure occurs. Each unit of the SMU is identical. The SMU performs the following primary tasks:

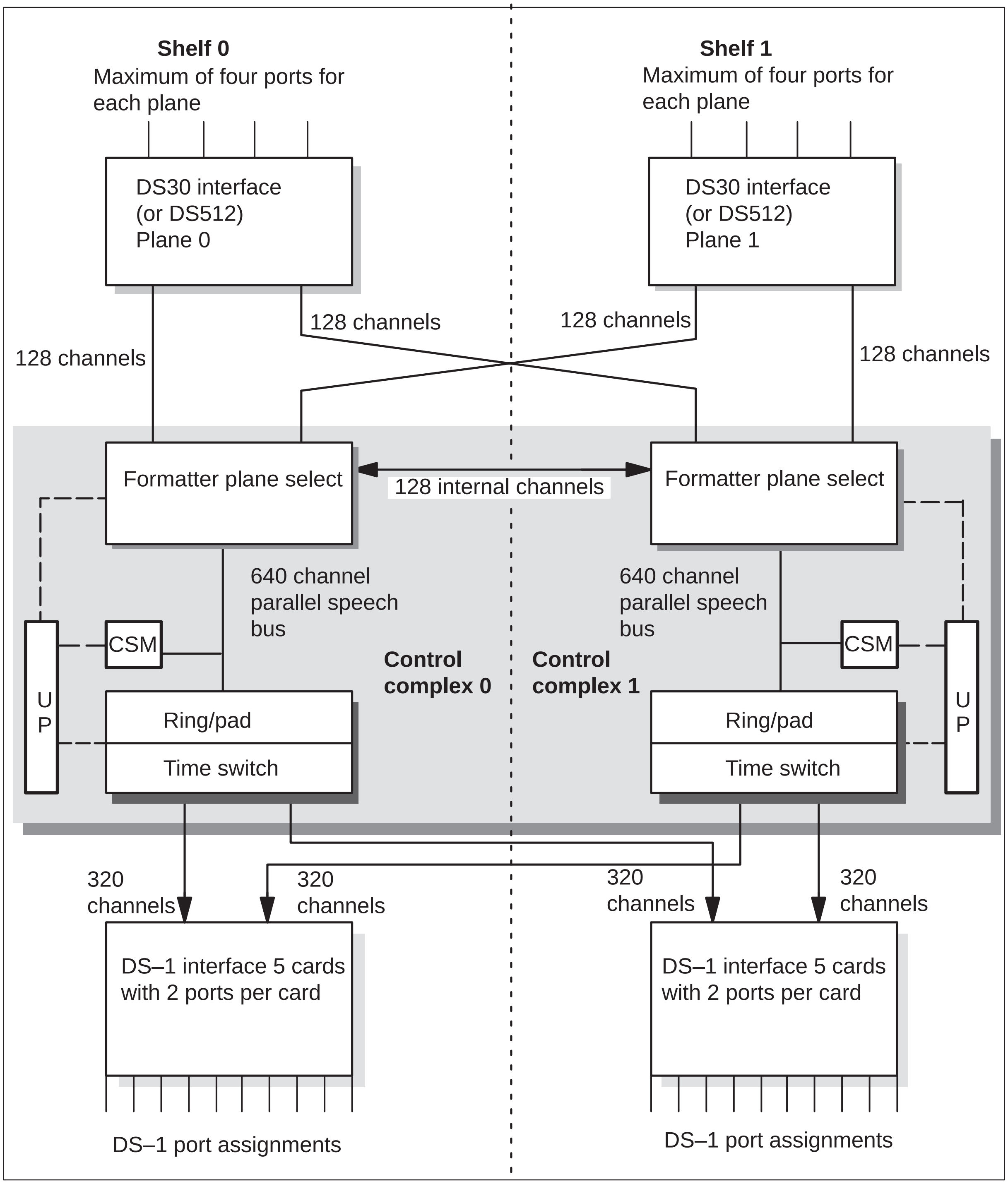
- interfaces to DS30 (or DS512) and DS-1 links
- connects peripheral side (P-side) and central side (C-side) channels
  - network to SMU to RCU messaging
  - special service hairpin connections
  - maintenance test connections, like a metal bypass to test subscriber loops
- connects setup for calls that originate from the RCU
- reports call originations to CM
- connects setup and ringing control for calls that end on the RCU
- supplies tones to the RCU-subscriber
  - dial tone to request dialed digits
  - busy tone to indicate that the called party is already busy
  - reorder tone to indicate that connection is not established
  - ringback tone to indicate to the calling party that the line of the party called rings
- takes down connections to and from the RCU-subscriber
- records dial pulse digits
- detects use of flash feature
- performs message forwarding, RCU to CM and CM to RCU

- receives and issues coin service control messages that include:
  - coin-first pay stations
  - dial-tone first pay stations
  - semi-post pay stations
- performs loss padding
- performs SWACT
- downloads provisioning data
- audits hardware and internal records
- executes internal diagnostics

SMU configuration

The SMU is based on line group controller (LGC) architecture. The LGC to SMU conversion occurs with the insertion of four cards. These cards include the two SMU cards, a ring/pad card, and a DS-1 interface card. The configuration of the SMU, based on the LGC architecture, appears in the following figure. A description of the configuration follows the figure.

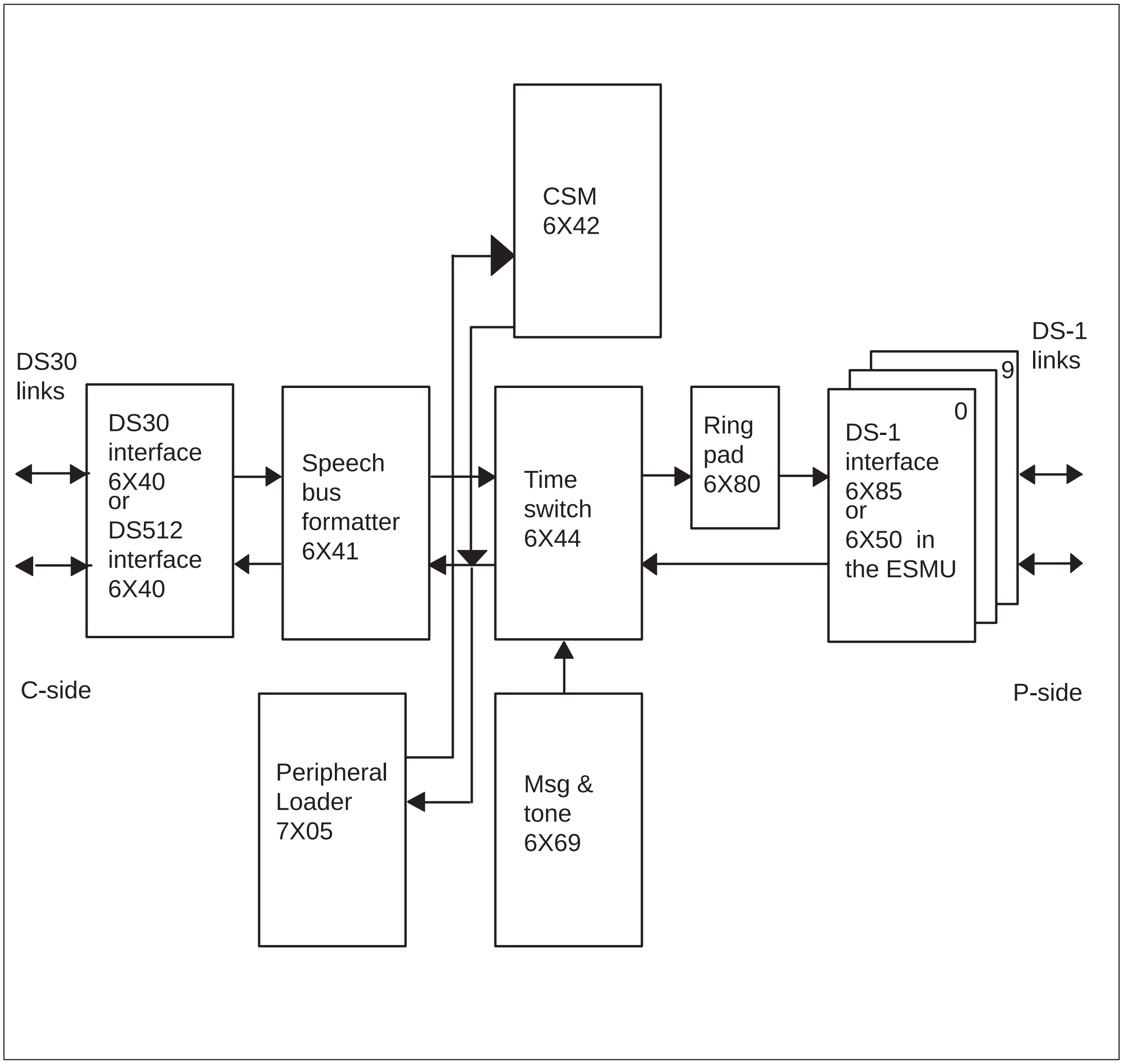
SMU configuration



Speech paths

The hardware that processes speech samples in the SMU appears in the following figure.

The PCM paths in SMU



The system receives speech from the network in the DS30 (or DS512) interface cards. The network connects to the SMU with a maximum of 16 pairs of DS30 links or two DS512 links.

- The DS30 links connect in the SMU to two DS30 interface cards (NT6X40), one in shelf 0 and one in shelf 1. Each card supplies 16 DS30 ports to provide a maximum of 32 (0 through 31) ports on a fully equipped SMU. Sixteen ports are for network plane 0 and 16 ports are for plane 1. Port assignments are distributed between the two DS30 cards. Even-numbered links are assigned to plane 0 and odd-numbered links are assigned to plane 1. A minimum of three ports for each SMU, (three pairs of duplicated links) are required for interface with the network module.
- The DS512 link connects in the SMU to two DS512 interface cards NT6X40, one in shelf 0 and one in shelf 1. One DS512 link equals 16 DS30 links, multiplexed on a single optical fiber.

Each DS30 interface card synchronizes the incoming information with the SMU. Each DS30 interface card provides 512 (16 x 32) channels for each plane to the formatter cards in units 0 and 1. This provision means a duplicated path is present through the currently active control complex.

Feature AN1121 enables loop around diagnostics for XPMs with 6X40 cards of version AD or FB. The enhanced diagnostic checks for missing or failed 6X40AD or FB cards. The enhanced diagnostic improves testing of the interface section on the 6X41 matrix card. Failure of one 6X40 card does not cause loss of service for the following reason. Links that connect the 6X40 cards to the matrix cards are fully redundant through the active unit.

Feature AN1121 enables the enhanced diagnostics of the 6X40AD and FB cards. Feature AN1121 enables these diagnostics when data entry for field PEC6X40 in table LTCINV is 6X40AD or FB. A PM777 log that contains a card list indicates faults.

Speech bus cards

The speech bus formatter/matrix card (NT6X41) multiplexes the incoming speech to a 640-channel bus. Each formatter handles 512 speech channels for each network plane. The 512 speech channels are added to 128 internal service channels. The 512 speech channels are converted to a 640-channel (512 plus 128) bus to the SMU control complex.

The channel supervisory message (CSM) card (NT6X42) extracts the channel supervisory message and checks for parity errors. The SMU works with the odd parity to make sure that an odd number of pulse code modulation (PCM) pulses occur for each 10-bit channel. Parity that is not correct indicates that a bit was altered during transmission from one peripheral module (PM) to another PM.

The CSM is a 40-bit message that contains 24 synchronization bits, eight integrity bits, and eight data bits. The complete message is transferred over 40 frames. The integrity bits must match between the PM that sends the CSM and the PM that receives the CSM. The CM informs the PM that receives of the integrity value to expect. The integrity check makes sure that a correct path from one PM to another PM is present. The 8-bit data byte relays data about call setup, maintenance, and other PM data.

Time switch cards

The time switch card, an NT6X44 in the SMU or an NTAX78AB in the ESMU, receives PCM. The unified processor (UP) directs the time switch card to switch the PCM to the correct P-side ports and channels. The time switch adds A/B signaling bits to the correct channels on the DS-1 lines. The time switch also adds tones and system control messages from the message and tone card (NT6X69) to these correct channels. The Digital Test Access (DTA) feature, that appears later in this section, requires the NTAX78AB card in the ESMU.

Attenuated speech goes from the SMU to the RCU. This attenuation occurs in the pad/ring card (NT6X80) with 0 to 7 dB loss. This attenuation reduces echo and other noise.

The NT6X85 DS-1 interface cards, or NT6X50 in the ESMU, convert the PCM speech from parallel to serial. These cards transmit the PCM speech to the RCU.

Each SMU shelf is equipped with DS-1 interface cards according to the number of RCUs to interface. Each DS-1 card connects to the control coupler of both shelves. Each shelf has a maximum of five DS-1 interface cards. Each of the DS-1 interface cards provides two DS-1 ports.

Port assignments for each shelf follow:

- shelf 0: ports 0, 1, 4, 5, 8, 9, 12, 13, 16, 17
- shelf 1: ports 2, 3, 6, 7, 10, 11, 14, 15, 18, 19

The active unit controls all the DS-1 ports (0–19).

The system processes speech that comes from the RCU for the network. The system processes this speech the same way as speech that comes from the network for the RCU. The exception speech is the incoming speech from the RCU that does not pass through the pad/ring cards. The system receives the incoming speech in a DS-1 card. The time switch removes messages and signaling bits.

The system switches incoming speech to the correct C-side channel. The CSM card adds CSM and parity bits. The formatter card removes the multiplex of the incoming speech. The DS30 cards transmit the speech to the network.

Digital test access

Digital test access (DTA) provides the ability to monitor:

- the PB service B-channels
- the TDM D-channel (marked 4:1 TDM)
- the Circuit switched B-channels
- the Bd channels that route to a DS1 interface to a data packet network (DPN) switch or to a DMS Packet Handler

Monitoring occurs with an external protocol analyzer. An ISDN line card or two channels on a digital trunk facility can access the external protocol analyzer. Two digital data streams derive from the monitored channel:

- downstream-data that flows from the switch toward the subscriber
- upstream-data that flows from the subscriber toward the switch

The upstream and downstream sides are one of the following two types of channels. Both sides can be 64 kbit/s serial digital streams to two (DS-0) channels of a DS-1 interface. In this condition, both sides have data entry for 64 kbit/s transmission. Both sides can be the B1 and B2 channels of an ISDN line card.

Loop monitoring points for EMSU-RCU systems are in the NTAX78AB time switch of the ESMU. The ISDN monitoring equipment can be off any DMS-100 ISDN line card (ISLC) or extended multiprocessor system-based peripheral module (XPM) that can support DTA.

Channels available for monitoring

The ISDN basic rate interface (BRI) service consists of two 64 kbit/s B-channels and one 16 kbit/s D-channel. Circuit switched voice or data can use the B-channel. One of the following conditions must be present to achieve PB service:

- a Bd channel connection from one of the subscriber B-channels to the DMS Packet Handler (DMS-PH)
- a Bd channel connection from one of the subscriber B-channels to a digital trunk interface to the DPN Packet Handler (PH)
- a nailed-up connection that directly links two subscriber B-channels

Each loop can have one DTA Bd connection at a time. One Bd connection can have multiple taps. This feature enables different loops that use the same Bd connection to have DTA Bd connections at the same time-division multiplexing time.

When DTA monitors a D-channel, the system sends all four time-division multiplexing (TDM) channels to the protocol analyzer. The CKTLOC command obtains the TDM group number for a specified line from the line test position (LTP) level of the MAP display. The EQUIP DTA QUERY command obtains this TDM group number at the LTPDATA level of the MAP display.

Protocol analyzer requirements for DTA

The protocol analyzer required for DTA must be able to interconnect with a DS1 digital interface of an ISDN NT1 S/T interface. This protocol analyzer must be able to resolve separate D-channel members from the TDM group. The protocol analyzer must use the group member number in the MAP display to resolve these members.

Provisioning DS1 monitoring equipment on ESMU

To use DS1 transmission facility for DTA monitoring, the following conditions must be present. The DS1 transmission facility must be provisioned to support 64 kb/s clear data transmission. The ESMU DS1 interface circuit card must be type NT6X50AB.

Provisioning ISLC as monitoring equipment on RCU

To use an ISDN line card to monitor the digital data, the following condition must be present. Data entry in table LNINV for the card must be hardware assigned–software unassigned (HASU). This data entry prevents the assignment of D-Channel Handler (DCH) resources. This assignment is not necessary and can occur with the use of a fully provisioned ISLC. The two B-channels of the ISLC cannot be nailed-up for provisioned B-channel service.

The loop state must be installation busy (INB). A command at the LTP level of the MAP determines this loop state.

The removal of a DTA connection while an XPM is out of service can increase the time to return the XPM to service. This increase occurs because the DTA connection information is downloaded as static data. The removal a DTA connection while the XPM is out of service requires the download of all static data to the XPM. This action must occur when the XPM is returned to service (RTSed). This process increases recovery time.

Limits

The following limits apply to the DTA:

- The host ESMU time switch card must be an NTAX78AB for the system to monitor an RCU ISDN loop.
- The last line card in an RCU ISDN line card carrier cannot be equipped. This limit is present because the B2 channel of this line card location is not an available ISDN resource.
- The SMUs that can perform DTA are the SMUs provisioned with the ISP16 optional card.
- The maximum number of DTA connections allowed at the same time in an XPM is six.
- The DTA allocates channels on the links between the loop monitoring point and the monitoring equipment. Connections between these channels occur across peripheral and network modules.
- The junctored network (JNET) to enhanced network (ENET) retrofits require the deletion of all DTA specconns.
- The DTA applications use C–side ports. The deletion of these ports can occur after the removal of the DTA specconns.
- The removal of all DTA connections must occur before a BCS application.
- When a monitoring point subtends an RCU, two channels must be available on the RCU for DTA to occur.

Peripheral/Remote Loader

The NT7X05 card provides local storage of XPM loads and images. The NT7X05 card provides this storage in a memory card that is steady and not mechanically based.

The Peripheral/Remote Loader-16 (PRL) provides the ability to reduce XPM simplex time. The PRL allows the following actions while an XPM unit is in service. The PRL allows the system to transfer XPM software loads to the XPM. The PRL allows the system to store the XPM software loads in the in-service XPM unit. This ability allows the replacement of a current loadfile with a new loadfile. During the process of a loadfile replacement, the last image continues to be available for recovery actions. The local storage mechanism is the NT7X05 circuit pack. A transfer of the software occurs later with the enhanced LOADPM command. This command instructs an XPM unit to load this XPM unit from the NT7X05 card while manually-busy (ManB). This process uses the following parameters:

WARNING
Possible service interruption
The LOCAL LOADFILE option of the LOADPM command has a parameter of [<file> string}]. The LOADPM command does not patch the loadfile when you use this parameter. Do not use this parameter unless you must use the NOPATCH option of the loadfile.

>LOADPM [PM] LOCAL LOADFILE
[INACTIVE]
[UNIT]

or

>LOADPM [PM] LOCAL IMAGE
[INACTIVE]
[UNIT]

Note: Support for the IMAGE parameter occurs in non-ISDN peripherals only.

The PRL uses image technology to accomplish peripheral loading improvements. The process of monitoring provides image control at a high level in the CM. The CM monitors changes to restart survivable objects in the XPM. The restart survivable objects are static data and code in the form of patches. The PRL dumps an image of the MX77 RAM in an active or inactive XPM unit that is in service. The PRL copies the image to the NT7X05. If the XPM must be reloaded, the image restores from the NT7X05 to the UP RAM.

The creation of loadfiles on the NT7X05 card occurs when the XPM is INSV. Create these loadfiles with the enhanced PM MAP level command, LOADPM, with the following parameters:

>XPMSTOR [PM] CC [load_file_name]
[ACTIVE]
[INACTIVE]

Note: The load_file_name must be the name of the data entry file in field LOAD in the inventory table LTCINV.

When the NT7X05 card is installed, the loadfile is not valid and must be loaded with the XPMSTOR parameter. The enhanced QUERYPM command has a new FILES option. Operating company personnel can use this command with this option to view the status of files on the NT7X05. This use of the QUERYPM command appears in the following example:

>QUERYPM FILES
and press the Enter key.

Example of a MAP response:

```
Unit 0:
   NT7X05 load File: ** Mismatch **
   NT7X05 Image File:
   CMR LOAD:   CMR03A
Unit 1:
   NT7X05 load File: ** Mismatch **
   NT7X05 Image File:
    CMR LOAD:   CMR03A
```

When loading must occur, the CM checks for data entry in the NT7X05. If NT7X05 is present, the system transfers information from the CM to the UP. This information includes a software load called the recovery software loader (RSL) and the name of the desired load file. This information also indicates if the image or loadfile must be loaded. The RSL checks for the loadfile name on the NT7X05. If the load name test passes, the RSL restores the image or load to the UP following instructions. To avoid loading delays that are not necessary, in conditions where the file to restore is good, the following action occurs. The image/loadfile integrity is verified as part of the restore/loading process. Operating company personnel can use the enhanced QUERYPM command to view the status of files on the NT7X05. The use of this command appears in the following example.

>QUERYPM FILES

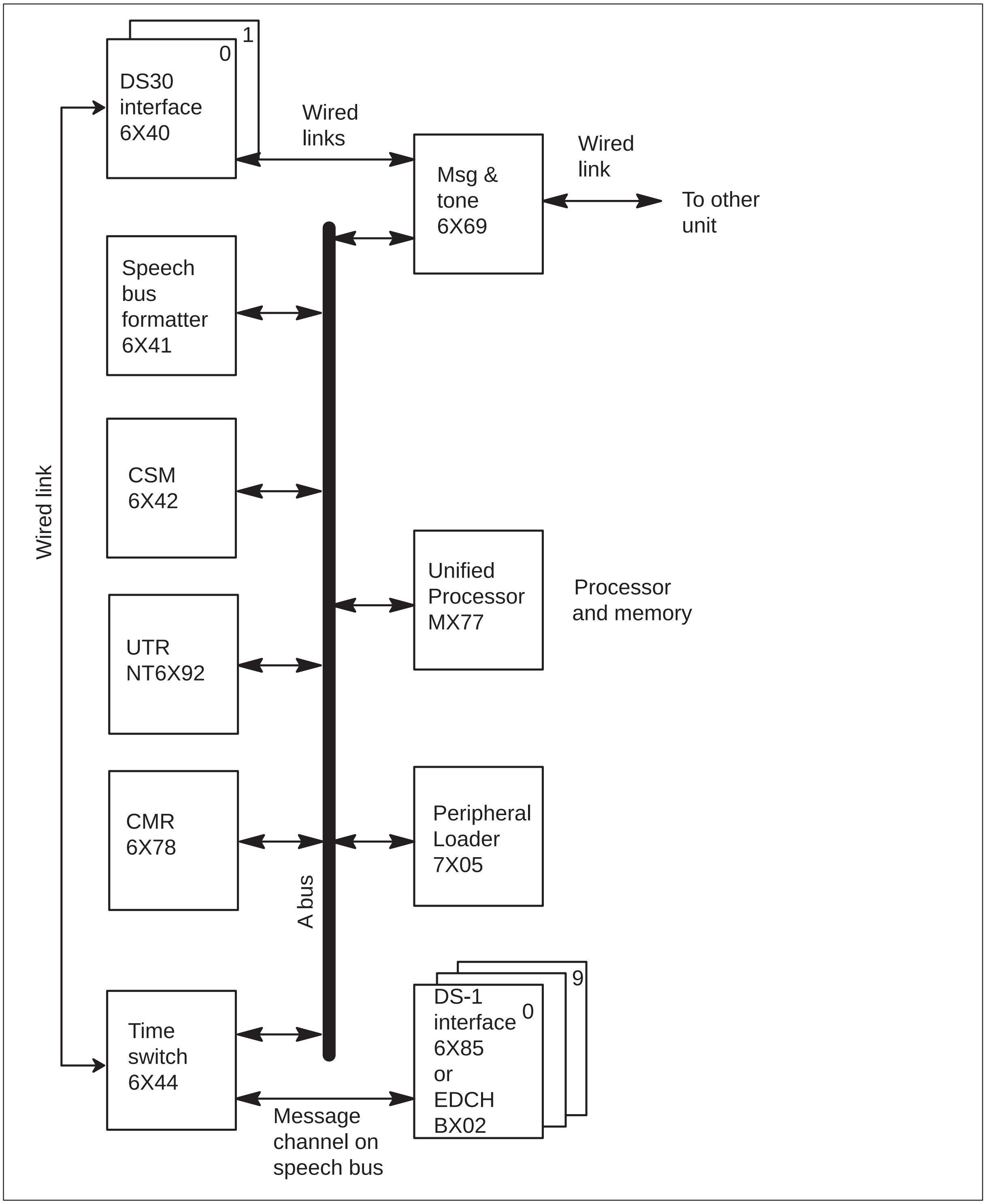
Example of a MAP response:

```
Unit 0:
   NT7X05 load File:ESU05AW
   NT7X05 Image File:
    CMR LOAD:  CMR03A
Unit 1:
   NT7X05 load File: ESU05AW
   NT7X05 Image File:
    CMR LOAD   CMR03A
```

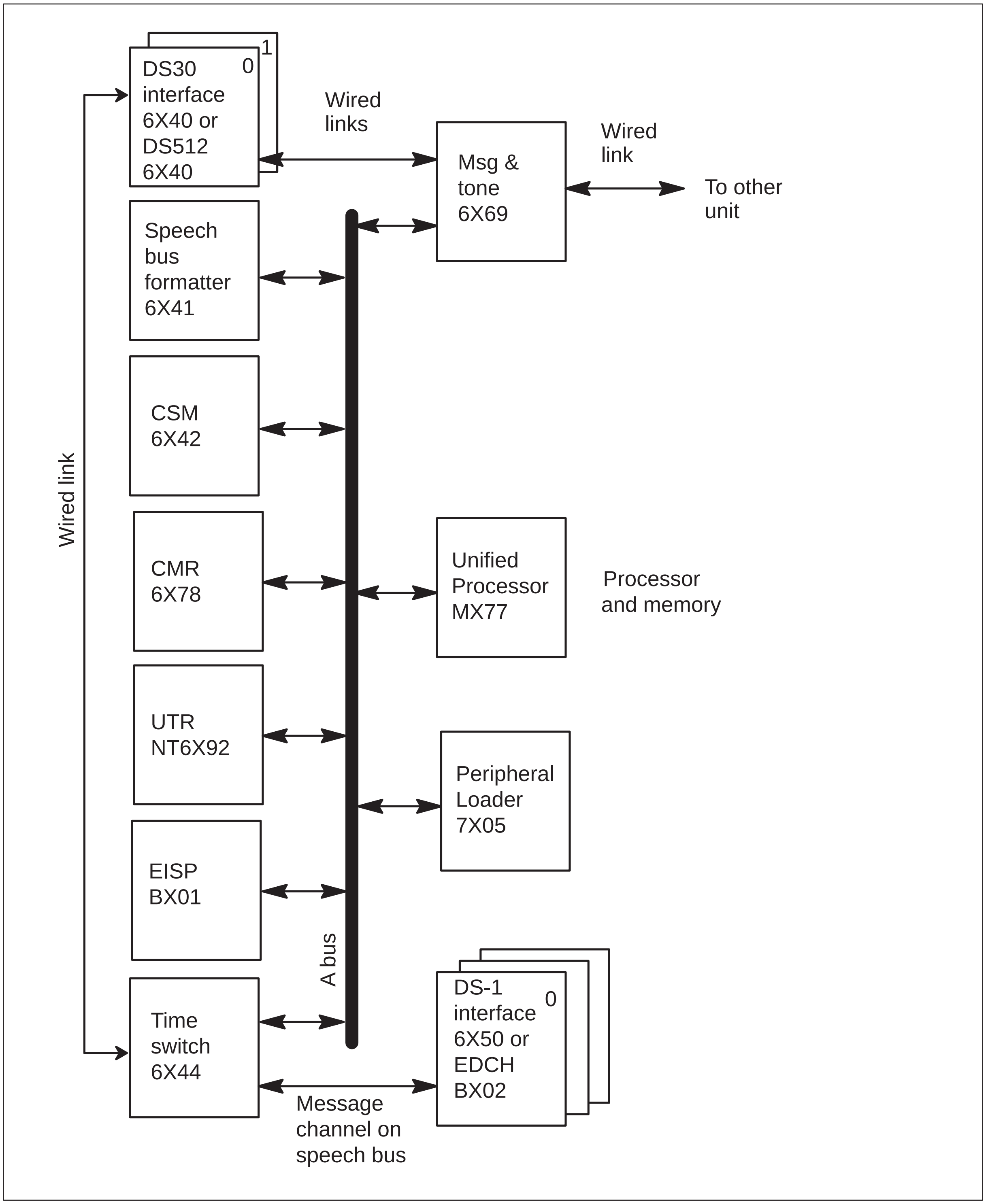
Internal messaging

The following figure shows message paths in the SMU. Message paths in the enhanced SMU appear in the next figure.

Message paths in SMU



Message paths in ESMU (SMU with ISDN/MBS capability)



The UP card (NTMX77) links cards through the A-bus. The UP polls each card and sends or receives messages by direct memory access (DMA). Each card has memory access protocol specified for that card.

The UP formulates SMU messages to transmit to the CM. The UP sends the messages through the DS30 (or DS512) cards from the message and tone card. The system places CM messages on channel 0 of DS30 links 0 and 2.

The message and tone card also extracts messages from the CM from the DS30 interface card. The UP scans the message and tone card, accesses the messages, and determines the meaning of the messages.

The message and tone card exchanges C-side messages with the DS30 card over a wired link. These C-side messages to the network use DS30 protocol. The message and tone card also allows message exchange between the active and inactive SMU units. The system uses intermodule communication (IMC) protocol to send these messages over a wired link. The Intermodule communication link in the next section describes this IMC transmission of messages.

The DS30 cards and the time switch exchange control messages over a wired link.

The system uses a message channel through the time switch to send control and status messages to and from the DS-1 cards. The time switch exchanges one message channel for each DS-1 link with each DS-1 card. Each card has two message channels because each DS-1 card handles two links.

The MX77 UP card provides call processing functions. These functions include digit collection (pulse), channel assignment, and message processing. Real-time call processing functions include the message transmission and reception, time switch control, and channel supervision.

The UP provides dynamic random-access memory (DRAM) and a direct memory access (DMA) from the EISP card, if equipped. The UP has 8 Mbytes of memory and provides firmware ability that can be downloaded. This ability allows operating company personnel to load firmware separate from the RAM load.

In-service firmware downloading

In-service firmware downloading permits XPM firmware loading in an XPM unit while the unit is in service (InSv). This feature reduces the amount of time one unit of the XPM is out-of-service (OOS). In-service firmware downloading supports NTMX77 and NTAX74 processors.

Note: In-service firmware downloading refers to the loading of the firmware while the unit is InSv. The upgrade of the firmware occurs with the XPM unit out of service (OOS).

This feature introduces the LOADFW command. The LOADFW command distinguishes the firmware load application from the firmware upgrade application. The command syntax for the LOADFW command is:

```
LOADFW: Load Firmware onto a PM or unit.
       All parameter will execute LOADFW on
       all PMs in the post set of the same
       PM type displayed on the MAP.
       LOADFW UPGRADE must be used to
       activate the new firmware.
Parms: <DEVICE> {UNIT <UNIT_NO> {0 TO 1},
                 PM,
                 INACTIVE,
                 ACTIVE}
          [<FILENAME> STRING]
           [UPGRADE]
           [NOWAIT]
           [ALL]
```

To download firmware to the XPM, execute one of the following commands. The following are examples of the LOADFW command.

>LOADFW PM

or

>LOADFW UNIT unit_no

or

>LOADFW INACTIVE

Note 1: If the firmware_file is not specified with the LOADFW command, the command applies the firmware_file datafilled in the appropriate inventory table.

Note 2: By using the LOADFW command without the UPGRADE option, the firmware downloads to the DMS system.

XPM Firmware Loader Robustness CM Component disables the firmware option of the LOADPM command. A message is output to the user if the firmware option of the LOADPM command is used. This message states this option is not supported and to use the LOADFW command.

Loadfile verification

Integrity checks are performed on the firmware for loadfile accuracy. A loadfile record length check ensures the file is a firmware file before submission to the XPM. If the record length is not 54, a message is output to the user and the LOADFW command fails.

Another accuracy check is a 32-bit cyclic redundancy check (CRC) along with a 16-bit checksum. The CM sends a validation message to the XPM to verify the accuracy of the firmware load. The XPM extracts the CRC and checksum that is in the firmware load. The XPM computes the CRC value and the checksum. The XPM compares the computed and extracted values to see if the values are the same. The XPM sends the result of the comparison to the CM.

To verify the firmware load enter the following command at the MAP display terminal:

>QUERYPM CNTRS

Firmware upgrade

After loadfile verification, the XPM can be upgraded to the new firmware. To upgrade the firmware use one of the following command string sets:

>BSY PM
>LOADFW PM UPGRADE
>RTS PM

or

>BSY UNIT unit_no
>LOADFW UNIT unit_no UPGRADE
>RTS UNIT unit_no

or

>BSY INACTIVE
>LOADFW INACTIVE UPGRADE
>RTS INACTIVE

Note: By using the LOADFW command with the UPGRADE option, the firmware is upgraded to the new firmware load.

When this procedure is performed on a by-unit basis, perform a switch of activity (SwAct) followed by the RTS command. Execute the LOADFW command with the UPGRADE option on the now inactive unit.

The next table lists parameters used with the LOADFW command.

LOADFW parameters

Parameter	Value	Definition
UNIT	n/a	Peripheral module unit
PM	n/a	Peripheral module
INACTIVE	n/a	State of peripheral module
ACTIVE	n/a	State of peripheral module
unit_no	0 or 1	PM unit number
filename	n/a	Name of firmware file. If the firmware file is not specified, the firmware load found in the appropriate inventory table is used.
UPGRADE	n/a	Upgrades the PM to the new firmware load. UPGRADE is an optional parameter.
ALL	n/a	Permits the use of the LOADFW command on a posted set of PMs. ALL is an optional parameter.
NOWAIT	n/a	Returns the prompt before the command is finished, on-screen status is not visible. NOWAIT is an optional parameter.
Note: In this table N/A is an abbreviation for not applicable.		

Providing ISDN and MBS ability in the SMU

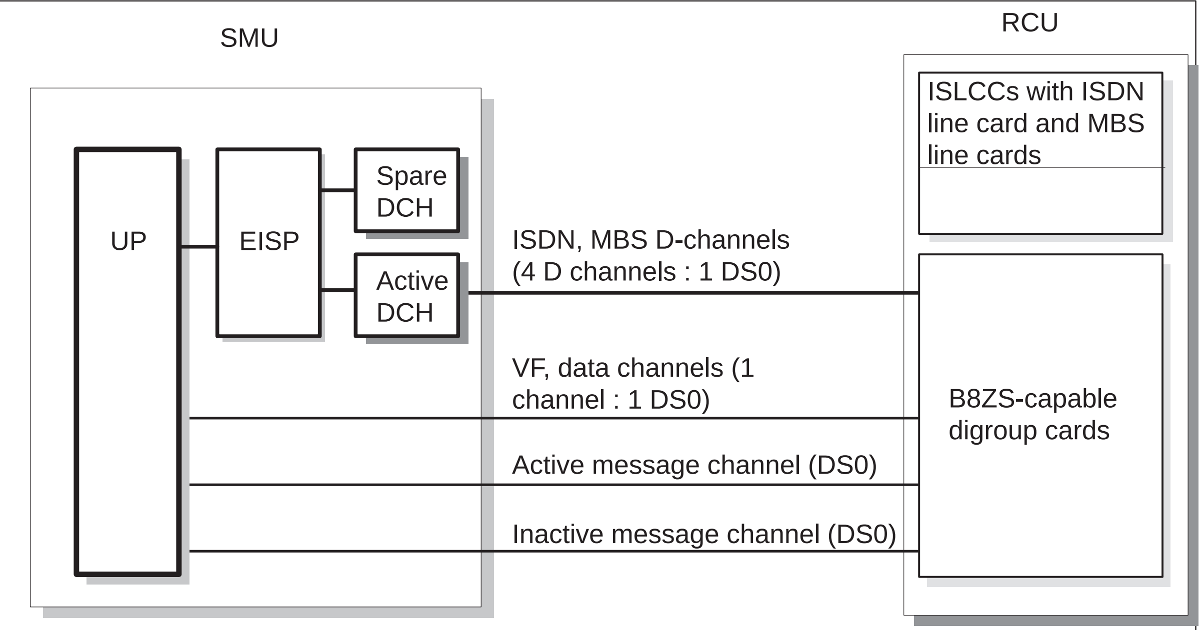
The SMU can provide ISDN ability, MBS ability, or both abilities as an option. For this provision to occur, the equipment must meet the software and hardware requirements for these abilities. The hardware requirements for the ESMU include a modified backplane and one or more DCH or enhanced DCH (EDCH) cards. These requirements also include a DS-1 interface card (NT6X50) with 64 kbps clear-channel ability, and an EISP card.

The RCU requires one or more integrated services line card carriers (ISLCC), enhanced digroup cards, and ISDN U-interface and/or MBS line cards. The software requirements include CM software, SMU software, and RCU firmware that can support ISDN, or MBS, or both features.

The DCH card (NTBX02) or the optional EDCH card (NTBX04) in the ESMU terminates specified D-channels. The D-channels operate at 16 kb/s for the out-of-band call control signaling that ISDN and MBS use. The DCH also transfers packet data to packet handlers for ISDN. The EISP card (NTBX01) provides a communication path between the DCHs and the master and signaling processors in the SMU.

Refer to the following figure for a functional diagram of an SMU-RCU system that provides ISDN and MBS ability.

Functional diagram of SMU-RCU with ISDN and MBS ability



Note: The RCU must be equipped with ISDN and MBS line cards in the integrated services line card carrier (ISLCC). Special service line cards can also be equipped in the ISLCC.

National ISDN-2/3 BRI Phase I feature

The National ISDN-2/3 BRI Phase I feature increases the operational versatility of BRI line interface configurations. This feature expands the BRI service options available to end users. This section addresses enhanced ISDN capabilities that you can access. This access requires the software optionality control (SOC) NI000050 in NA007.

- Two B-channel access—This ability enables a specified terminal to use a single terminal endpoint identifier (TEI) to access both B-channels. The specified terminal must support voiceband information (VI), or circuit mode data (CMD), or both of these features. This ability applies to both fully initializing terminals (FIT) and non-initializing terminals (NIT). Provisioning controls the number of B-channels a terminal can access.
- Support for non-initializing terminals (NIT)—This ability supports one non-initializing terminal on a BRI interface that has the default logical terminal. An NIT is a new class of BRI terminal that does not initialize Layer 3. An NIT does not require a service profile identifier (SPID). An SPID is an identification number that a terminal uses in the initialization process.

- Assignment of fixed feature keys to the default logical terminal for NITs.—This ability permits the assignment of the following features to the NIT: call forwarding, message waiting, conference calling, call transfer, and call drop. The NIT can use the dial-access procedures or feature key management procedures to access these features.

The National ISDN-2/3 BRI Phase I feature introduces the following interactions:

- This feature changes the way additional call offering (ACO) operates for terminals with the access privilege data entry for two B-channel access. When the terminal has a call active and one B-channel free, and a termination occurs, the following condition is present. The terminating SETUP contains the channel identifier information element (CID IE) coded to the value of the free B-channel. For terminals without the two B-channel access privilege, this message has the CID IE coded to no-channel.
- When flexible calling is active on a 2B FIT/NIT conference controller, all VI terminations that follow are offered to the terminal with the CID IE coded to no channel.

Universal tone receiver

The programmable universal tone receiver (UTR) is a 32-channel receiver that resides in an XPM. The UTR is an optional feature that allows the SMU to perform all digit collection functions at the originating terminal location. These functions include:

- allocation of a free receiver
- establishment of a path to the receiver
- collection and processing of digits
- deallocation of the receiver

The allocation or deallocation of receivers occurs in the SMU and not in the CM. Allocation and deallocation includes the creation and release of connections.

The system can activate this feature during the following conditions. A UTR card (NT6X92BB release 20 or later) must be present. Data entry for table LTCINV must indicate that UTR is on the SMU.

If an SMU is equipped with a UTR, the following conditions must be present:

- the message card must be release NT6X69AD (ASIC version)
- the CLASS Modem Resource must be NT6X78AB (ASIC version)

If these requirements are not met, the SMU can exceed the 50 A power rating of the shelf.

The UTR on the SMU is subject to the same limits as other XPMs with UTRs.

> ***Note:*** The UTR is a critical card. A failure of the UTR causes the unit where the UTR is located to go out of service.

The system requires a receiver request to start the sequence. If the request arrives from an SMU without a UTR, the CM obtains a receiver and a network connection.

When the terminal that originates is located on an SMU with a UTR, the following actions occur. The CM conveys to the SMU all information that relates to digit collection, and informs the SMU to start digit collection. The SMU obtains a receiver, connects the originator to the receiver, and collects and reports the digits.

DSCWID

To comply with an Analog Display Services Interface (ADSI) protocol, the NT6X78AB, the NT6X69AD, and the NT6X92BB cards are required. The ADSI protocol supports custom local area signaling (CLASS) features that provide information based on display to subscribers with ADSI-compatible customer premise equipment (CPE). The spontaneous call waiting identification with disposition (DSCWID) is an example of information based on display.

The NT6X92 card, also called the universal tone receiver (UTR), identifies and processes tones for channels on the parallel speech bus.

The NT6X78 CLASS modem resource (CMR) card supports Calling Number Delivery (CND) and other CLASS features. The CMR card provides the ADSI protocol to transmit CLASS data. This transmission occurs between the CM and the CPE that complies to ADSI.

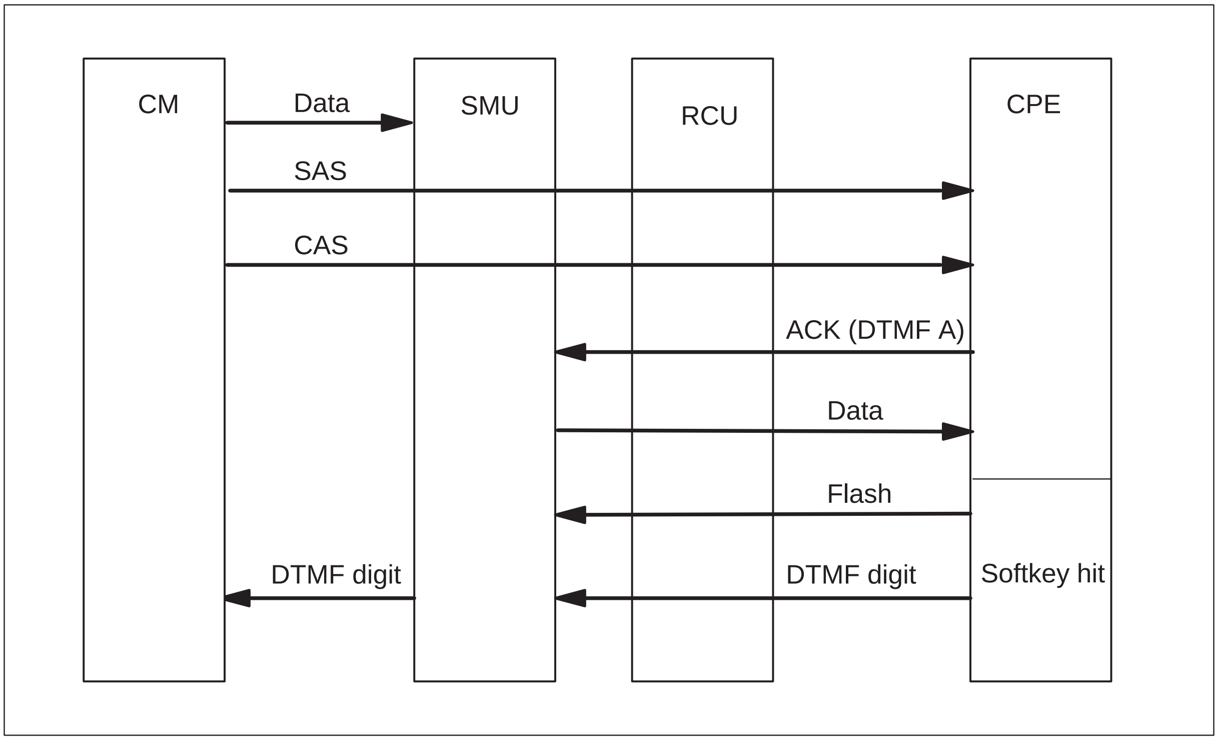
The DSCWID feature complies with the Bellcore TR-416. The Bellcore TR416 describes the requirements for DSCWID and specifies how this feature interfaces with the following sets:

- the ADSI set—An ADSI CPE based on a screen that can display options.
- the SCWID set—A CPE that is not ADSI that can deliver caller identification (CID) data.
- the 2500 set—A CPE that is not ADSI that can signal Dual Tone Multi-Frequency (DTMF) but cannot perform off-hook delivery of CID data.

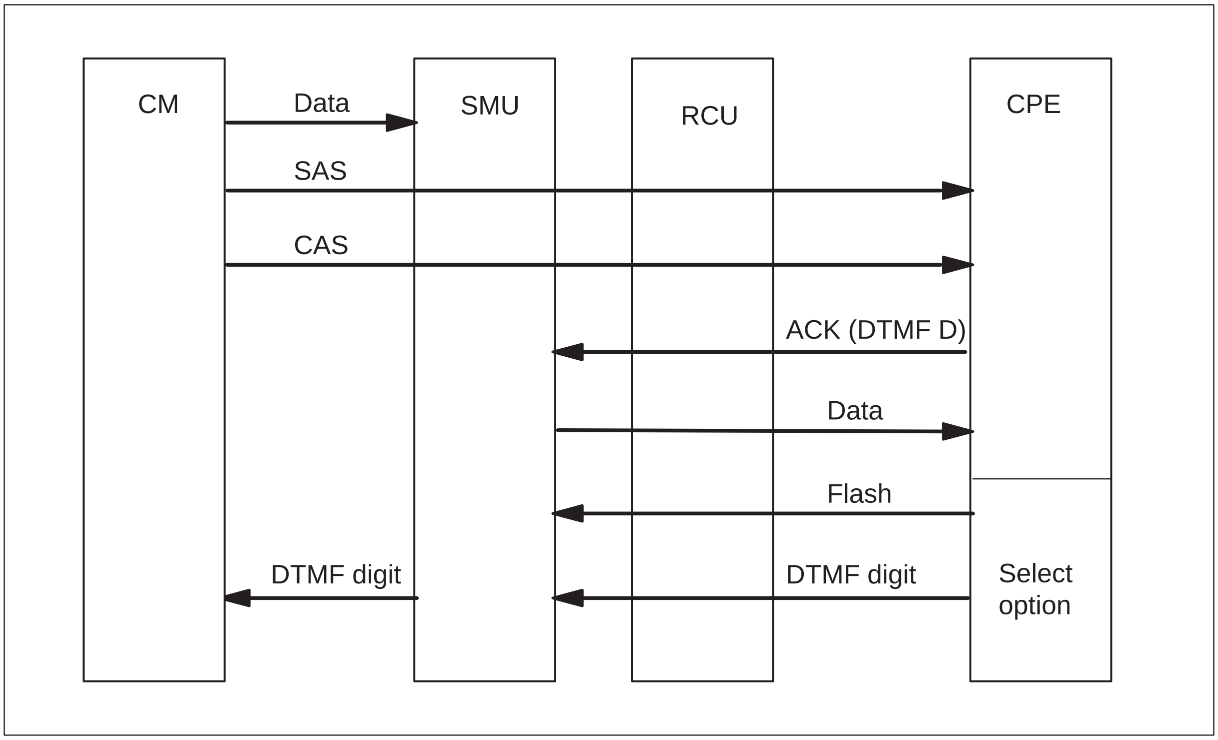
The CM sends tones that alert the DSCWID subscriber of a pending call, and the CPE of pending caller data. A line with the DSCWID option and a call established can have a second call attempt to terminate to that line. In this event, the CM provides one of two types of alerting signals. These signals include a Subscriber Alerting Signal (SAS), and an SAS followed by a CPE Alerting Signal (CAS). The subscriber recognizes the SAS tone as the call waiting tone (CWT). The CAS alerts the CPE of data that that will arrive. For this alert, the subscriber line must have the CID feature.

In response to alerting tones, the DSCWID CPE generates an acknowledgement (ACK) tone. This ACK tone indicates that the CPE is ready to receive DSCWID data. The system collects the ACK tone on the UTR card in the SMU. If the CPE is ADSI compatible, the CPE sends a DTMF A ACK signal in response to the CAS. If the CPE is a SCWID CPE, the CPE sends a DTMF D ACK signal in response to the CAS. When the transmission of alerting tones is complete, the subscriber can control the condition of the incoming call. The subscriber can use softkeys or hard-coded keys to respond. The subscriber uses the CPE softkeys if the CPE is ADSI. The subscriber uses hard-coded keys if the CPE is a SCWID or a 2500 set. If the CPE does not respond with an acknowledgment tone, the CPE is like a 2500 set. Examples of responses from the three set types appear in the following figures.

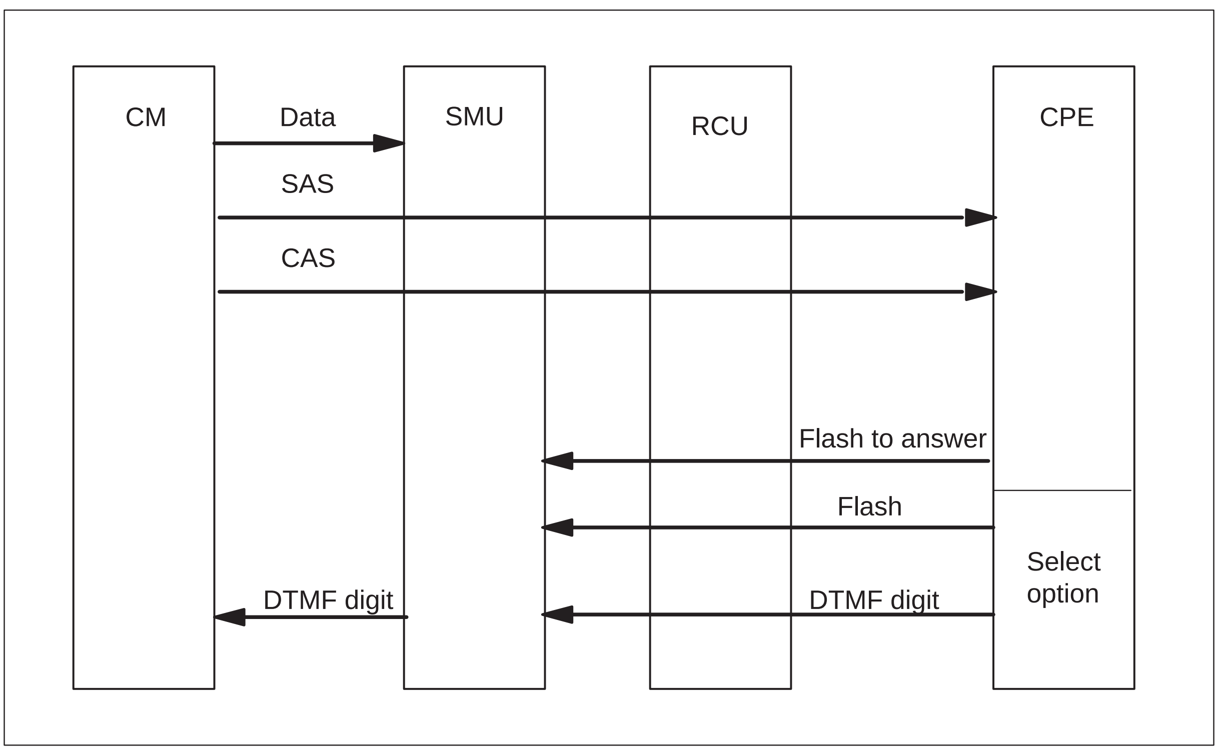
Example of a DSCWID call on an ADSI set



Example of a DSCWID call on a SCWID set



Example of a DSCWID call on a 2500 set



The CM also sends signals to alert the CPE when a UTR channel is not available. If UTR channels are not available, data does not submit to the CPE. In the proprietary DSCWID, when the SMU did not attach to a UTR, a flash was ignored. For Bellcore compliance, the switch must provide options if the system detects a flash and the SMU cannot attach a UTR. To comply with this requirement, the SMU sends a flash to the CM. The SMU sends this flash if the SMU cannot attach a UTR in 400 ms. If acknowledgement of the first pending call notification does not occur in 10 s, the CM sends a second alerting signal. The system does not send display data to the CPE if UTR channels are not available. In this condition, the system holds the data and sends the data if alerting occurs again.

After the SMU receives a flash signal from the customer ADSI-compatible CPE, the SMU starts a T-tone timer. The T-tone timer times the maximum time allowed between a transmitted flash and the DTMF digit on ADSI set. The timeout is 600 ms when the speech path is mute. The system starts the T-tone timer for the first option selection during a DSCWID call. Any ADSI DSCWID option selections that follow also start the T-tone timer.

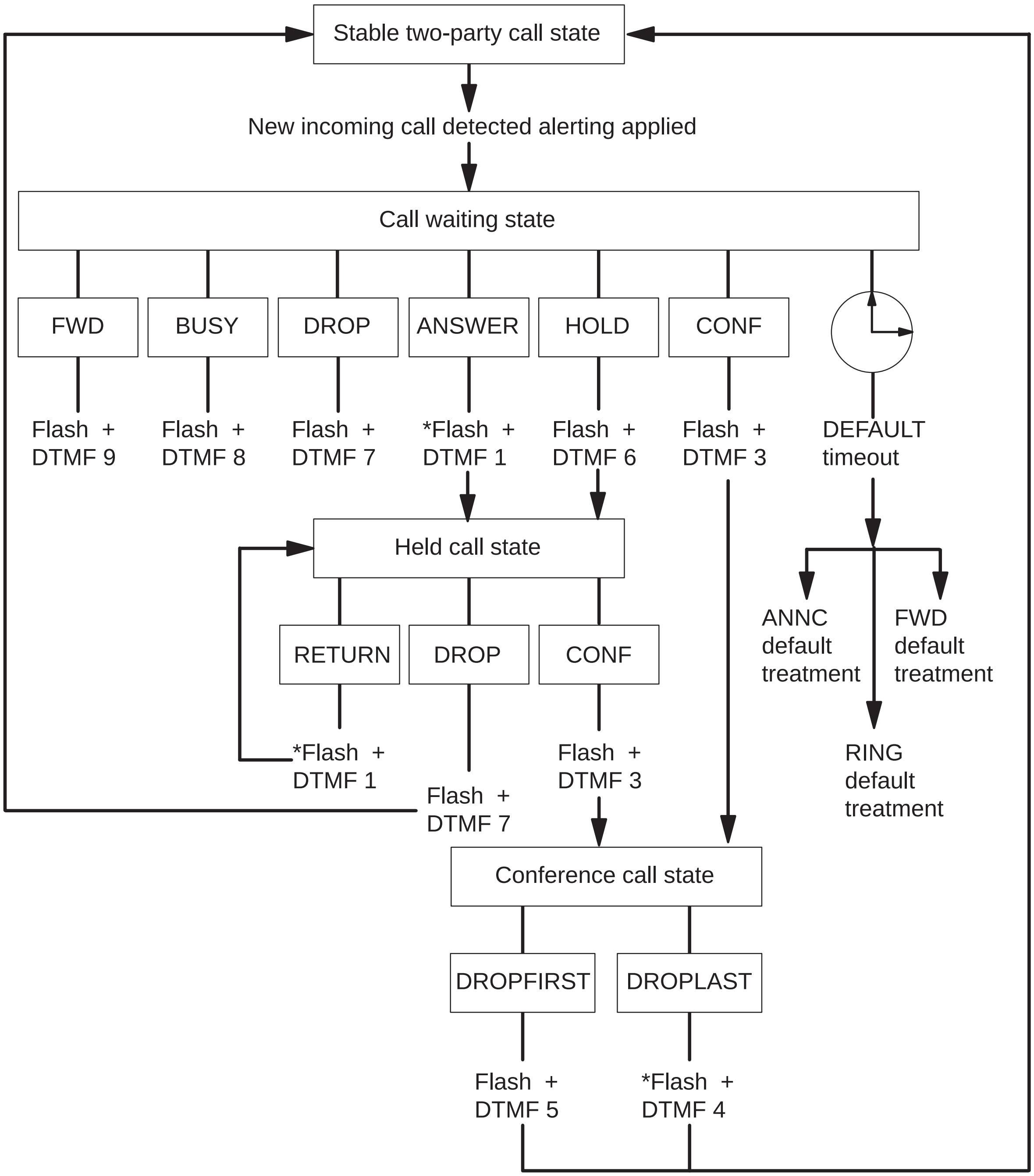
Any DSCWID option selections that follow on a SCWID or 2500 set use a new timer (T-flash). You use the T-flash timer after SCWID and 2500 sets answer a call. This action provides the customer with enough time to select an option after a flash. This new timer was introduced because 600 ms is not enough time to flash and dial a DTMF digit.

The operating company can set the T-flash timer from 1 to 8 s. Default is 1.5 s. The SMU starts the T-flash timer if the NONADSI field in table DSCWDTYP is set to Y (yes). The SMU receives a flash signal from a customer SCWID or 2500 set during the held or conference call state. The SMU must keep track of the DSCWID call state. This information determines the type of CPE as the timer used. If the SMU cannot attach a UTR before 400 ms, the system applies the RETURN option.

The CM attempts to synchronize with the CPE at all times. This supervision prevents specified conditions. In these conditions, CPE attempts to perform a function, but the switch does not process the option based on call state. The DSCWID call waiting disposition options are:

- Answer the new call and put the current call on hold.
- Disconnect the current call and answer the new call.
- Forward the new call.
- Connect the new call to a busy announcement.
- Put the new call on hold after the connection to a hold announcement.
- Conference the new call with the current call.

DSCWID with ADSI set dispositions



Note 1: An * indicates that the system can perform a flash to accomplish a function. This flash accomplishes the same function as when the system sends the DTMF code for that digit.

Note 2: Dispositions can be available if NONADSI = Y in table DSCWDTYP for the given DSCWID type. For this availability, one of the following conditions must be present. A non-ADSI set must have the configuration for hard-coded keys to perform DSCWID dispositions. The subscriber must provide a DTMF-digit in 600 ms.

Computing module data sync

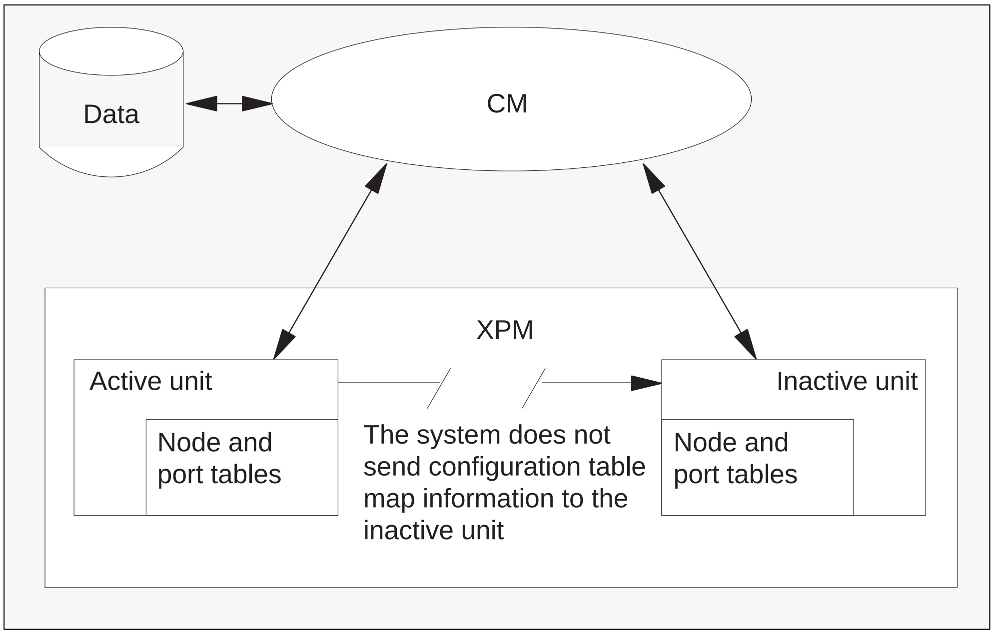
The XPMs must adhere to several requirements to maintain system sanity. Node and port tables in both units must remain synchronized. The same internal indexes must reference common tuples to both units. These common tuples must contain the same data. The maintenance of identical indexes in both units allows processes to communicate between units. Active processes continue to function after a warm SWACT. When XPMs were designed, this synchronization was easy to maintain. The introduction of new functionalities makes continuous synchronization of the mate unit node and port tables more difficult.

Node table sync enhancements

Table PMNODES contains a list of nodes in each XPM. Feature AF5678, XPM Node Table Sync Redesign, created table PMNODES. This table transfers XPM node information to the new CM load during a software upgrade. This transfer makes sure that the new CM software contains the correct node order for each XPM that becomes active. The CM controls the sequence and datafill of node and port tables in both XPM units. Synchronization maintains between the CM and the tables in both active and inactive XPM units. The XPMs converted to this table management system do not synchronize with specified mapping information. This mapping information is mapping information sent from the active unit to the inactive unit.

Table PMNODES is a read-only table. The system adds and deletes tuples as data entry occurs for related inventory tables. These tables include RCCINV and LCMINV. The system rejects user attempts to update this table. The system checks XPM resources when a tuple change or addition for a subtending node occurs in an inventory table. The system displays warnings when an XPM cannot support the new requirements. The XPM does not have the table space, port, or terminal resources to support the new requirements. Refer to the *XPM Translations Reference Manual* for a complete description of the data entry for table PMNODES.

Enhanced XPM node table synchronization



Feature AF5678A adds a new software component, configuration data table (CDT) management. The CDT bind interface allows XPM applications to bind an aspect with the set of procedures to a CDT. This action occurs during initial program load (IPL). An XPM with a software load bound with the new CDT management system notifies the CM during an XPM node data audit. The CM starts a CDT audit each 5 min. This action initiates the XPM node data audit in the XPMs.

The CDT/XPM node audits convert XPMs with compatible software loads into the new node table management control. The CDT/XPM node audits verify the sanity of converted XPMs. To maintain backward compatibility, XPMs with software loads and without CDT management ability continue to maintain mate unit synchronization. A previous section describes this synchronization maintenance process.

The system gives the CM control of both units of an XPM node in the following conditions.

- The CDT / XPM node data audits update the tuples of that node in table PMNODES. The audits update this tuple to match the data and index sequence of the tuples in the XPM node and port tables.
- The CM had control in a previous software load.

- A new XPM is added other than during a one night process (ONP) conversion. Nodes added during ONP are not new nodes. These nodes must be in service.

Note: When an office receives a first software load with the new node table management system, the following event occurs. The CM gains control of compatible XPM node and terminal tables during the next scheduled CDT / XPM node data audits. When an XPM is taken out of service (OOS), the CM does not assume control until the CDT/XPM audits perform the following two actions. The CDT/XPM audits convert an XPM to the CDT management system. The CDT/XPM audits align the CM tables with the node tables.

The CM initiates the audit request to an XPM with a VERTUPLE message. The message has a parameter that identifies how the XPM must respond. The XPM can respond with a message with current tuples of data, or a checksum of the table. The system requests the data of the tuples to supply the CM with information. This information allows the system to convert an XPM to CDT management control. If differences are present between the active and inactive unit tables, the following actions occur. The CM aligns to the table of the active units and sets the XPM in-service trouble (ISTb). After an XPM conversion to CDT, the system requests a checksum of the table when the CDT audit runs.

The system uses checksums of node and port table data to verify synchronization of XPM nodes under the CDT management system. To calculate the checksums, the system regenerates each tuple in the XPM table. After a tuple is formatted, the checksum is calculated for that tuple and added to the table checksum for the XPM. The system verifies XPM checksums against corresponding checksums that the system generates in the CM. A checksum that is not correct indicates an out-of-synchronization condition. This condition causes the system to set that unit ISTb. During the next audit cycle, if the unit checksum coincides with the CM checksum, the system clears the ISTb condition.

As the CM takes more action to maintain the accuracy of the node tables in XPMs, XPMs become less active. The XPM must accept the CM data as the CM sends the data without corrections or adjustments.

- The XPM does not derive node table data from a subset of data that the CM sends. The CM specifies all the data that the node and port tables contain. The XPM stores the data as the XPM receives the data.
- The CM notifies operating company personnel if resources are not available on an XPM when inventory tables are changed. This notification also occurs if the XPM is ManB or OOS at the time the inventory tables change.

- The XPM does not compare node tables between units. The CM makes sure that the node tables in each unit match because the CM controls the content of each table. Configuration download occurs when both units are taken out of service (OOS) and RTSed at the same time.
- Node and port table aspect and access routines allow applications to access the data. Read-only access is provided to applications. The system updates tuples in XPM tables from the CM while the XPM is INSV.
- A new external node number to internal node number look-up table is in the XPM. This table provides fast conversion from external to internal node numbers and eliminates collisions.
- An enhanced messaging interface includes status information between the CM and XPM. The new interface contains:
  - the ability to detect lost messages by the addition of a sequence number from 1 to 255 in the header.
  - a byte of data transfer status information that informs the XPM if more messages follow.
  - a count of tuples that the message affects.
  - a table format identification to identify the version of XPM table software. You can leave the current node table management software in the XPM until XPM06. This action maintains backward compatibility.

Enhanced Dynamic Data Sync (EDDS)

Dynamic data describes information. This information includes the link and node states in the XPM necessary for call processing support. These states are normally set in the active unit of an XPM through the following actions. These actions include node and link RTS or state changes that an external stimulus trigger. These states spread to the inactive XPM unit through the bulk and individual messages of the XPM data synchronization mechanism.

The EDDS is a necessary component of warm switch of activity (SWACT). A Warm SWACT preserves processing of ISDN and POTS calls. Warm SWACTs occur when the active XPM unit drops activity to preserve call and unit states. These states enable calls to continue without interruption.. An XPM trap, REX test, and other causes can cause an XPM to drop activity. For a warm SWACT to succeed, the inactive unit must be in service (INSV).

The inactive unit can be OOS in a manually busy (ManB), system busy (SysB), or C-side busy (CBsy) state. If the inactive unit is OOS before one of these states, the following events occur during an RTS.

- The inactive unit is initialized.

- The OOS tests run on the inactive unit.
- If the inactive unit static data checksum is not correct, the following actions occur. The CM sends new static data and marks the inactive unit in-service trouble (ISTb).
- The active unit sends dynamic data to the inactive unit (bulk synchronization).
- The CM marks the inactive unit INSV.

Intermodule communication link

The IMC links allow the two SMU units to exchange dynamic data. These links make sure that if the active unit fails, the inactive unit can take over call processing.

The IMC links in the SMU consist of one link between the NT6X69 cards and one link between the NTMX77 cards. The system audits these links to monitor the sanity of messages between the units.

If the IMC audit fails, and the system can detect the fault at the node level, the following occurs. The system places the SMU in the ISTb state.

If the system detects a fault at the unit level, the system places the defective unit in the ISTb state.

When the system detects an IMC link failure, the following events occur:

- The system reports the fault to the CM.
- The system closes link and SMU status changes to ISTb.
- The SMU processors do not use link.
- The system prevents warm SWACTs.

Refer to the Handling an IMC link fault in this document for corrective action. When the fault is fixed, the system audit opens the link again.

Information flow to and from the SMU

Information flow is between the SMU and other peripheral modules that connect to the DMS network (speech/supervision messaging). These peripheral modules include the RCU (control messaging and speech and signaling) and the CM (control messaging).

Control messaging between the SMU and the RCU

The transfer of messages from the SMU to the RCU and from the RCU to the SMU uses a message protocol. This message protocol is a dedicated control channel that uses DMSX protocol. The DMSX protocol is a process between terminals that contains handshaking messages. In the handshaking messages, two terminals engaged in message transfer inform each other of the present messaging condition of each terminal.

Channel 0 on a DS-1 link 3 is the primary control channel. Channel 0 on DS-1 link 4 is the secondary control channel.

If link 3 fails, link 4 assumes transmission of control messages. The types of control messages include the following:

- messages from the CM to the remote to
  - set up or to take down connections between a line card and a speech channel
  - update provisioning data records
  - initiate common equipment, DS-1 link, line card, or subscriber loop maintenance
- messages from the remote to the CM to
  - indicate subscriber hook status
  - acknowledge CM messages
  - return test results
  - signal fault conditions with alarms

The following figure shows the primary design of control messages the SMU and the RCU exchange. Messages normally consist of 15 bytes.

The DMSX message format

Destination identification (ID)	Byte 0
Source identification (ID)	Byte 1
Operation code	Byte 2
Filler and marker	Byte 3
Data	Byte 4 to Byte 9
Reserved data field	Byte 10 to Byte 12
Checksum (CRC-16)	Byte 13 and Byte 14

A description of the fields of the data packet follows:

- *Destination ID*—Byte 0 is an 8-bit field that identifies the functional area or tasks where the data packet is addressed. Examples of functional areas are RCU call processing, RCU common equipment (CE) maintenance, and SMU line maintenance. The RCU call processing has a destination ID of 3. The RCU common equipment (CE) maintenance has a destination ID of 17. The SMU line maintenance has a destination ID of 12.
- *Source ID.*—Byte 1 is an 8-bit field that identifies the functional area or task in the SMU or RCU that originates the message. When the RCU replies to SMU messages, the RCU switches the destination ID and source ID of the original SMU message.
- *Operation code*—Byte 2 is an 8-bit field that defines the operation destination ID must execute. Examples of operations include the abortion of a local line test for RCU line maintenance. Examples of operations also include the execution of a 24-hour switchover from one set of CE cards to an other.
- *Filler*—Byte 3 is a 7-bit field that contains all zeros and is reserved for future use.

- *Marker*—This single bit is set to 1 for single data packet messages. When a message contains several data packets, the marker is set to 0 for all packets but the last data packet. The last data packet has the bit set to 1 to indicate the last message of the data pack is coming.
- *Data field*—Bytes 4 through 9 contain 8 bits each. The information in these bytes varies with the destination and operation code fields. These fields can contain logical addresses of subscriber lines, test results, and equipment status.
- *Reserved data*—Data bytes 10 through 12 are reserved. The RCU normally copies the last three collocated bytes (10, 11, and 12) from the message the RCU receives from the SMU. The RCU copies these bytes into bytes 10, 11, and 12 of the data packet that the RCU transmits.
- *Checksum*—Data bytes 13 and 14 contain a 16-bit checksum value. The module that receives this value uses the value to make sure the data packet is accurate. A comparison occurs between the checksum value and the data packet sum value, or a value like the sum.

Speech and signaling between the SMU and the RCU

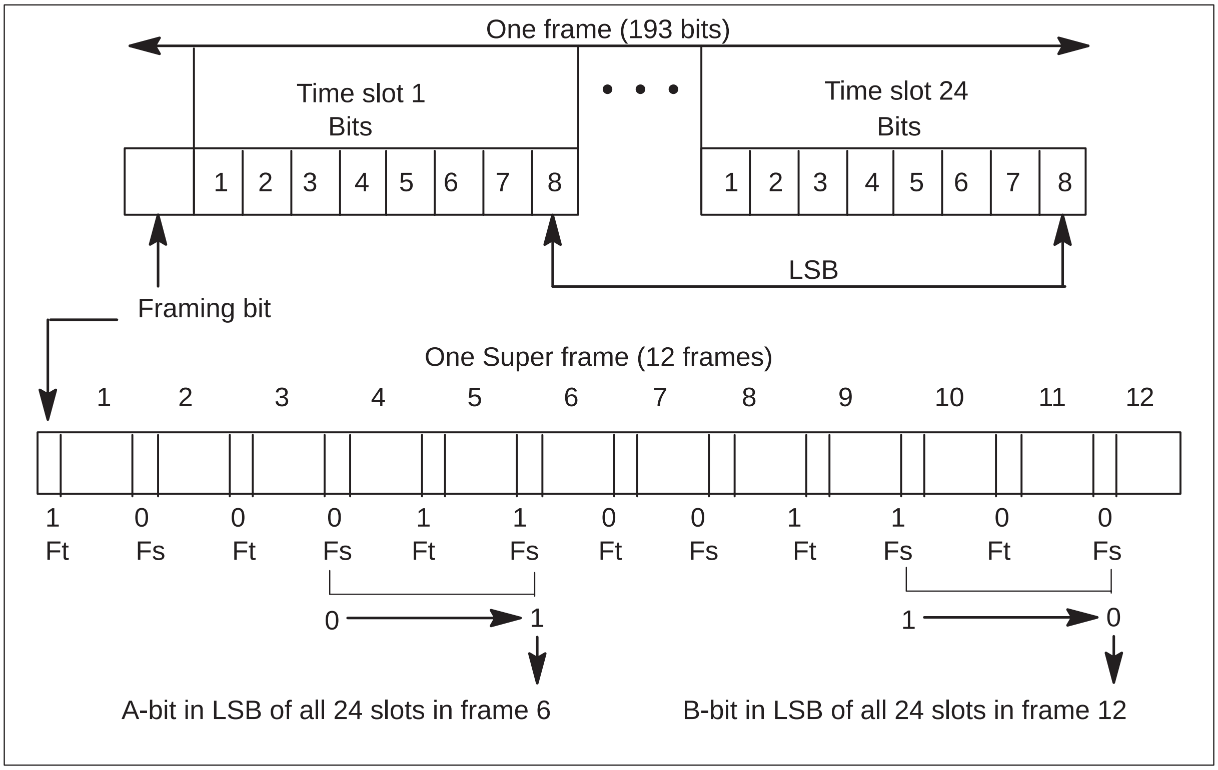
An SMU and an RCU exchange speech and signaling information over speech channels. A speech channel exchanges speech samples coded in a digit format.

The protocol for the exchange of speech samples also allows the transmission of two status indicators. The status indicators for each speech channel are an A-bit and a B-bit for each speech channel. The A-bit is the least significant bit (LSB) in each channel of frame 6. The B-bit is the LSB in each channel of frame 12. Refer to the following figure.

When the system uses the A- and B- bits as signaling bits, the bits send the following information:

- subscriber-line-status information and dial pulse digits from the RCU to the SMU
- subscriber-line-control information from the SMU to the RCU. This information includes ringing requests and coin commands.

Location of A- and B-bits



In coin operations, the SMU coin commands consist of A- and B-bit signals plus pulse coded modulation (PCM) values. The SMU issues these values before or after the provision of subscriber voice communication. The signals of the A- and B-bit indicate the RCU responses. Refer to the following table, Signals and control patterns for coin lines.

Signals and control patterns for coin lines

Signal sent from SMU		Signals sent to to the SMU by the RCU			
A- and B-bit signals	**Coin control patterns (PCM value)**	**Idle**	**Off-hook**	**Coin ground**	**Off-hook and coin ground**
Normal battery		X	X		X
Reverse battery		X	X		X
Coin control	Coin check positive (11101100)	X		X (see Note 1)	
Coin control	Coin check negative (11101000)	X		X (see Note 1)	
Coin control	Coin collect (11110000)	X			X (see Note 2)
Coin control	Coin return (11110100)	X			X (see Note 2)
Coin control	Ringing (11111000)	X	X (see Note 3)		

Note 1: Off-hook detection during ringing causes local ring trip. The RCU applies normal battery to the line.
Note 2: If coin is present, off-hook is inhibited in any hook state.
Note 3: Transmission of off-hook always occurs with ground in any current hook state.

Control messaging between the SMU and the CM

The CM and an SMU exchange control messages over dedicated control channels on the DS30 links. The dedicated control channels include channel 0 on links 0 and 2. Control information includes the following:

- messages to the CM
  - — change of subscriber status (for example, a subscriber goes off-hook)
  - — dialed digits
  - — maintenance information
- messages from the CM
  - — speech channel allocation for SMU-to-RCU or SMU-to-other peripheral connection
  - — accuracy values for supervision of SMU-to-other PM connections

- — data provision for the SMU
- — maintenance operation

Speech and supervision messaging between the SMU and other PMs

The SMU exchanges speech and channel supervision messages with other peripheral modules over a speech channel connected through the network modules. The CM establishes these connections as part of the call setup procedures.

The protocol used to exchange speech samples also allows for the transmission of supervision bits across the channel. The SMU transmits and receives 40-bit sequences, called channel supervision messages. These messages contain the integrity value allocated to the connection and other PM-to-PM control messages.

Call processing

The SMU basic call control supports ringing, hook status detection, digit collection, channel allocation, dial-tone speed recording, tones, pad, and RCU messaging loss. The SMU basic call control supports call processing for telephone calls between subscribers.

> ***Note:*** This description of call processing does not apply to ISDN call processing.

The SMU supports the following call processing tasks:

- scan for a change in subscriber line status
- assign a DS-1 channel to a subscriber that goes off-hook
- send dial tone to an off-hook subscriber that originates a call
- scan for digits and collect digits
- ring a subscriber line
- send an audible ringback tone to a calling subscriber
- trip ringing on a called subscriber when that subscriber goes off-hook
- disconnect the holding bridge on telephone keysets

The SMU basic call control monitors and controls these activities through signals and messages sent to the RCU.

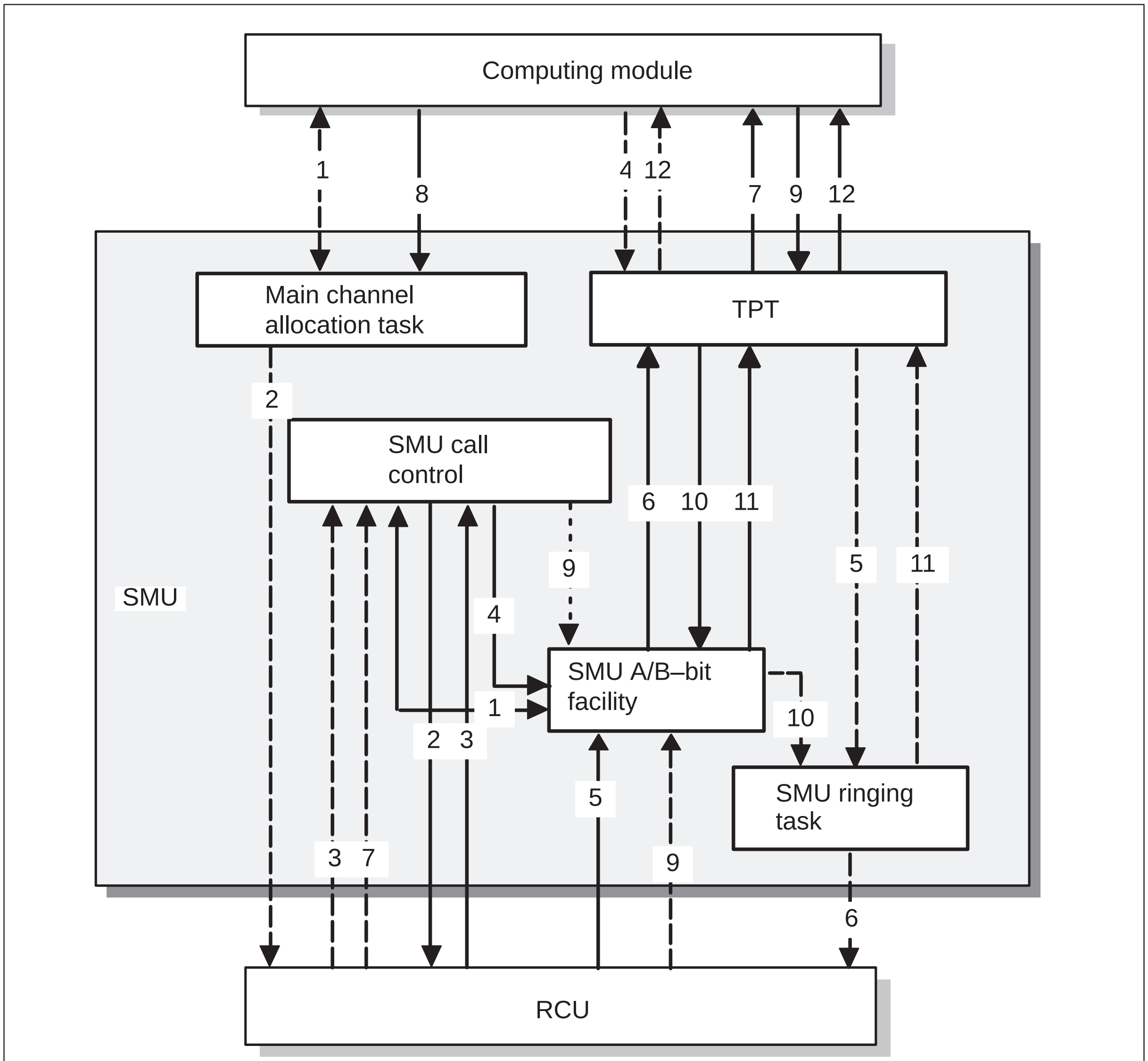
Call processing software modules

The primary SMU software modules that execute call control operations for line circuits, subscriber loops, and telephone sets include the following:

- terminal processing task (TPT), which is the main call processing task
- main channel allocation task, which is the DS-1 to DS30 and DS30 to DS-1 channel allocation task
- the SMU call control task, which coordinates the activities of the other software tasks
- the SMU A/B-bit facility, which is the call processing software to filter and scan logic
- the SMU ringing task, which is the call processing software for the cadent ring and signal actions

The way these modules relate to each other appears in the following figure. A description of each module follows the figure.

Call processing software modules



Path for origination
Path for termination

Note: The numbers associated with each flow arrow refer to the step in the sequence of events for origination and termination. This figure describes these sequences.

TPT software module The TPT processes call processing primitives or messages the CM sends to the SMU. The TPT sends TPT messages to other call processing software based on these messages.

A/B-bit facility software module The A/B-bit facility uses A/B-bits to send and receive signaling information on a channel-by-channel base to and from the RCU. The A/B-bit facility outputs signaling on a channel-by-channel base on the type of line card that is signaled.

SMU ringing task software module The SMU ringing task and the A/B-bit facility in the UP work together to initiate or cancel ringing P-side channel ringing. This action occurs in response to a TPT message. The ringing task provides cadent ringing and answer reports for all types of lines that hang off the RCU.

SMU call control software module The SMU call control software module coordinates the activities of the other call control modules. The other modules contain the work control processes.

SMU main channel allocation software module The SMU main channel allocation software module allocates and frees channels in the SMU call control software. The SMU code can allocate a P-side channel. The SMM guarantees that when the CM commands the setup of a new channel, the allocation of a new channel does not occur.

The RCU cannot receive a channel and scan the channel without direction. The RCU must be informed of the specified channel to make the time switch channel connection. The take down of the P-side (peripheral-side) then channel must be possible without CM permission.

The main channel allocation software module converts DS-1 channels from the RCU to the DS30 channels from the CM. The main channel allocation software module converts DS30 channels from the RCU to the DS-1 channels to the CM.

The following sections list the events that occur during call processing. Use these sections with the figure Call processing software modules in this chapter.

Call processing sequence of events—originating end

The following sequence of events occurs during call processing at the originating end of a call:

1 The A/B-bit facility scans for A- and B-bit pattern changes that indicate a subscriber goes off-hook. When the A/B-facility detects an off-hook, the facility sends a message to the SMU call control software module.

2 The SMU call control software module allocates a channel and sends a setup connection message to the RCU.

3 The RCU sends a setup connection acknowledgement.

4 Call processing informs the A/B-bit facility to verify off-hook A/B bits.

5 The RCU line card sends off-hook A/B-bit signaling and starts after connection setup occurs in RCU.

6 The A/B-bits verification completes, and the origination message goes directly to the TPT module.

7 The TPT reports origination to the CM.

8 The CM directs the SMU to associate a network channel to a P-side channel.

9 The CM sends origination supervision primitive that starts dial tone and digit collection.

10 The TPT module sends a message to the A/B-bit facility to start a scan for digits.

11 A/B-bit facility sends digit messages to the TPT software module.

12 The TPT software module relays the digits to the CM that performs translations.

Call processing sequence of events—terminating end

The following events occur during call processing at the terminating end of a call:

1 The main channel allocation task software module allocates the network and P-side channel.

2 Send message to the RCU to connect the P-side channel to the line.

3 The call control from the RCU receives acknowledgement. There is no action taken.

4 The TPT software module processes a primitive command to start ringing.

5 Sends message to SMU ringing to start ringing.

6 The SMU begins cadent ringing and writes out A/B bits to ring lines.

7 The RCU sends an off-hook signal to the call control software module when the line answers.

8 The call control software sends messages to the A/B-bit facility to scan for an answer.

9 The RCU sends off-hook A/B-bits and the A/B-bit facility identifies these bits.

10 The A/B-bit facility sends an answer message to the SMU ringing software module.

11 The SMU ringing stops ringing and sends the reply to the TPT software module.

12 The TPT software module reports to the CM if necessary.

UTR effect on call processing in the SMU

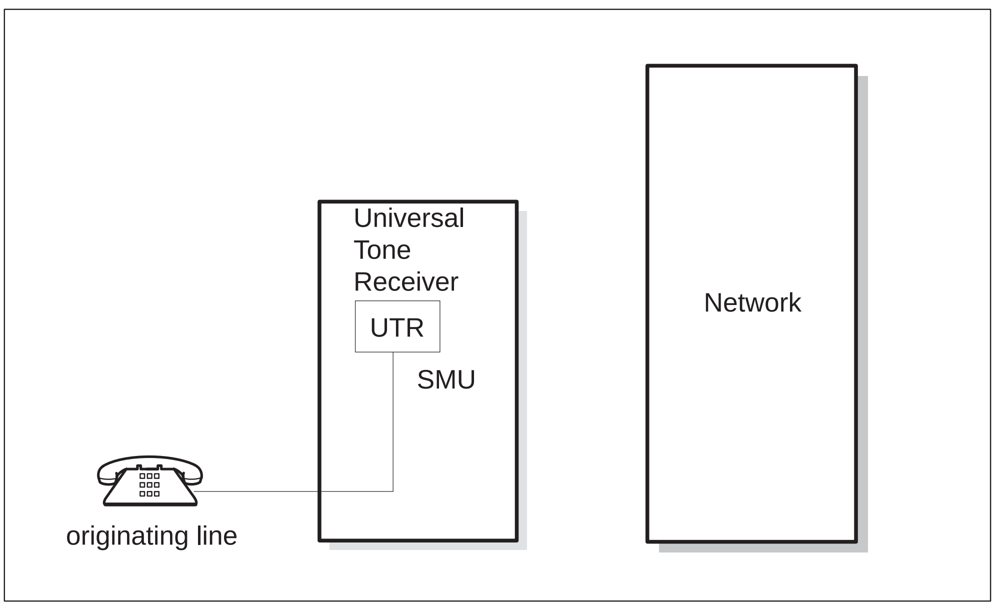
When the originating terminal resides on a SMU with a universal tone receiver (UTR), the CM performs the following actions. The CM conveys information for digit collection to the SMU and commands the SMU to start digit collection. The SMU obtains a receiver, connects the originator to the receiver, and collects and reports the digits. The following figure shows this process. Configuration for digit collection with UTR is present.

The responsibilities of the line remain the same with UTRs and without UTRs. Differences occur when the digits arrive from the UTR channel, and the allocation, and later deallocation, of the UTR channel for digit collection.

When a UTR is present, the SMU is responsible for the allocation and deallocation of receivers. The receivers are in the SMU not in the CM. These tasks include the creation and release of connections.

When digit collection functions are not required, the terminal stops digit collection. Digit collection stops cause deallocation of the receiver. After this deallocation, the call continues as before.

Configuration for digit collection with UTR present



Switch of activity

A SWACT is the process in which the two units of an XPM exchange activity status. This exchange allows the active unit that handles call processing to become the inactive unit. The inactive unit becomes the active unit and takes over call processing at the same time. The system drops calls in a transient state. Feature AF6436 provides EDDS and warm SWACT and SWACT back capabilities for ISDN basic rate interface (BRI) calls on the SMU.

The SWACTs can be controlled SWACTs or uncontrolled SWACTs. Controlled SWACTs occur because of manual action like the input of the SWACT command. Controlled SWACTs also occur because of planned system requests, like the REX test schedule. Controlled SWACTS also occur when the active unit is busy while the inactive is INSV.

If both units are INSV, a controlled SWACT can occur. If a previous REX test failure causes the SMU to be ISTb, a controlled SWACT can occur.

The system implements uncontrolled SWACTs when a hardware fault or a trap in the active unit is present. The PM181 log messages inform the operating company personnel of the reason the active unit dropped activity.

In a controlled SWACT, the following message interchange occurs:

1 The CM messages the active unit of the SMU to start an audit of the inactive unit.
2 The active unit messages the inactive unit to start a pre-SWACT audit.
3 The inactive unit messages back to the active unit pre-SWACT audit results. The system initiates a Warm SWACT based on the audit results.
4 The original active unit stays INSV and clears data that is not stable.
5 The new active unit sends five gain messages to the CM .
6 The CM sends five gain-acknowledge messages to the SMU.
7 The SMU sends three gain-acknowledge received messages to the CM.
8 The CM directs the original active unit to drop activity.
9 The original active unit sends the CM a drop message. The CM expects to receive this message.

If a controlled Warm SWACT fails, the following message exchange occurs:

1 The CM messages the active unit of the SMU to start an audit of the inactive unit.
2 The system implements pre-SWACT audit.
3 The system initiates a Warm SWACT based on the audit results.
4 The original active unit stays INSV and clears data that is not stable.
5 The new active unit does not send messages to the CM.

6 The original active unit wait time of 5 s expires and a SWACT-back occurs.

7 The original active unit sends a SWACT-failed message to the CM.

8 The CM SysB and RTS the inactive SMU unit.

In a SWACT that is not controlled, the SMU initiates the pre-SWACT audit. The sequence of messages follows:

1 The active unit messages the inactive unit to start a pre-SWACT audit.

2 The system implements the pre-SWACT audit.

3 The system initiates a Warm SWACT based on the audit results.

4 The new active unit messages the CM that a gain occurs that is not requested.

5 The original active unit stays INSV and clears data that is not stable.

6 The new active unit sends five gain messages to the CM.

7 The CM sends five gain-acknowledged messages to the SMU.

8 The SMU sends three acknowledge-received messages to the CM.

9 The CM tells the original active unit to drop activity.

For controlled and uncontrolled SWACTs SWACTs, the SWACT is complete when the following events occur. The CM receives a gain message from the newly active unit, and acknowledges the gain to the original active unit. When a SWACT occurs, the CM and the SMU exchange a series of drop and gain messages that clarify activity. The following table explains common phrases in these messages.

Message phrases that describe CM-to-SMU SWACT communication

Message phrase	Explanation
Original active unit	Active unit before the SWACT (unit 0)
Original inactive unit	Inactive unit before the SWACT (unit 1)
Newly active unit	Active unit after the SWACT (unit 1)
Newly inactive unit	Inactive unit after the SWACT (unit 0)
Gain message	The message the new active unit (unit 1) sends to the CM. This message informs the CM that the unit gained activity.

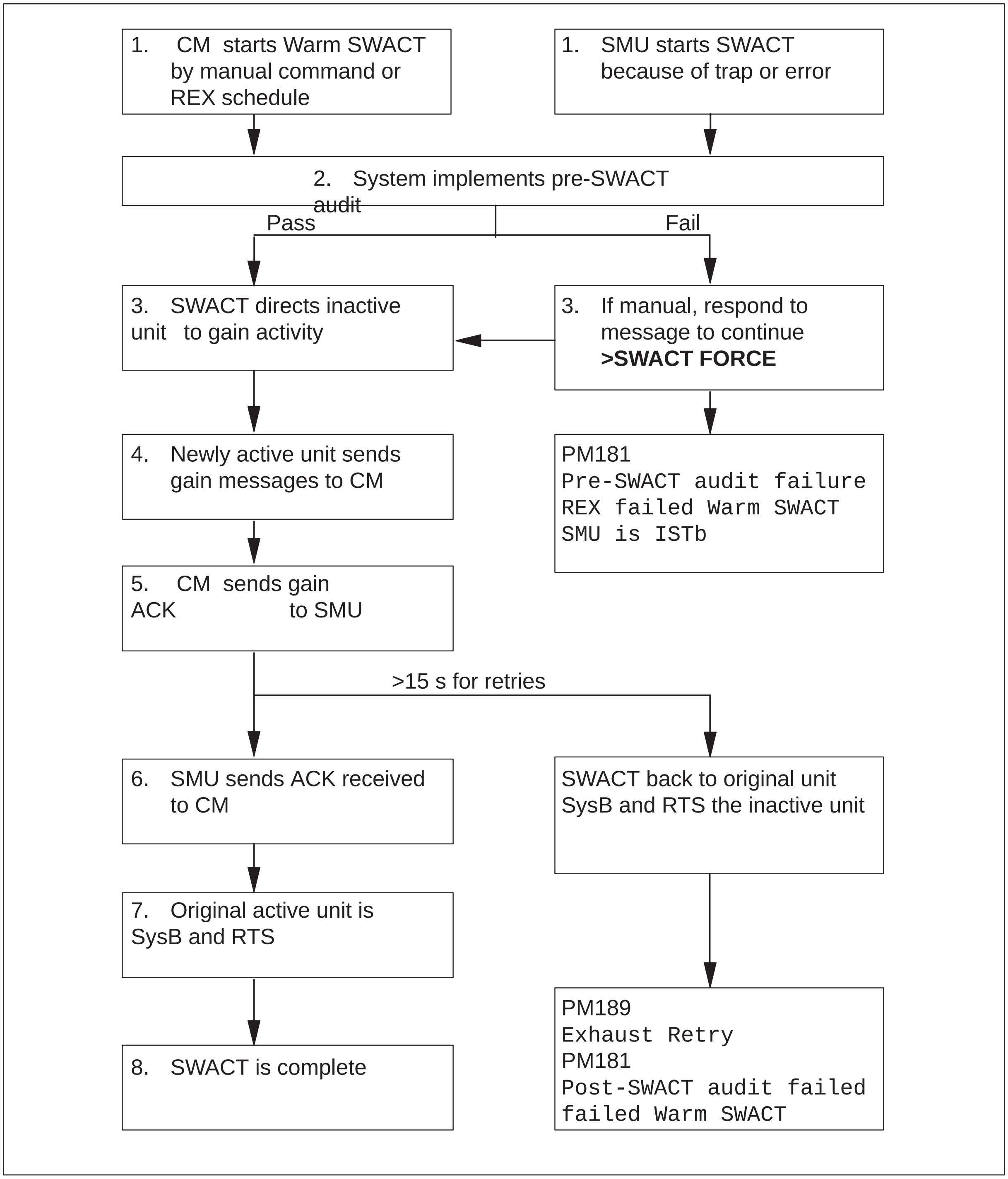
—continued—

Message phrases that describe CM-to-SMU SWACT communication
(continued)

Message phrase	Explanation
Gain acknowledge message	The message the CM sends to original active unit to confirm the new active unit sends messages.
Gain acknowledge received	Message original active unit sends to CM to confirm the new active unit passed the post-SWACT audit.
Drop message	Message the original active unit (unit 0) sends to the CM. This message informs the CM the unit dropped activity.
—end—	

The sequence for a controlled and uncontrolled SWACT and the SWACT-back operation appears in the following figure.

SWACT sequence



Pre- and post-SWACT audits

Feature AN0538, SMU Pre-SWACT/Post-SWACT Audit improves the Warm SWACT operation. This feature denies the SWACT if the system determines the inactive unit cannot maintain activity or communicate with the CM. In these conditions, feature AN0538 provides the ability to SWACT-back to the original active unit. The software that drives this feature is the SWACT controller in the CM, and an autonomous ability addition to SMU software.

SWACT controller

The system routes all manual requests and specified system requests for Warm SWACTs to the SWACT controller in the CM. The SWACT controller polls PM diagnostic history datas in the CM and XPM status data in the XPM. The XPM status data is different that the XPM static data. Based on this data, the SWACT controller denies the Warm SWACT request or allows a Warm SWACT to proceed.

If the SWACT controller denies a manual request for a SWACT, the system informs operating company maintenance personnel of the request denial. The system provides a reason for the denial. In most conditions, the system informs the maintenance personnel that personnel can override the SWACT controller. To override the SWACT controller, enter the command string:

>SWACT FORCE

If the technician decides to override the SWACT controller, a Warm SWACT attempt occurs without diagnostic history or status data consult. The active unit of the XPM drops activity and becomes the inactive unit. This unit remains in service until the new active unit can verify exact abilities. The unit must verify two-way communication with the CM and the ability to maintain activity.

If two-way communication is available, and the new active unit can maintain activity, the inactive unit is SysB and RTS. If communication fails, or the new active unit cannot maintain activity, a SWACT back to the original active unit occurs. Refer to the figure SWACT-back example as an example of a SWACT back.

Pre-SWACT audit

Before the execution of a SWACT, the active unit performs the following actions. The active unit queries the mate SMU unit over the intermodule communication (IMC) links and messages the SWACT controller in the CM. An improved pre-SWACT audit of the inactive unit includes the state of the unit during diagnostics. The improved pre-SWACT audit also assigns a weighted value to the results of the diagnostics. The result of the pre-SWACT audit query is a boolean pass or fail.

If the SWACT controller denies a manual SWACT request, the system informs the user of the request denial on the MAP terminal. The system provides a reason for the denial. The system informs the user that the user can override the SWACT controller. The user enters the SWACT FORCE command to override the controller. If the user overrides the SWACT controller, a Warm SWACT attempt occurs without diagnostic history or status consult.

Post-SWACT audit

The system can SysB and RTS the inactive unit after a SWACT. These actions occur if two-way communication is available with the CM and the newly active unit can maintain activity. The previous active unit remains in service until the new active unit verifies capability to maintain activity, and communication. This communication must be two-way communication with the CM. The SMU executes a SWACT-back to the original active unit if communication fails. The SMU executes a SWACT-back to the original unit if the new active unit cannot maintain activity.

SWACT-back

If an SMU does not receive a gain-acknowledged message from the CM, the original active SMU unit initiates a SWACT-back. During a SWACT-back, the original active unit attempts to regain activity. If successful, the inactive unit is set SysB and RTS, and the active unit remains in service. The system preserves stable calls from the original active unit over the SWACT- back. The system drops all new calls made after the SWACT and before the SWACT-back.

> ***Note 1:*** After a SWACT-back, operational measurements (OM) and peg counts are not initialized again.

Note 2: The system does not support this feature during XPM or CM overload.

SWACT back occurs for the following manual SWACT commands:

- SWACT
- SWACT TST
- SWACT NOW
- SWACT ALL
- SWACT FORCE
- TST REX NOW
- BSY UNIT unit_no

  where

  unit_no   is the number of the active unit
- BSY ACTIVE

Manual switch of activity

To perform a manual SWACT, enter the SWACT command at the MAP terminal. The following message appears at the MAP display.

```
A Warm SWACT will be performed
after data sync of active terminals are attempted.
The inactive unit may not be capable of gaining activity
(please check logs).  Do you wish to continue regardless?
Please confirm (YES or NO)
```

The default is to not proceed because the new inactive unit can take over call processing again.

Uncontrolled switch of activity

An uncontrolled SWACT can occur when both units are INSV, the active unit is INSV and the inactive unit is ISTb. Each of these states results in a different SWACT condition. The state of the units and the reason for the activity drop determines the sequence of events during an uncontrolled SWACT.

If a hardware fault occurs, the system produces a PM181 log. This log can contain messages that indicate the following conditions:

- activity timeout
- no CM links

Messaging cannot occur because message links to the CM or host XPM are broken.

- duplicate fault

  A critical hardware fault occurs.

- jammed

  The unit jams and the unit cannot change status (active/inactive).

- static data corruption
- The original active unit sends a drop message to the CM.
- The new active unit must send a gain message.

As with controlled SWACTs, the XPM continues to send the gain message for a maximum of 15 s.

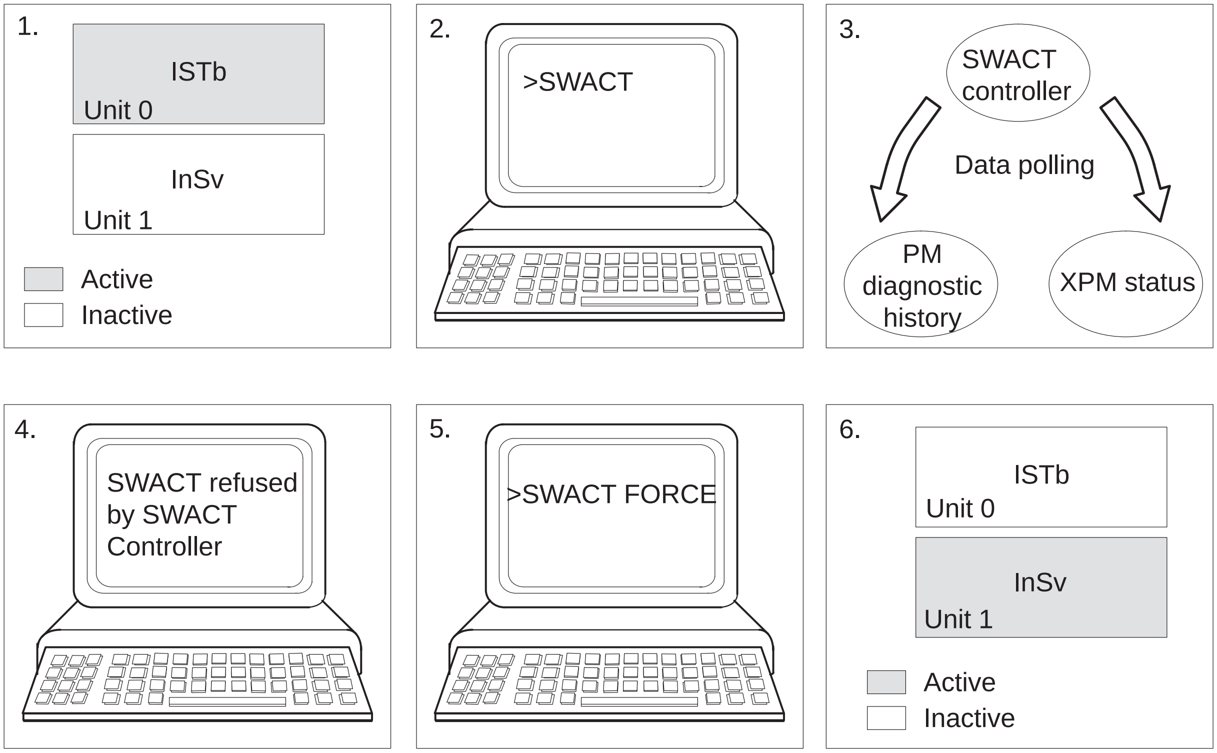
If the original active unit is INSV less than 3 min, the unit will RTS without OOS diagnostics. The reason for this condition is a previous SWACT occurred with the following condition. If less than 3 min passed, OOS diagnostics are run on the active unit at that time. If the original unit is active more than 3 min, the active unit will RTS with OOS diagnostics.

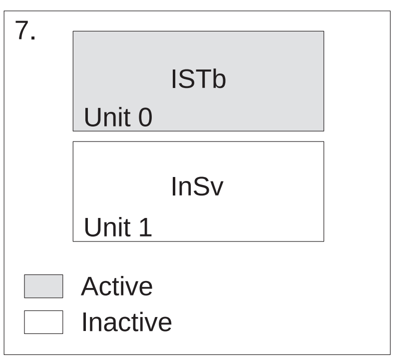
The active unit attempts to regain activity with all types of RTS. If the unit cannot regain activity, both units are set SysB and all of the XPM is set SysB.

PM diagnostic history data . The PM Diagnostic History provides a data base of information on each XPM unit that subtends the DMS-100 switch. The SWACT controller uses this information to determine if an inactive unit can maintain activity in a Warm SWACT event. The information collected is reset when the unit gains activity.

SMU status data. The SWACT controller polls data in the SMU to determine if the inactive unit can maintain activity. The SMU responds to the SWACT controller query. The SMU communicates that the active unit can or cannot comply with a request to drop activity. The status data determines this response.

SWACT back example





1. Both units are in service; unit 0 is active.
2. An attempted Warm SWACT from unit 0 to unit 1.
3. The SWACT controller in the CM polls PM diagnostic history data in the CM and XPM status data in the XPM.
4. Based on the polled data, the SWACT controller denies the request for a Warm SWACT.
5. The user decides to override the SWACT controller.
6. Unit 0 drops activity but remains in service while post WACT audits are run on unit 1.
7. Post SWACT audits detect a problem in unit 1. This event causes a

Functional description of the RCU

Figure RCU configuration is on the following page. This figure shows the layout of the RCU frame and the product engineering codes (PEC) equipped in the shelves.

Transmission of information

The figure RCU transmission hardware follows RCU configuration. This figure shows the RCU hardware used for transmission of speech, signaling, and system control information. The system control information is from the RCU to the DS-1 links leading to the SMU.

Line cards on the control and line shelves convert analog voice signals from subscriber lines into digital signals. These line cards and shelves send these signals in time slots over loop PCM buses to the switch card. Control extension (CE) cards also send signals and system control messages to the switch card in time slots over a CE PCM bus. The supervisory card sends system control messages for the SMU. The line test access (LTA) and maintenance cards send tones used for testing.

The switch card multiplexes the time slots of the three PCM buses on one bus. The time slot interchanger connects digroup card time slots to the time slots that face the line circuit. If a second RCU control shelf and line shelf is present, the following action occurs. An intergroup PCM bus allows the switch card to route specified time slot information to the other group switch card.

The switch card connects to the four digroup cards over a bidirectional digroup PCM bus. The digroup card assigns time slots to DS-1 channels and inserts bits into the PCM stream. These bits consist of A-bits, B-bits, and framing bits.

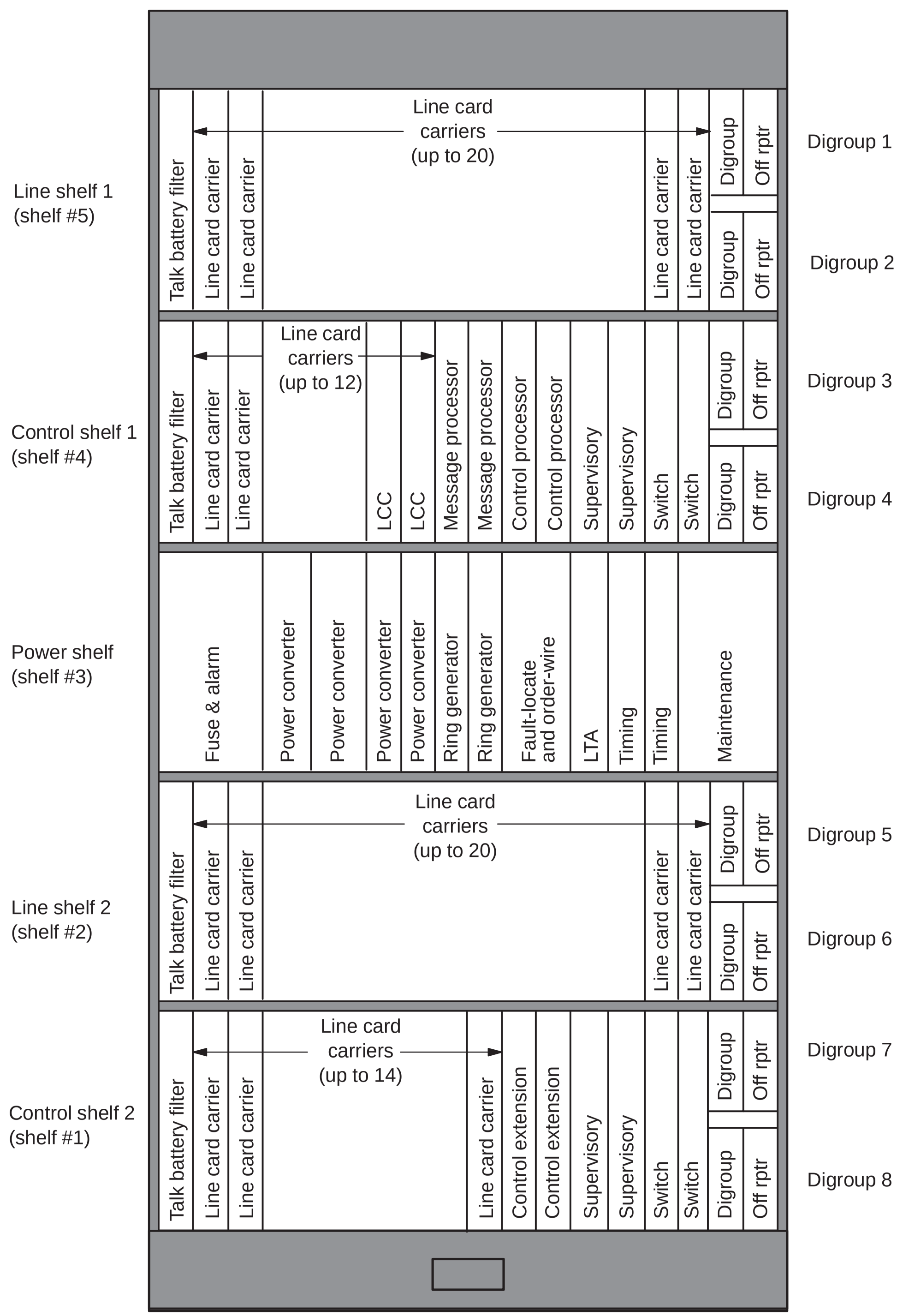
Reception of information

Figure RCU reception hardware shows the RCU hardware involved in speech reception, signaling, and system control information from the SMU.

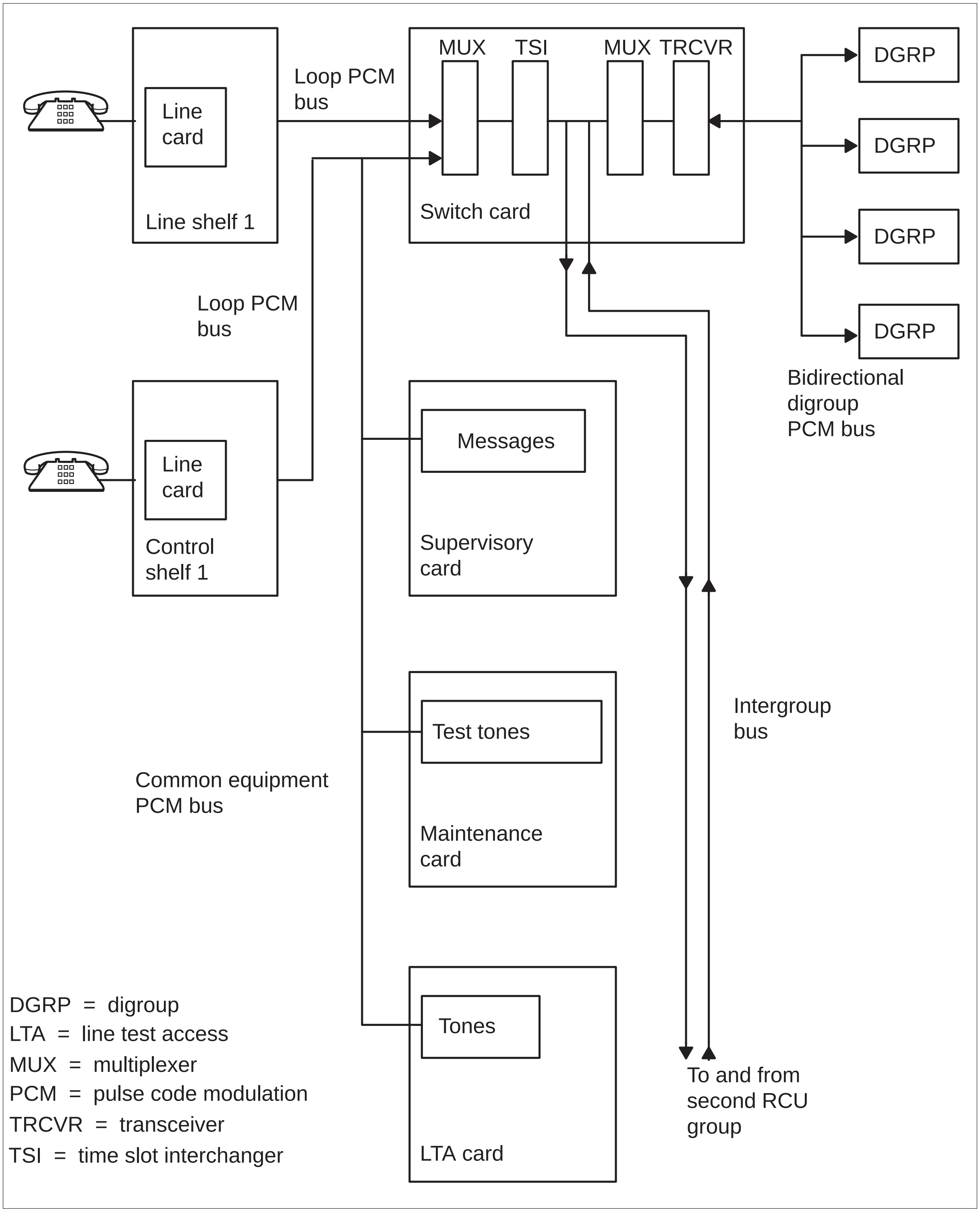
The digroup card detects the framing pattern and bipolar violations (BpV) from the incoming DS-1 PCM stream. The digroup card extracts A- and B-bits. The digroup card transfers speech, signaling, and messages from the DS-1 channels to the time slots on the digroup PCM bidirectional bus.

The switch card connects the digroup PCM bus with the intergroup bus or with a time slot interchanger. The interchanger connects digroup-side time slots with line-circuit side time slots. The switch card demultiplexes the information that comes to the switch card from the time slot interchanger. The switch card routes this information to the PCM loop buses. The system converts speech information from digital to analog in the control and line shelf line cards. This information is sent to subscribers on loops.

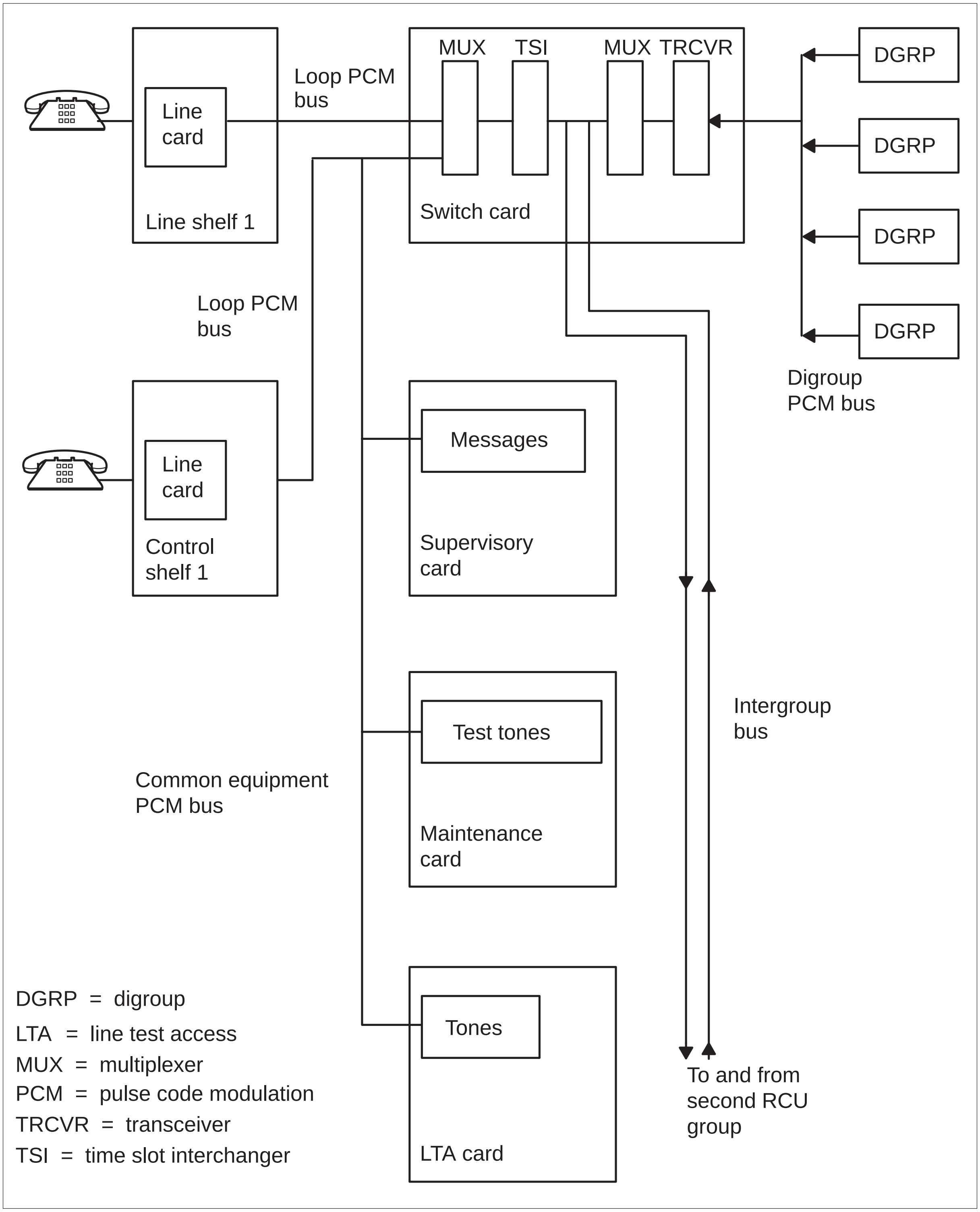
The RCU configuration



The RCU transmission hardware



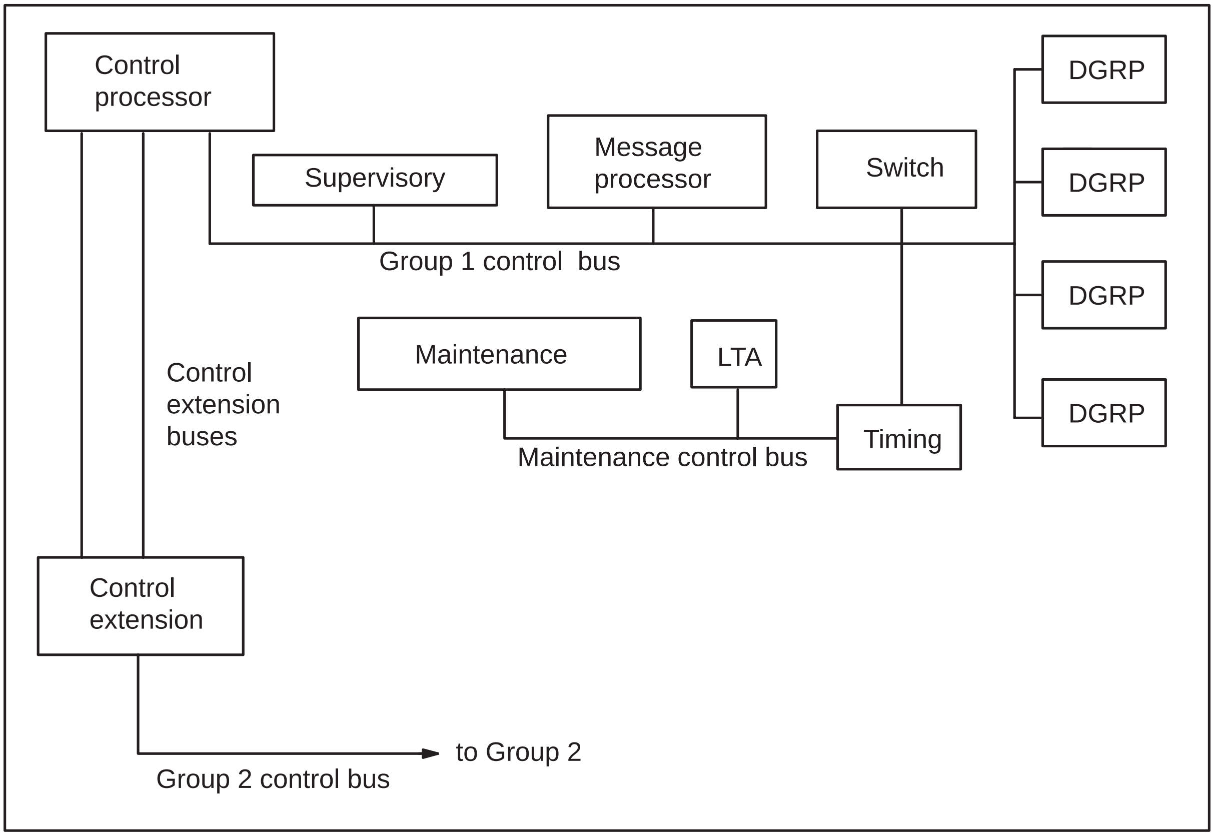
The RCU reception hardware



Control information and hardware

The RCU system control hardware appears in the following figure.

The RCU system control hardware



The control processor card coordinates RCU operation. The control processor card contains a program that executes call processes, alarm reports, system performance audits, and fault detection.

The control processor accesses the switch, supervisory, unified processor (UP), timing, and digroup cards through the group 1 control bus. Through the bus, the control processor detects the presence, removal, and failure of cards. The control processor performs the following actions to control the status of the cards. The control processor switches the activity from failed active cards to backup cards, sets alarms for failed cards, and executes related activities.

Through the UP and supervisory cards, the control processor receives system control messages from the SMU. The control processor initiates call processing and maintenance operations based on these messages. The control processor routes acknowledgment and not requested messages to the SMU through the UP and supervisory cards.

The control extension card extends the control functions of the control processor to the second RCU group.

The timing card synchronizes the RCU with the clock signal derived by the digroup card from the DS-1 signal. Through the timing card, the control processor selects the power converter. This power converter must supply power to the line cards and the ring generator, and drive the ringing bus. The power converter must send control signals to these cards. The timing card is the interface between the control bus and the maintenance bus.

A description of switch and digroup cards is in the previous description of RCU information transmission to and reception from the SMU.

Use of the maintenance and LTA cards occurs during line card and subscriber loop testing.

Power distribution

The following figure shows the primary components of the RCU power system.

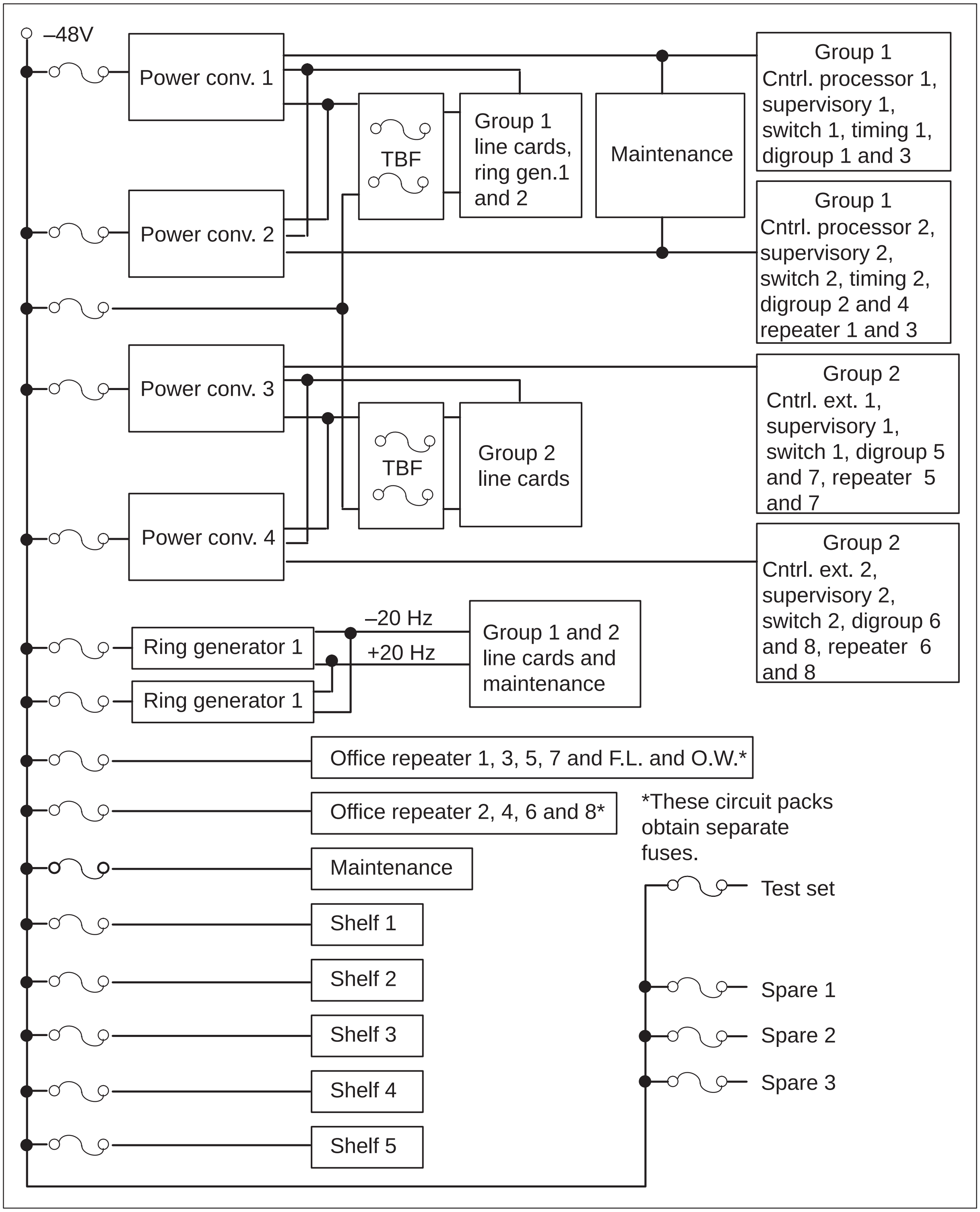
The fuse and alarm unit distributes –48 V dc through the RCU. This unit provides fuses for the four power converters, two ring generators, and four talk battery filters. This unit also provides fuses for the repeaters and the maintenance card.

Each RCU group has two power converters. Each converter supplies one set of CE cards and two digroup-repeater card pairs. One power converter supplies all line cards of an RCU group. If this power converter fails, the backup power converter takes control.

The power converters supply –28V dc to talk battery filters with filter circuits for –48 V.

One of two ring generators at the RCU supplies ringing voltages to both RCU groups. The backup ring generator takes control if the active ring generator fails.

RCU power distribution



Ringing schemes

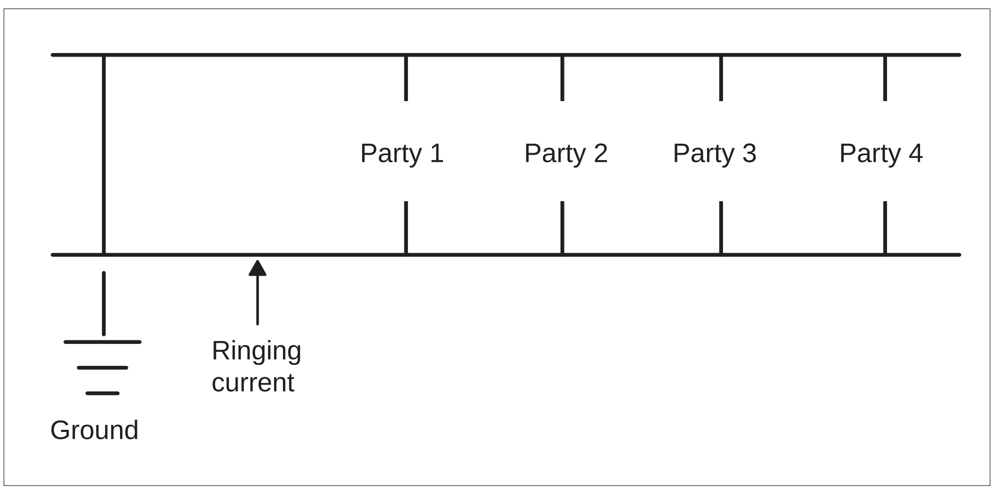
In ringing, all cadences fit into one 6 s interval. This interval applies for most types of ringing, single-party, coin, and most multiparty. This interval consists of 2 s phases.

Most telephone service uses a cadence of 2 s of ringing followed by 4 s of silence. For an exact line, one of these phases is a ringing phase. Any one of the three phases can be assigned as the ringing phase (unless a ring flags Immediate ringing is set for the line). When the system must ring many lines, the SMU spreads the load evenly among the three phases. Ringing normally starts at the beginning of a phase, not halfway through a current phase. Refer to the section Immediate ringing in this document.

Frequency selective ringing (FSR)

The SMU supports FSR for subscribers that connect to an RCU. The SMU supports two-party bridged automatic number identification (ANI) FSR and four-party bridged operator number identification (ONI) FSR. The ringing configuration for a four-FSR party line appears in the following figure.

Frequency selective ringing configuration



Any of four frequencies selected from one of the following designated groups can ring a subscriber station.

- synchromonic-16 16 16Hz 30Hz 42Hz 54Hz 66Hz
- synchromonic-20 20 20Hz 30Hz 42Hz 54Hz 66Hz
- decimonic-20Hz 30Hz 40Hz 50Hz 60Hz
- harmonic–16 2/3Hz 25Hz 33 1/3Hz 66 2/3Hz

Selection of these frequencies occurs when data entry for table RCUINV occurs. The CM downloads the four frequencies to the SMU-RCU subsystem. Refer to *Service Order and Query System Reference Manual* to assign a subscriber line a specified frequency.

The SMU informs the RCU of the frequency to ring a subscriber and how to control the cadence. The ring/pad card (NT6X80) in the SMU generates ringing frequency instructions with PCM. The time switch card switches these frequencies to the DS-1 channels that are associated with the subscriber loops to ring.

The A- and B-bits accompany the PCM frequencies on the DS-1 link. The time switch card inserts the bits into correct DS-1 channels. The A- and B-bits are signaling bits and control ringing. When both bits are 0, a subscriber station is idle. When the A-bit is 1 and the B-bit 0, or both bits are 1 for foreign exchange with battery (FXB) lines, the subscriber station rings. The ringing cadence is 2 s of ringing followed by 4 s of silence.

Two power converters at the RCU supply FSR line cards with the voltages required for ringing. The FSR cards are standard, plain ordinary telephone service (POTS) line cards that support two subscribers. Four FSR line cards fit into a NT3A07AA (or NT3A07BA) line card carrier on an RCU shelf. Twenty subscriber lines can ring at the same time for each RCU group that is a control shelf and line shelf. A fully-configured RCU has two groups. Forty subscribers can ring at the same time.

The ringing scheme consists of three two-second phases. Ringing lines occur in one of these phases. A maximum of 120 lines can be part of the ringing sequence in a fully configured RCU. Ringing occurs in two-second bursts followed by four seconds of silence. While one set of lines rings, two other sets are in the silent phase.

Coded ringing

Coded ringing involves the use of a code of ringing and silence to alert subscribers on multiparty lines of a call. Combinations of long (1.5 s), medium (1 s), and short (0.5 s) bursts of ringing provide a limited set of codes. These codes appear in the following figure.

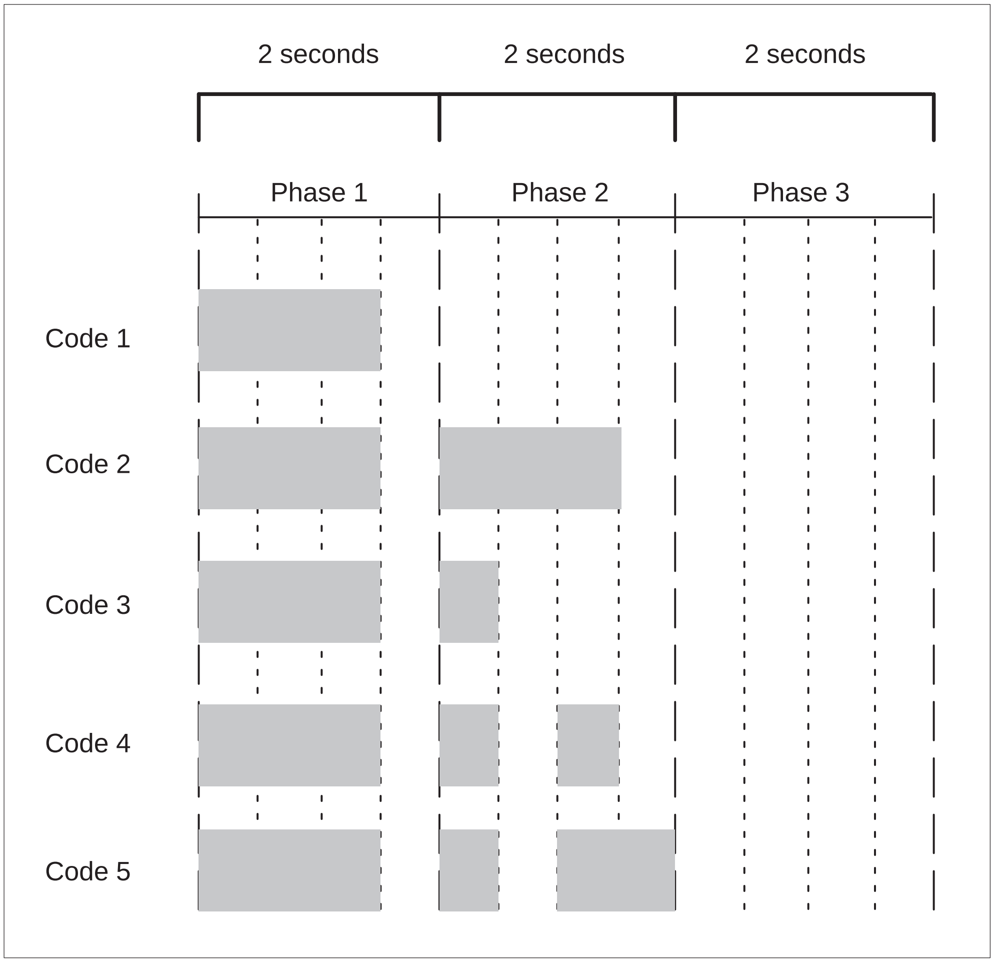
The next phase requires coded ringing to start the phase. If part of the code ring in the current phase is present, the system can produce a wrong ringing code. This problem occurs because part of a ringing burst can be abbreviated.

For coded ringing, all of the code starts on the next 0.5 s slot. If a revertive ring is immediate, the burst occurs in the next slot.

Refer to *Service Order and Query System Reference Manual* for information on how to assign coded ringing to a subscriber.

The RCU ring generator supplies ringing to all shelves. This generator can ring a maximum of 50 lines in the same phase on an RCU. An RCU has one or two ring generators.

Coded ringing schemes



Revertive ringing

Revertive ringing occurs when one party of a party line calls another party on the same party line. The calling party dials the called party and hangs up. A one-slot 0.5 s interval burst of ringing each 6 s informs the calling party that the called party line rings.

Ring tip and sides of a divided ringing telephone cannot ring at the same time. The selection of the revertive slot must be a careful selection. The ringing burst occurs in the first slot of the phase after the phase chosen for the lines ring phase. For coded patterns, the system sends the revertive signal in the last slot of the phase where the code begins. The previous figure shows that this slot is the fourth slot of phase one.

Note that the system does *not* support revertive ringing with FSR.

Immediate ringing

Immediate ringing requires a line to ring starting with the next slot. This requirement can cause the first ringing burst to be abbreviated. The office parameter IMMEDIATE_RING_ENABLE enables immediate ringing. Refer to *Office Parameters Reference Manual* for additional information on this parameter.

Providing ISDN and MBS capability in the RCU

To provide ISDN and MBS ability, the RCU must have enhanced digroup cards. The RCU must have one or more ISLCC that contain ISDN and MBS line cards. In addition, the RCU firmware is upgraded to support ISDN and MBS ability.

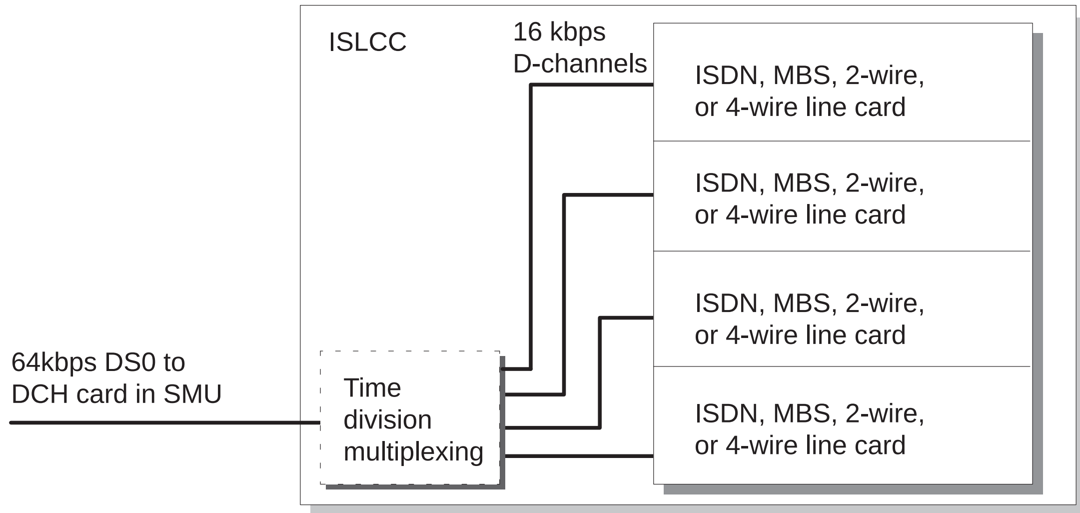
The enhanced digroup card supports 64-kbps clear channel ability through the use of the bipolar with 8-zero substitution (B8ZS) line code scheme. This scheme is necessary for 64-kbps channels that carry ISDN B-channels and ISDN and MBS D-channels.

The ISLCC can house a maximum of four ISDN, MBS, 2-wire, or 4-wire line cards. The ISLCC supports a 16-kb/s D-channel for each line card equipped. The D-channels send and receive call control and packet messages to and from the enhanced SMU. The ISLCC multiplexes four 16 kbps D-channels on to a single 64 kbps DS0. This DS0 terminates on a DCH in the ESMU. Refer to the following figure ISLCC with ISDN or MBS line cards.

The RCU ISDN line card provides a U-interface with the 2B1Q line code scheme to provide ISDN BRA. The ISDN BRA is the 2B + D service. An ISDN card in the last slot of the carrier has a limit of 1B+D service because the last B-channel is used as a D-channel.

The RCU MBS line card uses new firmware to convert signaling. This card converts the signaling used over the subscriber loop to the corresponding MBS operation codes. The MBS line card also implements a data link layer protocol that uses the Q.921 link access procedure on the D-channel (LAPD) frame format. The transportation of MBS operation codes between the MBS line card and the DCH card in the SMU requires this protocol.

The ISLCC with ISDN or MBS line cards



Note: Special service line cards can be in the ISLCC, but do not require D-channels.

National ISDN-2/3 BRI Phase I feature

The National ISDN-2/3 BRI Phase I feature increases the operational versatility of BRI line interface configurations. This feature expands the BRI service options available to end users. The software optionality control (SOC) NI000050 in NA007 is necessary to access the enhanced ISDN abilities this section addresses.

- Two B-channel access—This ability enables a terminal that supports voiceband information (VI) and circuit mode data (CMD) or VI or CMD to have access to both B-channels at the same time. Access occurs with a single terminal endpoint identifier (TEI). This ability applies to both fully initializing terminals (FIT) and non-initializing terminals (NIT). Provisioning controls the number of B-channels a terminal can access.
- Support for non-initializing terminals (NIT)—This ability supports one non-initializing terminal on a BRI interface that is provisioned with the default logical terminal. An NIT is a new class of BRI terminal that does not initialize Layer 3 and does not require a service profile identifier (SPID). A SPID is an identification number that a terminal uses in the initialization process.

- Assignment of fixed feature keys to the default logical terminal for NITs—This ability permits the assignment of the following features to the NIT. These features are call forwarding, message waiting, conference calling, call transfer, and call drop. The NIT can use dial-access procedures or feature key management procedures to access these features.

The National ISDN-2/3 BRI Phase I feature introduces the following interactions:

- This feature changes the way additional call offering (ACO) operates for terminals that have the access privilege data entry for two B-channel access. When the terminal has a call active and one B-channel free, and a termination occurs, the following condition occurs. The terminating SETUP contains the channel identifier information element (CID IE) coded to the value of the free B-channel. For terminals without the two B-channel access privilege, this message has the CID IE coded to no-channel.
- The system offers all VI terminations that follow to the terminal with the CID IE coded to no channel. The system does this when flexible calling is active on a 2B FIT/NIT conference controller,

SMU fault conditions

Several faults can occur to the components of the SMU-RCU configuration. In the host office, the C-side links from the SMU to the network can go down. If these network links are defective, the system can lose messaging from the CM, and subscriber service. A defective DS30 or DS512 card in the SMU also can cause defective communication with the CM.

In the SMU, circuit cards can be defective and can have a negative affect on subscriber service. These circuit cards include the power converter card. The SMU equipment other than circuit cards also can become defective.

The SMU P-side links toward the subscriber carry messages important to the maintenance of subscriber service. A defective P-side link can damage subscriber service. In a P-side link, a channel must be available for a call attempt to succeed. Signal or software problems can make a channel not available for a subscriber call.

These faults are general faults. The following faults are exact faults, and include the XPM parity fault and data mismatch.

XPM parity fault

The CM handles parity faults when possible with feature AJ1116. The CM allows a fast return to service.

Three types of parity faults can occur:

- hard—requires the intervention of operating company maintenance personnel
- soft—the CM can clear this fault
- intermittent—the CM can clear this fault

When a parity fault occurs, the CM determines the action to perform on the XPM unit. The action depends on if the status of the unit that reports the fault is active or inactive. The CM handles all three types of faults the same way.

When the CM detects a parity fault in the active unit of the XPM, the CM sets the unit ISTb with a reason of parity. The CM recovers the unit during a maintenance window. The maintenance window for a parity fault recovery on the active unit is the XPM REX test window. If the time for the XPM REX test window is the same as the current time of the switch, the following action occurs. An audit checks if the active unit of the XPM has an ISTb of parity. If an ISTb is present, the CM performs a SWACT and reloads the XPM if dependencies are not present. This action clears the ISTb parity fault and the short term failure (STF) parity fault peg. This action resolves the parity fault in the XPM.

When the active unit reports the parity fault, the system generates a PM181 log. This log notifies operating company personnel of the problem. The CM performs the following recovery actions. The CM performs a SWACT of the XPM. The CM loads the newly inactive unit with the XPM software load, defined in the corresponding inventory table. The CM considers this loading action as an autoload. A manual or CM or mate reload of the XPM software to the affected unit clears the ISTb.

The CM does not permit an REX test to occur

- on a P-side or C-side node of the XPM while the system recovers the XPM from a parity fault
- on the XPM while the system recovers a P-side or C-side node from a parity fault

The CM does not allow two XPMs in the same configuration to perform a parity reload. A P-side node cannot perform a parity reload at the same time as the C-side node that corresponds. A C-side parity reload cannot occur at the same time as the corresponding P-side node. This restriction makes sure one XPM in a configuration is in simplex at one time.

The CM informs operating company personnel of a parity fault through PM181 log reports. This log is the primary trouble indicator. Operating company personnel also can check for associated logs, like the PM128, to understand the CM actions. This section provides examples of the messages associated with the PM181 and PM128 logs.

The XPM unit can be set ISTB with multiple reasons at the same time. When you perform a QUERYPM FLT at the MAP level, information appears. This information includes the ISTb reasons that occurred on the unit and the reasons the reasons are not cleared.

Hard parity fault

When the active unit of the XPM reports a hard parity fault to the CM, the system generates a PM181 information log. This log notifies operating company personnel that

- a parity fault occurs on the active unit, and the unit is set ISTb
- the CM reloads the unit during the next XPM REX test window

The performance of a manual SWACT and reload can clear the ISTb and the parity fault.

An example of a PM181 log report follows:

```
PM181 JUL23 23:29:16 7700 INFO SMU 0 Unit 0
Node: Istb, Unit0 Inact: ISTb, Unit1 Act: ISTb
Parity audit has detected a hard parity fault.
The system will autoload the unit during the next
XPM REX test window.
Monitor the system for maintenance and recovery.
Site Flr  RPos  Bay_id  Shf Description Slot  EqPEC
RAL1 00   C05        00  18  SMU : 000   3    MX77
```

When a unit changes state to ISTb of UP RAM parity fault, the system generates a PM128 log report. This log informs operating company personnel that the unit changes status.

An example of a PM128 log follows:

```
*PM128 MAY09 09:49:56 9000 TBL ISTB SMU 1
 Node: ISTb (Unit ISTb)
 Unit0 Inact: InSv
 Unit1   Act: ISTb (UP RAM Parity)
```

The command string QUERYPM FLT causes the system to display the faults on a posted XPM. The following example MAP response shows a hard parity fault is present in unit 1 of the posted XPM:

```
>querypm flt
Node is ISTb
    One or both Units inservice trouble
Unit 0
    no fault exists
Unit 1
    The following inservice troubles exists:
        Parity audit has detected a hard parity fault.
        A reload is required to clear this fault.
        The system will autoload this unit during the next
        XPM REX test window.
```

Action by the CM: The CM SWACTs and reloads the SMU during the next XPM REX test window. After the reload, the SMU does not have this ISTb fault.

User action: There is no action required by operating company personnel. The user can initiate a manual SWACT and reload to clear the parity fault.

Data mismatch

Three types of updates keep the inactive unit of the SMU provided with the data necessary to control maintenance and call processing:

- static data
- bulk data
- dynamic data

Static data update

Static data holds SMU-RCU configuration information, like the association between SMU P-side ports and RCU link numbers. The CM sends this information to both units of the SMU when the system returns SMU to service. The CM also sends this information to an in-service SMU when table RCUINV or table LNINV is modified.

When operating company maintenance personnel alters configuration information, the system sets the SMU to in-service trouble (ISTb). The system informs personnel that a static data mismatch is present, and provides information for correct action to take.

In some occurrences, the system prompts operating company maintenance personnel to perform the following actions. The personnel must busy the inactive unit, return the unit to service, and switch unit activity.

Bulk data update

A bulk data update transfers the following information from the active SMU unit to the inactive unit. This information transfer occurs when the inactive unit is returned to service:

- the RCU status, in service and busy
- the FSR codes
- the subscriber states, idle and busy

A bulk data update brings the inactive unit of the SMU to date with the active unit.

Dynamic data update

A dynamic data update occurs on a continuous base as the system updates active unit data changes in the inactive unit. Dynamic data updates include the following information:

- the RCU status, in service/busy
- the FSR codes
- the subscriber states
- the channel reassignment
- the port statuses
- the DS-1 link information

Enhanced Dynamic Data Sync (EDDS)

The EDDS is a necessary component of warm switch of activity (SWACT). A Warm SWACT preserves processing of ISDN and POTS calls. Warm SWACTs occur when an XPM active unit drops activity because of an XPM trap, REX test or other causes. Warm SWACTS preserve call and unit states. Calls continue without interruption. For a warm SWACT to succeed, the inactive unit must be INSV.

The following events occur during a RTS. If the inactive unit was OOS before in a ManB, SysB, or C–side busy-side busy (CBsy) state,

- The system initializes the inactive unit.
- The system runs OOS tests on the inactive unit.
- If the inactive unit static data checksum is not correct, the CM performs the following actions. The CM sends new static data and marks the ISTb.
- The active unit sends dynamic data to the inactive unit (bulk synchronization).

- The CM marks the inactive unit INSV.

Errors not exact to processor cards

The following errors are not specified for processor cards of the SMU:

- static data mismatch faults

  Static data defines the SMU configuration and does not change as the system connects and disconnects calls. When static data in the host and the SMU do not match, data corruption can result. This mismatch can have the following result. The host recognizes that a line is present, while the SMU recognizes that the line is not present. This mismatch causes the system to lose calls.

- unit node table mismatch faults

  Each XPM unit has tables that contain information about nodes the unit connects to and terminals the unit uses. The following two systems determine unit table mismatches:

  — Mate unit matching compares the inactive unit tables with the active unit and sets the XPM ISTb for mismatch. The active unit sends table mapping information to the inactive unit during updates.

  — Node table audits determine if this information corresponds to data in the computing module (CM) table PMNODES. To prevent differences in data entry for the XPM units, the CM maintains all node information. Refer to the *XPM Translations Reference Manual* for a complete description of the data entry for table PMNODES, introduced in feature AF5678.

Feature AF5678, Node Table Sync Redesign, introduces the following error handling changes.

- Table Control applications that change inventory tables reject some tuples. These applications reject tuples that the system cannot support when a peripheral does not have the required resources available.
- The node table audit raises an ISTb condition on an XPM with a node table mismatch with the CM. The user must BSY and RTS all of the XPM to clear the ISTb condition.
- The system aborts the loading or RTS process when the system receives a negative acknowledgment from the XPM during the following condition. This condition occurs while downloading the configuration data table (CDT) node or port information during a bulk download.
- The system raises an ISTB condition on the XPM when the system receives a negative acknowledgment from the XPM during the following condition. This condition occurs while downloading the node CDT or port CDT data during a dynamic configuration update.

RCU fault conditions

In the Remote Carrier Urban (RCU), line cards can become defective and affect subscriber service. Subscriber loops that attach to these line cards can become defective.

Fault identification at the RCU maintenance unit

The maintenance unit at the RCU provides the following three functions:

- alarm reports
- provisioning
- tests

At the maintenance unit, operating company personnel can identify major and minor alarms, identify link failures, and read coded alarms. When the alarm occurs, the DMS-100 switch generates a PM128 log report. This log report contains the alarm value and a text string that describes the alarm.

In addition, operating company personnel identify the location of the RCU with the alarm. This text string appears at the MAP display when the RCU on which the alarm occurs is posted and personnel enter the command string **>QUERYPM FLT**.

Automatic system tests can isolate the fault. Refer to the description of Automatic system test for RCU on page 1-92.

Automatic maintenance for the SMU

The following section explains system maintenance, like audits, that help determine if a fault is present in the SMU.

SMU basic audits

The subscriber carrier module-100 urban (SMU) basic audits check data in the SMU and RCU to guarantee hardware integrity and consistency between the two modules. The following list describes the basic audits:

- ring/pad card (NT6X80)
- XPM parity
- unsolicited report handler
- timeswitch connection
- call processing connection
- IMC link
- Class modem resource (CMR) card

- ISDN signalling preprocessor (ISP) and D-channel handler (DCH) data integrity

Ring/pad card audit

The ring/pad card drives FSR and provides signals that weaken calls. The ring/pad card audit checks indicators on this card that display if the system generates a 1 ms interrupt properly. The audit also checks if the PROM and RAM on the card are fault-free. The diagnostic can fail to switch to a shelf with a good ring/pad card. If the diagnostic fails two times in a row, the system generates a PM181 log. The audit drives a Warm Switch of Activity (SWACT) of the SMU. The log indicates the part of memory that fails, PROM or RAM.

> ***Note:*** The 1 ms interrupt is tied to link timing. The ring/pad card synchronizes when pulse code modulation (PCM) values are written to a DS-1 link.

XPM parity audit

This audit runs as a low priority background task in the UP card. When the audit runs, the audit walks through the UP memory and reads memory locations. If the audit finds a defective area, the audit reads the location again. If the reread indicates a defect, the audit attempts to write a test pattern to the defective memory location.

The computing module (CM) acts on this audit so the memory fault can be corrected in the best way.

Unsolicited report handler audit

This audit causes a software error message (PM180 log) when the RCU sends the SMU a message. This message is not solicited and not defined. An example of one message is `Invalid timeswitch connection found`. This message indicates that a software digroup to DS-1 channel connection does not have corresponding hardware connection or vice versa. The DMS system takes the invalid timeswitch connection out of service (OOS).

Timeswitch connection audit

This audit checks and corrects timeswitch connection discrepancies between the SMU and RCU after every SMU Warm SWACT. Message transfer, between the active and inactive SMU units, occurs at a lower priority than other tasks. Message transfer contains call connection information and other data. After a SWACT, the new active and former active SMU units and the RCU can contain different information.

After a warm SWACT, the SMU sends a message to the RCU to request that the RCU report the timeswitch connections. The audit compares these connections to SMU connections. If a discrepancy is present between SMU and RCU connections, the system generates a software error message. The connections are made idle.

Call processing connection audit

This audit maintains consistency between the SMU and RCU timeswitch connection records. The audit removes connections that associate with connection removal and connection setup messages. The SMU removes the messages that the SMU sends to the RCU that fail to receive acknowledgments from the RCU.

IMC link audit

The system audits the two IMC links in the SMU to monitor the sanity of messages between the units. One link is between the NT6X69 cards and the other link is between the NTMX77 cards. If the IMC audit fails and detects the fault at the node level, the node is placed in the in-service trouble (ISTb) state. The node is two units of the SMU. If the audit detects a fault at the unit level, the fault unit is placed in the ISTb state.

When the audit detects an IMC link failure, the following events occur:

- system reports fault to the CM
- link is closed and SMU status changes to ISTb
- SMU processors do not use link
- Warm SWACTs cannot occur

Refer to the Handling an IMC link fault section for corrective action. When the fault is fixed, the system audit opens the link again.

CMR card audit

An audit runs in-service diagnostics on the CMR card approximately each minute. If the audit detects an in-service fault, the SMU is set to ISTb. The system generates a PM181 log that indicates that calling number delivery (CND) does not work for RCU lines that connect to the SMU. The operating company personnel can perform maintenance on the defective CMR card.

ISP and DCH data integrity audit

The ISDN signaling processor (ISP) and DCH data integrity audit provides an audit of time slot and logical terminal data. This audit makes sure that a static data mismatch between the UP, ISP, and DCH processors is detected, reported, and corrected. The following paragraph describes these processes.

The UP data is protected. The UP controls the audit. To initiate the audit, the UP sends UP data to the ISP for comparison.

If the data does not match, the ISP returns a failure message to the UP. A PM180 log warns of an update.

If the data match, the ISP requests audits of the DCH suspected to be defective and spare DCHs. The DCH compares the DCH data with the audit data and reports a failure or pass message to the ISP. The ISP forwards this information to the UP.

If the mismatch occurs in the DCH, a PM180 log provides an update warning. If the mismatch occurs in a spare DCH, the system busies the card.

Pre-SWACT audit

Note: The Pre-SWACT audit supports SMUs with ISDN and Meridian Business Set (MBS) ability.

In BCS31, an audit is added that helps determine if a successful Warm SWACT can occur. This audit occurs when a planned SWACT takes place. The SWACT can occur through the command SWACT or during the routine exercise (REX) test. When the SWACT begins, the audit begins before the active unit drops activity. The audit checks different maintenance and call processing status information. The audit checks this information to make sure the inactive unit is sane enough to take over call processing.

Pre-SWACT and post-SWACT audits

The SWACT audits provide a mechanism in the SMU that increases SWACT reliability. The mechanism prevents a SWACT to a mate unit that cannot maintain activity.

If a SWACT occurs and the new active unit does not establish two-way communication with the CM, the system attempts a SWACT to the original active unit. The following audits determine the activity of the new mechanism in the XPM. The mechanism provides this additional SWACT reliability.

- pre-SWACT audits
  - pre-drop
  - pre-gain
- post-SWACT audits
  - post-gain
  - post-drop

Each of these audits are in each unit. A SWACT drops of activity by one unit and the mate unit of a peripheral gains activity. Because of these actions, each audit has a role in the different states of a SWACT. The following sections describe the audits that control a SWACT in the XPM.

Pre-drop audit

The pre-drop audit accepts a request to drop activity and determines if the mate unit can accept activity. This audit runs in the active SMU unit.

One of two possible sources can initiate a SWACT of the peripheral. These sources are:

- the CM, as a request to the active unit to drop activity
- the active SMU unit, that causes an autonomous SWACT

To determine a drop of activity, the pre-drop audit evaluates the following information:

- source of the request (CM or SMU)
- type of drop request
- status and history of the current active unit
- status and history of the inactive mate unit

When the CM initiates SWACT, the SWACT Controller queries the XPM. The pre-drop audit in the XPM responds to this query. The response informs the CM if the active unit can comply with a request to drop.

Pre-gain audit

The pre-gain audit monitors the SMU status data in the inactive unit and sends this information to the pre-drop audit in the active unit. The pre-drop audit uses this information to determine if the active unit must drop activity. The audit examines the following SMU status data:

- Facility audits—the result of the last run for each facility audit diagnostic for a given peripheral if recorded in the SMU.
- Status information in the unit—this information includes the inactive unit
  - — is in-service and ready
  - — has CM links OK
  - — does not have corrupt static data
  - — is in synchronization
  - — is not jammed as the inactive unit

Note: An inactive unit cannot reach each diagnostic. Perform a manual SWACT with the FORCE option to clear a failure from the pre-gain audit record.

The pre-gain audit continues to monitor and report unit status and condition information while the unit is inactive. The pre-drop audit can determine if the active unit can drop activity. The audit uses the information that the pre-gain audit provides. If the unit can drop activity, a Warm SWACT occurs and the post-gain audit in the new active unit runs.

Post-gain audit

The post-gain audit runs in the new active unit. The audit verifies that the unit establishes two-way communication with the CM. If communication happens, the new active unit maintains activity. If the communication check fails, the unit forces a drop of activity to initiate a SWACT to the original active unit. The pre-drop audit does not refuse the SWACT and allows the SWACT to proceed. If the SWACT back fails, the whole SMU node is busy (BSY) and return to service (RTS).

Post-drop audit

The post-drop audit runs in the new inactive unit. The new inactive unit remains in-service for a short time and does not initialize. The main function of the post-drop audit is to clean up the call processing data structures of calls that are not stable. The post-drop audit is also for calls that are not synchronized and not stable. When a SWACT back is not required or a SWACT back is complete, the SMU informs the CM. The inactive unit is BSY and RTS.

For controlled and SWACTs that are not controlled, the SWACT is complete when the central control (CC) receives a gain message. The gain message is from the new active unit. The CC acknowledges the gain to the original active unit. When a SWACT occurs, the CC and the SMU exchange drop and gain messages that clarify activity. The following table explains common phrases in these messages.

Message phrases that describe CC to SMU SWACT communication

Message phrase	Explanation
Original active unit	Active unit before the SWACT (unit 0)
Original inactive unit	Inactive unit before the SWACT (unit 1)
New active unit	Active unit after the SWACT (unit 1)
New inactive unit	Inactive unit after the SWACT (unit 0)
Gain message	The message the new active unit (unit 1) sends to the CC to inform the CC that the unit gains activity

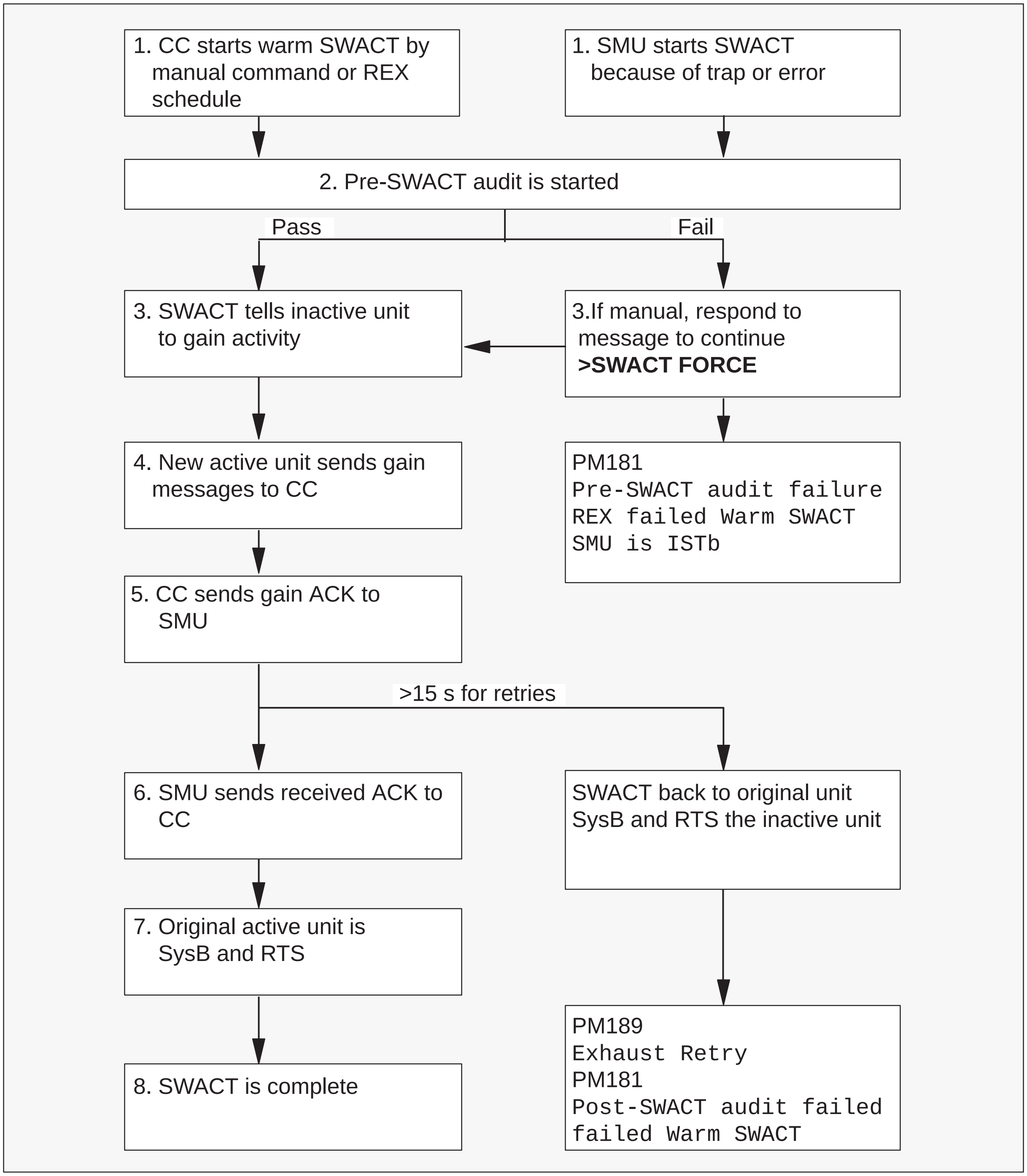
—continued—

Message phrases that describe CC to SMU SWACT communication
(continued)

Message phrase	Explanation
Gain acknowledge message	The message the CC sends to original active unit to confirm the new active unit sends messages
Gain acknowledge received	Message original active unit sends to CC to confirm the new active unit passes the post-SWACT audit
Drop message	Message the original active unit (unit 0) sends to the CC to inform the CC that the unit drops activity
—end—	

The following figure displays the sequence for a controlled and SWACT that is not controlled. The figure also describes the SWACT-back operation of feature AN0538. The following sections discuss this feature.

SWACT sequence


1. CC starts warm SWACT by manual command or REX schedule
1. SMU starts SWACT because of trap or error
2. Pre-SWACT audit is started
Pass
Fail
3. SWACT tells inactive unit to gain activity
3.If manual, respond to message to continue
>SWACT FORCE
4. New active unit sends gain messages to CC
PM181
Pre-SWACT audit failure
REX failed Warm SWACT
SMU is ISTb
5. CC sends gain ACK to SMU
>15 s for retries
6. SMU sends received ACK to CC
SWACT back to original unit SysB and RTS the inactive unit
7. Original active unit is SysB and RTS
8. SWACT is complete
PM189
Exhaust Retry
PM181
Post-SWACT audit failed
failed Warm SWACT

REX test

Note: The REX test information in this section applies to SMUs that support ISDN and MBS.

The REX tests are a series of tests that occur on an SMU unit. The system scheduler initiates these tests daily. The operating company personnel and the user can initiate these tests. The following list describes the REX sequence:

1. Test the inactive unit and includes in-service (InSv) tests.
2. System busy (SysB) the inactive unit.
3. RTS the inactive unit. This RTS includes OOS tests.
4. Wait for superframe and data synchronization to be achieved.
5. Perform a pre-SWACT audit.
6. Perform a Warm SWACT.
7. Maintain call processing ability on earlier active units.
8. Perform a post-SWACT audit.
9. SWACT back to earlier active units if necessary.
10. SysB the new inactive unit.
11. RTS the inactive unit.
12. Wait for superframe and data synchronization to be achieved.
13. Run InSv diagnostics (TST) on the new active unit.
14. Run InSv diagnostics (TST) on the inactive unit.

The system generates PM131 logs for each state change that occurs because of the REX. The PM131 log is exactly like the PM128 log. The PM131 log is an information log that does not generate minor alarms that are not necessary.

When a REX sequence completes, the system generates a PM181 log.

The NAGSUB subsystem generates a log each hour to list out-of-service (OOS) nodes. The log also indicates if a problem in REX tests is present. For a node to be included in the report, the node must be in one of the following states: SysB, C–side Busy (CBSY), ISTb, or Manual Busy (ManB). A node can also be included if the node fails, aborts or does not complete the last REX test. If a node does not have a REX problem, the string ATP appears in the REX column. The ATP indicates that each test passes.

The **>QUERYPM**, **>QUERYPM FLT**, and **>TST REX QUERY** commands contain information about the last REX. System and manually initiated REXs cause a new date, time, and status (PASSED/FAILED) to be stored in the REX maintenance record and appear at the MAP display. The PASSED status indicates the REX is complete and does not find errors. The FAILED status indicates the REX does not complete because of an error condition. This information is available through the **>QUERY PM** and **>TST REX QUERY** commands. If the REX fails, operating company personnel must perform a manual RTS, a manual REX, or an automated REX. Personnel must perform one of these actions to return the SMU to service.

Each SMU stores a REX maintenance record. The stored information includes:

- if an SMU is in the system REX scheduler
- date and time and result of the last REX
- if the last REX fails, the failure reason and defective card list
- date and time of earlier failed REXs
- date and time of first passed REX after a failure

Routine exercise test

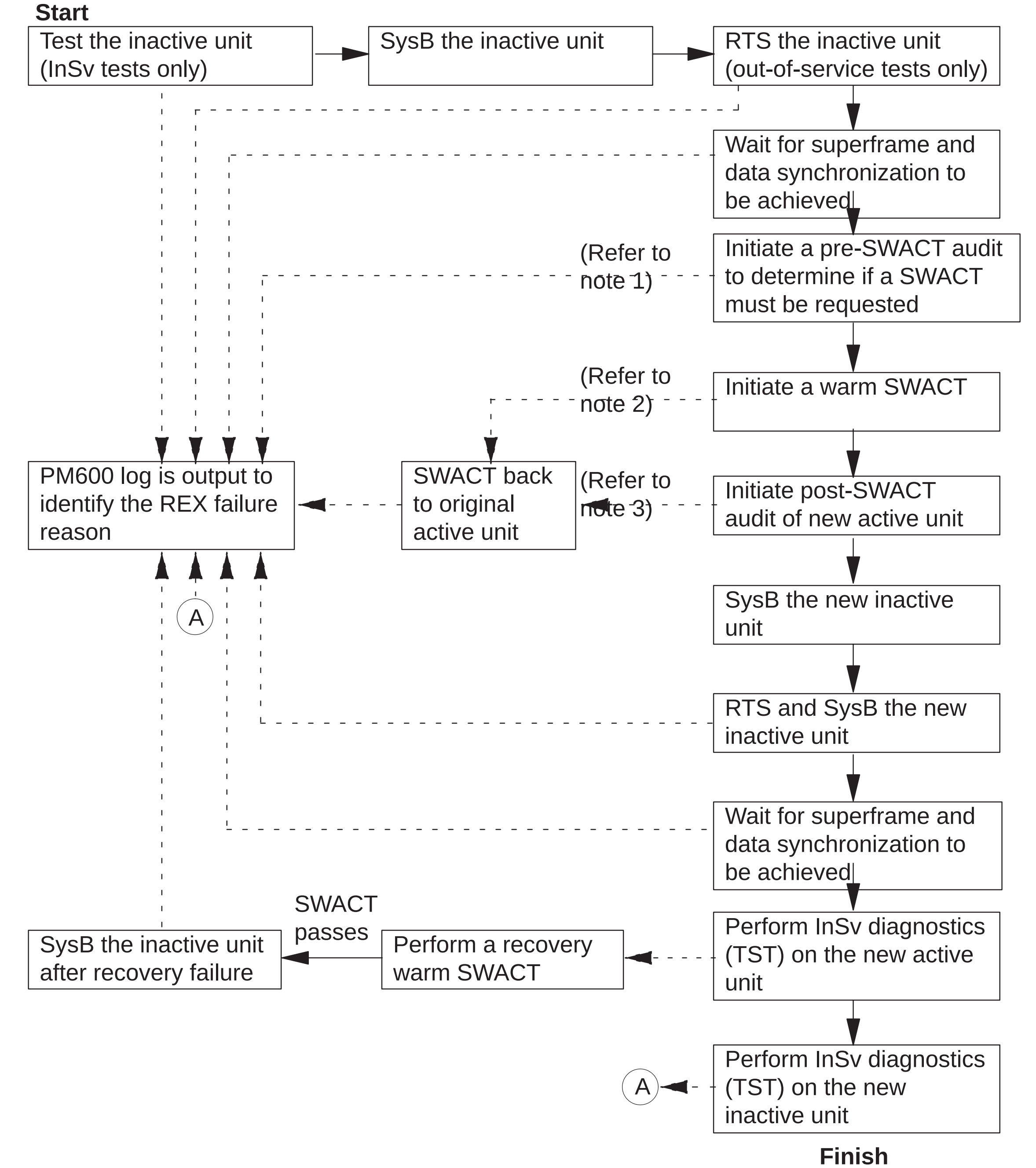
A REX test includes a series of tests that take place on an SMU unit. The system scheduler or operating company personnel must initiate tests each day. The REX test combines the diagnostic and functional routines available on SMUs. Results of the REX test can divide into four classes:

- not performed
- pass
- fail
- aborted by manual action: maintenance action with the FORCE parameter or the ABTK command from another MAP terminal with the SMU posted.

The four classes output a log or display a message at the MAP terminal. The maintenance record stores passes and fails REX tests. Failed REX tests have failure reasons.

The REX state controller actions appear in the following figure.

REX state machine actions



Note 1: Pre-SWACT audit fails
Note 2: SWACT fails
Note 3: Post-SWACT audit fails

Indicates process fails
Indicates process passes

If a REX test fails, the system generates a PM600 log. The PM600 log initiates a major alarm for the SMU that fails the REX test. The major alarm appears at the MAP display under the PM banner at the top of the display.

If an InSv or OOS diagnostic test fails, the REX failure reason includes an abbreviation of the diagnostic that fails. The reason also includes the unit that fails (0 or 1).

The PM600 log details the start time of each step that the REX test performs, the unit that the REX step affects, and the failure reason. The REX steps included in the log, after the failed step, are recovery actions that REX initiates because of the failure. The REX includes the unit number if the REX action is unit specified: BSY unit, RTS unit, TST unit, synchronization. The REX action cannot be an action that affects the node: SWACT, BSY the two units. The additional data of the log consist of a cardlist and mnemonic of the failed diagnostic. The following table lists the mnemonics for the diagnostics and a description of the diagnostic.

Diagnostic name and description

Diagnostic name abbreviation	Description of diagnostic
ABDIAG	A/B Bits
AMUDIAG	6X50 External Loop
CDS1 DG	C-Side DS1
CMRDIAG	CMR Card
CONT DG	Continuity Diag
CSMDIAG	CSM Diag
CS SPCH	Network Links
DS1DIAG	P-Side DS-1
FORMATR	Local Formatter
MSGDIAG	6X69 Messaging Card
MSG IMC	IMC Link
PADRING	6X80 Pad/Ring
PS LOOP	P-Side Loops
PS SPCH	P-Side Speech Links

—continued—

Diagnostic name and description (continued)

Diagnostic name abbreviation	Description of diagnostic
SPCH DG	Speech Path
SYNC DG	Synchronization Diag
TONE DG	Tone Diag
TS DIAG	Time Switch Diag
UTRDIAG	UTR Card

—end—

The QUERYPM command and command strings QUERYPM FLT and TST REX QUERY contain information about the last REX. System and manually-initiated REXs store and display a new date, time, and status in the REX maintenance record. *Passed* status means the REX is complete and does not have errors. *Failed* status means the REX is not complete because of an error. This information is available through the QUERY PM and TST REX QUERY commands. If the REX fails, the user performs a manual RTS, a manual REX, or an automated REX. The user performs these actions to return the XPM to service from ISTb.

Each SMU stores a REX maintenance record that contains the following information:

- the REX scheduler, if the SMU is in the system
- the date, time, and result of the last REX
- the failure reason, diagnostics failures, and a list of defective cards, if the last REX fails
- the date and time of earlier failed REX
- the date and time of first passed REX after a failure

The following restrictions apply to REX tests:

- The system REX (SREX) controller, refer to page 1-86, runs REX on one SMU at a time if the office uses the NT-40 processor. SuperNode supports concurrent REX tests for a maximum of ten SMUs with the same REX test class.

- For REX to be run, the node must be
  - — InSv
  - — ISTb because of a REX failure
  - — ISTb because P-side DS-1 links are OOS
- If a Warm SWACT is not possible, REX ends.
- After completion of REX, the SMU has a new active unit because of the SWACT.
- If a restart occurs when REX is in progress, the system does not output the PM600 log. The restart deallocates the temporary data store used to build the PM600 log.
- A SWACT controller override is not provided for manual REX. Refer to the SWACT controller section.

REX state machine interface to the pre-SWACT and post-SWACT audits

The REX state machine or controller permits the SWACT controller to refuse to attempt a SWACT. For information on the pre-SWACT and post-SWACT audits, refer to Pre-SWACT and post-SWACT audits.

The REX controller does the following:

- calls the SWACT controller during the pre-SWACT step before the SWACT request occurs. The SWACT controller determines if a SWACT can occur. A SWACT can occur according to the diagnostic history of the unit the diagnostic history database maintains. A SWACT can also occur according to the result of the last SWACT attempt to the inactive unit, and the data that the SMU returns in the pre-SWACT query message. An XPM can fail the pre-SWACT step of REX and not describe failures in the DiagHist level of the MAP. An XPM can fail in this method if the reasons for the pre-SWACT failure do not include diagnostic failures.
- calls the pre-SWACT audit, messages the other unit, and the Warm SWACT is performed if the audit passes
- accounts for SWACT denial and failure reasons
- terminates a REX test if a SWACT is denied
- terminates a REX test if a SWACT occurs. The active unit of the XPM does not change from the time the REX test begins. The REX terminates. The termination does not involve recovery actions because the SWACT code submits a BSY and RTS of the inactive unit.

- displays the failure reason for a SWACT denial or failure that occur during a manual REX at the MAP terminal as *REX failed*. Use the command string **>TST REX QUERY** for the posted XPM to obtain the detailed reason for the failure. The system generates a PM600 log report that describe the REX failure reason.

SREX scheduler feature AF3771

Feature AF3771, System REX Controller: The XPM Maintenance, provides the SuperNode switch with an SREX controller. The SREX controller coordinates the system REX tests under a common REX scheduler. This feature permits the system to schedule SMU REX tests when other REX tests are in progress.

The SREX controller allows the system to REX the whole switch, with peripherals like the SMU, in less time.

Feature AF3771 permits the user to locate and resolve the REX test failures earlier. This action reduces power failures in the field. The SREX controller also allows the operating company personnel to do the following:

- change the order in which peripherals are tested
- coordinate between manual and system-initiated REX tests
- receive alarms for the SMU, that are not REX tested in a time limit set, through Table REXSCHED

The SREX scheduler permits the user to enter the command interpreter (CI) level command REXTEST and the following parameters.

- The SUSPEND parameter suspends REX testing for one maintenance window. A maintenance window is the period between the time the REX START and STOP time entered in Table OFCVAR under parameter NODEREXCONTROL.
- The RESUME parameter resumes REX tests after the REX tests are scheduled.
- The QUERY parameter returns the status of the REX test, active or suspended.
- The HELP parameter returns a description of the REX test.

Note: The maximum number of XPM REX tests of each type that can run at the same time is ten.

The REX test order for feature AF3771 is critical nodes first, like CM and message system (MS). Second, the number of days after the last system or manual REX test. Third, the order of internal PM (SMU) number.

Table REXSCHED must contain data to establish the REX schedule for the SMU. This table contains the information that the REX coordinator requires to schedule the tests to comply with operating company specifications. In addition, the datafill of data in Table REXSCHED can disable the test. For additional information on Table REXSCHED, refer to the data schema section of the *Translations Guide*.

When the SMU does not perform REX tests for a maximum of 7 days, the system generates log report IOAU112. If a REX test cannot start after a defined number of attempts, the system generates log report IOAU112 again.

NAG command

The CI level node assessment graph (NAG) command allows the operating company personnel to display each OOS node. The MAP response to the NAG command is like the response in the NAG400 log report. The command and log report are part of the NAG feature. The NAG feature provides a snapshot of nodes in the system that are OOS or have a REX issue. Operating company personnel can enter the NAG ALL command string to include the offline nodes in the output. The log report function runs each hour. The function can be turned on and off with the command string NAG ON to include a node, or NAG OFF.

For the output or log report, the node must be in one of the following states: SysB, CBsy, ISTb, or ManB. A node can also be included if the node fails, aborts, or does not complete the last REX test. If a node does not have a REX problem, the string ATP appears in the REX column. The ATP indicates that every test passes.

The following output depicts an abbreviated report in response to the NAG command.

```
Front End Load: FSL37AO
Level   Node        Status  REX INFO        UNTI 0  UNIT 1
   CPU      1         ACT
CM                  NORMAL
MS                  NORMAL
MS                  NORMAL
IOD                 NORMAL
NET                 NORMAL
PM RCCI     0        SYSB   ATP             SYSB    SYSB
   LCM  KOPM 12 0    SYSB   PASS:   PASS    SYSB    SYSB
   RMM      1        SYSB   ----             --      --
   ESA      4        SYSB   ----             --      --
    :       :         :       :              :       :
    :       :         :       :              :       :
   SMSR     5        SYSB   ATP             SYSB    SYSB
   LTC      0        ISTB   ATP             ISTB    ISTB
   LTC      1        ISTB   ATP             ISTB    ISTB
   SMA      1        ISTB   ATP             ISTB    ISTB
   IDT      37       ISTB   ---              --      --
   IDT      38       ISTB   ---              --      --
   SMA2     0        ISTB   ATP             ISTB     .
   SMU      1        ISTB   ATP             ISTB    ISTB
    :       :         :       :              :       :
    :       :         :       :              :       :
   LCM KRCM 03  0     .     PASS:   ----      .       .
Offline Node count:  3
```

Digital phase lock loop (DPLL) clock failure

The enhanced field failure information feature (phase I) in BCS32 allows the system to identify when a loss of synchronization causes a SysB. The SysB is the result after a DPLL clock failure.

This feature addresses this problem. This feature makes the CM acknowledge the reception of the synchronization lost message. If the SMU does not receive the acknowledgment, the SMU can go system busy. In this occurrence, the next time the SMU RTS, the SMU generates a sync_was_lost log.

This feature also provides information on when the DPLL clock has problems when the DPLL logs each large out-of-phase reading. For additional information on the PM189 sync_was_lost log and the big_sync_hit log, refer to the description and log report format for each log.

Automatic maintenance for the RCU

RCU audits that the CM executes

The CM performs audits on specified areas of software and hardware. Each audit must make sure the area of software and hardware for which the audit is responsible operates correctly. Each audit must also make sure that software on each processor is in agreement.

Audits must detect and report faults. Audits do not always allow the system to recover from faults if the fault does not require manual action like the replacement of a card.

The CM performs the following audits:

- link-node status
- call processing node status
- P-side node status
- link test
- query alarms

The following paragraphs describe these audits.

Link-node status

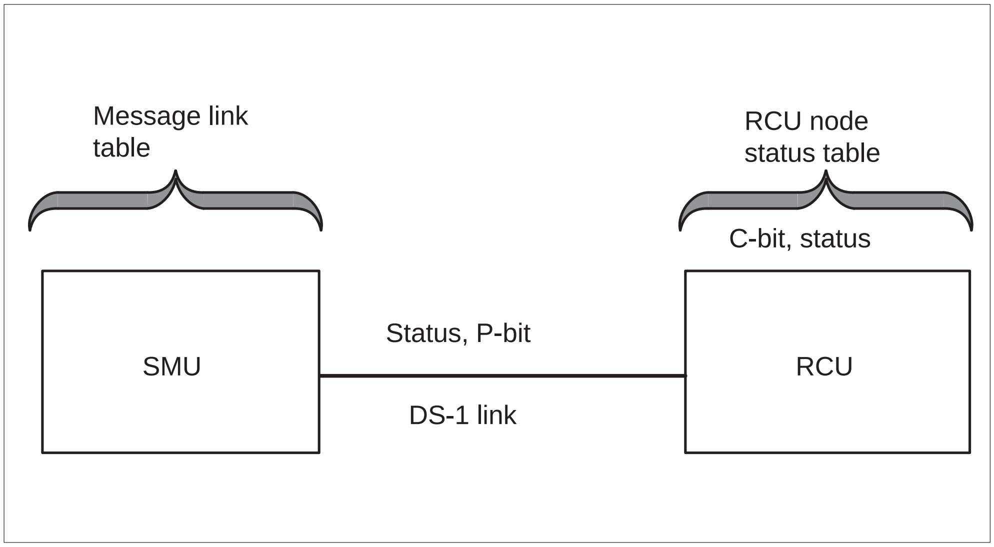
The link-node status audit verifies information stored in the CM on the status of the RCU and attached DS-1 links. The audit compares two CM tables to check RCU status information. One table, the message link table or link status table, contains a P-bit. The P-bit is set when the RCU is NOT_OK (SysB, ManB, or ISTb).

When the RCU is OK, operates and does not have faults, this bit is not set. The message link table is compared to the RCU node status table. This table is a CM table. The node status table contains the status, OK or NOT_OK, of the RCU. The following figure describes the relationship between the message link and RCU node status tables.

When a discrepancy occurs between the two tables, the tables are compared again after 400 ms. The comparison makes sure the RCU is not in a transient state, like RTS. If the discrepancy continues a maximum of five times, the P-bit of the message link table changes to agree with the status of the RCU. The P-bit agrees with the status of the RCU in the RCU node status table lists.

The message link table holds the status of DS-1 links that connect SMU and RCU modules. The RCU node status table contains a C-bit. The C-bit is set when a DS-1 link is NOT_OK. The C-bit is not set when the link is fault free.

Message link and node status tables



A discrepancy can be present between the message link and RCU node status tables. If a discrepancy continues a maximum of five times, the C-bit of the node status table changes to agree. The table changes to agree with the state of the link. The state of the link appears in the message link table.

Call processing node status

The call processing node status audit compares the RCU node status table in the CM against another CM table used for call processing. The call processing table maintains a list of RCU modules and statuses. Call processing software uses the call processing table during software operations. If the RCU node status and call processing tables disagree, the RCU updates the call processing table to match the RCU node status table.

P-side node status

This audit runs on a 1 min interval. This audit checks DS-1 link and RCU status information in CM tables against the same information in SMU tables.

The CM requests the SMU to send CM P-side link and node information. The CM compares the SMU to the internal information. If discrepancies are present, the SMU tables are corrected.

RCU link tests

The CM sends a message to the SMU each 5 min. The message requests that the SMU send a message to the RCU to perform DS-1 link tests. The RCU performs a DS-1 link test for in-service RCU modules. The DS-1 test consists of the following parts:

- DS-1 loopback test (RCU) – The SMU requests the RCU to perform a DS-1 loopback self-test and return results to the SMU. The link must be OOS for this test.
- During loopback tests, the RCU maintenance card inserts an encoded PCM sample in the RCU common equipment test bus. The PCM sample goes through the RCU switch card, and returns to the maintenance card. The control processor analyzes the PCM.
- DS-1 card test – The RSU tests the SMU port on the DS-1 interface card to which the RCU link connects. The CM receives the results.
- DS-1 loopback test (SMU end-to-end) – The SMU sends a PCM sample on one DS-1 channel. The SMU also sends a PCM sample on each DS-1 channel over the DS-1 link to the RCU. The RCU must be in-service for this test. At the RCU the sample or samples are looped at the time switch and return to the SMU.
- The SMU reports the results to the CM. The failed links are SysB. The SMU assigns calls on these failed links again to DS-1 links that operate correctly. Each minute the audit attempts to return SysB links to service.

RCU query alarms

The CM sends a message to the SMU each 10 min. The message requests that the SMU send a message to the RCU to query RCU alarms. The RCU alarm information goes the CM. The system stores the information in CM tables and uses the information to update MAPs.

Hardware configuration audits

Common equipment (CE) audit

The RCU runs a CE configuration audit each 2 s. During this audit, the RCU compares the CE hardware present at the RCU to the hardware the provisioning data lists. The CE hardware includes the control processor, CP extension, message processor, switch, supervisory, timing, power converter, and line test access (LTA) cards. If a discrepancy is present, a configuration alarm record datafill is made in the RCU. If the system detects a power converter failure or removal, all configuration alarm records generated for the cards that power converter powers are deleted.

First time failures in the RCU cause the RCU to send the SMU an alarm report. To clear the alarm, operating company personnel must remove the defective common equipment card for a minimum of 2 s. The RCU takes 2 s to change the failure alarm to a configuration alarm. To clear the configuration alarm, operating company personnel can alter the provisioning data to agree with the hardware on the RCU shelves. To clear the alarm, operating company personnel can also insert or remove CE cards to match the provisioning data.

Line card configuration audit

The RCU runs line card configuration audits every 15 s. During this audit, line card carriers and line cards on the RCU shelves are compared to the carriers and cards the provisioning data lists. Discrepancies make the RCU raise a line configuration alarm.

Note: A mismatch must be present on four line cards to raise a configuration alarm. If a line card carrier is removed, the subscriber lines that associate with the carrier are put in the idle state. The RCU puts the lines in the idle state.

Call processing audits

The RCU runs the call processing audit each 5 min. This audit verifies that call connections set up in the switch card connection memory match software records for these connections. This audit also verifies that software records that use loop-timeslot compare to software records that use digroup DS-1 channel.

If a discrepancy is present, hardware and software connections for that logical line are restored to idle. The RCU sends a message to the SMU.

This audit causes the RCU to send the SMU an on-hook or off-hook message. The SMU sends a message for each logical line number that does not have switch connections in the RCU. This action guarantees consistency between RCU and SMU records.

Automatic system test for RCU

The automatic system test (AST) is a set of system verification tests that execute diagnostics on RCU cards. Two types of AST are available: basic (phase I) and enhanced (phase II).

Basic AST performs diagnostics on the RCU maintenance card and backup CE cards. These diagnostics include control processor, supervisory, power converter, switch, timing, and ring generator. The basic AST performs a switchover to the backup cards that pass diagnostics. Basic AST takes approximately 30 s to complete. New calls are not always processed during that time.

Enhanced AST performs the same diagnostics as basic AST but also runs single-end (L-mode) tests on line cards. Enhanced AST tests take a maximum of 2 h to complete. Call processing on lines is affected during CP switchover and on separate lines if the associated line cards are tested.

The following sequence of events takes place during enhanced AST.

1 The AST tests maintenance card and backup CE cards.

2 Single-end tests run on line cards.

3 Backup cards are activated and active cards are set to backup (switchover).

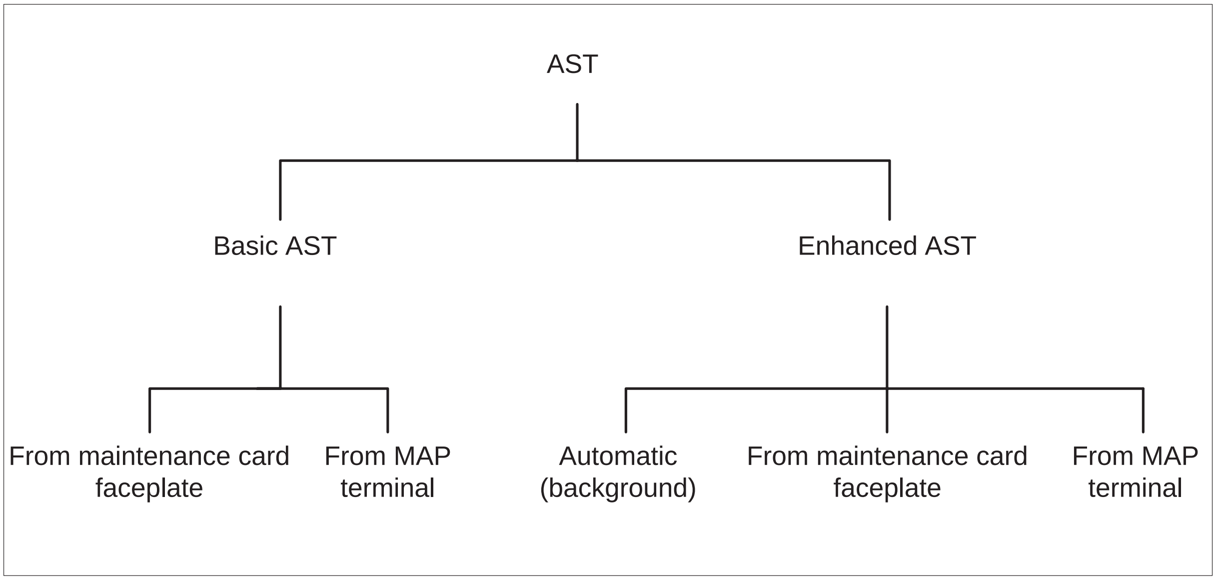
4 This sequence repeats.

If a line card fails AST, additional RCU tests isolate the fault to one of the following items:

- RCU common equipment
- line card/loop
- RCU shelf

The following figure indicates that you can activate basic AST from the MAP terminal. You can also activate from the faceplate of the maintenance card at the RCU. From the MAP terminal, the TST command activates AST. From the faceplate, the command to activate AST is P6044.

Automatic system test



Datafill of the command ABTK can abort basic AST from the MAP terminal. This command aborts tests if you initiate AST from the MAP terminal or from the maintenance card faceplate.

Operating company personnel can press the EXEC push button to abort basic AST from the faceplate of the maintenance card. This action aborts tests for AST initiated from the maintenance card faceplate.

The field AUTOTEST you enter in Table RCUINV determines if basic or enhanced AST runs when you enter TST from the MAP terminal. The field also determines if enhanced AST runs when you enter P6044 from the faceplate of the maintenance card.

If the field contains the Y (yes) datafill, enhanced AST runs. If the field contains the default N (no) datafill, basic AST runs.

Even if the AUTOTEST field contains Y, enter the following command string to run the basic AST

>TST NOLNTST

at the MAP terminal.

The parameter NOLNTST causes a basic AST to run. Table RCUINV datafill do not determine if the basic AST runs.

When the AUTOTEST field contains Y, the AST allows slow-mode background AST, which takes a maximum of 24 h to complete. Slow-mode AST runs in the background. The AST tests CE backup cards, performs switchovers, and tests line cards. If the AUTOTEST field contains N, a background AST does not run.

The MAP command TST and the maintenance card faceplate command P6044 invoke the enhanced AST.

The status of AST in an SMU-RCU subsystem can be queried, if the AUTOTEST field contains Y. Datafill of the command string **>TST QUERY** at the MAP terminal results in a MAP display that indicates if AST is run or is inactive.

To abort enhanced AST, enter the command string:

>TST ABORTLNTST

You can issue this command string for enhanced AST. The command aborts AST if you initiate AST from the MAP terminal or from the maintenance card faceplate.

The following limits apply to AST:

- When enhanced AST is active, commands TST (P6044), BCKPSEL (P6011 and P6022), and PMRESET (P6055) are prohibited.
- AST initiated from the MAP terminal cannot abort from the faceplate of the maintenance card.
- Call processing on a line is AST inhibited if the line card that associates with the line is tested during AST.

In BCS30 and up, when AST fails a line during the line sensitivity test, the RCU sends a message to the CM. The CM produces an alarm that indicates where the failure occurs. The line(s) on the line card are not put in the line module busy (LMB) state if the RCU firmware is not pre-RU30.

The following messages can appear at the MAP terminal when a QUERYPM FLT or in a PM128 log:

- AST – line card 1 failure or missing
- AST – line card 2 failure or missing
- AST – line card 3 failure or missing
- AST – line card 4 failure or missing
- AST – line cards 1-4 failure or missing

The first four messages appear when AST fails a line on line cards 1 through 4. These messages correspond to failure types 1 through 4. If AST fails the four line cards, the first four alarm messages clear and the last alarm message appears. This alarm is type 5.

Background system tests

Background system tests consists of the following areas:

- backup card exercise
- insertion exercise
- power converter failure scan
- 24-hour switchover

Backup card exercise

The RCU performs backup card exercises each hour on backup or duplicated cards. The RCU also performs exercises on card insertion. The RCU software makes sure a card is initialized and is in operation before the card switches to active mode.

Exercises run on the following cards each hour:

- supervisory
- timing
- ring generator
- maintenance

Insertion exercise

Insertion exercises are run on the following cards. The actions that run appear in parentheses:

- switch (tests on insertion and system verification)
- digroup (initializes on insertion)
- control processor (performs self diagnostics in backup mode)
- maintenance (RCU enters warm start initialization on insertion)
- power converter (RCU enters warm start initialization on insertion)
- control extension (RCU enters warm start initialization on insertion if control extension is inserted on same side as active CP. If the opposite action occurs, the associated backup CP tests the control extension.)

Power converter failure scan

When CE cards duplicate for each RCU group, two power converters are available. Each power converter supplies power to the CE cards on the power converter side. Each power converter can supply power to the line cards in the group. One power converter supplies the line cards. The power converter also supplies power to two digroup cards in the group. The converter supplies power to one digroup on the control shelf and one digroup on the line shelf.

When you remove a power converter or the converter fails, the RCU informs the SMU. Do not assign calls to the affected cards.

The RCU generates two types of power converter failure alarms: one alarm for CE and one alarm for line cards. For line card power failure, the system generates a minor coded alarm if a backup power converter is available. The system generates a major alarm if a duplicated power converter is not availablea.

Failure or removal of a power converter on the same side as the active CP causes the inactive CP to become active. The SMU does not know until after the switchover when the RCU sends a warm start message.

Failure or insertion of the power converter on the backup side causes the RCU to send a release control message to the SMU. This message informs the SMU that the RCU is going to automatically reset.

The 24 h switchover

Each 24 h, the duplicate CE backup cards in the inactive mode switch to active mode. The exception to this action is the message processor. The maintenance card and the CE backup cards are not tested. Switchover proceeds. Card failures to switch do not determine if the switchover proceeds.

Switchover of cards can fail if the backup card is not present or is defective before the switchover. Card failures cause the system to generate alarms.

During a switchover, the system maintains calls in the talking or ringing state. The system inhibits new calls for a maximum of 30 s. The system drops calls in the digit collection or dial tone states.

If a DS-1 link fails during switchover, the system drops calls on that link, like nailed-up special-service calls. Nailed-up specials are reassigned on a different DS-1 link after switchover.

Office parameter LCDREX_CONTROL determines if a 24 h switchover occurs for an RCU. If a switchover occurs, LCDREX_CONTROL determines when the switchover occurs. Enter this parameter in the office parameter Table Office Variable (OFCVAR). Default disables the 24 h switchover.

If the office parameter allows the switchover, the default time for the performance of a 24 h switchover is between 1 a.m. and 3 a.m.

The following actions cause a CP switchover:

- Enter the backup select command (code P6011 or P6022) at the maintenance card faceplate of the RCU. This command switches the active CE cards to backup and backup to active.

  Enter the BCKPSEL command at the PM level of the MAP terminal places the active CE cards in the backup mode.

- Enter the system verification command at the maintenance card faceplate of the RCU. This command tests CE cards and places backup CE cards in active mode.

  Enter the TST command at the PM level of the MAP terminal against a posted RCU. The TST command also tests CE cards and places backup CE cards in active mode.

- Enter the relinquish control command at the maintenance card faceplate of the RCU. This action places the backup CP of the RCU in the active mode. The CE cards on the same side as the active CP become active.

  Note: Complementary DMS command is not available.

- Active CP fails, is removed, or loses power.
- Automatic 24 h switchover occurs. This action places the backup CE cards of RCU in the active mode.

RCU initialization

The RCU can initialize in four ways:

- cold start
- warm start
- interterminal reset
- backup switchover

The following events occur during RCU initialization:

- The RCU sends the SMU a message to indicate the RCU prepares to initialize. The SMU relays this information to the CM.
- The CM generates a log that indicates the RCU initializes.
- The CM sets the RCU ISTb.
- The CM suspends call processing at the RCU.
- RCU alarms and CM alarm records clear, except during backup switchover.
- Manual and system maintenance is inhibited during initialization.

After initialization, the following events occur:

- The RCU sends a message to the SMU to indicate that initialization is complete. The SMU relays this information to the CM.
- The CM generates a log to indicate that the RCU completes initialization.
- The CM sets the RCU InSv, if alarms are not present on the RCU. If alarms are present on the RCU, the RCU is set SysB or ISTb.
- The RCU generates alarms again for faults that persist after initialization. The CM generates the records again for these alarms.

The CM cannot perform maintenance during initialization because the CM cannot communicate with the RCU. When you post an RCU at the MAP terminal when the RCU initializes, enter one of the following commands. A message appears. The message indicates that the following initialization is in progress:

- BSY
- TST
- BCKPSEL
- STATUS
- PMRESET
- ACO

reAP:

An example of the initialization message appears in the following description:

```
NO ACTION TAKEN; RCU REM1 04 0 INITIALIZATION IN PROGRESS
```

The system accepts other MAP commands, like TRNSL.

To enter maintenance commands on an RCU that initializes at the MAP terminal, type

>ABTK

and press the Enter key.

Initialization proceeds and the rejection message does not appear. The system can perform the BSY command. You can enter other commands. Proceed after the initialization completes.

The CM puts a threshold of 20 initializations every 10 min for each RCU. If an RCU exceeds this threshold, the CM assumes the RCU is in trouble and sets the RCU to SysB.

Automatic maintenance for DS-1 links

System maintenance of DS-1 links

The DMS-100 switch performs a PCM loopback test on InSv DS-1 links each 5 min. The DMS-100 switch attempts to RTS OOS links each minute. You or the system can return the link to service. The switch checks the link for proper framing and bipolar violation (BpV) levels. The DMS-100 switch also tests the port of the SMU DS-1 interface card. A common equipment digroup PCM loopback test runs on the RCU. If part of the RTS fails, the link remains OOS.

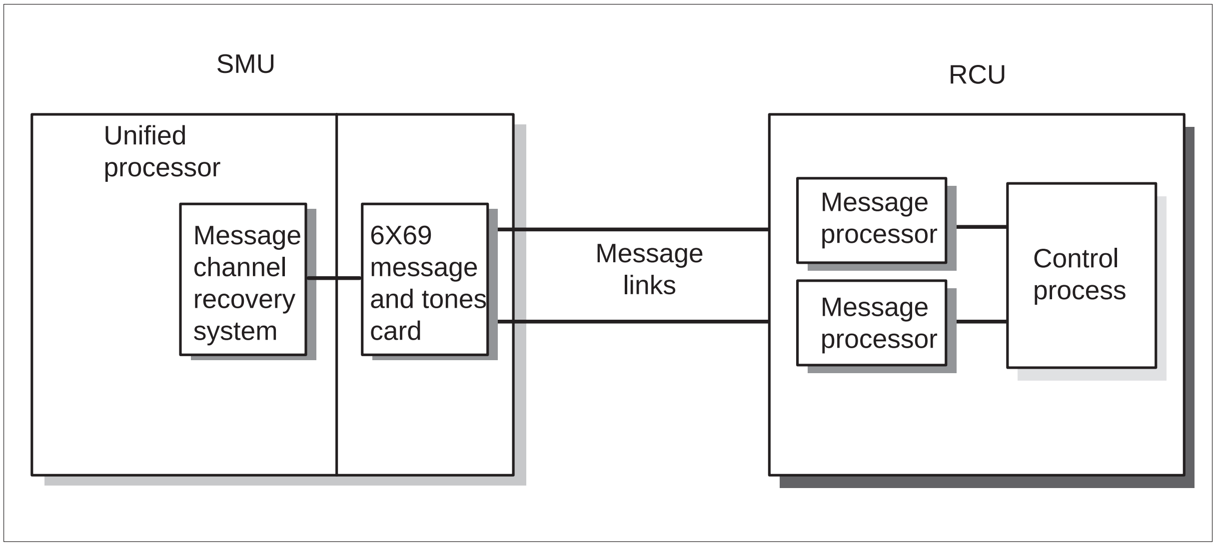
How the message channel recovery system operates

Message channel recovery software guarantees communication between the SMU and RCU. When a fault occurs, the SMU invokes the message channel recovery system software to establish a communication path again. The SMU establishes the path again if the fault interferes with SMU-RCU communication.

The SMU and RCU communicate through the exchange of system control messages, like maintenance and call processing requests and updates. The exchange occurs in the first channel of DS-1 link 3. This channel is normally the active or primary message channel. The first channel of DS-1 link 4 can be in use for system control messages. The first channel of DS-1 link 3 is the active message channel. The first channel of DS-1 link 4 is inactive. This channel is the secondary message channel.

The following figure illustrates the hardware for the message channel recovery system.

Message channel recovery system



The RCU messaging system consists of two message processor (MP) cards, one card for each DS-1 line that contains a message channel. An MP card is dedicated to one DS-1 line and does not switch to the other DS-1 line.

The RCU CP card stores and removes messages to and from the two MP cards. The CP controls the operation of the two MP cards.

When the active message channel fails, the message channel recovery system switches to the inactive link. This switch to the inactive link makes the link active. The failed message channel becomes inactive.

The SMU initiates the switch from the active link to the inactive link. The RCU scans the two links for incoming SMU messages to follow the SMU switching actions. Normally, the SMU sends messages to the active MP. When the SMU switches from the active to inactive link, the SMU sends a message to the inactive MP. The CP detects this action and uses the new active MP to transmit messages to the SMU.

The message channel recovery system also has the following responsibilities:

- Allows operating company personnel to RTS, ManB, and test a message link.
- Tests the message channel of a DS-1 link that connects to an MP after an MP failure alarm clears that an RCU raised. The MP failures cause messaging on the associated link to be closed.
- Maintains the RCU in an in-service state. The message channel recovery system makes sure that the RCU receives a may-I-send (MIS) or software vintage message each 20 s.

If the RCU fails to receive messages in 20 s, the RCU determines that the SMU fails. The SMU enters the total operation failure (TOF) state. The TOF occurs when messaging fails on the two messaging links. An MP failure, DS-1 link failure, or SMU failure can cause messaging to fail. The system monitors messaging links in TOF to detect recovery of timing and messaging on the message channel. When communication between the RCU and SMU recovers, the RCU enters warm start initialization mode.

Operating company personnel can perform the following operations on a DS-1 line that contains a message channel:

- ManB
- RTS
- TST

Messaging failures and alarms

When a fault occurs on the message path between the SMU and the RCU, the SMU notifies the CM. The SMU notifies the CM through one or two alarms, failure message, or alarms and messages. The CM acts when the CM receives messages. The CM does not act when the CM receives alarms. The system saves alarms for display at the MAP terminal.

Message processor failure alarm The RCU sends this alarm to the SMU when the RCU detects a fault in the message processor card. An alarm display appears at the maintenance card faceplate at the RCU. The alarm also appears at the MAP display. The alarm appears when you enter command QUERYPM with the FLT option from the PM level of the MAP display. Enter the FLT option against a posted RCU. The system generates a PM128 log for a message processor card failure.

Messaging failure alarm The RCU sends this alarm to the CM when the message channel recovery system detects a failure in part of the SMU-RCU message system. If the two messaging links fail or close, the CM sets the RCU system busy. The alarm appears when you enter the QUERYPM command with the option FLT against the posted RCU.

The following list contains parts of the message system that, if defective, cause a messaging failure alarm:

- message processor card
- SMU message card
- SMU DS-1 interface card
- RCU digroup card
- DS-1 link
- defective SMU message system software errors (SWERR)
- DMSX handshaking timeout error or negative acknowledgment

DS-1 failure message The SMU sends this message to the CM when the system detects a fault. The system detects a fault in the DS-1 link between the SMU and RCU. Faults include frame loss, BpV, and slips.

Many message processor, messaging failure alarms, and DS-1 failure messages can occur at the same time. A message failure alarm always accompanies a message processor and DS-1 failures. A message processor and DS-1 failures do not always accompany an alarm. The CM acts as one when the CM receives a DS-1 failure message. The CM busies the DS-1 link.

Example maintenance plans for alarm and message failures

The following is an example of alarm and message failures. The system raises a message processor failure alarm. The system can raise a messaging failure alarm. Operating company personnel can replace the defective message processor card at the RCU. The RCU performs diagnostics to verify the operation of the new message processor. The control processor card performs a loopback test through the message processor and RCU time switch cards. The control processor card performs the test during message processor testing. The control processor card performs this loopback during tests of an active or inactive MP.

If the MP diagnostic passes, the system clears the MP failure alarm. The message channel recovery system tests the message channel on the DS-1 link that connects to that MP. If the test passes, the system clears the message failure alarm. If the test fails, a problem persists. Operating company personnel must isolate the problem.

Message channel recovery system usage notes

Aspects of the RCU message system affect the message channel recovery system. The active and inactive message processor cards can detect internal failures and failures in communication with the SMU. If the active MP detects internal hardware faults or DMSX handshaking errors, the active MP notifies the control processor (CP). The CP makes the inactive MP active and performs a loopback test through the failed MP and time switch cards.

If the test passes, the MP becomes available for messaging again. The MP remains the inactive MP. If the test fails, the system raises an MP failure alarm and displays the alarm at the MAP terminal.

If the inactive MP detects internal hardware faults, the CP performs a loopback test. The CP performs the test through the MP and the time switch card. If the test fails, the system raises an MP failure alarm and displays the alarm at the MAP terminal. If the test passes, the MP becomes available for messaging.

When operating company personnel replace a MP card, the RCU performs diagnostics on the card. If the card passes, the RCU sends a transparent alarm message to the SMU. The SMU receives this message and notifies the message channel recovery system. The message channel recovery system tests the DS-1 line that connects to the MP with a message channel test.

SMU channel reassignment

Peripheral processor (PP) SMU channel reassignment software protects against lost calls when DS-1 links that connect an SMU and associated RCU modules fail. During these failures, channel reassignment software locates traffic that occupies channels. The channels are on the failed link to free channels on functional links. The software locates calls in the talking or ringing state. The system drops calls in other states, like digit collection or dial tone. A subscriber hears audible silence during the time required to locate the call again to a free channel.

Channel reassignment provides advantages because calls on the failed DS-1 link are distributed over several functional DS-1 links. The system can save calls when multiple DS-1 links fail. During heavy traffic, each DS-1 channels can be filled before or during channel reassignment. In this event, the system normally drops calls on the failed link.

Two types of channel reassignment are available, critical and noncritical.

Critical reassignment

In critical channel reassignment, the software must locate each call from the failed DS-1 link again.

The following conditions cause critical reassignment to occur:

- DS-1 framing or signaling is lost. Signaling loss is grouped under DS-1 framing. The SMU and RCU can detect framing and signaling loss.
- DS-1 card is removed at the SMU, or digroup card is removed at the RCU.
- DS-1 link is speech-closed because you enter the BUSY LINK command at the MAP terminal or through system action.
- BpV, slips, or frame loss at the OOS limit occur. The BpV OOS limit for dedicated and nondedicated lines is 1 error in 10^4 bits.

  Note 1: Dedicated calls can be reassigned at the maintenance limit (1 error in 10^6 bits) of BpV.

  Note 2: DS-1 or digroup card removal causes the system to detect frame loss first. Card removal is a part of of frame loss.

When the MP detects these faults, a search begins for free channels on functional DS-1 links. Calls are reassigned from the failed link to current free channels. Calls on the failed link are reassigned in a specified order. The order depends on the type of call. The system can drop calls that wait to be reassigned when each free channels is filled.

Channel reassignment software locates calls again in the following order:

1 Dedicated lines (nailed-up special-service lines)

2 Nondedicated lines in the talking state

3 Nondedicated lines in the ringing state

The system drops calls that are not in the talking or ringing state. The system aborts maintenance, like a line test that uses an allocated channel on the failed DS-1 link. The system assigns a call from a failed link to a free channel on another DS-1 link. If this second link fails, the call is reassigned to a third DS-1 link.

Noncritical reassignment

In noncritical channel reassignment, one or more special-service calls can be reassigned from a DS-1 link to another DS-1 link. The noncritical reassignment process occurs when BpVs reach their maintenance limit on a DS-1 link. The maintenance limit is 1 error in 10^6 bits. The POTS and nondedicated coin lines are not reassigned under noncritical reassignment. These coin lines remain not affected.

If not enough channels are present on functional DS-1 links to accommodate special-service calls, the calls where channels are not available are not reassigned. These calls remain on the current link.

If each DS-1 links reaches the maintenance limit for BpV, the system does not bounce special-service calls to be reassigned, from link to link. The system bounces calls to check for a free channel on a fault-free link. These calls remain on the current link.

Channel blockage during reassignment

If not enough free channels are present on functional DS-1 links to accommodate traffic from one or more failed DS-1 links, the system drops calls. The system drops calls that are not special service calls on the failed link or links. The system drops these calls because the system cannot correctly detect the on-hook, that terminates a call, is not possible. Billing is not always accurate.

For the same reason, the system drops special service calls. Special service calls can bump POTS calls during reassignment. The special-service priority (SSPRI) field in Table RCUINV indicates if POTS calls can be removed. A special-service call from a failed DS-1 link can replace the POTS calls.

If SSPRI is Y, the system drops POTS calls until each special service call from failed DS-1 lines is reassigned. If SSPRI is N, the system drops special service calls that wait to be reassigned, like nailed-up special service calls. The default setting for SSPRI is N.

RCU control processor (CP) switchover during reassignment

The RCU CP switchover is the switch of activity from the active CP of an RCU to the backup CP. The CP switchover does not affect A-bit and B-bit signaling or the RCU time switch card. The system maintains calls in the talking, ringing, and digit collection states during a CP switchover.

The RCU cannot perform channel reassignment during a CP switchover. The RCU cannot receive messages from the SMU during the approximately 30 s that a CP switchover lasts.

The following actions do not cause CP switchover. These actions affect channel reassignment in the same way as a CP switchover.

- Enter the PMRESET command at the MAP terminal. This action causes an RCU system reset. The RTS command also causes a reset.

- Loss of messaging between the RCU and SMU occurs. A maximum of 20 s can lapse before an RCU enters TOF. If the RCU and SMU regains the messaging in less than 20 s, the RCU does not enter TOF.

Channel reassignment and CP switchover can occur at the same time under two conditions:

- A DS-1 link fails when CP switchover is in progress.
- A CP switchover occurs when channel reassignment is in progress.

The system drops the calls on the failed link when:

- a DS-1 link fails when the RCU has a CP switchover
- the RCU enters CP switchover when reassignment is in progress

Nailed-up special-service calls on the failed DS-1 link are reassigned on a different DS-1 link after the CP switchover completes.

The system drops calls for other types of lines. These calls are not reassigned because the system cannot detect on-hooks on failed DS-1 links. This action can cause billing records that are not accurate. The RCU cannot perform channel reassignment during a CP switchover. During the 15 or 20 s required for switchover, most subscribers go on-hook.

Busying a link and channel reassignment

If the system busies a DS-1 link and you busy the link through the BSY LINK command at the PM level, channel reassignment occurs. If the RCU to which the DS-1 link connects becomes busy or goes offline, the system drops the calls on the link. These calls include nailed-up special service connections. If the RCU is not busy, calls are reassigned normally.

Reconfiguring DS-1 links on an in-service ESMU

Feature AF4252, ESMU ISDN SPECCONN Link Reconfiguration, allows operating company personnel to reconfigure C-side links. The links are reconfigured of an ESMU-RCU subsystem from one ESMU to another subsystem. Operating company personnel perform this action when the ESMU remains in-service. Operating company personnel change the CSPMNO field in Table RCUINV to reconfigure the RCUs C-side links. The links states of the RCU that are reconfigured must be ManB. The following limits apply:

- A link reconfiguration must guarantee SMU C-side capacity for current SPECCONN and call processing requirements.

- If a C-side node of an RCU returns to service during reconfiguration, a static data mismatch can occur between the CM and the ESMU. The ESMU must go to an ISTb state with the reason `static data mismatch`. The ESMU must be removed. The ESMU performs an RTS after reconfiguration is complete.
- Reconfiguration cannot occur if 2-wire or 4-wire special connections are present or logical terminal identifiers (LTID) are provisioned.
- The system supports reconfiguration of an RCU from and to ISDN ESMUs.
- Locate the current connections again in the new configuration. If the connections are not located, the system rejects the table change. The operating company personnel must determine the connections to delete with current tools. The personnel must also increase the number of C-side links that the personnel enter.

Line maintenance

Line maintenance for the RCU consists of the following areas:

- commands entered from the line test position (LTP) and automatic line test (ALT) levels of the MAP terminal
- the line diagnostic that a system diagnostic scheduler initiates, a DMS-100 software process, when a call fails twice
- subscriber station tests
- line tests that the system performs through a mechanized loop tester (MLT) or test desk facility, like a local test cabinet (LTC) or Centralized Automated Loop Reporting System (CALRS)
- line and line card tests that the system performs from the RCU maintenance card faceplate
- line tests by the remote line test processor (RLTP) card

The system or you can test line circuits, subscriber loops, and stations under the lines maintenance (LNS) subsystem.

Line tests help determine if a line circuit, loop, station, or line circuit and loop group function correctly. If the line is defective, line tests determine if the fault is with the line circuit or the attached loop. When a fault is in the loop, the loop is moved to another department, like plant maintenance. When the fault is in the line circuit, replace the line card. A test occurs on the line again to verify that the fault clears.

Line maintenance occurs under the following conditions:

- Enter a command from the LTP, LTPMAN, LTPLTA, LTPDATA, or LTPISDN level of the MAP terminal.

- Tests are scheduled from the ALT level of the MAP terminal.
- Digit reception is defective and causes the DMS system for foreign potential to test a line.
- A call fails twice and places the call in the shower queue for full diagnostic testing.
- Initiate tests from the subscriber telephone set.
- Initiate tests from the RCU maintenance card.
- Initiate tests from a test desk.
- The RCU initiates local tests through an audit or through AST.
- A clock on the RLTP card initiates RLTP line tests; the system can download detected defective lines from the on-board modem to a connected user.

Manual line tests

The switch operator performs manual line tests on line circuits, loops, and stations. The switch operator tests line circuits and loops separately. The results appear to the switch operator at a MAP terminal after the tests complete.

Test lines manually as part of routine maintenance. Test lines manually also when the system generates a customer report or automatic line test (ALT) failure occurs.

You can use one of the four levels of the line maintenance (LNS) subsystem to perform manual line tests at the LTP level: LTPMAN (LTP manual), LTPLTA (LTP line test access), LTPDATA, and LTPISDN.

A manual line test at the ALT level defines one set of lines that you must test immediately. At the other three levels, you place the line to be acted on in the control position to perform manual tests. The switch operator can control and manipulate this line. The switch operator must post the line and place the line in the control position.

Automatic line tests

The system performs automatic line tests on line circuits and loops at normal intervals. These tests include schedule creation and inspection of logs. The system performs automatic line tests in a DMS-100 office under the LNS subsystem. This subsystem includes tests of the line circuits and the attached loops.

Lines that do not meet specified standards of quality are identified to the switch operator. The system posts the failures at the LTP or the ALT log subsystem can generate output reports to identify the lines. Refer to *Input/Output System Reference Manual*. Test and correct the failures.

Posting ISDN lines with the POST DK command

The POST DK command can activate the following POST command parameters if the customer purchases the SOC NI000050 2B-FIT/NIT feature:

POST DK dn_number [<key#>| 'all']

The POST DK command displays a DN appearance on the specified key on an ISDN terminal. The following figure describes this appearance. If the DN appearance is active, the key number of the DN appearance, the bearer ability of the call and the far-end information appear.

LTP MAP level display with a posted ISDN line with key number and bearer capability

```
  CM    MS    IOD    Net    PM    CCS    Lns     Trks    Ext   Appl
   .     .     .      .   4 SysB   .      .       .       .      .
                              M
LTP
0  Quit     POST  95    DELQ            BUSYQ           PREFIX
2  Post_
3           LCC PTY RNG ....LEN....       DN    STA F S LTA TE Result
4           ISDN LOOP   HOST 02 1 08 02 6215986 CPB       613 6215982
5  Bsy                                    33 SP
6  RTS
7  Diag                                          Bearer ability
8
9  AlmStat                                Key number
10 CktLoc
11 Hold
12 Next
13
14
15
16 Prefix
17 LCO_
18 Level_
   userid
TIME  hh : mm>
```

After the POST DK command posts the ISDN line, the line below the control position displays the key number and bearer ability. In the earlier example, the CPE has DN 621-5986 assigned to key 33, and has a speech call active. The possible bearer abilities appear in the following table:

Bearer capability display codes

Bearer capability	Display
Speech	SP
3.1 kHz audio	3AU
Circuit mode data, rate adapts to 56 kHz	56C
Circuit mode data 64 kHz	64C
Packet data	PMD

The DN state is checked when one second passes and the system updates the display.

Responses to LTP level commands

The following table lists responses to commands that you initiate at the LTP level.

Responses to LTP level command

POST		
Response	**What the response means**	**What to do**
`Option NI000050 is not enabled`	You attempt to use the POST DK command and cannot enable software optionality control (SOC) option NI000050.	Use a different POST command to post the DN.
`The DN is not an ISDN DN Posted circuits unchanged`	The POST DK command is issued on a non-ISDN line. This command is valid for ISDN lines.	Enter the command again on an ISDN line, or use a different POST command.
The system displays `NO EQUIPMENT` in the LEN field and `NEQ` in the status field as a response.	The posted DN is assigned to an LTID. This LTID is not mapped to a LEN in Table LTMAP.	Map the LTID to a LEN with the SLT ATT command before you post the DN.

—continued—

Responses to LTP level command (continued)

POST		
Response	**What the response means**	**What to do**
`Incorrect DN Appearance.`	The specified DN does not appear on the specified Key.	Enter the POST DK command again with the correct key, or use the ALL option to list the keys for the DN.
`ACO/AFC DN:The key number shown may be different than the actual key in use`	You post a DN Appearance with provisioned AFC or ACO. The DN Appearance is a member of a group of Appearances for the DN. The key numbers used for these DNs are not the same as the keys on the ISDN set. The Q.931 message protocol causes this difference. This protocol first refers to the DN and does not involve a reference to the key number in use. The user or the ISDN set determine the key to use for a call. The CM or XPM do not receive this information.	Information only.
	—end—	

Station tests

Station tests occurs under the LNS subsystem at a MAP terminal. Station tests can also occur with the silent switchman (SSMAN), station ringer, and dialable short circuit tests from a station. Test the stations.

The SSMAN cuts off the subscriber loop from the line card. The line card becomes free of connections. This action involves a bypass in or out configuration. Operating company personnel can test the subscriber set and loop and not affect other parts of the system. Refer to page 1-124 for additional information on bypass tests.

The following are two station tests:

- The *station ringer test* checks the digits that a station sends with the digits that the DMS switch receives.

- The *dialable short circuit test* checks the continuity path from the subscriber station through the metallic test access (MTA).

The system returns these results from the two station tests to the station. Station tests help determine if a station functions correctly.

The following three sections describe the types of line maintenance that test RCU lines and the configurations that support the related tests. The RCU line maintenance consists of the following three areas:

- local
- jack access
- remote

Local tests

Local tests consist of voice frequency and supervisory signaling tests that the system performs on line cards. Use L-mode to initiate local tests from the RCU maintenance card faceplate. The RCU can initiate local tests after the replacement of a defective card with a new card, or during automatic system tests.

Note: Manual local tests remove active calls.

Jack access setup

Jack access provides the ability to connect external test equipment at the RCU maintenance card faceplate to line circuits or subscriber loops. The RCU must send the SMU a message to request permission to arrange jack access. The SMU can return a message to give permission. The SMU, on CM instruction, can abort jack access.

Use J mode to activate jack access at the faceplate of the maintenance card.

The following figure describes the following jack access:

- to test subscriber loops for short or open circuit conditions and ac/dc voltage. Test equipment is plugged in the LOOP jack.
- to determine the condition, idle or busy, of a subscriber line. Monitoring equipment is plugged in the LOOP jack. This equipment determines if a subscriber line is busy or idle.
- to test line cards. Test equipment, like a transmission test set, is plugged in the EQPT jack to test the line card.

The DMS-100 switch gives permission to run local tests and set up jack access, even if a loop is call processing busy. If CM-initiated tests continue, the DMS-100 switch does not give permission to run local tests and arrange jack access. Operating company personnel at the RCU know the line status.

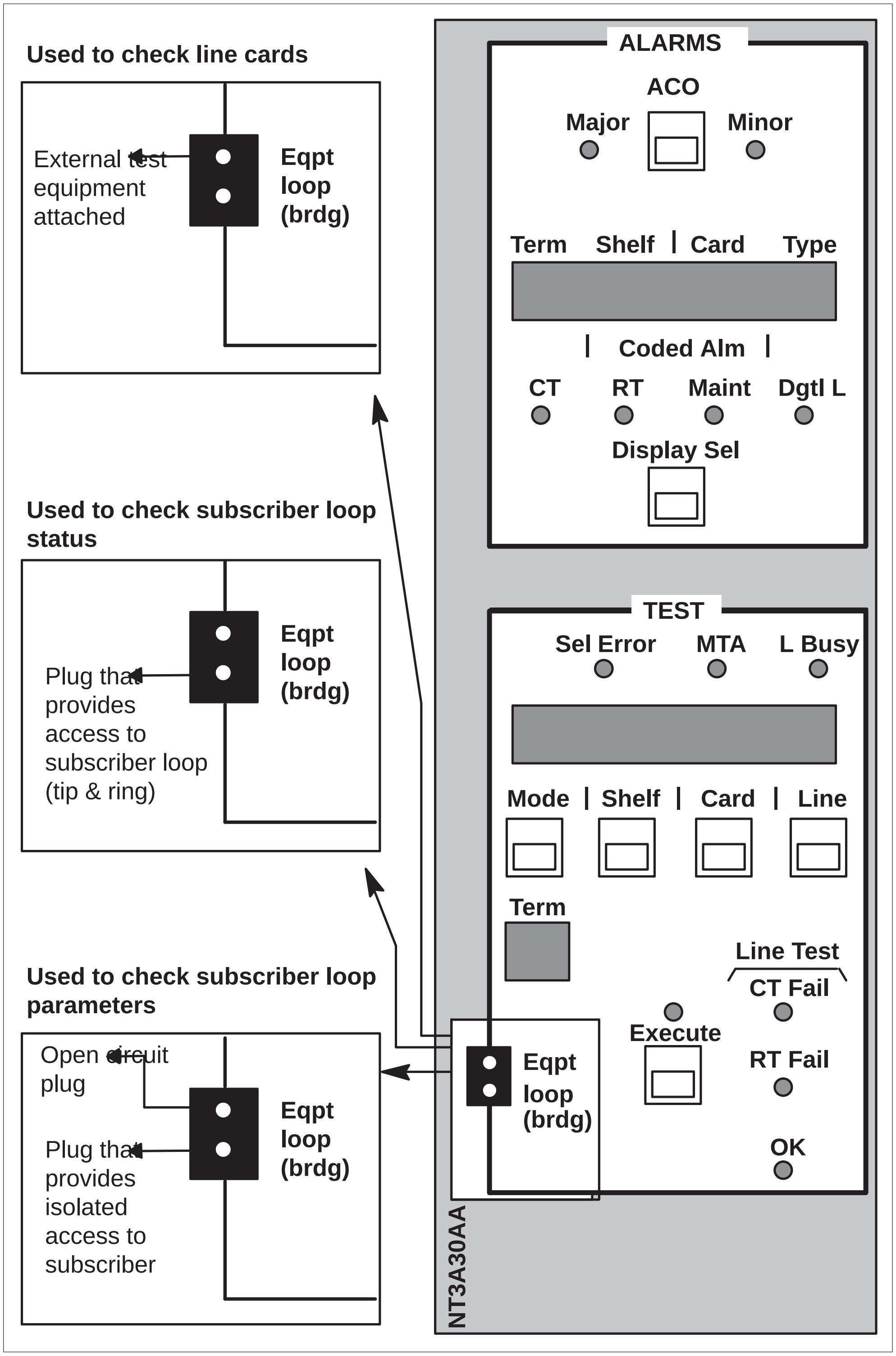
When you enter an L-mode command for a line, the L BUSY LED lights up if the line is call processing busy (CPB). This action occurs before operating company personnel request a local test or jack access setup.

When you enter the following command at the MAP terminal, the system aborts local and jack access tests:

>FORCRLS

One type of test, local, jack access, or remote, can be active at a time on an RCU. One line card and subscriber loop can be tested at a time. The system can perform multiple tests. Multiple tests are when more than one RCU module connects to an SMU, one for each RCU module that connects to the SMU.

Jack access to check subscriber loop parameters



Remote tests

The system performs RCU remote maintenance from the central office. The following paragraphs describe the required types of remote tests and the test configurations.

Single-end test Single-end tests check the operation of RCU line cards. The RCU or the CM initiates single-end and local tests. The RCU calls the single-end test the local test even though the single-end tests and local tests check the same items.

A single-end test is equivalent to the DMS-100 short diagnostic test that you issue from the MAP terminal. The extended diagnostic uses single-end tests when the LTA card is not present. The diagnostic uses the tests also when the line is a foreign exchange with battery office-end (FXBO) line. External test equipment is not used for single-end tests.

When the RCU initiates single-end tests, the tests proceed separately in the RCU. The CM and the SMU cannot supervise these tests. If the RCU initiates a local test, the RCU must send a message to the SMU to request permission to run the tests. The SMU sends the RCU an positive message to give permission. If the SMU does not reply, the test cannot continue. The SMU also can request the RCU to abort a single-end or local test in progress. The RCU can abort a test that the RCU initiates. The RCU cannot abort a single-end test the CM initiates. The RCU uses the RCU maintenance card for the tests. When the RCU completes single-end tests, the RCU returns the results to the SMU. The SMU reports the results to the CM.

Single-end tests are a group of tests. The group depends on the type of line card involved. The system performs the tests as a group. The system does not distinguish test failures.

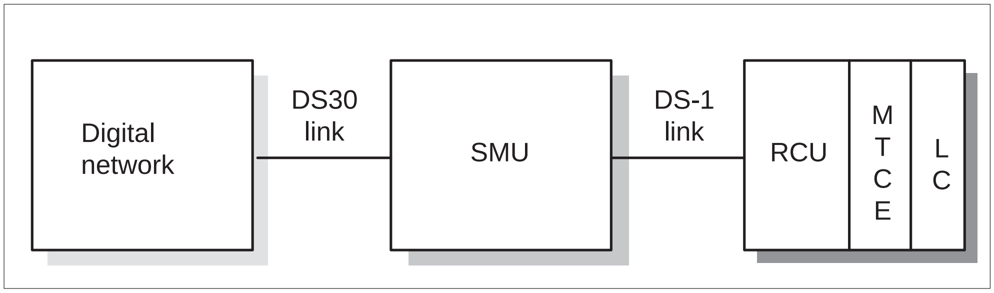
Operating company personnel use the following MAP levels and commands to run single-end tests:

- LTP level
  - — DIAG (single-end tests if LTA card is not available or line is FXBO)
- ALT level
  - — DIAG (single-end tests if LTA card is not available or line is FXBO)
  - — SDIAG

Opemode.

The test equipment configuration for single-end tests appear in the following figure. The maintenance card performs the tests in the RCU. The RCU reports the test results to the SMU.

Single-end test configuration



The groups of tests for the different types of DMS-100 line cards appear in the following table.

Single–end test abilities

Test	POTS	FSR	FXS FXO	MPDR	Coin	MBS
Voice frequency (VF)	X	X	X	X	X	X
Idle	X	X		X	X	
Off-hook	X				X	
Ringing and ring trip	X	X				
Off-hook (ring side party)		X		X		
Off-hook (tip side party)		X		X		
Ground idle			X			
Loop idle			X			
Ringing			X			
Loop talk			X			
Ground station ring			X			
Ringing (ring side) and ring trip				X		
Ringing (tip side) and ring trip				X		
Reverse battery					X	

—continued—

Single–end test abilities (continued)

Test	POTS	FSR	FXS FXO	MPDR	Coin	MBS
Coin return					X	
Blown fuse detection test						X
—end—						

The single-end voice frequency (VF) loopback test that occurs on MBS line cards opens tip and ring and establishes two local link connections. One connection routes a 1020 Hz tone to the MBS line card. The other connection routes the returned tone to PCM sample memory. The system calculates a signal level from the collection of PCM samples. If the measured level falls in the allowed limits, this test passes. If the measured level falls out of the allowed limits, this tests fails.

End-to-end tests End-to-end tests check signaling and transmission parameters. These tests simulate link pair gain test controller (PGTC) tests. AT&T Technologies, Inc. manufactures the PGTC. The transmission tests check the integrity of the communication path from the SMU to the RCU and back to the SMU. The tests verify that the speech path is good with line and line card parameters, like loss, in acceptable limits.

The signaling tests check to make sure the RCU line card can respond correctly to SMU A-bit and B-bit signals. The tests check that the RCU line card can request simulation of system services, like on-hook and off-hook. In response to the SMU signals, the RCU LTA card applies specified terminations to the RCU line card. These terminations simulate specified conditions, like off-hook, on-hook, or ringing. If the RCU detects the simulated condition, the RCU returns appropriate A-bit and B-bit signals to the SMU. The signals are sent to the SMU to indicate that the simulated condition is present.

End-to-end tests are more accurate than single-end tests. End-to-end tests exercise many elements of the communication path and tests the integrity of services that the DMS-100 switch supports.

Issue the DIAG command from the MAP terminal to initiate end-to-end tests. The following table lists the three remote tests, where you initiate the test, and if the tests are manual or automatic.

How remote tests are initiated

Type of test	Method	How to initiate
Local	Manual	Mode L from the RCU maintenance card (manual line test)
	Automatic	RCU audit
		Automatic system test
Single-end	Manual	>DIAG at ALT level (LTA card or line is not FXBO)
	Automatic	>SDIAG at ALT level
		Mechanized loop tester at remote service office (LTA card or line is not FXBO)
		DMS detects call that fail twice (LTA card or line is not FXBO)
End-to-end	Manual	>DIAG at LTP level (LTA card and line is not FXBO)
	Automatic	>DIAG at ALT level (LTA card and line is not FXBO)
		Mechanized loop tester at remote service office (LTA card and line is not FXBO)
		DMS detects call that fails twice (LTA card and line is not FXBO)

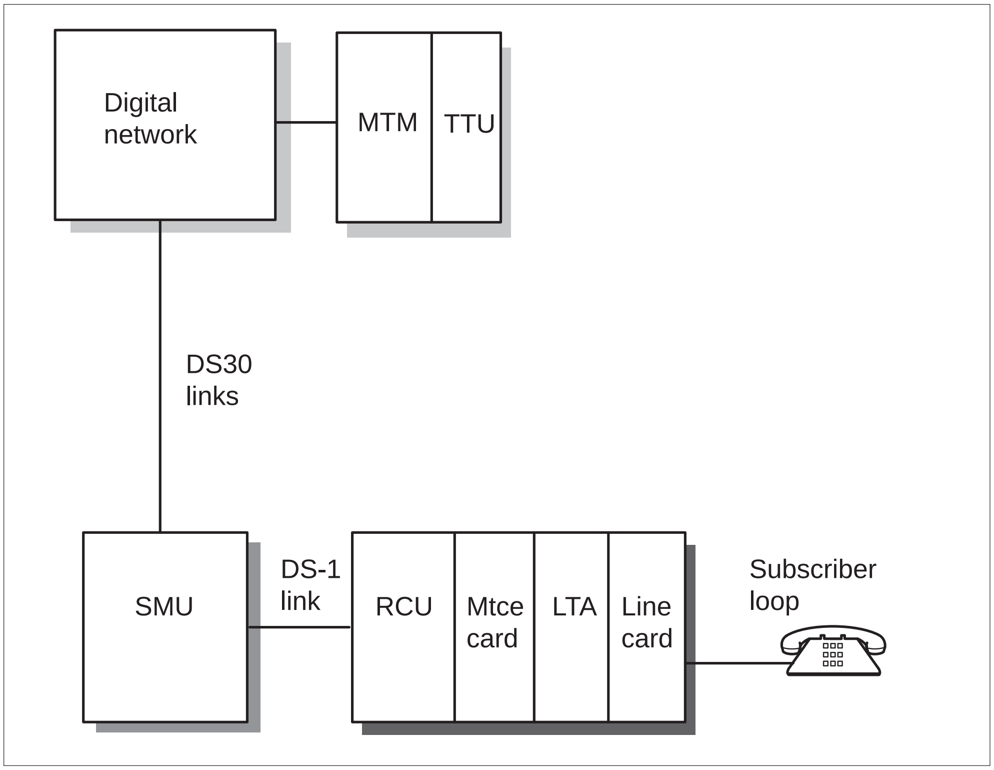
Note: End-to-end tests require the installation of the LTA card in the RCU. This card must connect to the line on which tests must run. Before tests are run, the SMU must signal the RCU to connect the LTA to a line card. A DS-1 channel must be present between the SMU and the RCU.

The following usage notes apply:

- If digit reception for a line is defective, the system tests the line for foreign potential.
- The MLT requires an LTA card. Line cards can be tested from the MAP terminal and do not require an LTA card. More intricate diagnostics are run when an LTA card is present.

The test equipment configuration for end-to-end tests appear in the following figure.

End-to-end test configuration



The end-to-end test configuration is like the single-end test configuration. The end-to-end is like single-end with the addition of the LTA card in the RCU and the transmission test unit (TTU). The LTA card applies different completions to the line card, and simulates conditions like off-hook, ringing, and call processing functions. The TTU is for transmission tests. The TTU verifies that these terminations are applied correctly. A connection through the digital network links the TTU and RCU. The extended diagnostic that you issue at the MAP terminal uses this configuration.

The following table describes these tests according to line type.

RCU end-to-end test capabilities

Test	POTS	FSR	FXS	MPDR	Coin	MBS
Off-hook detection	X	X	X	X	X	
Single party ringing	X	X	X	X	X	
Idle channel noise	X	X	X	X	X	
Echo return loss	X	X	X	X	X	
Carrier channel loss	X	X	X	X	X	
Remove RCU test termination (on-hook detection)	X	X	X	X	X	
Apply ringing on tip				X		
Detect and reproduce ANI ground				X		
Positive coin control voltage					X	
Negative coin control voltage					X	
Positive coin control ground					X	
Negative coin control ground					X	
Reverse battery					X	
Voice frequency						X

End-to-end tests are a group of tests. The group depends on the type of line. These tests occur separately. These tests require the installation of an LTA card in the RCU. These tests also require the LTA field in Table RCUINV set to Y.

For end-to-end tests, the LTA card applies the following four terminations at the RCU:

- Absorb: A 900 Ω resistor connects between the tip and ring of the line card circuit. This completion causes the system to absorb an incoming signal.
- Reflect: A loop connects between the tip and ring of the line card circuit. The tip and ring are shorted together. This termination causes the system to reflect an incoming signal.

- Absorb-positive tip party ground (PTPG): This termination is the same as the absorb termination, except that a PTPG is available. The PTPG is a dc path to ground that the system detects if the RCU provides a positive dc voltage to the tip or ring.
- Reflect-negative tip party ground (NTPG): This termination is the same as the reflect termination, except that a NTPG is available. The NTPG is a dc path to ground that the system detects if the RCU provides a negative dc voltage to the tip or ring.

To remove a termination, the SMU sends a message to the RCU that causes the removal of the termination.

End-to-end tests for MBS lines consist of a VF test that you can initiate from the MAP terminal. Initiate the test if the RCU has a LTA card. The CP card connects the MBS receive signal to the MBS transmit signal. The card connects the signals through the LTA card to set up a loopback. This loopback allows the DMS-100 switch to evaluate the quality of the test tone. The test tone originates at the DMS-100 switch, passes through the RCU MBS line card, and terminates at the DMS-100 switch. Because of D-channel signaling, MBS end-to-end signaling tests are transparent to the control processor card software.

Extended diagnostics for end-to-end tests For end-to-end tests, a communication path is arranged between a TTU and the line under test. This path requires a DS-1 channel. The following lists describe tests of the extended diagnostic. The lists describe the tests according to the types of lines. The tests run in the order that appears in the list.

For POTS and FSR lines, the following sequence of tests run:

1. Off-hook: This test checks the ability of the RCU line card to detect an off-hook. The CM requests the SMU to arrange the LTA at the RCU. When this test runs, the LTA applies an absorb-PTPG termination to the RCU line card. This action simulates a subscriber off-hook. If the RCU correctly detects the off-hook, the RCU sends an off-hook message. The RCU also sends an off-hook A-bit and B-bit pattern.
2. Echo return loss: This test is the same as the flux cancellation test that occurs on line module lines. This test checks the flux cancellation circuits of a line card. The TTU and an absorb-PTPG termination are in use.
3. On-hook: The SMU sends the RCU a message to remove the LTA termination to remove the absorb-PTPG termination. The RCU must detect removal of the termination as a simulated on-hook. The RCU must send the SMU the on-hook message. The RCU must also send the A-bit and B-bit pattern that associates with on-hook subscriber lines.

4 Single-party ringing: The SMU sends the RCU the A-bit and B-bit pattern for ringing. When the RCU receives this pattern, the RCU connects a reflect termination to the line card. This termination simulates a subscriber answer. The RCU sends an off-hook message and off-hook A-bit and B-bit pattern to the SMU.

5 Carrier channel loss: The test checks the PCM and analog path on a line card circuit. A TTU sends four ac signals to a line card. The line card has a connected reflect termination. The system reflects these signals to the TTU. The DMS-100 switch analyzes these signals.

6 Idle channel noise: The TTU and a reflect termination are in use.

The test sequence for POTS and FSR lines is in use for multiparty divided ringing lines with the following addition:

- Tip ringing and automatic number identification (ANI) ground. The RCU removes the connected test termination when the SMU sends the RCU a remove termination message. When the SMU sends an A-bit and B-bit pattern to ring the tip party, the RCU connects a reflect-NTPG termination. The RCU connects the termination to the line card. This termination simulates a subscriber answer. The RCU sends the SMU an off-hook message and tip party off-hook A- and B-bit pattern.

  The system performs a carrier channel loss test next. This test repeats at this point to make sure the reflect-NTPG termination is complete.

Coin lines follow the same test sequence for POTS, FSR, and foreign exchange with battery station-end (FXBS) lines, with the following additions:

1 Coin collect: This test checks the ability of the line card

— to simulate off-hook with coin present

— to detect the termination that simulates off-hook and coin presence

— to return an A-bit and B-bit signaling pattern to the SMU to indicate off-hook and coin collect.

The SMU sends a coin function A-bit and B-bit pattern and coin collect code. The SMU sends the code in the appropriate DS-1 channel, to the RCU. The RCU connects an absorb-PTPG termination to the line card. This termination simulates an off-hook condition with coin present. The RCU sends the off-hook and coin ground A-bit and B-bit pattern to the SMU. This action indicates off-hook with coin present.

2 Off-hook: The SMU sends an idle A-bit and B-bit pattern to the RCU. The RCU the off-hook and coin ground A-bit and B-bit pattern to the RCU to respond.

3 Positive coin presence: this test checks the ability of the line card

- — to simulate off-hook with coin present
- — to detect the termination that simulates off-hook and coin presence
- — to return the A-bit and B-bit pattern to the SMU that indicates off-hook and coin presence

The SMU sends the coin function A-bit and B-bit pattern and coin presence code to the RCU. The RCU responds with the coin ground A-bit and B-bit pattern.

The echo return loss test repeats at this point to make sure the absorb-PTPG termination is complete.

4 Reverse battery: The SMU sends the RCU the reverse battery A-bit and B-bit pattern and reverse battery coin control code. The RCU reverses polarity on the tip and ring at the line card to respond to the pattern and code.

The SMU sends the idle A-bit and B-bit pattern to the RCU. The RCU responds with the off-hook simulation. The RCU also responds with the A-bit and B-bit pattern to ring the tip side of a multiparty line to the RCU. When the RCU receives this signal, the RCU connects a reflect-NTPG termination to the line card. This termination simulates an off-hook (answer). If the RCU detects this simulation, the RCU returns an off-hook message. The RCU also returns a tip party off-hook A-bit and B-bit pattern to the SMU.

5 Negative coin control voltage and ground:this test checks the ability of the line card

- — to simulate off-hook and coin presence
- — to detect the termination that simulates off-hook or coin presence
- — to return an A-bit and B-bit signaling pattern to the SMU that indicates off-hook, coin return, or coin presence

The SMU sends an A-bit and B-bit coin function pattern and coin control code for coin return. The pattern and code are sent in the appropriate DS-1 channel to the RCU. The RCU sets up a reflect-NTPG termination, which simulates off-hook and coin present. The RCU sets up the termination as a response to the pattern and code. The RCU detects this condition and return a coin ground A-bit and B-bit pattern to the SMU. Following additional SMU signals, the RCU returns off-hook and coin present A-bit and B-bit patterns.

6 Reverse battery: The SMU sends the RCU the A-bit and B-bit pattern that associates with reverse battery and a coin control code in the appropriate DS-1 channel. The RCU reverses polarity on the tip and ring leads. The SMU sends an idle A-bit and B-bit pattern to the RCU. The RCU responds with an off-hook message and A-bit and B-bit pattern.

   The CM performs the carrier channel loss test at this point. Because a diode is present between tip and ring, the resistance changes from a reflect termination to infinite. The reverse battery test can pass or fail.

7 Coin return: The SMU sends the RCU an on-hook A-bit and B-bit pattern. The RCU removes the termination present, to simulate on-hook. The SMU sends the coin function A-bit and B-bit pattern and coin return code to the RCU. The SMU sends the pattern and code in the appropriate DS-1 channel. The RCU connects a reflect-NTPG termination to the line card. This termination simulates an off-hook with coin present. The RCU sends the coin ground A-bit and B-bit pattern to the SMU.

8 Off-hook: The SMU sends the idle A-bit and B-bit pattern to the RCU. The RCU replies with the off-hook and coin ground A-bit and B-bit pattern to the SMU.

9 Negative coin presence: The SMU sends the coin function A-bit and B-bit pattern and negative coin presence code to the RCU. The RCU responds with the coin ground A-bit and B-bit pattern.

   The CM performs the carrier channel loss test to make sure that the reflect-NTPG termination remains complete.

Bypass (metallic test) The SMU supports single-end and end-to-end tests on RCU line cards. The SMU handles requests from the CM to connect a dedicated metallic test pair as a bypass to an RCU line card. The SMU can connect a pair also out to a subscriber loop.

A bypass that connects to a line card allows the CM to perform dial tone, dial pulse, ringing, and on-hook/off-hook tests. A bypass that connects out to a subscriber loop allows the CM to make ac, dc, capacitance, and resistance measurements.

The figure on page 1-126 describes the basic bypass configuration.

The RCU metallic test access relays can be in three states: normal, inward, or outward. The following table displays the relation of these states to the separate relay contacts.

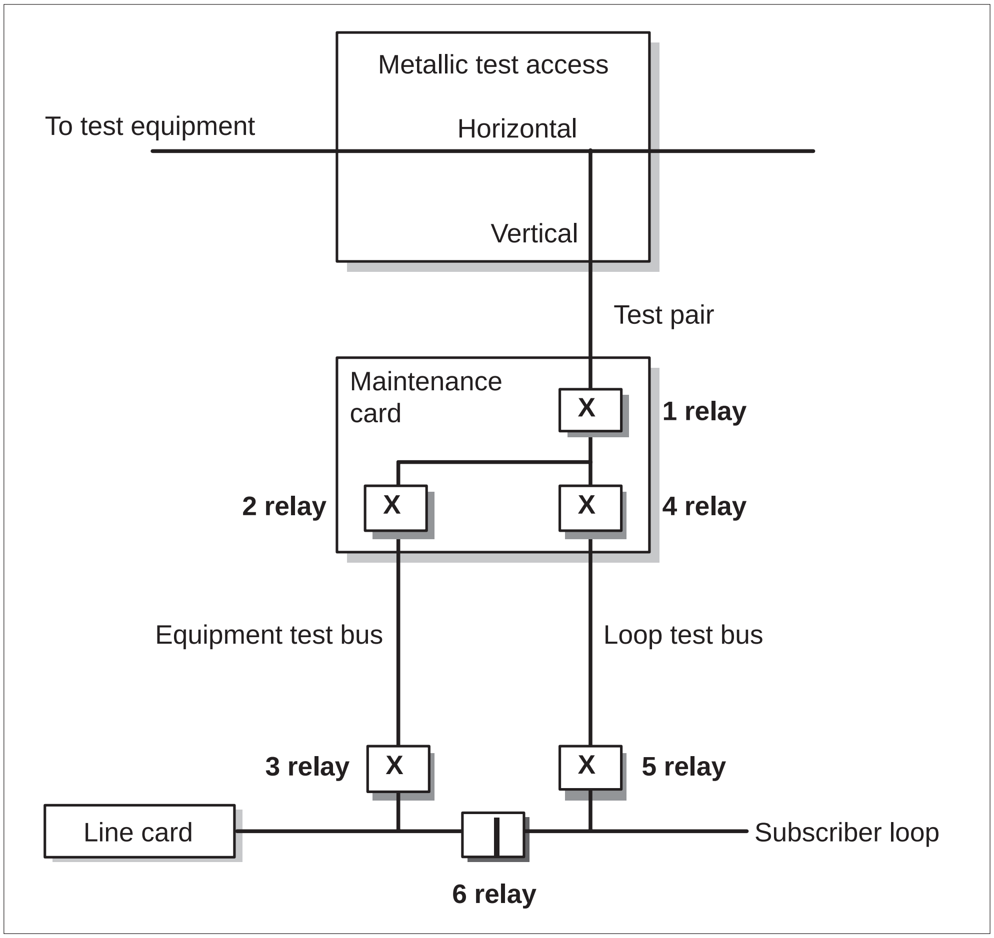
Metallic test access relay states

Relay contact number	Normal state	Inward state	Outward state
1	Open	Closed	Closed
2	Open	Closed	Open
3	Open	Closed	Open
4	Open	Open	Closed
5	Open	Open	Closed
6	Closed	Open	Open

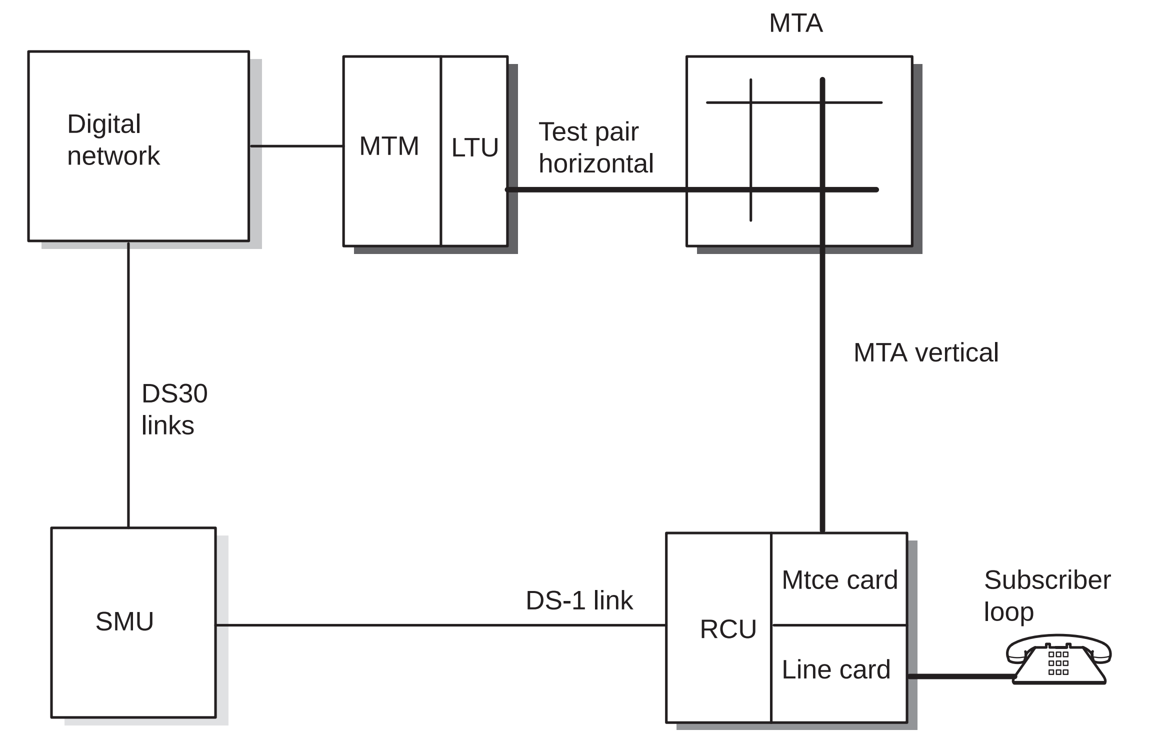
Two modes of bypass operation are available:

- *In* to the line card. In this mode, on-hook, off-hook, ringing, ring trip, and dial pulse tests can occur. Refer to the figure on page 1-127 for a display of the bypass in test configuration.
- *Out* to the subscriber loop. In this mode, ac, dc, resistance, and capacitance tests can occur. Refer to the figure on page 2–62 for a display of the bypass out test configuration.

Bypass test configuration



Bypass in test configuration

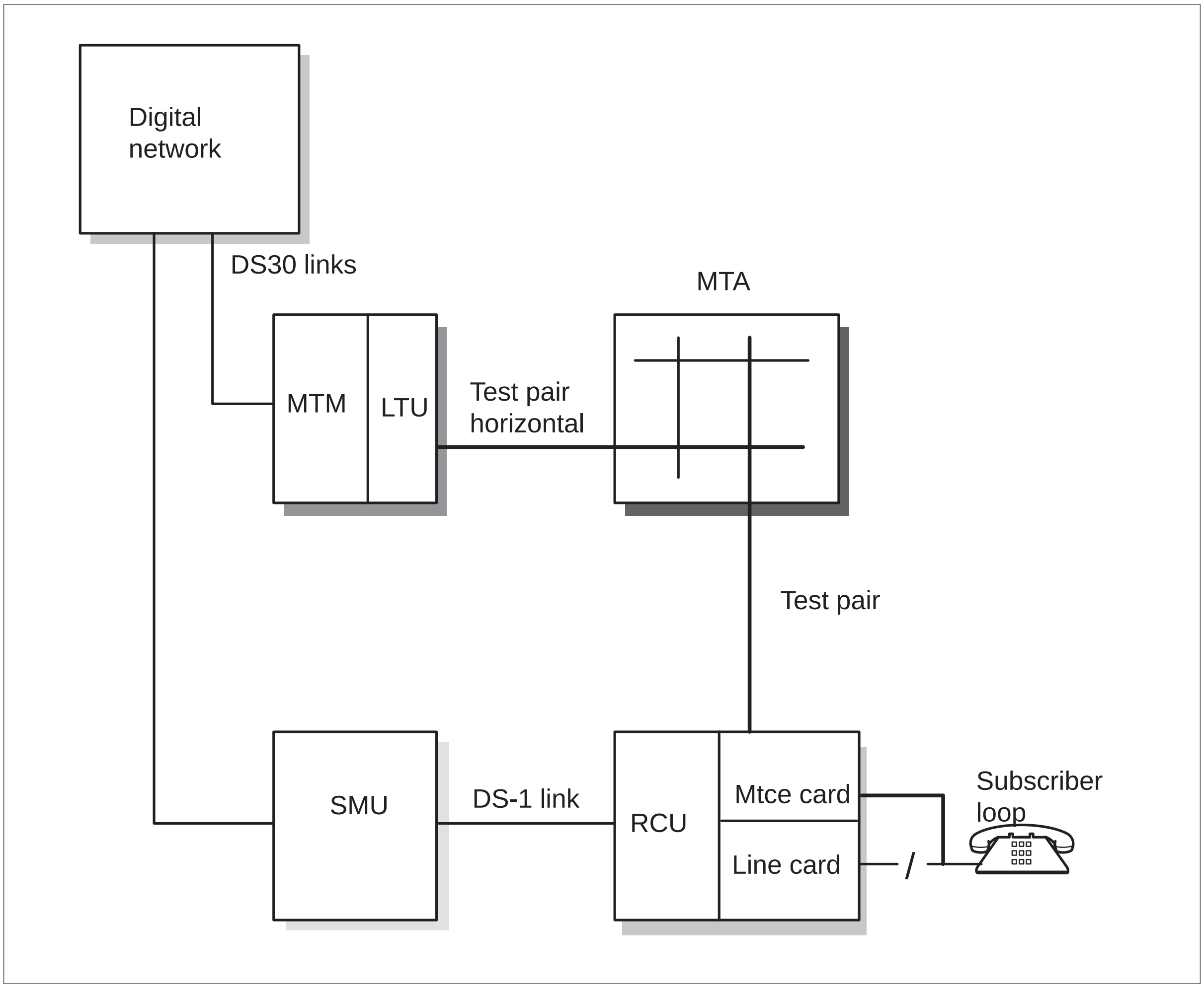


Note 1: A minibar driver card (NT3X09AA) contains the driver and the switch relays.
Note 2: The metallic test access network also can consist of minibar switches (NT2X46AA) and a minibar driver card (NT2X50AB).

Bypass, like other test configurations that use an MTA, requires that three tables, MTAMDRVE, MTAHORIZ, and MTAVERT, receive data.

The bypass in configuration establishes a connection between the line test unit (LTU) and the RCU line card. The bypass establishes the connection during the TSTRING test at the LTP level. The subscriber loop is severed from the line card in this configuration.

Bypass out test configuration



Enter the test pair connection between LTU and the MTA in Table MTAHORIZ. Enter the connection between MTA and the RCU in Table MTAVERT.

A minibar driver associates with the minibar switch in Table MTAMDRVE during installation.

The out configuration establishes a connection between the LTU and the subscriber loop. The connection is like the LTU bypass in test configuration. The connection is the same except the metallic test pair connects out to the subscriber loop and not in to the line card. The loop is cut off from the line card.

The LNTST, VDC, VAC, RES, and CAP tests at the LTPLTA level use the LTU bypass out test configuration. The LIT test at the ALT level uses the LTU bypass out test configuration.

The test pair connection between LTU and the MTA receive data in Table MTAHORIZ. Enter the connection between MTA and RCU in Table MTAVERT.

RLTP tests The remote line test processor (RLTP) is a card (NT4A16AA) that occupies slots 9 and 10 of the RCU power shelf. The RLTP provides an on-board test head, processor, and modem. The RLTP performs automatic tests of subscriber lines for each period, normally during off-peak hours. The RLTP stores information about the defective lines that the system detects. The on-board modem provides a remote interface to a computer. This remote interface allows test results and control information to exchange between the RLTP and the subscriber that connects to a modem. The advantage of the RLTP is that a test pair is *not* required for subscriber loop tests.

Provisioning the RLTP in the RCU requires data datafill changes to Table RCUINV. The new field RLTP is added with a default value of N. This value must be Y if the RLTP card is provisioned in the RCU.

The LTA card cannot be provisioned in the RCU when the RLTP card is provisioned. This action cannot occur because the RLTP occupies slots 9 and 10 of the RCU power shelf. The RLTP card provides LTA functionality and supports the tests that associate with the LTA card.

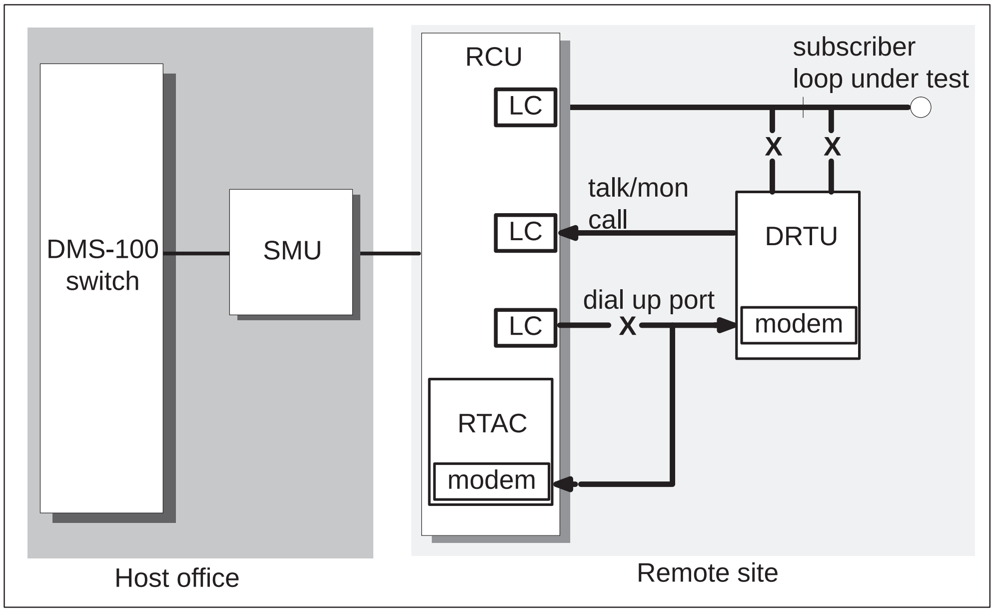
Note 1: Fields LTA and RTAC in Table RCUINV must be N if the RLTP field is Y.

Note 2: The RCU must define a DN in the RCU for the RLTP modem to provide user dial-up access.

DRTU tests The NT #3704 digital remote test unit (DRTU) at the RCU eliminates the requirement for the metallic bypass test pair normally used in subscriber loop tests. This line test configuration appears in the following figure. The NT4A16BA remote test access card (RTAC) in the RCU is required to support MAP terminal supported DRTU tests. The system suppports the line test commands at the LNS level and associated sublevels.

The DRTU test configuration cannot be present with the current bypass test configuration. This action cannot be present because the DRTU shorts the IN and OUT busses in idle. Operating company personnel must select bypass or DRTU for line tests. Operating company personnel set field DRTUTEST in Table RCUINV to N for bypass or Y for DRTU tests.

DRTU line test configuration



The following limits apply to DRTU tests:

- For MONLTA, a cutover that does not hit is not possible because of the current line card carrier design. A click is audible. The hit lasts milliseconds. The hit does not drop the call.
- The system does not support the special services module (SSM).
- New local RCU/DRTU maintenance faceplate commands are not provided. The system supports new DRTU tests through the MAP terminal or the remote MAP terminal.
- One line access for each DRTU.
- The system supports the NTY3704 DTRU.
- The system supports four wire circuits.
- The system does not support external test desks that require a test bypass desk. Other external test desks, except Centralized Automated Loop Reporting System (CALRS), are not in use. If the test bypass pair is not required, other external test desks are in use.
- Bring out the 67AB lead on the front access bay to wire the lead to the DRTU.

MBS loop tests MBS line tests from the LTP level consists of extended or short diagnostics. The diagnostics depend on the type of test configuration in use. If the LTA, RTAC, or RLTP is installed in the RCU, the extended diagnostic set runs. If LTA functionality is not provided at the RCU, the short diagnostic set runs.

The short diagnostic set consists of the following tests:

- loop signal at key set
- add-on and extension test
- MBS display micro test
- single-end diagnostics

The extended diagnostic set consists of key set, end-to-end, and single-end tests. In addition to the above tests, the following tests run on the posted MBS line when the extended diagnostic set occurs:

- echo return loss
- carrier channel loss
- idle channel noise

Descriptions of the specified MBS tests follow. The MBS uses a D-channel for signaling. These tests do not require LTA functionality like an LTA, RTAC, or RLTP card, at the RCU. A DS0 test channel between the SMU and RCU is not required. If the DCH card in the SMU fails during these tests, the tests fail.

The *Loop signal at key set* test checks to determine if the MBS line card can exchange messages with the associated terminal. This test verifies the integrity of the loop and the functionality of the main MBS terminal.

The *add-on and extension test* checks to determine if the add-on and extension modules on an MBS line respond. If the modules that respond match the expected configuration, modules that are not known do not respond, the test passes.

The *MBS display micro test* checks the functionality of the MBS display processor in the MBS set. This test does not change the contents of the MBS display. The SMU-RCU MBS also uses the D-channel for signaling. The *DCH continuity* checks the connectivity of the D-channel link from the DCH card to the RCU and back.

Single-end diagnostics for an MBS line consist of the following MBS-specified tests:

- single-end VF loopback test
- blown fuse detection test
- single-end signaling loopback test

The system performs subscriber loop measurements on MBS lines in the same method as other types of lines, like POTS lines. Configurations of tip and ring on the subscriber loop measure line voltage, ac and dc, line capacitance, and line resistance parameters. The difference for MBS lines is that an MBS set loses the stored volume setting when the loop opens and power is lost. A display at the MAP terminal notifies operating company personnel. Operating company personnel can abort the request for a loop measurement.

ISDN loop tests The system supports the following diagnostics for ISDN loops off an RCU:

- LC occupancy test
- relay test
- LC restore test
- LC self test
- LU continuity
- NT1 restore
- NT1 status test
- T continuity
- U loop tests
- termination test
- sealing current test
- near-end block errors test
- far-end block errors test
- error register query
- hard reset
- restore (LC and NT1)

Usage notes for line test configurations The following notes apply to the line test configurations:

- The CM and the SMU divide the processes required to test a line. The CM performs the whole test procedure and controls test equipment, like the transmission test unit or line test unit. The SMU performs lower level details, like the transmission of messages to the RCU to connect test terminations. The SMU receives messages from the RCU to indicate test results.

- One line can be tested at a time on an RCU, and SMU software can conduct multiple tests at the same time. The SMU can test one line for each RCU that connects to the SMU. A request from the RCU maintenance card faceplate can occur even if a line is CPB, except for ISDN lines. If the RCU requests a test on a CPB line, except ISDN lines, the SMU sends a message to the CM. The CM removes the call.
- Local tests or jack access called from the RCU maintenance faceplate can interrupt a CPB line. Operating company personnel at the RCU can determine if a subscriber line is CPB from the RCU faceplate. Operating company personnel must check this status before personnel request a line test. The CM, not the SMU, decides to remove calls to perform line tests.
- During tests, the CM can request the SMU abort tests. The SMU sends the RCU a message to abort the current test. A CM abort message also terminates RCU-initiated tests.
- If local or single-end tests fail, an indication of the specified test that causes the single-end failure does not appear. With the exception of failure, the system cannot perform tests because a maintenance bus or maintenance card is not available.
- If the bypass is active for 5 min or more, the SMU generates a PM180 log. The system generates this log to indicate the bypass is active for 5 min. This log makes sure that operating company personnel know a bypass that can be stuck.
- A SWACT terminates the line tests on each RCU that connects to an SMU that has a SWACT.
- End-to-end tests are not possible for SSM.
- End-to-end tests use one channel between the SMU and RCU.
- A bridge connection is not possible. A bridge connection is where a metallic test pair bridges to tip and ring leads of the subscriber loop. This action occurs when the loop connects to the line card.
- A separate relay, to cut off the line card from the loop, is not present. The cutoff relay on the path between the subscriber loop and a relay contact that leads from the loop or equipment test buses activates the line card. For additional information, refer to the the figure on page 1-126.
- RCU line cards have fixed and not programmable balance networks.
- One type of test, local, jack access, or remote, can continue at one time on an RCU.
- An RCU can test one subscriber loop-line card at one time.
- End-to-end tests require an LTA card. An end-to-end test is not possible on FXBO lines.

- Monitor and talk access from a test desk is not possible.
- The ANI test is not possible for FSR that uses end-to-end test configuration. Use of the single-end test configuration is possible.
- Single-end, end-to-end, and RLTP line test configurations do not support testing of ISDN lines. A bypass test pair through the MTA network is required for ISDN line tests, and does not involve a DRTU.

Special-service line audits

A CM audit, activated one time each 8 min guarantees consistency between special-service connection information in the CM and in-service SMUs. The audit detects and corrects two types of errors:

- connection information that is not correct in the SMU
- connection status that is not correct in the CM

The following table describes special-service connection faults. The table details corrective action that the system takes when these connections have inconsistencies.

Special-service line audits

Connection fault	Corrective action
The SMU is missing data for a connection.	The connection data is added to the SMU. The SMU attempts to establish the connection. The system generates an SCSS100 log.
The SMU has data for a connection that Table SPECCONN does not have. Defective software operation normally causes this difference.	The CM removes the connection in the SMU. The SMU deletes connection data from the SMU. The system generates an SCSS100 log.
The SMU data that specify the location of an end point does not match the connection data in Table SPECCONN. These data include SCSEL and LEN or SCSEL, XPMTYPE, PMNO, PORT, and CHANNEL.	The CM removes the SMU connection. The SMU deletes connection data from the SMU. The SMU adds connection data for a new connection in the SMU. The SMU attempts to establish the new connection. The system generates an SCSS100 log for the addition of this new connection.
The SMU data on connection type, trunk conditioning type, trunk conditioning data, attenuation, RCU-to-subscriber side supervisory signaling, or C-side channel information does not match the data in the CM.	The SMU data is updated. The system generates an SCSS102 log.

—continued—

Special-service line audits (continued)

Connection fault	Corrective action
The connection status in the SMU and Table SPECCONN does not match.	The connection status in Table SPECCONN is updated. The system generates an SCSS101 log.
A special-service connection in Table SPECCONN with a connection type of PEND has a connection status other than INACTIVE.	The connection status in Table SPECCONN is forced to become inactive. The system generates an SCSS101 log.
The SMU has correct connection data and a timeswitch connection that is not correct.	A new timeswitch connection is established. The system generates an SCSS103 log.
—end—	

If an audit occurs on a special-service connection, operating company personnel that attempt to change the connection through table control can experience a delay of 10 s.

The CM audit skips a special-service connection that changes in table control. The CM audit checks the connection during the next audit cycle. The audit does not check the validity of a special-service connection if the associated SMU is not in-service.

The CM aborts the audit of a tuple if the associated SMU goes OOS.

Escalation to manual maintenance

The maintenance policy of this document maintains a level of customer service with a minimum of operating company personnel action. Although the DMS-100 switch operates with a minimum of operating company personnel intervention. The system requires manual maintenance activity.

Trouble indicators, like MAP displays, log reports, and operational measurements (OMs) receive the specified type of manual maintenance activity required.

SMU hardware

Hardware components

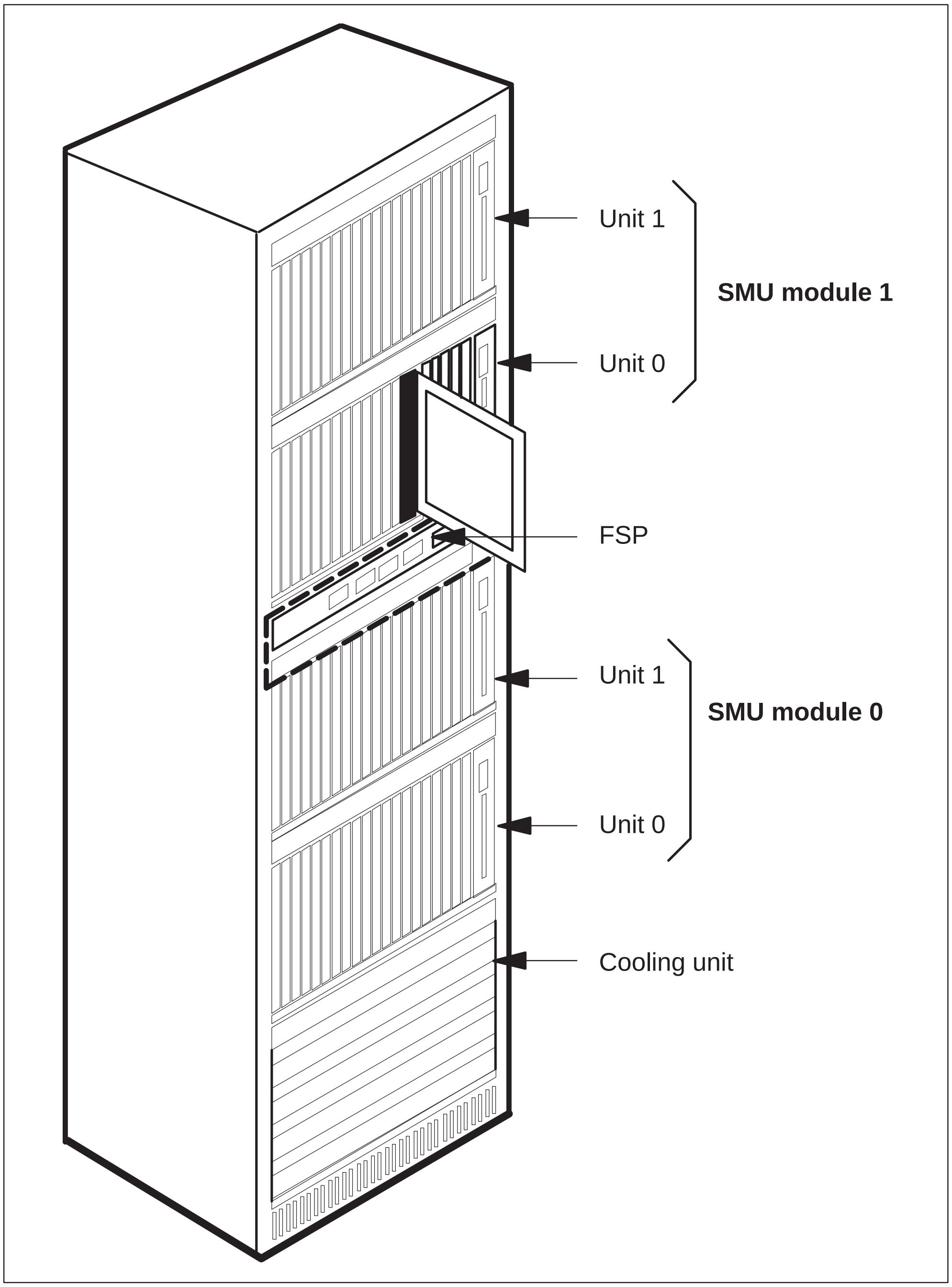
This chapter describes the subscriber carrier system hardware components. These components give subscribers the full resources of a digital switching system for call processing and maintenance. The sections of this chapter that follow describe the hardware. These sections describe:

- SMU components and what they provide. This description begins on page 2-1.
- RCU hardware. This description begins on page 2-9.

Physical characteristics

The SMU is a peripheral module (PM) that contains two modules. The modules contain two units. The subscriber carrier equipment (SME) frame (NT6X01AA or NT6X01AB), shown in the following figure, contains a maximum of two SMU modules. The SMU modules can be NT6X02EG for the SMU or NT6X02EL for an SMU that can support ISDN or MBS. The SME can contain both modules. Unit 0 occupies the lower shelf of the module and unit 1 occupies the upper shelf.

Subscriber carrier equipment frame



Each SMU module is in a dual-shelf configuration. This arrangement allows the control system in each shelf to control call processing in the SMU. Each shelf contains a control system made of an NTMX77 Unified Processor. An SMU configured for Integrated Services Digital Network (ISDN1) needs an enhanced ISDN Signaling pre-processor (EISP) card. Other SMUs configured for Meridian Business Set (MBS) also need an enhanced ISDN Signaling pre-processor (EISP) card. The EISP card provides a communication path between the DCH cards and the unified processor.

Each shelf provides a duplicated DS30 interface. This interface allows 3 to 16 DS30 links to connect to the network. When the SMU unit connects to the enhanced network (ENET), a DS512 interface card can configure the unit. This card allows a single fiber optic link to connect the unit to the network. The unit connects the network instead of the 3 to 16 DS30 links.

A DS-1 interface is distributed across both shelves of an SMU module. The interface provides a maximum of 20 DS-1 ports to service DS-1 links for a maximum of ten remote carrier urbans (RCU).

ISDN/MBS applications require a minimum of one D-channel or enhanced (EDCH) cards. Each provisioned DCH or EDCH card makes two DS-1 ports not available. The DCH card stops 16 kbit/s D-channels used for the out-of-band call control signals of ISDN and MBS. The transfer of packet data to packet handlers for ISDN occurs through the DCH card.

For more information on SMU hardware, refer to the *Operational Measurements Reference Manual*. The manual has a list of the product engineering codes (PEC) for SMU circuit packs.

Capabilities

In this section, the capabilities of the SMU are explained from the view of the subscriber.

Plain ordinary telephone service (POTS)

The following features are available with POTS:

- single-party (flat rate [1FR] and message rate [1MR])
- more than one party
  - — frequency selective ringing (FSR), which includes two-party FSR automatic number identification (ANI) and four-party operator number identification (ONI)
  - — two-party, four-party, eight-party, and ten-party coded ringing multiparty divided ringing (MPDR), which includes two-party, four-party, and eight-party ONI and two-party ANI

SMU coin capability

The SMU-RCU subsystem supports four types of coin service:

Coin first

In coin-coin-first (CCF) service, the DMS-100 switch supplies the station dial tone. The switch supplies dial tone when the pay station telephone is off-hook and the calling party deposits coins.

Dial tone first

In coin-dial-tone-first (CDF), the DMS-100 switch supplies dial tone when an off-hook occurs at the station. The call fails unless the calling party deposits the correct amount of coins. The calling party must deposit the coins by the end of dialing.

Semi-postpay

In coin-semi-postpay (CSP), the DMS-100 switch provides dial tone, allows dialing, and connects the station caller with the called party. The switch does not allow the caller to talk until the caller deposits coins.

Forward disconnect or cutoff on disconnect

Forward disconnect (FD) is the ability of the DMS-100 agent to interrupt the subscriber loop current in a controlled way. This ability is important for the following reasons:

- When a customer uses a key telephone set, the customer can put the incoming call on hold. The calling party can go on-hook. When the FD interrupts the loop, the holding light turns off. This event tells the customer the holding party is not on the line.
- When the customer uses special terminal equipment for example, some answering machines, the terminal can lock the line. The line can lock when the calling party disconnects. The terminal recognizes that the calling party has gone on-hook when the calling party interrupts the battery feed. This interruption forces the loop open for a controlled period of time.

Ringing

The SMU supports the following ringing designs:

- frequency selective ringing with two-party ANI
- a minimum of one party divided, coded ringing
- single-party bridged ringing
- two-party divided ringing with ANI

Dialing

Methods to dial that are available include dial pulse and Digitone.

Tones

The following tones are available:

- dial tone
- audible ringback
- reorder
- busy

Universal tone receiver services

An universal tone receiver (UTR) circuit pack (NT6X92) can be present. The UTR card provides a dedicated channel for digit collection during call setup. The digit channel unloads the network for an allocation of call setup responsibility. To activate the UTR feature on the SMU or ESMU, the UTR card table LTCINV must contain the UTR card. Refer to the *Operational Measurements Reference Manual* for more information.

E911

The NTX447AA E911 package provides a digital interface between the public safety answering point (PSAP) and a tandem switch. The line digital trunk (LDT) node provides the digital interface.

The LDT node is a DS-1 trunk on the peripheral side (P-side) of an SMU that connects to a channel bank. The node provides a connection between the computing module (CM) and the public safety answering point (PSAP). The SMU provides the needed conversion between line signaling and trunk signals.

A line appearance on a digital trunk (LDT) PSAP can provide features like call transfer, speed calling, and call forwarding.

Other LDT PSAP features include the following:

- the reception of automatic number identification
- the reception of anonymous calls
- the test of the ability of a PSAP to receive ANI

For more information about LDT PSAPs, refer to the *Operational Measurements Reference Manual*.

> ***Note:*** The DMS-100 software does not allow an E911 PSAP to stop on an SMU provided with an EISP card.

ISDN capability

The ISDN capability is available in the ISDN/MBS capable SMU, known as the enhanced SMU or ESMU. The ISDN provides voice and data services. The ISDN provides these services through a minimum of one DCH or EDCH circuit card and an EISP circuit card. The ISDN voice services include the following:

- POTS
- electronic key telephone service (EKTS)
- direct inward dial (DID)
- direct outward dial (DOD)
- network class of service
- call forwarding
- call pickup
- automatic callback
- call waiting
- flexible calling
- hunt groups
- calling-line ID
- busy override
- authorization codes

The ISDN data services include circuit-switched data and packet-switched data.

An ESMU supports the UTR and allows the ISDN/MBS SMU to perform all digit collection functions where the originating terminal is.

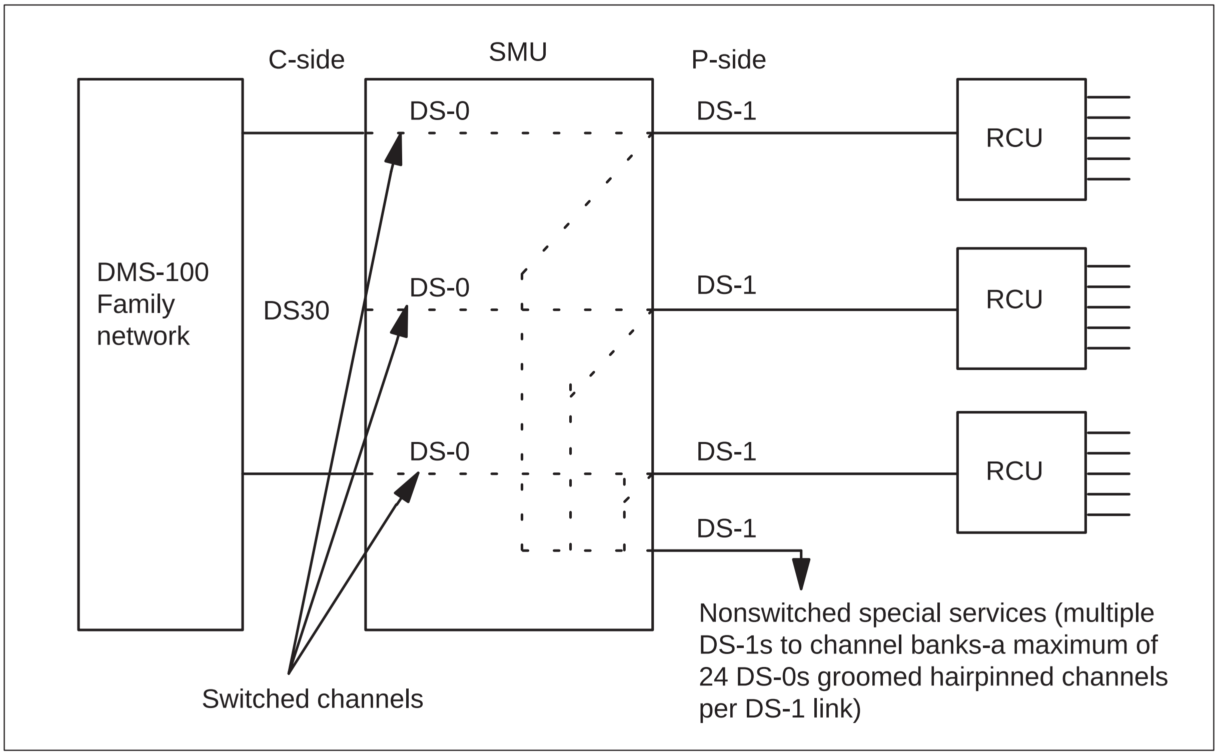
Special services

The SMU supports the following switched and nonswitched special services:

- Special services provided by the foreign exchange with battery (FXB) line cards, that is Class 1 and Class 2 special service lines. Some special services are private branch exchange (PBX), teletypewriter exchange service, wide area telephone service (WATS), and foreign exchange (FX). Other special services are off-premises station, off-premises extension, and PBX central office (CO) trunks. The MAP terminal can provide FXB line card options.

- Special services are provided by the special services module (SSM). The SSM can accommodate special service needs not served by the FXB line cards. The SSM contains improved channel units to provide special services like voice band data, 2.4 kb/s to 56 kb/s data services, and tie trunks.
- Hairpin connections are for not local switched services and not switched special services. The SMU can cross-connect services from a P-side port to another P-side port (refer to the following figure). These hairpin connections are dedicated and not supervised. The SMU does not extract and describe the signaling bits. A service person sets up hairpin connections at the MAP terminal. These connections are present until maintenance personnel take them down. The hairpin carries the DS-0 channel, which includes data and signaling bits.

SMU hairpin cross-connection



The SMU Special Services (NTX621AB) software package provides special services for the SMU.

Custom local area signaling services (CLASS)

The SMU-RCU subsystem supports CLASS features. These features have already been implemented for lines served by the line group controller. The features are implemented for lines that the remote cluster controller and Subscriber Carrier Module-100 SLC-96 serves.

Calling number delivery (CND) is a CLASS feature. The CND allows single-party subscribers and Meridian Digital Centrex (MDC) customers to receive the number of the incoming calling party on the customer premises equipment (CPE). The CND allows customers to receive the time and date of the call.

If the operating company wants lines off the RCU to have CND, the operating company must observe the following requirements:

- The SMU must ahve a CLASS Modem Resource (CMR) card (NT6X78). The CMR card transmits the CND data. Refer to the *Operational Measurements Reference Manual*.
- Table LTCINV must have the CMR card in it as datafill. Refer to the *Operational Measurements Reference Manual*.

  Note: CND is compatible with the present RCU POTS line cards and EPOTS line cards.

Custom calling features

The SMU-RCU subsystem provides custom calling features like Speed Calling, Call Waiting, Three-way Calling, and Call Forwarding.

Meridian Digital Centrex features

The SMU-RCU configuration supports all current MDC features except features that require trunks. The ESMU supports Meridian business sets (MBS). The following MBS features are available:

- NTX106AA—IBN Proprietary Business Set
- NTXA33AA—MADN Ring Forward
- NTXA35AA—Network Number Display
- NTXA36AA—Network Wide Ring Again
- NTXA72AA—Secondary MADN Call Forwarding
- NTXE40AB—MBS Inspect Key
- NTXJ97AA—Direct Station Selection/Busy Lamp Field For MBS
- NTXJ98AA—MBS Camp On
- NTXN50AA—MDC Single Button Transfer
- NTX108AA—IBN Display Features
- NTX719AA—Business Set Busy Indicator
- NTX269AA—Universal Tone Receiver (UTR)
- NTX387AC—Subscriber Carrier Module-100 Urban (SCM-100U)

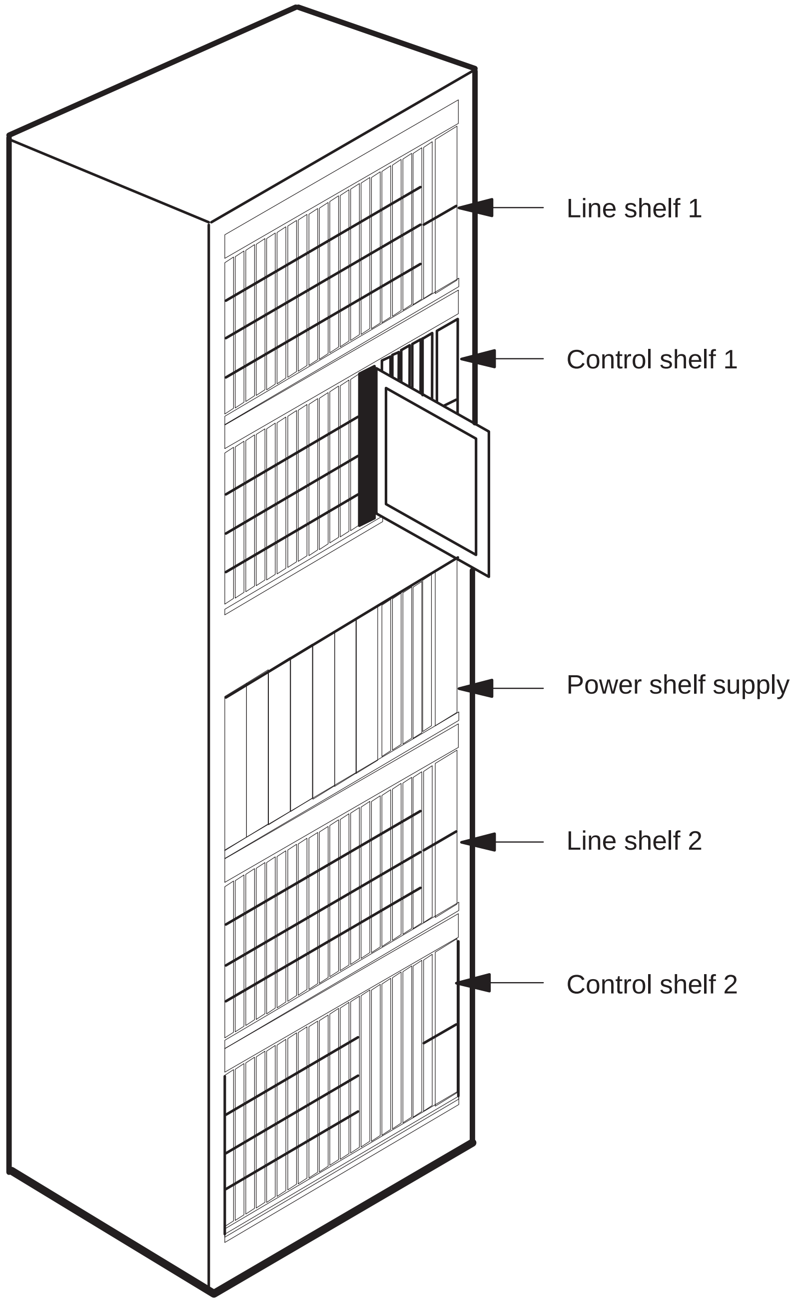
Additional components

RCU hardware

The DMS-1 urban is a remote carrier urban (RCU). The DMS-1 Urban is a digital carrier system. The system extends normal telephone and special services from a central office. These services are for residential and business subscribers. The RCU connects to the DMS-100 switch through the SMU or ESMU.

A fully-equipped DMS-1 Urban frame consists of five shelves mounted in an 8-foot frame. Refer to the following figure.

DMS-1 Urban frame



Line shelf 1 contains 20 line card carrier packs and 2 digital line terminations. Line card carrier packs contain four line cards. Control shelf 1 contains common equipment, 12 line card carrier packs, and 2 digital line terminations. The power supply shelf contains power converters, system common equipment, and optional system maintenance features.

Line shelf 2, like line shelf 1, contains 20 line card carrier packs and 2 digital line terminations. Control shelf 2 contains common equipment, 14 line card carrier packs, and 2 digital line terminations.

For detailed information on RCU hardware, refer to the *Operational Measurements Reference Manual*. The manual contains a list of the PECs for RCU circuit packs.

Ringing

An RCU has one or two ringing generators (NT3A39) that supply ringing to all shelves.

Coin

The RCU coin line card (NT3A27AA) supports a maximum of four lines. The RCU coin line card (NT3A27AA) does not have line cards that operating company personnel can remove.

All lines on the coin card must be set to the same mode, which can be loop or ground start. Coin-coin-first (CCF) lines are set in ground start mode. Hardware in a ground start telephone has a special configuration. In a ground start telephone the system does not supply dial tone until the telephone receives coins. After the caller dials the number, dialing proceeds and the system returns the deposit.

Coin-dial-tone-first (CDF) and coin-semi-postpay (CSP) lines are set in loop start mode. The hardware in loop start telephones is configured so that the system supplies dial tone when the receiver is off-hook. After the caller deposits coins and the call connects, a coin telephone does not return the deposit. Coin telephones do not return coins in a telephone call that involves a CSP line.

Loop start lines can allow operator-assisted calls (like 911 and 411) and inward area telephone service (INWATS) calls free of charge.

Four-wire special services

Special services can have the following special service line cards:

- NT7A20AA—FXB Voice Frequency
- NT7A21AA—Duplex Voice Frequency
- NT7A22AA—Signaling Module (SM)
- NT7A23AA—Office Channel Unit Data Port

The operating company can provide special services without an SSM when these cards operate with the special service line card carrier (NT3A11BA).

For more information on four-wire special services, refer to the *Operational Measurements Reference Manual*.

ISDN and MBS services

The ISDN and MBS services have the following line cards, line card carrier, and circuit pack:

- NT7A31AA—ISDN line card
- NT7A33AA—MBS line card
- NT3A11CA—Integrated services line card carrier
- NT3A34BA—Enhanced digroup card

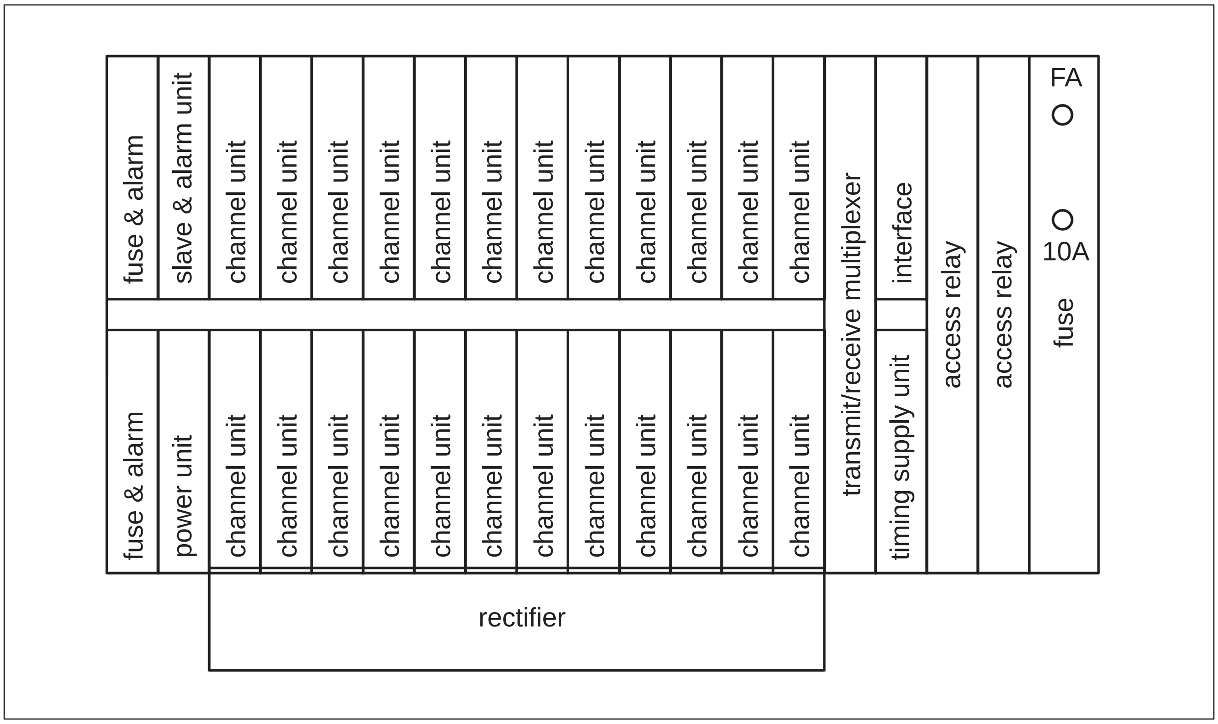
Special services module (SSM)

The two-wire FXB station or office line cards in the SSM can provide special services. Standard equipment cards and a maximum of 24 Nortel DE-3 and DE-4 channel units fit in an SSM shelf. Refer to the following figure.

Each SSM channel unit needs a dedicated channel on one of the DS-1 lines that connect the SMU and RCU. Each channel is part of a dedicated special service hairpin connection through the SMU.

For more information on two-wire special services, refer to the *Operational Measurements Reference Manual*. The manual includes a list of PECs for SSM channel units..

SSM shelf


fuse & alarm
slave & alarm unit
channel unit
transmit/receive multiplexer
interface
access relay
access relay
FA
10A
fuse
fuse & alarm
power unit
timing supply unit
rectifier

SMU signaling

Signaling for SMU

This section describes the signaling the subscriber carrier module urban 100 (SMU)-remote carrier urban (RCU) subsystem uses.

The following sections describe SMU-RCU signaling format, signaling protocols, and the features this signaling supports

SMU signaling links

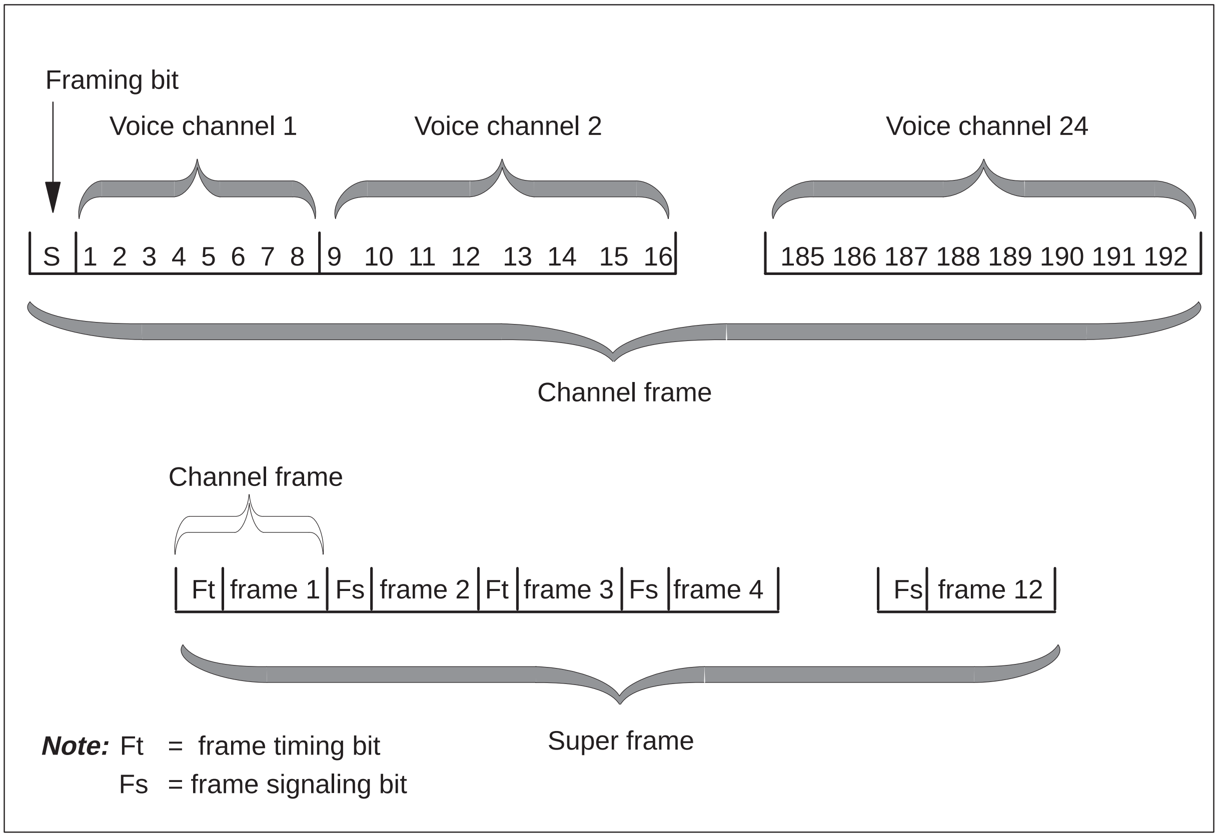
The SMU and the RCU exchange information over DS-1 lines. These exchanges use an extended super frame design. The DS-1 lines operate at a rate of 1.544 Mbytes/s. The DS-1 lines have a sampling frequency of 8000 frames every second.

The DS-1 link consists of 24 channels. Each channel contains eight bits of pulse code modulation (PCM) data. The system includes a framing bit at the front of the sequence. The name stuffing or S-bit refers to this framing bit. The S-bit makes sure that the SMU and the RCU recognize the start of each 24-channel sequence. A channel frame occurs when the system sends 192 bits of information in each 24-channel sequence with a framing bit.

These channel frames carry one of the following types of information:

- speech information
- signaling information
- operations information

The design of a DS-1 frame and a super frame appear in the following figure.



Twelve channel frames comprise one super frame. A derived data link (DDL) frame consists of six super frames or 72-channel frames. The DDL does not appear in the above figure.

The 24-bit pattern conveys three types of information:

- frame pattern sequence
- facility data link performance
- cyclic redundancy check

The frame pattern sequence (FPS) is 001110. Every fourth framing bit carries an FPS bit. This property starts at the fourth bit. The cyclic redundancy check (CRC) and the FPS define an in-frame condition.

The 4 Kbit/s facility data link (FDL) bit begins with the first framing bit. Every other frame carries an FDL messaged bit.

The cyclic redundancy check (CRC) bit begins with the second bit. Every fourth bit carries the CRC. In an extended super frame, the CRC checks a block check field six times. The CRC-6 check detects bits that emulate an

FSP bit. The CRC-6 check determines if an out-of-frame conditions is present.

A- and B-bit signaling

The following channel signaling messages use A- and B-bits.

Per-channel signaling The A- and B-bits are signaling bits that provide the following supervisory information:

- status of subscriber lines (on-hook or off-hook)
- ringing
- dial pulses

Digitone signals consist of two frequencies. The system sends this information to a Digitone receiver in a maintenance trunk module (MTM). This system uses the eight bits of the time slot assigned to the subscriber to send the Digitone signals. The system does not use A- bits to send the Digitone signals

Signaling uses A- and B-bits with a value of 0 or 1 together. The interpretation of the bits depends on the type of line card that receives or sends the bits. For dial pulses, a series of makes and breaks are sent on the subscriber loop. The equation A=1 represents a make, and A=0 represents a break.

> ***Note:*** The SMU transmits frequencies in the range from 16 through 66 Hz to the RCU. The SMU transmits frequencies in the DS-1 channel assigned to the RCU subscriber.

Coin signaling Coin lines use A- and B-bits in selected DS-1 speech channels for separate channel signaling. Coin lines use 8-bit patterns in appropriate speech channels for supervision. Coin lines use the A- and B-bits and 8-bit coin signaling patterns together to perform supervision. The coin line card handles ground start or loop start supervisory signaling.

FXB special service signaling Foreign exchange with battery (FXB) line cards are in the RCU. The FXB line cards handle ground-start or loop-start signaling modes. When the RCU has station end cards, the system uses A- and B- bit signaling across the RCU-SMU interface and the SMU for FXB lines.

Message channels

The SMU and RCU use two 64 Kbytes/s message channels to exchange system control information. The first time slots of the number three and four DS-1 lines contain this information. The RCU uses system control messages to inform the SMU of the RCU activities.

The SMU uses system control messages to control call processing, initialization, and maintenance at the RCU

The information that the system control messages contain includes time slot assignments to off-hook subscriber lines, test requests, and the state of alarms.

One message channel time slot is the primary message link, the other message channel is the secondary message link. The primary link is active, the secondary link is not active.

The RCU monitors both links for messages. The RCU responds only to messages on the primary link. When DS-1 lines three and four are first installed, the system selects the first channel on DS-1 link 3 as the primary message channel. The system transmits only idle code over the secondary channel.

ISDN BRA signaling

The ISDN basic rate access (BRA) contains two 64 kbit B-channels for voice and data and a 16-bit D-channel for signaling and packet data. The name 2B+D refers to the ISDN BRA. Two types of ISDN BRA signaling are present, functional and stimulus.

Software supports the functional BRA signaling. This software is part of the set of the operating BRA terminal. The system uses Q.931 protocol with the signaling control protocol (SCP), to send call control messages. The system sends call control messages between the operating BRA terminal and the network.

The SMU-RCU configuration does not support stimulus BRA signaling.

The SMU supports the following ISDN BRA features:

- Attendant Console
- Basic Conference
- Call Forwarding
- Call Request
- Emergency Service Bureau
- Flexible Call
- Mass Call
- Multiple Access Directory Number

- Privacy
- Privacy Release

MBS signaling

The MBS signaling allows call processing software to communicate directly with the MBS terminal. The system uses an above-voice frequency, low-speed data channel to transport the MBS messaging over the loop. This data channel sends signaling information over a separate D-channel. The D-channel is between the SMU DCH card and the RCU line card.

The data channel is an 8 kHz signal with data which the absence or occurrence of the data channel communicates. The SMU supports the following MBS features:

- Automatic Answer Back
- Automatic Dial
- Automatic Line
- Executive Busy Override
- Call Back Queuing
- Call Forward All Calls
- Call Park
- Call Pickup
- Call Waiting
- End-to-End signaling
- Group Intercom
- Individual Business Line
- Intercom
- Listen on Hold
- Make Set Busy
- Malicious Call Hold
- Multiple Appearance DN
- On-Hook Dialing
- Privacy Release
- Ring Again
- Speed Calling
- 3-Way Call/Call Transfer

- 6-Port Conference
- Feature Display
- Display Called Number
- Display Calling Number
- Query Time
- Business Set Inspect Key
- Automatic Inspect Mode
- Business Set Call Forward Universal Per Key
- Call-Request Enhancement
- Direct Station/Busy Lamp Field for MBS
- Station Camp-On for MBS
- Group Intercom All Call
- MADN Cut-Off on Disconnect (COD)
- MADN Bridging - Three-Way Call
- Multiple Executive Message Waiting Keys per DN

Signaling protocols

The SMU-RCU subsystem uses the following signaling protocols to communicate and provide subscriber services:

- A- and B-bit messages
- DMS-X
- Q.931 - CCITT Digital Network Access protocol

A- and B-bit messages

The least significant bits from each channel are taken in every sixth twelfth channel frames. The least significant bits from frame six are replaced with A-bits. The least significant bits from frame 12 are replaced with B-bits. The A- and B-bits pass information about specified channels.

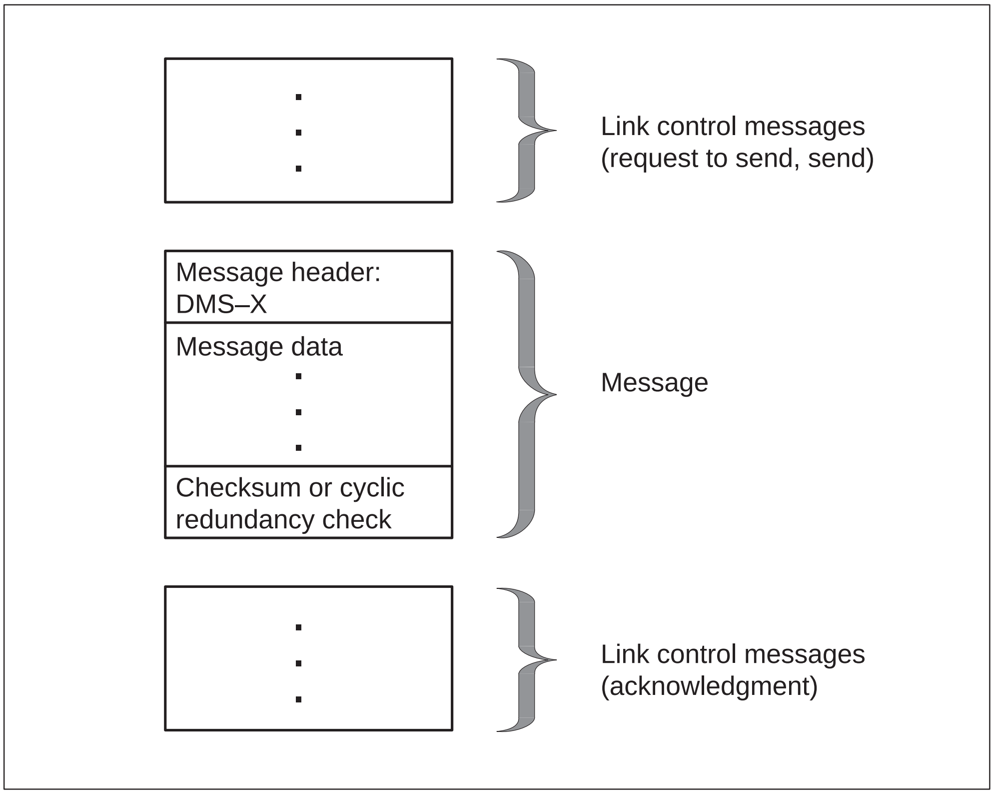
DMS–X protocol

The DMS–X protocol is a half-duplex protocol. The DS-1 links between the RCU and the SMU use this protocol. The DMS–X protocol includes a CRC code for error detection.

The DMS–X protocol process occurs in the terminal. This process contains handshaking messages. Handshaking messages occur when two terminals use a message transfer to inform each other of present messaging condition.

A general form of handshaking protocol, which comprises DMS–X protocol appears in the following figure.

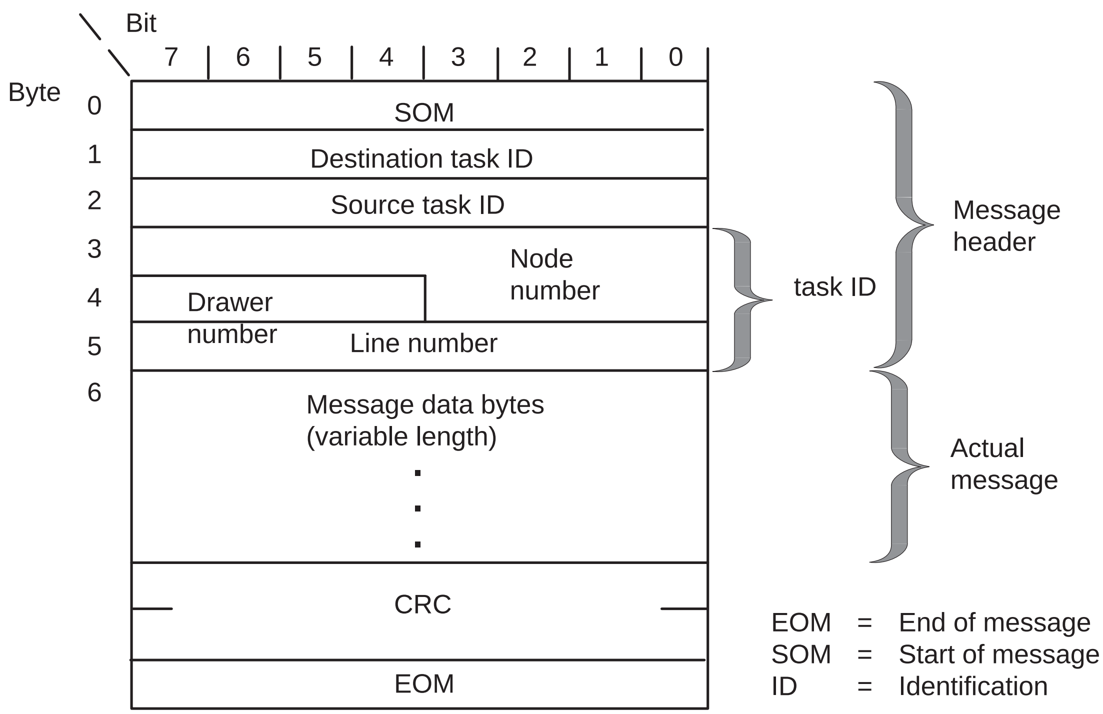
DMS–X handshaking protocol



Message time-out, message checksum, or CRC calculation performs message error detection.

In the event of protocol, checksum, or CRC failure on an outgoing message, the sending node attempts the send sequence again. On an incoming message failure, the sending node routes the message again over an alternate control side (C-side) link. Hardware redundancies provide a different path to and from a node. The design of DMS–X messages appears in the following figure.

DMS–X message format



The system transmits the message over a link. Link control messages precede and follow the message. Messaging occurs between programs that run in the SMU and in the RCU. Many process tasks communicate through messages over the DS-1 links.

The first six bytes compose the DMS–X message header as follows:

- The first byte is the start of message.
- The second byte is the destination task identification (ID) of the message. An outgoing message uses this ID to identify the process and to receive the message.
- The third byte is the source task ID. An incoming message uses this ID to identify the process that sent the message.
- The last three bytes are the task ID number.

The number of bytes in the correct message or data varies. The CRC occupies two bytes and detects transmission errors. The end of message occupies one byte.

Q.931 Digital Network Access protocol

Call control uses Q.931-signaling protocol. The following elements determine the protocol procedure:

- setup and take-down of calls and features between the network and terminals
- address displays and progress indicators at the terminal and the network
- B-channel control from the network

The Q.931 protocol supports basic error-handling procedures. This protocol supports initialization again, after the occurrence of errors from which the system can recover. The Q.931 protocol also determines the signaling methods for use in circuit-switched calls.

SMU signaling functions

Universal Tone Receiver (UTR) features

The RCU lines that connect to an SMU can use the optional UTR feature. This feature allows the system to remove part of the processing load from the computing module (CM). The system implements this part of the processing load in the PM.

When the SMU contains the UTR feature, the SMU on which the originating terminal resides performs all digit collection functions.

These digit collection functions include:

- the allocation of a free receiver
- the establishment of a path to the receiver
- the collection and processing of digits
- the dc allocation of the receiver

The CM employs the UTR to indicate that the SMU requires a receiver. The SMU performs the steps that follow:

1. Requests a UTR channel.
2. Instructs the UTR to begin monitoring tones.
3. When the UTR begins to monitor tunes, the system informs the SMU of digits. The SMU normally performs some translation functions on the digits.
4. When the CM does not require a receiver any longer, the SMU releases the allocated UTR channel.

The CM requires a receiver request to start the sequence. If a request arrives from an SMU that does not have a UTR, processing continues.

Deluxe Spontaneous Call Waiting Identification (DSCWID)

The SMU creates alerting tones to support the Deluxe Spontaneous Call Waiting Identification (DSCWID) feature. When a line with the DSCWID option has an active call and a second call attempts to terminate to that line, the SMU provides alerting signals. The two types of alerting signals are a Subscriber Alerting Signal (SAS) and a Customer Premises Equipment (CPE) Alerting Signal (CAS). The tones alert the DSCWID subscriber of the pending call. The tones alert the DSCWID CPE of pending caller data.

The subscriber recognizes the SAS as the Call Waiting Tone. The CAS alerts the CPE of new data. The system requires the SAS and a CAS to trigger an Analog Display Services Interface (ADSI) compatible CPE. This CPE displays the DSCWID options. The CAS tone prepares the CPE to receive Caller Identification (CID) data.

The DSCWID CPE generates an acknowledge (ACK) tone. This tone indicates that the system can receive DSCWID data. If the CPE is ADSI compatible, the CPE sends a DTMF A ACK signal in response to the CAS. If the CPE is a SCWID CPE, the CPE sends a DTMF D ACK signal in response to the CAS. When the subscriber receives alerting tones, the subscriber can control distribution to the incoming call. The subscriber uses the CPE softkeys if the CPE is ADSI. If the CPE is a SCWID or a 2500 set the subscriber uses hard-coded keys.

A T-tone timer sets the maximum amount of time between sending a flash and the DTMF digit on an ADSI set. The SMU starts a T-tone timer when the SMU receives a flash signal from the ADSI compatible CPE of a customer. The value of T-tone is 600 ms. During this time the system mutes the speech path. The SMU uses the T-tone timer for the first option of a DSCWID call. The CPE type does not affect the SMU use of the T-tone timer. The DSCWID options that follow on an ADSI set also use the T-tone timer.

The DSCWID options that follow on a SCWID or 2500 use a T-flash timer. Use the T-flash after the user answers a call. This option, with SCWID and 2500 sets, provides the operating company with enough time to select an option after a flash. A subscriber that does not have this option does not have time to flash and dial a DTMF digit in 600 ms. The T-flash is a timer that operating company personnel can set from 1 to 8 s. The default value is 1.5 s. The SMU starts the T-flash timer when the NON-ADSI field is set to Y and the SMU receives a flash signal. This flash signal is from the SCWID or 2500 set of the customer. The SMU must receive this flash during the held or conference call state to start the T-flash timer. If the SMU cannot attach a UTR before 400 ms, the system applies the RETURN option.

Note: To comply with Bellcore TR-416, the SMU must provide options if the SMU detects a flash and cannot attach a UTR. If the SMU cannot attach a UTR in 400 ms, the SNU sends a flash to the CC. This action allows the SMU to comply with the Bellcore TR-416 requirement.

Peripheral processor (PP) SMU basic call processing

The PP SMU basic call processing supports basic call processing in an RCU that uses single-party (20 Hz ringing) and multi-party (divided ringing) line cards. Other features use foreign exchange with battery cards (FXB) or special service module channel units to support FSR cards and special services.

This feature performs the following call processing activities:

- decodes and routes computing module call processing messages
- performs steps in originating a call from an RCU
- performs steps in terminating a call to an RCU
- establishes a speech connection from the DMS-100 network to an RCU
- tracks information about a call

The SMU and RCU exchange system control messages over the DS-1 message channel to support these activities. Each channel signaling message uses A- and B-bits from selected speech channels.

The following areas are necessary for call processing:

- origination and channel allocation
- tone generation with dial tone speed recording
- digit collection
- ringing
- automatic number identification
- loss padding
- messaging loss to RCU
- busy/return to service of lines

Origination and channel allocation When the subscriber that originates a call goes off-hook, a loop closure occurs. When current that flows in the loop exceeds a set threshold, the RCU line card detects the current.

The RCU uses the message channel to send an off-hook message to the SMU. This message contains the logical number loop time slot (LPTS) associated with the off-hook subscriber line. This message also contains the RCU group number where the subscriber belongs.

The SMU receives the RCU off-hook message. The SMU allocates a channel on a DS-1 link to serve the off-hook subscriber line.

The SMU sends the RCU a setup connection message through the message channel. This message directs the RCU to set up a connection between the off-hook subscriber and the channel that the SMU allocates. The message contains the LPTS, DS-1 line number, and the associated DS-1 channel.

The RCU establishes the physical connection. The RCU changes the A-bit from 0 to 1 to set the RCU signaling bit pattern to off-hook (A=1, B=0). The RCU sends this pattern to the SMU. The RCU returns a setup connection acknowledgment message to the SMU in the message channel.

When the RCU encounters a problem in associating the DS-1 channel and subscriber line, the RCU informs the SMU of the problem. The RCU uses the return code of the setup connection acknowledgment message to transfer this information. For example, if the line to be associated with the DS-1 channel already connects to another channel. If the DS-1 channel is associated with another subscriber line, the RCU informs the SMU.

The SMU scans A- and B-bits that the SMU receives from the RCU to verify the off-hook. The off-hook pattern must continue for 360 ms for the SMU to treat the pattern as an origination. After 360 ms, the SMU reports an origination to the CM. The CM sets up a connection from the SMU time switch to the CM network over a DS30 channel.

Tone generation After the CM receives the origination message, the CM directs the SMU to send a treatment to the subscriber. The most common treatment is dial tone.

The message and tones card in the SMU generates dial tone. The time switch card switches the tone. The unified processor (UP) card, on the correct DS-1 channel directs the card to perform these functions. If the called line is busy, the message and tones card generates busy tone. The cards sends this tone to the originating party. Originating subscribers can receive other treatments, like reorder tone and announcements. These other treatments depend on conditions present at the time the subscriber places the call.

The SMU continuously monitors A- and B-bits that come from the RCU. If the A-bit returns to 0 (on-hook) for 480 ms or more, the SMU defines this as a disconnect. The SMU also defines the originating subscriber as on-hook. The SMU sends a disconnect message to the CM. The SMU also sends a take down connection message to the RCU. The RCU must return an acknowledgment message to the SMU.

The exception to this disconnect occurs if the flash feature is enabled. With flash enabled, the on-hook signaling bit pattern must persist for 1440 ms or more for SMU to detect a disconnect.

A flash can be enabled and an off-hook subscriber can go on-hook for less than 360 ms followed by off-hook. The SMU treats this occurrence as a glitch and the call connection remains. In some occurrences, the subscriber goes on-hook for 360 ms or more and goes off-hook before 1440 ms expire. This action is set by the dial tone speed recording (DTSR) (1440 ms from the time the subscriber first goes on-hook). In this occurrence, the system treats the sequence as a flash.

Digit collection The subscriber telephone set transmits dial pulse digits to the RCU as a series of makes and breaks. These breaks are off-hooks and on-hooks. The RCU uses the A-signaling bit to indicate a make or break. For a make, the RCU sets the A-bit to 1. For a break, the RCU sets the A-bit to 0. To transmit the digit six, for example, the RCU sends a series of six makes (A=1) and breaks (A=0) to SMU.

For Digitone digits, the RCU codes the digits into pulse code modulation (PCM). The Digitone sends these PCM-encoded tones to a tone receiver outside the SMU. The SMU collects the digits, builds the digits into a string, and forwards the digit string to the CM. The CM translates the digits and sets up a channel for the called line through the network. The SMU and RCU set up a channel for the called subscriber to the originator channel setup.

Ringing The SMU determines the type of ringing to employ. The SMU sends a ringing signaling pattern to RCU over the DS-1 channel associated with the subscriber line rung. For example, the ringing pattern for single-party lines is A=1, B=0. This directs the RCU to connect the ring generator to that line and ring the line.

The ringing signal pattern is not transmitted continuously. Ringing (A=1, B=1) and idle (A=0, B=0) are sent alternately. This process establishes ringing cadences.

The SMU-RCU subsystem supports the following ringing capabilities:

- single-party 20 Hz ringing
- multiparty divided 20 Hz ringing
- frequency selective ringing
- all available coded ringing designs

- ringing lines on all RCU modules that an SMU supports
- ringing up to 50 lines in the same phase for each RCU. The system blocks calls above this number.

The originator receives a ringback tone while a called line (terminating line) rings.

When the called subscriber goes off-hook, the RCU detects the change in line current and trips ringing. The RCU sends a pattern of A- and B-bits to the SMU. This pattern indicates that the subscriber answers the telephone.

The RCU sends an off-hook message to the SMU through the DS-1 message channel on link 3 or link 4. The SMU removes the ringing signal when the SMU receives the A- and B-bit signaling pattern that indicates off-hook. This pattern must continue for 180 ms. The SMU sends the CM an answer message. The SMU sends this message if the A- and B-bit pattern remains as off-hook for 180 ms.

Automatic number identification(ANI) The DMS system uses ANI to determine which party, tip or ring, of a two-party line is off-hook. The ANI feature allows automatic billing.

The SMU call processing software provides this information in response to a CM request. The SMU scans the A- and B- bits that the multi party line card generates to detect which party is off-hook. When a party goes off-hook, the RCU sends an off-hook message in the DS-1 message channel to the SMU. This message indicates which line is off-hook. The SMU directs the RCU to connect this line to a specified DS-1 channel. The SMU detects A- and B-bits on this channel. The SMU scans the A- and B- bits to determine how long the subscriber remains off-hook and when the subscriber goes on-hook.

Loss padding Padding or attenuation of pulse code modulation (PCM) samples occurs in the ring/pad card. The PCM compensates for expected signal loss through the network. The CM directs the SMU to apply padding to specified lines. The ring/pad card in the SMU provides the padding, and the time switch card under SP card direction. The ring/pad card also introduces the padding to appropriate channels.

Messaging loss Message link failures, RCU control extension (CE) card failures, 24-hour switchover, and backup switchover cause messaging loss. This messaging loss occurs for a temporary or extended periods.

The system cannot detect new originations and disconnects through the message channel during messaging loss. The SMU cannot send messages to the RCU during messaging loss. The SMU cannot direct the RCU to set up or take down subscriber lines to DS-1 channel speech connections. New originations and terminations cannot occur while a loss of messaging is present.

Messaging does not affect the A- and B-bits which ringing, digit collection, and hook-status scanning use on active connections. As a result, the system maintains call processing for lines that have an active connection through the DMS-100 switch. The system maintains calls in the states that follow:

- talking
- digit collection
- audible ringback
- flash
- ringing

Calls that terminate (go on-hook) during messaging loss are taken down when the system establishes messaging again. When a call is taken down, the call connection in the DMS-100 switch is removed.

Busy/return to service of subscriber lines The CM can direct the SMU to direct the RCU to busy a subscriber line. This busy prevents call processing on the subscriber line. The system normally performs the busy during maintenance. For example, enter a MAP command from the line test position (LTP) level to test a line.

The CM also can direct the SMU to return a line, or all lines of an RCU, to service. When the SMU returns a line to service, call processing can occur on the line.

Limits to call processing The limits that follow apply to call processing (some data can vary):

- When a loss of messaging occurs, new calls are not established.
- The SMU supports up to 32 lines in the digit collection state at the same time.
- The SMU supports up to four calls each second.
- The SMU supports up to 255 lines in the ringing state at the same time.
- The RCU supports up to 150 lines in the ringing state at the same time.

SMU-RCU coin operation

Coin operations begin when the CM sends the SMU a coin command that must go to a coin card in the RCU.

The SMU translates these commands and sends the RCU signals. The RCU coin card translates these signals into voltages to send to the coin telephone. Coin collect, coin return, coin presence, partial coin presence, and ringing on coin telephones use A-bits, B-bits, and 8-bit PCM patterns. The A- and B-bits send normal and reverse battery to coin telephones.

When the RCU receives the SMU signals, the coin card applies voltages, or opens to the tip and ring of the line. The application of these electrical signals to the tips and rings of coin telephone lines causes the coin station to initiate actions. An example of these coin station actions is the return of a deposit to a station user or the collection of a deposit.

The CSP lines do not use coin collect, coin return, or coin presence tests. The system only uses reverse battery for these tests. Reverse battery on a line allows an originator to hear the terminating party. The terminating party cannot hear the originator.

When a subscriber (originator) goes off-hook on a CSP line, the system provides dial tone. After the subscriber dials, the system sends reverse battery. When the originator hears the terminating party, the originator must make a deposit. This action restores normal battery. Long distance calls also use reverse battery.

A list of these coin operation commands follows:

- coin collect—This command directs a coin first (CCF) or coin dial-tone first (CDF) telephone to collect money that a subscriber originates for a telephone call. When the subscriber first deposits the coins, the coins go to the hopper. The hopper is a temporary holding location that stores money before coin collect or coin return. The coin collect command causes the coins to drop from the hopper in to the coin vault.

  On coin telephones that require a flat rate, the coin collection occurs when the call is complete. On coin telephones that connect to a switching system which supports local coin overtime, coin collection occurs every few minutes.

  Coin semi-postpay (CSP) phones collect coins automatically if the subscriber deposits the coins when a connection is set up. Coins that the subscriber deposits before the connection establishes can drop immediately into the return holder.

- check for partial coin presence—Use of check for partial coin presence occurs in local coin overtime. This command directs CDF telephones to check for an initial deposit or stuck coins. This command helps CCF telephones check for stuck coins.

Long distance calls and CSP telephones do not use coin presence. An operator processes long distance calls on CCF and CDF telephones. The operator monitors tones that the telephone station generates to process these calls. The coins that the subscriber deposits determines these tones.

- return coin—After you deposit money, a coin return command directs the coin telephone to return the money that the subscriber deposited. The telephone returns the money when the calling party on a coin telephone hangs up before the terminating party answers.

  When channel reassignment occurs and the call cannot be reassigned the SMU sends a coin return message to the RCU. This process also occurs if the system drops the call for a higher priority call, or cannot connect a call because all channels are busy. The system sends the message over the message channel of DS-1 links three or four. The message is necessary for coin return. A channel is not associated with a specified line on which a coin must return.

  The CSP coin telephones collect coins that the subscriber deposits only when a call connection is complete. The connection disables until you deposit a coin.

- ring telephone station—This command directs the RCU to apply ringing to a correct station.
- reverse battery on coin line—All types of coin telephones use this command to prevent communication between the calling and called parties. The system also uses this command to reset the telephone totalizer. The telephone totalizer is an electromechanical device which totals initial rate deposits, and prepares a telephone station for calling. The telephone totalizer also signals coin denominations to the operator.
- supply normal battery on coin line—This command enables the talking state. Also use this command on some CDF and CCF telephones use this command to reset the totalizer.

Coin operation limits and interactions Limits that apply to coin functions and interactions between coin operations and features of the SMU-RCU subsystem are as follows:

- The logical line equipment number (LEN) connections are consecutive. The LEN connections use the top four circuit numbers in a subgroup. The tip and ring connections skip every other LEN.

- During a warm SWACT or CP switchover you cannot initiate coin telephone calls. This condition applies to all calls. You cannot initiate calls at this time because messaging between the SMU and RCU is inhibited.

Coin operations interact with other features of the SMU-RCU subsystem in the ways that follow:

- If a DS-1 link fails, the system causes channel reassignment. A coin line call can occupy a channel on the failed link and cannot be reassigned. In this event, the SMU sends a coin return message to the RCU. The telephone station user receives the money you deposited earlier.
- When the RCU is made busy, the RCU causes all subtending coin telephone stations to return coins to station users.
- When a warm SWACT occurs, the system cannot add any call that entered talking state to the records of the newly active unit. The system drops the call, and returns money that you deposited earlier to the telephone station user. This condition occurs after the user originates the call again and hangs up.
- If a coin line is force released through the use of the LTP-level commands FORCRLS or FRLS, the line is busied immediately. The system does not return money.

RCU to SMU signaling

The RCU uses A- and B-bits to return the state of the lines to the SMU. The states are idle, coin ground, off-hook, and coin ground. Use a coin presence test to check for initial deposit. The response to the occurrence of a deposit is normally coin ground. If you do not make the deposit, the response is off-hook.

SMU to computing module (CM) messages

The SMU responds to CM commands like coin collect, coin presence, partial coin presence, and coin return. The CM uses these responses to determine the next operation to initiate.

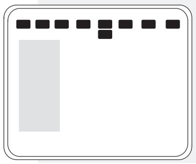
SMU alarm clearing procedures

This chapter contains the alarm clearing procedures for the Subscriber Carrier Module-100 Urban (SMU) and the remote carrier urban (RCU). Maintenance personnel use these procedures to clear alarms as the alarms appear at the MAP.

The alarm indicates the procedure that maintenance personnel must use to clear the trouble. Procedures correspond to the alarms as the alarms appear at the MAP. The procedures appear in alphabetical order.

PM RCU critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nRCU**	.	.	.	.	.
				C					

Indication

The remote carrier urban (RCU) alarm appears under the PM header in the MAP subsystem display. This alarm indicates an alarm condition exists in the RCU. The *n* indicates the number of RCUs with alarms. The **C** appearing under the alarm indicates the alarm class is critical.

Meaning

This alarm indicates the RCU is in total operation failure (TOF) and has been system busied (SysB) by the central control (CC). This condition is caused by CC cold or reload restart, both messaging links (3 and 4) going out of service, or faulty RCU common equipment cards or software.

Impact

A critical alarm class code indicates that the RCU is SysB and call processing is disabled.

Common procedures

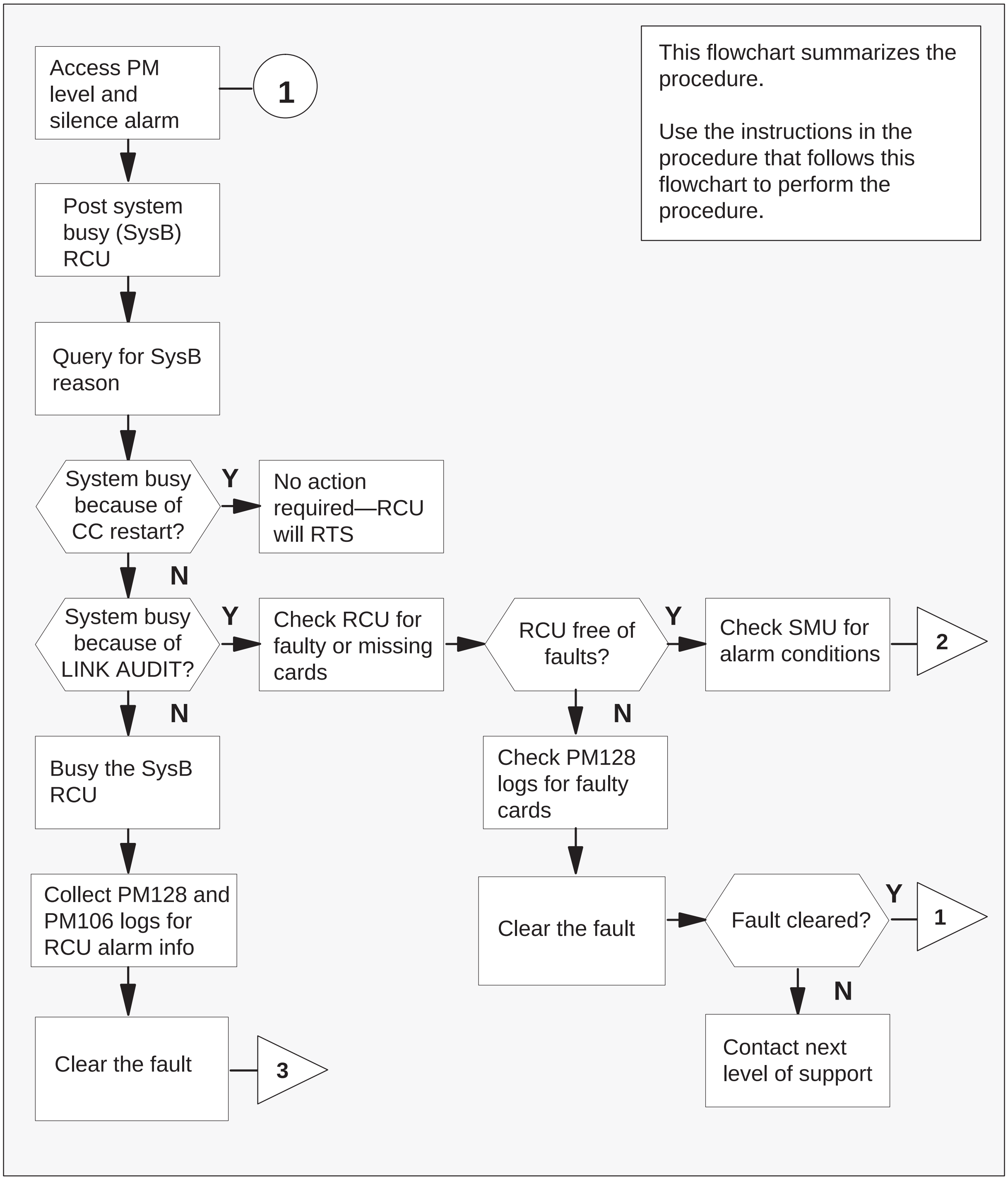
Not applicable

Action

The following flowchart is a summary of the procedure. Use the instructions in the step-action procedure that follows the flowchart to clear the alarm.

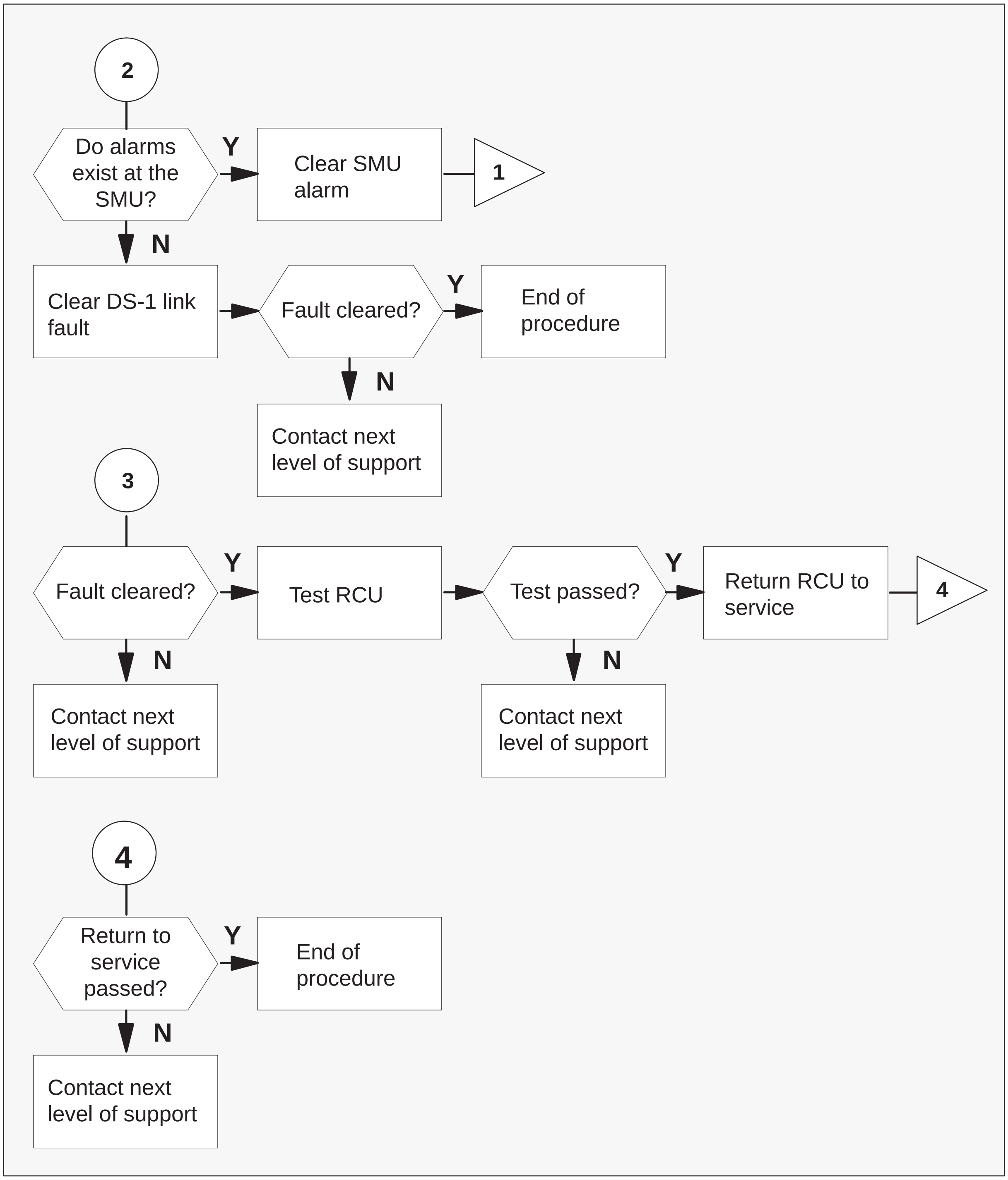
PM RCU
critical (continued)

Summary of PM RCU critical alarm



PM RCU
critical (continued)

Summary of PM RCU critical alarm (continued)



Clearing a PM RCU critical alarm

At the MAP terminal

1 When the system detects a fault, it may trigger an audible alarm. Access the MTC level of the MAP (maintenance and administration position) terminal and silence the alarm by typing

>MAPCI;MTC;SIL
and pressing the Enter key.

2 Display the RCU or RCUs that are SysB by typing

>PM;DISP STATE SYSB RCU
and pressing the Enter key.

Example of a MAP response:

```
SysB RCU : RCU0 00 0
```

Note: If more than one RCU is SysB, select one. If no RCU is SysB, go to step 16.

3 Access the SysB RCU by typing

>POST RCU site_name frame_no unit_no
and pressing the Enter key.

where

site_name is the name of the remote site displayed in step 2, for example, RCU0
frame_no is the frame number of the RCU displayed in step 2
unit_no is the unit number of the RCU displayed in step 2

Example of a MAP response:

```
RCU     SysB   ManB   Offl   CBsy   ISTb   InSv
    PM     1      4      0      0      3     28
   RCU     1      0      0      0      2      0

RCU RCU0 00 0  SysB       Links_OOS: Cside 4
```

PM RCU
critical (continued)

4 Determine the system busy reason by typing

>QUERYPM FLT
and pressing the Enter key.

Example of a MAP response:

```
SysB reason: LINK AUDIT
```

Note: Additional alarms may be displayed.

If SysB reason is	Do
Link audit	step 5
CC restart has occurred	step 9
initialization limit exceeded	step 10
unsolicited message limit exceeded	step 10
messaging failure	step 10

5 Verify that links 3 and 4 are out of service by typing

>TRNSL
and pressing the Enter key.

Example of a MAP response:

```
LINK1: SMU 2  2;CAP; S;STATUS:  OK
LINK2: SMU 2  4;CAP; S;STATUS:  OK
LINK3: SMU 2 19;CAP; MS;STATUS:  SysB;MSGCOND: CLS
LINK4: SMU 2  7;CAP; MS;STATUS:  SysB;MSGCOND: CLS
```

Note: In this example, messaging links 3 and 4 connected to ports 7 and 19 of SMU 2, are out of service.

6 Check PM128 log reports for alarms indicating a missing, faulty, or improperly configured RCU digroup, time switch card, or faulty RCU repeater card.

If	Do
Digroup, time switch, or repeater card is indicated.	Replace card, then return to step 1 of this procedure.
RCU is free of faults.	step 7

PM RCU
critical (continued)

7 Observe the PM header in the MAP subsystem display.

If SMU alarm is	Do
displayed	alarm clearing procedure for the indicated SMU alarm. Next, return to step 1 of this procedure
not displayed	step 8

8 Use DS-1 link fault locating procedures to isolate fault to a section of DS-1 line or to a DS-1 repeater.

If fault is	Do
not found and alarm persists	step 15
found and alarm cleared	step16

9 No action is required. After restart is complete, the RCU automatically returns to service. Go to step 16.

10 Manually busy the posted RCU by typing

>BSY
and pressing the Enter key.

Example of a MAP response:

```
RCU RCU0 00 0 Bsy Passed
```

11 Collect the PM128 and PM106 log reports that occurred during the 10 minutes prior to the RCU going system busy. Take note of the coded RCU alarms included in the log information. Go to step 12.

12 Identify and replace the faulty component. After the faulty component has been replaced, go to step 13 of this procedure.

PM RCU
critical (end)

13 Test the RCU by typing

>TST
and pressing the Enter key.

Example of a MAP response:

```
OSvce Tests Initiated
RCU RCU0 00 0 Tst COMPLETED NO FAULT DETECTED
```

If test	Do
passed	step 14
failed	step 15

14 Return the RCU to service by typing

>RTS
and pressing the Enter key.

Example of a MAP response:

```
RCU RCU0 00 0 Rts Passed
```

If RTS	Do
passed	step 16
failed	step 15

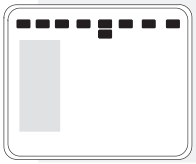
15 Contact personnel responsible for higher level support and get further help to clear this alarm.

16 You have successfully completed this procedure.

If there are other alarms displayed, refer to the appropriate alarm clearing procedures for the indicated alarms.

PM SMU critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nSMU**	.	.	.	.	.
				C					

Indication

The SMU alarm appears under the PM header in the MAP subsystem display. This alarm indicates an alarm condition exists in the SMU. The *n* indicates the number of SMUs with alarms. The **C** appearing under the alarm indicates the alarm class is critical.

Meaning

This alarm usually indicates one or more common peripheral controller cards in the SMU is faulty.

Impact

A critical alarm class code indicates the SMU is unable to process calls.

Common procedures

Not applicable

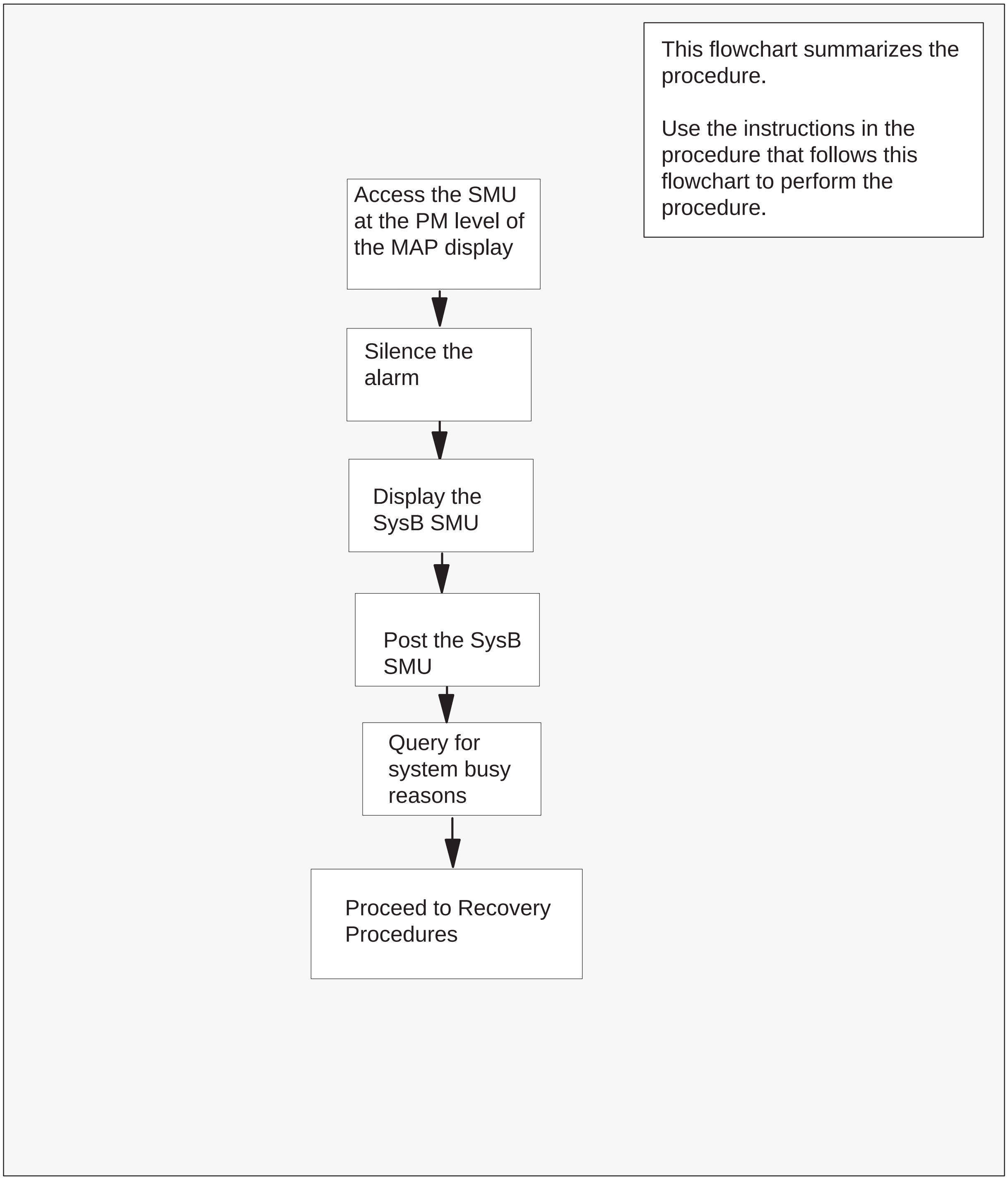
Action

The following flowchart is a summary of the procedure. Use the instructions in the step-action procedure that follows the flowchart to clear the alarm.

Refer to the *Card Replacement Procedures* for more information on replacing cards in the SMU.

PM SMU
critical (continued)

Summary of PM SMU critical alarm



Clearing a PM SMU critical alarm

At the MAP terminal

1 When the system detects a fault, it may trigger an audible alarm. Access the MTC level of the MAP (maintenance and administration position) terminal and silence the alarm by typing

>MAPCI;MTC;SIL
and pressing the Enter key.

2 Display the system busy (SysB) SMU by typing

>PM;DISP STATE SYSB SMU
and pressing the Enter key.

Example of a MAP response:

```
SysB SMU: 1
```

3 Access the SysB SMU by typing

>POST SMU smu_no
and pressing the Enter key.

where

smu_no   is the number of the SMU displayed in Step 2.
Example of a MAP response:

```
SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0    1     0     2    13
    SMU     1     0    0     0     0     7

SMU 0 SysB  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   SysB
Unit1:  Inact SysB
```

4 Check for fault indicators by typing

>QUERYPM FLT
and pressing the Enter key.

5 Proceed immediately to the recovery procedure for the SMU.

PM RCU major

Alarm display

CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nRCU**	.	.	.	.	.
				M					

Indication

The RCU (remote carrier urban) alarm code appears under the PM header in the MAP subsystem display. This code indicates that an alarm condition is present in the RCU. The *n* indicates the number of RCUs with alarms. The *M* that appears under the alarm indicates a major alarm.

Meaning

This alarm normally indicates that one or more common equipment cards in the RCU has faults. This alarm also can indicate conditions like open doors, low battery voltages, temperature alarms, blown fuses, or fan failure.

Result

A major alarm class code indicates the RCU has an in-service trouble (ISTb) condition. This ISTb condition affects service on nine or more lines.

Common procedures

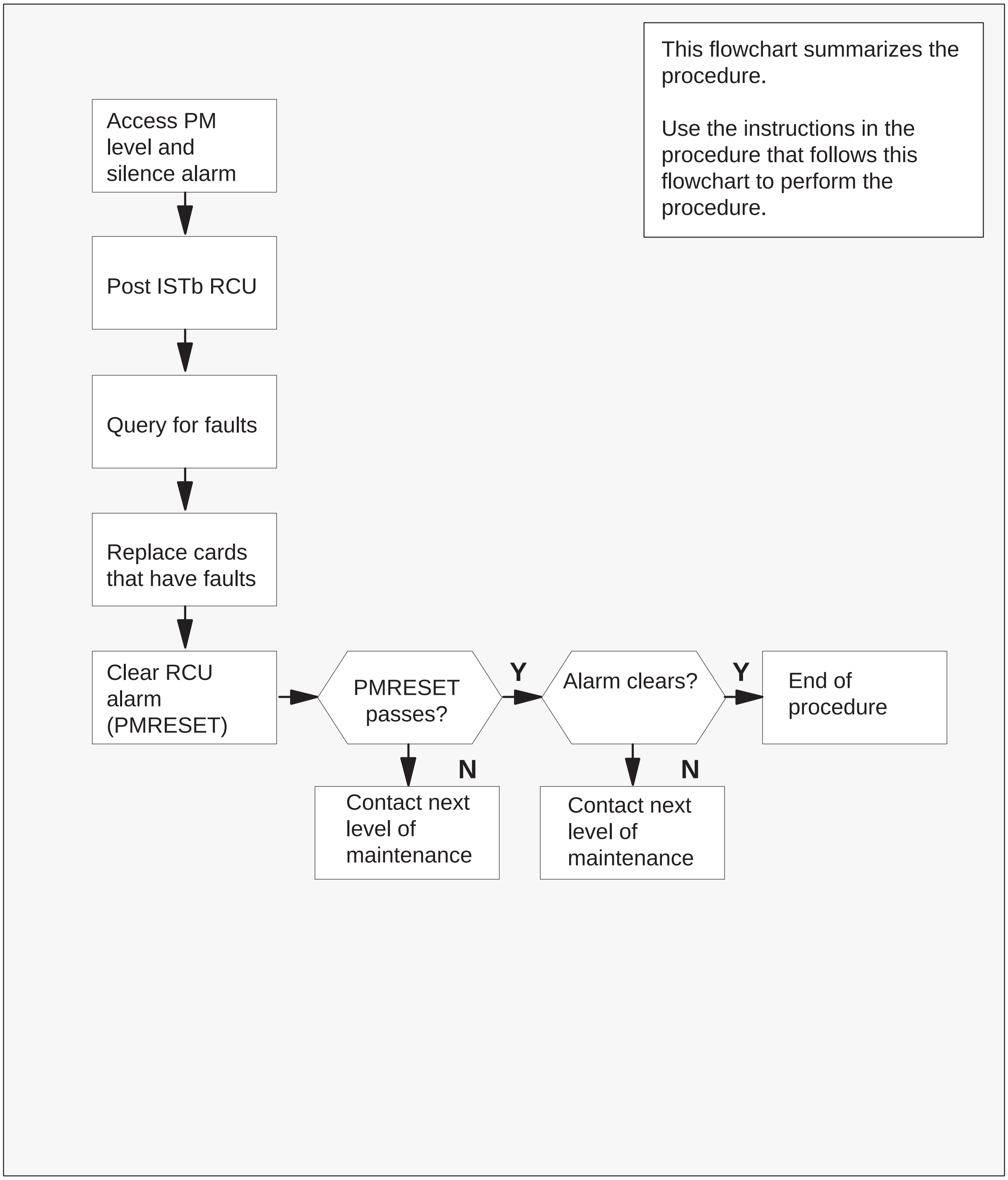
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Use the steps to perform the procedure.

PM RCU
major (continued)

Summary of PM RCU major alarm



PM RCU
major (continued)

Clearing a PM RCU major alarm

At the MAP terminal

1 When the system detects a fault, the system can trigger an audible alarm. To access the MTC level of the MAP terminal and silence the alarm, type:

>MAPCI;MTC;SIL
and press the Enter key.

2 To display the RCU or RCUs with ISTb, type:

>PM;DISP STATE ISTB RCU
and press the Enter key.

Example of a MAP response:

```
ISTb RCU : RCU0 00 0, RCU1 01 0
```
If more than one RCU is ISTb, select one.

3 To access the ISTb RCU, type:

>POST RCU site_name frame_no unit_no
and press the Enter key.

where

site_name is the name of the remote site name displayed in step 2. For example, RCU0 is a site name.
frame_no is the frame number of the RCU displayed in step 2
unit_no is the unit number of the RCU displayed in step 2

Example of a MAP response:

```
RCU     SysB   ManB   Offl   CBsy   ISTb   InSv
    PM    0      4      0      0      3     28
   RCU    0      0      0      0      2      0

RCU RCU0 00 0  ISTb        Links_OOS: Cside 0
```

4 To check for fault indicators, type:

>QUERYPM FLT
and press the Enter key.

Example of a MAP response:

```
Alarm  Code   Shelf   Slot   Description
Major   103                  Blown fuse
```

Note: This information also appears in PM128 logs generated for the ISTb RCU.

PM RCU
major (end)

5 To identify and replace the component that has faults, refer to *DMS-100 Remote Carrier Urban Integration Description, Ordering, Installation and Maintenance*. After replacing the component that has faults, return to this point.

6 To clear the RCU alarm, type:

>PMRESET
and press the Enter key.

MAP prompt:

```
No new calls will be processed for up to 1–3 minutes.
Please confirm (“YES” or “NO”):
```

To affirm the confirmation request, type:

>YES
and press the Enter key.

If PMRESET	Do
passes	step 7
fails	step 8

7 Observe the PM header in the MAP subsystem display.

If the system	Do
regenerates the alarm	step 8
clears the alarm	step 9

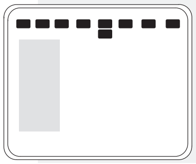
8 For additional help, contact the next level of maintenance.

9 The procedure is complete.

If other alarms appear at the MAP display, refer to the appropriate alarm clearing procedures for the indicated alarms.

PM SMU major

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nSMU**	.	.	.	.	.
				M					

Indication

At the MAP subsystem display, the SMU alarm code appears under the PM header. This code indicates that an alarm condition is present in the SMU. The *n* indicates the number of SMU modules with alarms. The letter *M* that appears under the alarm indicates that the alarm class is major.

Meaning

This alarm normally indicates that one or more of common peripheral controller cards in the SMU has faults.

Result

A major alarm class code indicates that the SMU has an in-service trouble (ISTb) condition. The SMU continues to process calls, but a fault condition is present that can affect service.

To reduce the potential impact to subscriber service, isolate the fault condition to the component that has faults. Replace the component that has faults.

Common procedures

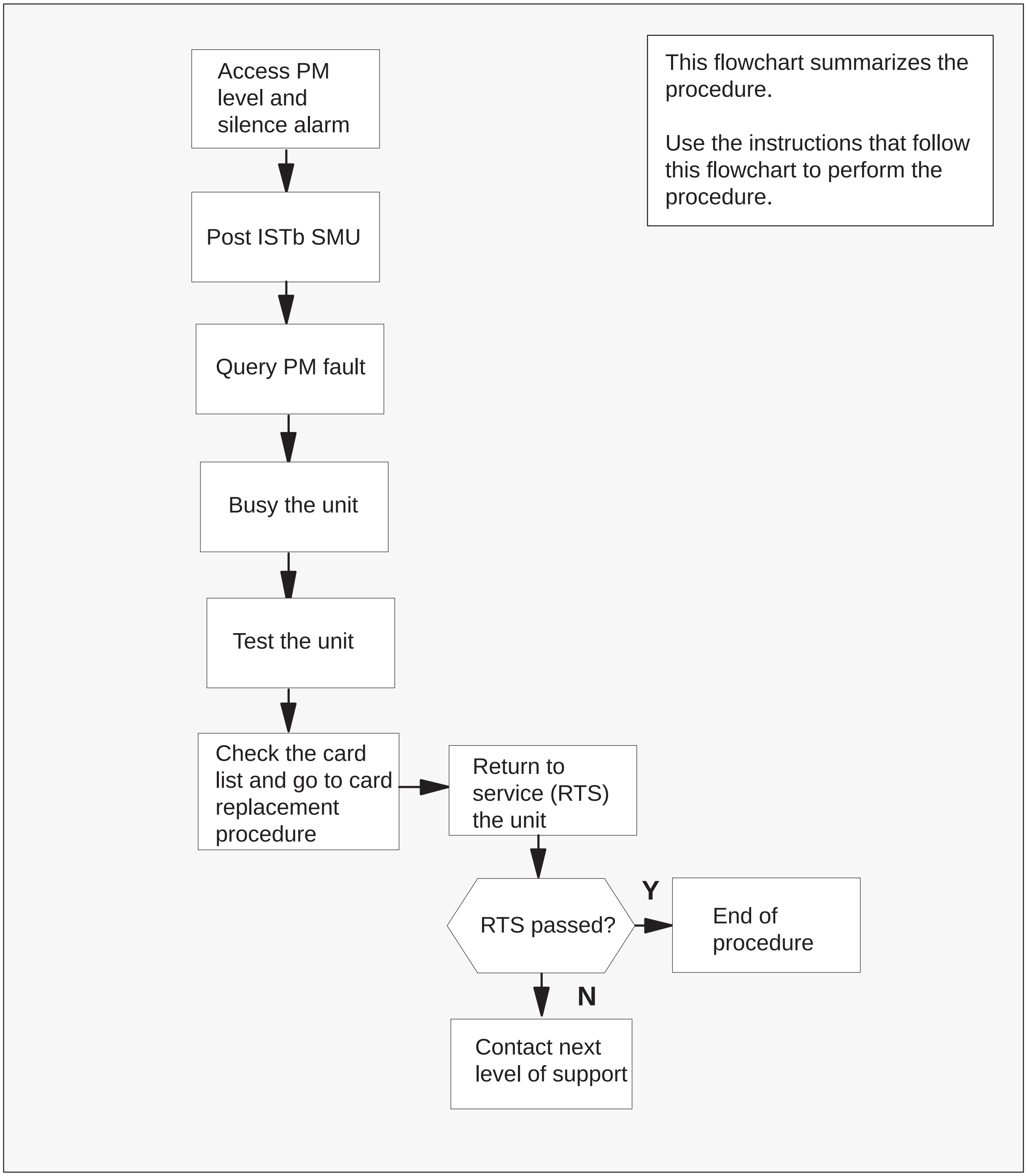
This procedure refers to the procedure “Updating static data”.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

PM SMU
major (continued)

Summary of clearing a PM SMU major alarm



PM SMU
major (continued)

Clearing a PM SMU major alarm

At the MAP terminal

1 When the system detects a fault, the system can trigger an audible alarm. To access the MTC level of the MAP display and silence the alarm, type

>MAPCI;MTC;SIL
and press the Enter key.

2 To access the PM level of the MAP display and determine which SMU is ISTb, type

>PM;DISP STATE ISTB SMU
and press the Enter key.

Example of a MAP response:

```
ISTb SMU:  1
```

3 To access the ISTb SMU, type

>POST SMU smu_no
and press the Enter key.

where

smu_no   is the number of the SMU displayed in step 2

Example of a MAP response:

```
SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0    1     0     2    13
    SMU     0     0    0     0     1     7
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   InSv
Unit1:  Inact SysB
```

If	Do
one unit is system busy (SysB)	step 13
one unit is C-side busy (CBsy)	step 11
one unit is manually busy (ManB)	step 4
both units are in service (InSv)	step 18
both units are ISTb	step 10
one unit is ISTb and inactive	step 10
one unit is ISTb and active	step 5

PM SMU
major (continued)

4 To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

If RTS	Do
passes	step 19
fails	step 15

5

CAUTION
Service disruption: calls can end!
The system can prompt you to confirm a cold SwAct, only perform this activity during a period of low traffic. The system ends calls that this PM handles, including data calls.

To switch the activity of the units, type

>SWACT
and press the Enter key.

The system determines the type of SwAct that the system can perform. The system can perform a warm SwAct or a cold SwAct. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
cannot continue at this time	step 6
can continue at this time	step 7

6 Do not switch the activity of the units. To reject the SwAct, type

>NO
and press the Enter key.

The system does not continue the SwAct.

Return to step 5 during a period of low traffic.

PM SMU
major (continued)

7 To switch the activity of the unit, type

>YES

and press the Enter key.

The system runs a pre-SwAct audit to determine if the the inactive unit can accept activity correctly.

Note: A maintenance flag (`Mtce`) appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

Example of a MAP response:

```
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb     Mtce
Unit1:  Inact InSv     Mtce
```

If the message	Do
is `SwAct passes`	step 10
is `SwAct fails`	step 18
is `SwAct fails Reason: XPM SwActback`	step 8
is `SwAct refused by SwAct controller`	step 9

8 The inactive unit cannot establish two-way communication with the central control (CC). The inactive unit switches activity back to the first active unit. Clear all faults on the inactive unit first. Attempt to clear the alarm condition on the active unit second.

Go to step 10.

9 The SwAct controller does not recommend a SwAct for the reason(s) stated. Clear all faults on the inactive unit first. Attempt to clear the alarm condition on the active unit second.

Go to step 10.

10 To check for fault indicators on the inactive unit, type

>QUERYPM FLT
and press the Enter key.

Example of a MAP response:

```
Node is ISTb
  One or both units inservice trouble
Unit 0
The following inservice troubles exist:
   Static data mismatch with CC
Unit 1
The following inservice troubles exist:
   Static data mismatch with CC
```

If	Do
C-side links out of service	step 11
PM Audit	step 13
REX fails	step 13
no WAI received	step 13
none of these conditions occur	step 13

11 To display the central side (C-side) link information, type

>TRNSL C
and press the Enter key.

12 Check the status of the links.

If	Do
status is OK	step 18
status is not OK	step 13

PM SMU
major (continued)

13 To manual busy the inactive unit, type

>BSY UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

14 To test the inactive unit, type

>TST UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

If test	Do
passes	step 17
fails, and the system generates a card list	step 15
fails, and the system does not generate a card list	step 18

15 Check the card list that appears at the MAP terminal.

Example of a MAP display:

```
Site Flr RPos  Bay_id Shf Description Slot EqPEC
HOST  00  M07  SME 00  51  SMU : 000    12  MX77
HOST  00  M07  SME 00  51  SMU : 000    22  6X40
HOST  00  M07  SME 00  65  SMU : 000    22  6X40
HOST  00  M07  SME 00  65  SMU : 000    12  MX77
```

If you	Do
replaced all cards on the card list	step 18
did not replace all cards on the card list	step 16

16 To replace the next card on the list, go to *Card Replacement Procedures*. Complete the card replacement procedures. Go to step 14 of this procedure.

PM SMU
major (continued)

17 To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	**Do**
passes	step 19
fails	step 18

18 For additional help to clear this alarm, contact the next level of support.

19 You returned the inactive unit to service. Determine if the active unit is in-service.

If active unit	**Do**
is InSv	step 25
is ISTb	step 20

PM SMU
major (continued)

20

> **CAUTION**
> **Service disruption: calls can end!**
> When the system prompts you to confirm a cold SwAct, only perform this activity during a period of low traffic. The system ends all calls that this peripheral module (PM) handles, including data calls.

To switch the activity of the units, type

>SWACT

and press the Enter key.

The system determines the type of SwAct the system can perform. The system can perform a warm SwAct or a cold SwAct. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
cannot continue at this time	step 21
can continue at this time	step 22

21 Do not switch activity of the units. To reject the SwAct, type

>NO

and press the Enter key.

The system does not continue the SwAct.

Return to step 20 during a period of low traffic.

PM SMU
major (end)

22 To switch the activity of the unit, type

>YES
and press the Enter key.

The system runs a pre-SwAct audit to determine the if the inactive unit can accept activity correctly.

Note: A maintenance flag (`Mtce`) appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

If the message	Do
is `SwAct passes`	step 24
is `SwAct fails`	step 18
is `SwAct fails Reason: XPM SwActback`	step 23
`SwActmrefused by SwAct controller`	step 23

23 To force a SwAct to the active unit, type

>SWACT FORCE
and press the Enter key.

The SwAct controller can use short term history reasons to refuse a SwAct. After the SwAct is complete, the short term history reasons are reset.

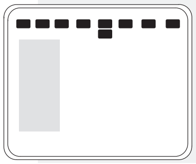
24 To clear the alarm condition on the new inactive unit, go to step 10.

25 The procedure is complete.

If other alarms appear, refer to the correct alarm clearing procedures for the indicated alarms.

PM RCU minor

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nRCU**	.	.	.	.	.

Indication

The remote carrier urban (RCU) alarm appears under the PM header in the MAP display. This alarm indicates an alarm condition in the RCU. The *n* indicates the number of RCUs with alarms. The blank space that appears under the alarm indicates a minor alarm.

Meaning

This alarm normally indicates that one or more common equipment cards, digroup cards, or repeater cards in the RCU has defects or is not available. This alarm can indicate problems with a DS-1 link or links and associated line repeaters. This alarm indicates conditions like blown fuses, ac rectifier failure, loss of commercial power, or fan failure.

Impact

A minor alarm class code indicates an in-service trouble (ISTb) condition in the RCU. A minor alarm class code indicates that the condition affects service on fewer than nine lines.

Common procedures

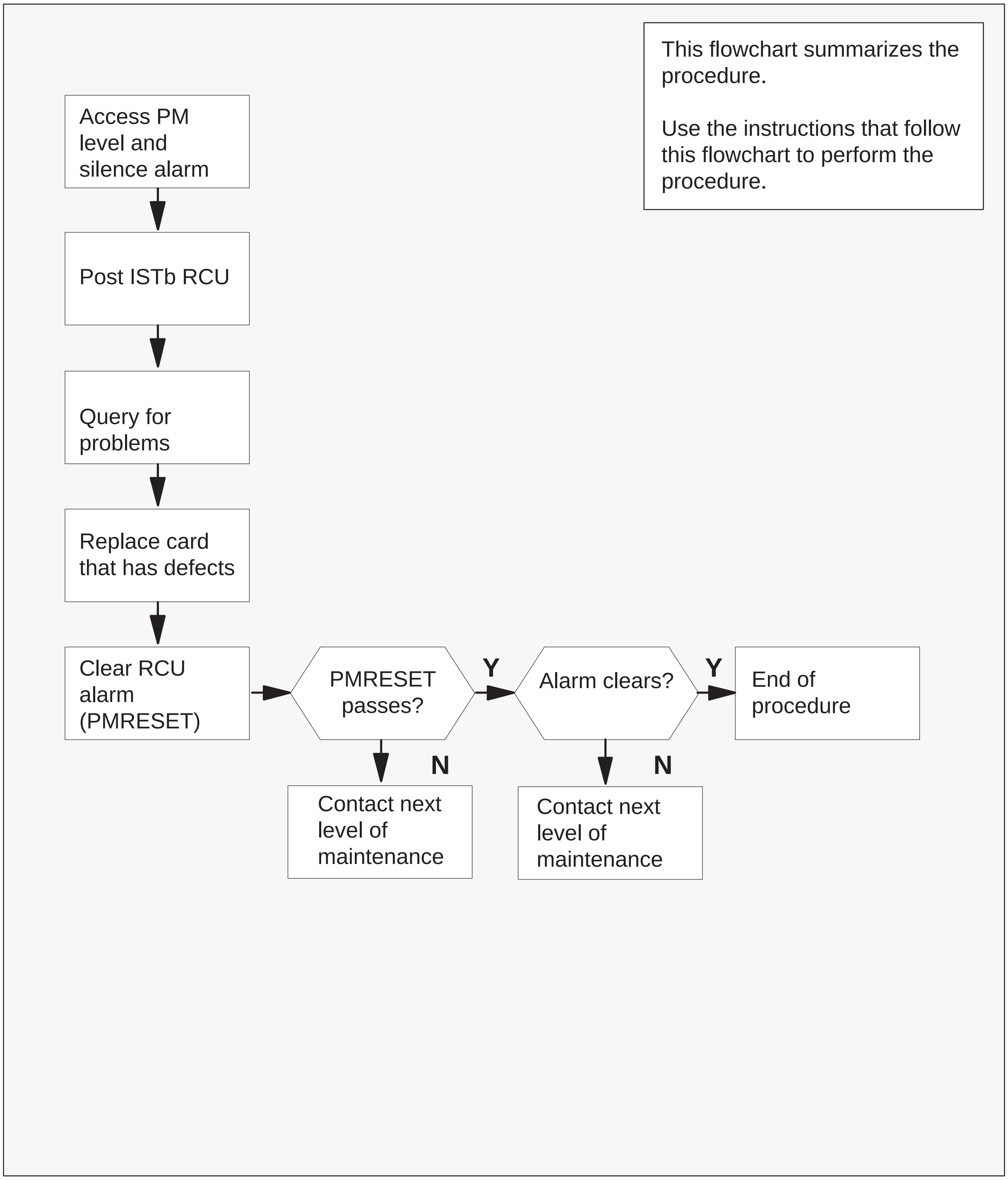
Does not apply

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

PM RCU
minor (continued)

Summary of PM RCU minor alarm



PM RCU
minor (continued)

Clearing a PM RCU minor alarm

At the MAP terminal

1 When the system detects a problem, the system can trigger an audible alarm. To access the MTC level of the MAP terminal to silence the alarm, type:

>MAPCI;MTC;SIL
and press the Enter key.

2 To display the RCU or RCUs with ISTb, type:

>PM;DISP STATE ISTB RCU
and press the Enter key.

Example of a MAP response:

```
If more than one RCU is ISTb, choose one.
```

3 To access the ISTb RCU, type:

>POST RCU site_name frame_no unit_no
and press the Enter key.

where

site_name is the name of the remote site that appears in step 2
frame_no is the frame number of the RCU that appears in step 2
unit_no is the unit number of the RCU that appears in step 2

Example of a MAP response:

```
RCU     SysB   ManB   Offl   CBsy   ISTb   InSv
    PM     0      4      0      0      3     28
   RCU     0      0      0      0      2      0

RCU RCU0 00 0  ISTb        Links_OOS: Cside 0
```

4 To check for problem indicators, type:

>QUERYPM FLT
and press the Enter key.

Example of a MAP response:

```
Alarm  Code   Shelf   Slot   Description
Minor            3      6    Card failure
Minor            4     16    Configuration alarm
Minor    4                   Digital line failure
```

Note: This information appears in PM128 logs that the system generates for the ISTb RCU.

PM RCU
minor (end)

5 Isolate and replace the component that has defects. After you replace the component that has defects, return to this point.

6 To clear the RCU alarm, type:

>PMRESET
and press the Enter key.

Example of a MAP response:

```
No new calls will be processed for up to 1–3 minutes.
Please confirm (“YES” or “NO”):
```

To affirm the confirmation request, type:

>YES
and press the Enter key.

If PMRESET	Do
passes	step 7
fails	step 8

7 Observe the PM header in the MAP subsystem display.

If alarm	Do
regenerates	step 8
clears	step 9

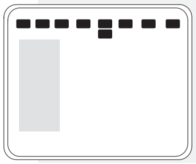
8 For additional help, contact the next level of maintenance.

9 The procedure is complete.

If other alarms appear at the MAP display, refer to the correct alarm clearing procedures.

PM SMU minor

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nSMU**	.	.	.	.	.

Indication

The Subscriber Carrier Module - 100 Urban (SMU) alarm appears under the peripheral module (PM) header in the MAP subsystem display. This alarm indicates an alarm condition is present in the SMU. The *n* indicates the number of SMU modules with alarms. The blank space below the alarm indicates a minor alarm.

Meaning

This alarm normally indicates that one or more common peripheral controller cards in the SMU have defects. This alarm can indicate that message links on the network side are out of service.

Result

A minor alarm class code indicates that the SMU has an in-service trouble (ISTb) or central-side busy (CBsy) condition.

If the condition is ISTb, the SMU continues to process calls, but a potential service-affecting fault condition exists. To reduce impact to subscriber services, isolate the fault condition to the component that has defects. Follow this procedure to replace the component that has defects.

If the condition is CBsy, the SMU cannot process calls until a message link on the SMU network returns to service.

Common procedures

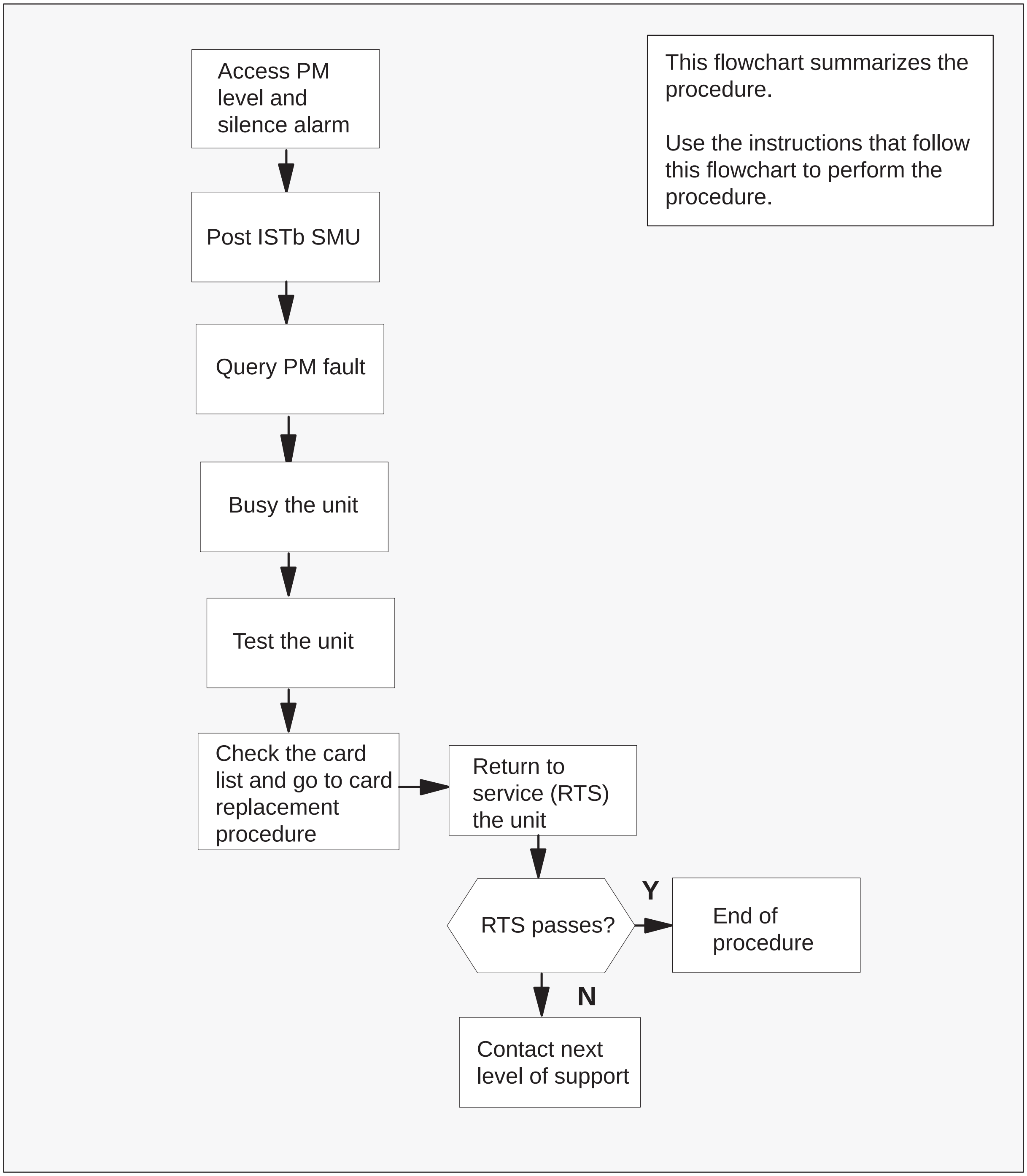
This procedure refers to the procedure *Updating static data*.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

PM SMU
minor (continued)

Summary of PM SMU minor alarm



PM SMU
minor (continued)

Clearing a PM SMU minor alarm

At the MAP terminal

1 When the system detects a fault, the system triggers an audible alarm. To access the MTC level of the MAP and silence the alarm, type

>MAPCI;MTC;SIL
and press the Enter key.

2 To determine which SMU is ISTb, type

>PM; DISP STATE ISTB SMU
and press the Enter key.

Example of a MAP response:

```
ISTb SMU:  1
```

3 To access the ISTb SMU, type

>POST SMU smu_no
and press the Enter key.

where

smu_no is the number of the SMU displayed in step 2

Example of a MAP response:

```
SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0    1     0     2    13
    SMU     0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

If	Do
both units are in-service (InSv)	step 9
both units are in-service trouble (ISTb)	step 9
one unit is ISTb and inactive	step 9
one unit is ISTb and active	step 4

PM SMU
minor (continued)

4

> **CAUTION**
> **Service disruption: calls can drop!**
> If the system prompts you to confirm a cold SWACT, perform this activity during a period of low traffic. The system drops all calls that this PM handles including data calls.

To switch the activity of the units, type

>SWACT
and press the Enter key.

The system determines the type of SWACT (warm or cold) the system can perform. The system displays a confirmation prompt for the selected SWACT.

If SwAct	Do
cannot continue at this time	step 5
can continue at this time	step 6

5 Do not switch activity of the units. To reject the switch, type

>NO
and press the Enter key.

The system does not continue the switch of activity.

Return to step 4 during a period of low traffic.

PM SMU
minor (continued)

6 To switch the activity of the unit, type

>YES
and press the Enter key.

The system runs a pre-SWACT audit to determine if the inactive unit can accept activity correctly.

Note: A maintenance flag (Mtce in the following example) appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

Example of a MAP response:

```
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb      Mtce
Unit1:  Inact InSv      Mtce
```

If the message is	Do
`SwAct passed`	step 9
`SwAct failed`	step 27
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 8

7 The inactive unit cannot establish two-way communication with the central control (CC) and switches activity back to the original active unit. You must clear all faults on the inactive unit before you attempt to clear the alarm condition on the active unit.

Go to step 9.

8 The SWACT controller does not recommend a SWACT for the reason(s) stated. You must clear all faults on the inactive unit before you attempt to clear the alarm condition on the active unit.

Go to step 9.

9 To check for fault indicators on the inactive unit, type

>QUERYPM FLT
and press the Enter key.

Example of a MAP response:

```
Node is ISTb
  One or both units inservice trouble
Unit 0
The following inservice troubles exist:
   Static data mismatch with CC
Unit 1
The following inservice troubles exist:
   Static data mismatch with CC
```

If	Do
peripheral side (P-side) links are out of service	step 20
C-side link is out of service	step 10
static data mismatch with CC	step 11
CLASS modem resource (CMR) card is out of service	step 14
none of the above conditions occur	step 27

10 Determine if net links for the SMU are out of service.

If lines for the SMU	Do
are out of service	follow the “Clearing a network alarm” procedure
are not out of service	step 11

PM SMU
minor (continued)

11 To manually busy the inactive unit, type

>BSY UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit
Go to step 12.

12 To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 34
fails and the system does not generate a card list	step 27
fails and the system generates a card list	step 13

13 Check the card list that appears at the MAP terminal. The card that can have defects appears first on the list.

Example of a MAP display:

```
Site Flr RPos  Bay_id Shf Description Slot EqPEC
HOST  00  M07  SME 00  51  SMU : 000    22  6X40
HOST  00  M07  SME 00  51  SMU : 000    23  6X40
```

Go to step 24.

14 To manually busy the inactive unit, type

>BSY UNIT unit_no CMR
and press the Enter key.

where

unit_no   is the number of the inactive unit
Go to step 24.

PM SMU
minor (continued)

15 To test the card, type

>TST UNIT unit_no CMR
and press the Enter key.

where

unit_no is the number of the unit that contains the card that has defects

If test	Do
passes	step 16
fails and the following message appears: `CMR Tst failed No reply from PM`	step 17

16 To return the CMR card to service, type

>RTS UNIT unit_no CMR
and press the Enter key.

where

unit_no is the number of the unit that contains the CMR card that has defects

If RTS	Do
passes	step 28
fails	step 27

17 To load the CMR card, type

>LOADPM UNIT unit_no CC CMR
and press the Enter key.

where

unit_no is the number of the unit that contains the CMR card that has defects

If load	Do
passes	step 16
fail	step 18

PM SMU
minor (continued)

18 Check the card list that appears at the MAP terminal.

Example of a MAP display:

If the NT6X78 card in the card list	Do
is replaced	step 27
is not replaced	step 19

19 Go to the *Card Replacement Procedures* for the first (or next) card on the list. When you return from the card replacement procedures, go to step 16 of this procedure.

20 To display information about the P-side links, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
LINK 1 RCU RCU0 01 0 1;CAP S;STATUS: SysB
LINK 2 RCU RCU0 01 0 2;CAP S;STATUS: OK
LINK 3 RCU RCU0 01 0 3;CAP MS;STATUS: OK MSGCOND: OPN
LINK 4 RCU RCU0 01 0 4;CAP MS;STATUS: OK MSGCOND: OPN
LINK 5 RCU RCU0 01 0 5;CAP S;STATUS: OK
```

21 To busy the SysB link, type

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of the SysB link displayed in step 20

22 To test the link busy in step 21, type

>TST LINK link_no
and press the Enter key.

where

link_no is the number of the link busy in step 21

If test	Do
passes	step 25
fails, and a card list appears	step 23
fails, but card list does not appears	step 27

23 Check the card list that appears at the MAP terminal.

Example of a MAP display:

```
Site Flr RPos  Bay_id Shf Description Slot EqPEC
HOST  00  M07  SME 00  51  SMU : 000    01  6X85
HOST  00  M07  SME 00  51  SMU : 000    05  6X85
```

If all cards	Do
are replaced	step 27
are not replaced	step 24

24 Go to the card replacement procedure in *Card Replacement Procedures*. for the first (or next) card on the card list.

If card	Do
NT6X40 has been replaced	step 12
NT6X85 has been replaced	step 22

PM SMU
minor (continued)

25 To return the link to service, type

>RTS LINK link_no
and press the Enter key.

where

link_no is the number of the link tested in step 17

If RTS	Do
passes	step 26
fails	step 27

26 Determine if additional SysB links are present.

If additional SysB links	Do
are present	step 21
are not present	step 28

27 For additional help to clear this alarm, contact the next level of support.

28 You returned the inactive unit to service. Determine if the active unit is in-service.

If active unit	Do
is InSv	step 34
is ISTb	step 29

29

CAUTION
Service disruption
If the system prompts you to confirm a cold SWACT, perform this activity during a period of low traffic. The system drops all calls that this system handles including data calls.

To switch the activity of the units, type

>SWACT
and press the Enter key.

The system determines the type of SWACT it can perform, (warm or cold). The system displays a confirmation prompt for the selected SWACT.

If SWACT	Do
cannot continue at this time	step 30
can continue at this time	step 31

30 Do not switch activity of the units. To reject the switch, type

>NO
and press the Enter key.

The system does not continue the switch of activity.

Return to step 29 during a period of low traffic.

31 To switch the activity of the unit, type

>YES
and press the Enter key.

The system runs a pre-SWACT audit to determine if the inactive unit can accept activity correctly.

Note: A maintenance flag, Mtce, appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

If the message is	Do
`SwAct passed`	step 33
`SwAct failed`	step 27
`SwAct failed Reason: XPM SwActback`	step 32
`SwAct refused by SwAct controller`	step 32

32 To force a switch of activity to the active unit, type

>SWACT FORCE
and press the Enter key.

PM SMU
minor (end)

When the SWACT is complete, the short term history reasons that the SWACT controller uses to refuse the SWACT are reset.

33 Go to step 9 alarm condition on the newly inactive unit.

34 You have completed this procedure.

If other alarms display, refer to the correct alarm clearing procedures for the indicated alarms.

SMU
Updating static data

Application

Use this procedure to update static data in the Subscriber Carrier Module-100 Urban (SMU).

Action

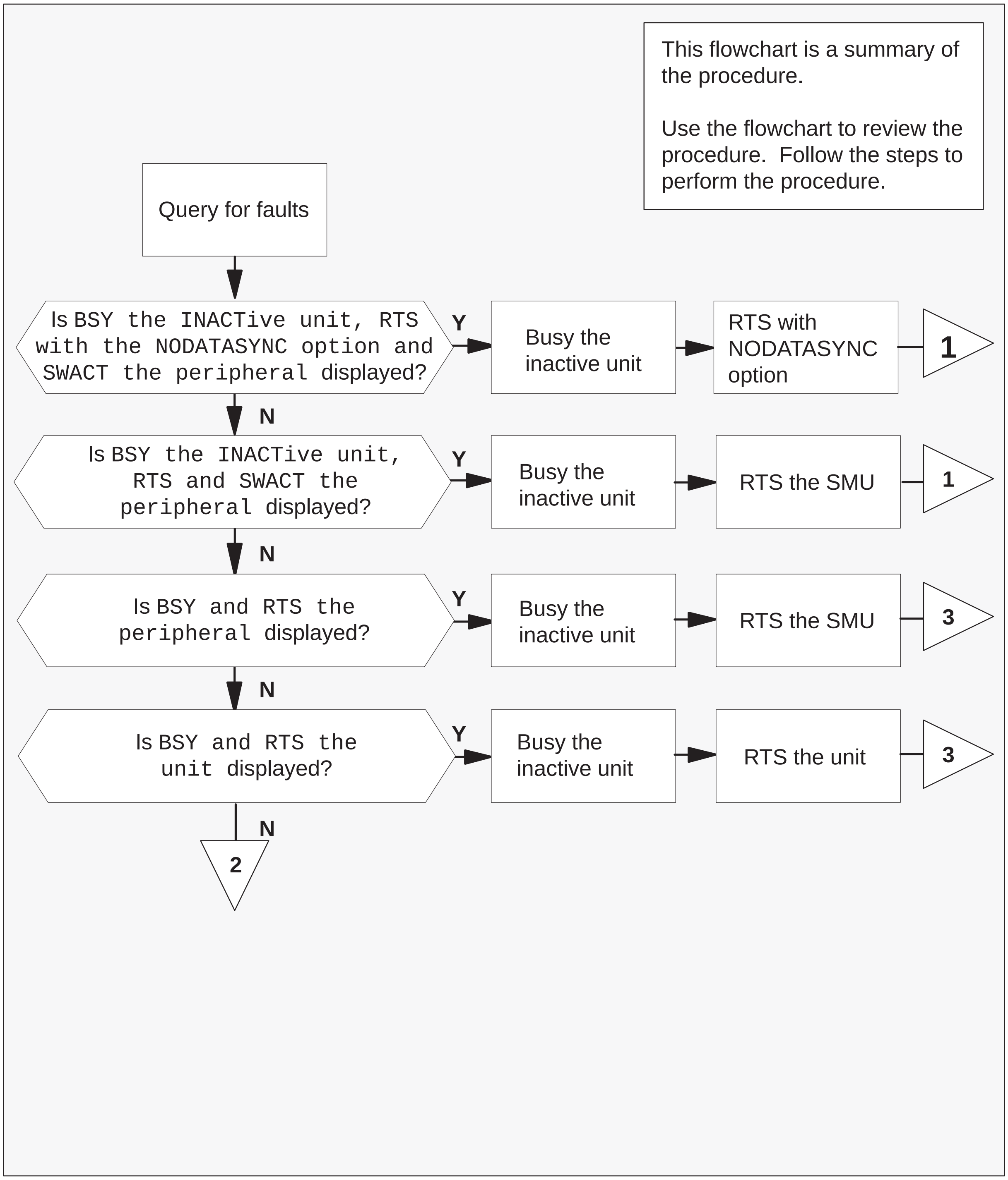
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

ATTENTION

The following return to service (RTS) procedure(s) with the NODATSYNC option applies to XMS-based peripheral modules (XPMs) that are not converted to XPM configuration data table (CDT) management.
The XPMs with software loads that contain this feature, synchronize node and port tables of both units with the computing module (CM).
The XPMs do not synchronize unit to unit.
All the XPMs must be busied and returned to service to clear an in-service trouble (ISTb) conditions with configuration download.
You must clear an ISTb to synchronize both units.
This process must occur during periods of low traffic to minimize out-of-service (OOS) impact.

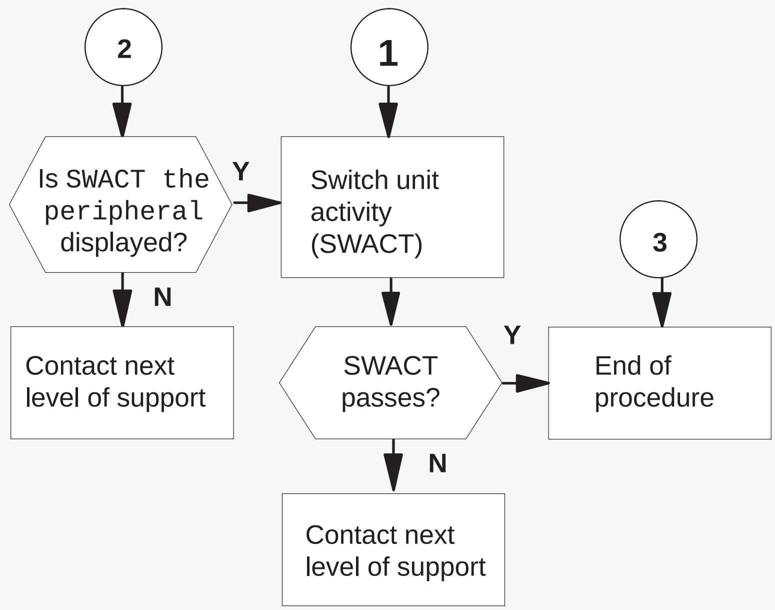
SMU
Updating static data (continued)

Summary of Updating static data and SMU alarm



SMU
Updating static data (continued)

Summary of Updating static data and SMU alarm (continued)



SMU
Updating static data (continued)

Updating static data and SMU alarm

At the MAP terminal

1 Only proceed if a step in a maintenance procedure directed you to this procedure. The separate use of this procedure can cause equipment damage or loss of service.

2 To check for fault indicators, type:

>QUERYPM FLT
and press the Enter key.

If the response is	Do
`BSY the inactive unit, RTS with the NODATASYNC option and SWACT the peripheral`	step 3
`BSY the inactive unit, RTS and SWACT the peripheral`	step 7
`BSY and RTS the peripheral`	step 11
`BSY and RTS the unit`	step 13
`SWACT the peripheral`	step 16

3 To busy the inactive unit, type:

>BSY UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

4

CAUTION
Loss of service
The system will lose all calls, including data calls, that this peripheral module (PM) handles. Perform the next step during a period of low traffic.

To RTS the inactive unit, type:

>RTS UNIT unit_no NODATASYNC
and press the Enter key.

where

unit_no is the number of the inactive unit

5 To perform a Switch the Activity (SWACT) of the units, type:

>SWACT
and press the Enter key.

The system determines the type of SWACT, warm or cold, that the system can perform. The system displays a confirmation prompt for the selected SWACT.

6 To perform a SWACT of the unit, type:

>YES
and press the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity with a reliable method.

Note: A maintenance (Mtce) flag appears when maintenance tasks are in progress. Wait until the flag does not appear before you proceed with the next Mtce action.

Example of a MAP response:

```
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb      Mtce
Unit1:  Inact InSv      Mtce
```

If the message is	Do
SWACT passes	step 18
SWACT fails	step 17

7 To busy the inactive unit, type:

>BSY UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

SMU
Updating static data (continued)

8

CAUTION
Loss of service: PM will drop calls
The system will lose all calls, including data calls, that this PM handles. Perform the next step during a period of low traffic.

To RTS the inactive unit, type:

>RTS UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

9 To perform a SWACT of the units, type:

>SWACT
and press the Enter key.

The system determines the type of SWACT, warm or cold, that the system can perform. The system displays a confirmation prompt for the selected SWACT.

10 To perform a SWACT of the unit, type:

>YES
The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity with a reliable method.

Note: A Mtce flag appears when Maintenance tasks are in progress. Wait until the flag does not appear before you proceed with the next maintenance action.

Example of a MAP response:

```
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb      Mtce
Unit1:  Inact InSv      Mtce
```

If the message is	Do
`SWACT passes`	step 18
`SWACT fails`	step 17

11 To busy the inactive unit, type:

>BSY UNIT unit_no
and press the Enter key.

SMU
Updating static data (continued)

where

unit_no is the number of the inactive unit

12

> **CAUTION**
> **Loss of service: PM will drop calls**
> The system will lose all calls, including data calls, that this PM handles. Perform the next step during a period of low traffic.

To RTS the inactive unit, type:

>RTS
and press the Enter key.

If the RTS	Do
Passes	step 18
Fails	step 17

13 To busy the inactive unit, type:

>BSY UNIT unit_no
and press the Enter key.

where

unit_no is the number of the inactive unit

14

> **CAUTION**
> **Loss of service: PM will drop calls**
> The system will lose all calls, including data calls, that this PM handles. Perform the next step during a period of low traffic.

SMU
Updating static data (continued)

To RTS the inactive unit, type:

>RTS
and press the Enter key.

If the RTS	Do
Passes	step 18
Fails	step 17

15

> **CAUTION**
> **Loss of service: PM will drop calls**
> The system will lose all calls, including data calls, that this PM handles. Perform the next step during a period of low traffic.

To perform a SWACT of the units, type:

>SWACT
and press the Enter key.

The system determines the type of SWACT, warm or cold, that the system can perform. The system displays a confirmation prompt for the selected SWACT.

16 To perform a SWACT of the unit, type:

>YES
and press the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity with a reliable method.

Note: A Mtce flag appears when Mtce tasks are in progress. Wait until the flag does not appear before you proceed with the next maintenance action.

Example of a MAP response:

```
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb     Mtce
Unit1:  Inact InSv     Mtce
```

If the message is	Do
SWACT passes	step 18
SWACT fails	step 17

17 For additional help to clear this alarm, contact the next level of support.

18 This common procedure is complete. Return to the main procedure that sent you to this procedure and continue as directed.

SMU card replacement procedures

This chapter contains card replacement procedures for the Subscriber Carrier Module-100 Urban (SMU). These procedures are used by maintenance personnel to remove and replace hardware modules. Unless these procedures are part of verification or acceptance procedures, use them only when instructed to do so by some other maintenance procedure, such as an alarm clearing.

NT2X70 in an SMU

Application

Use this procedure to replace an NT2X70 card in an SMU.

PEC	Suffixes	Name
NT2X70	AA, AD, AE	Power converter

Common procedures

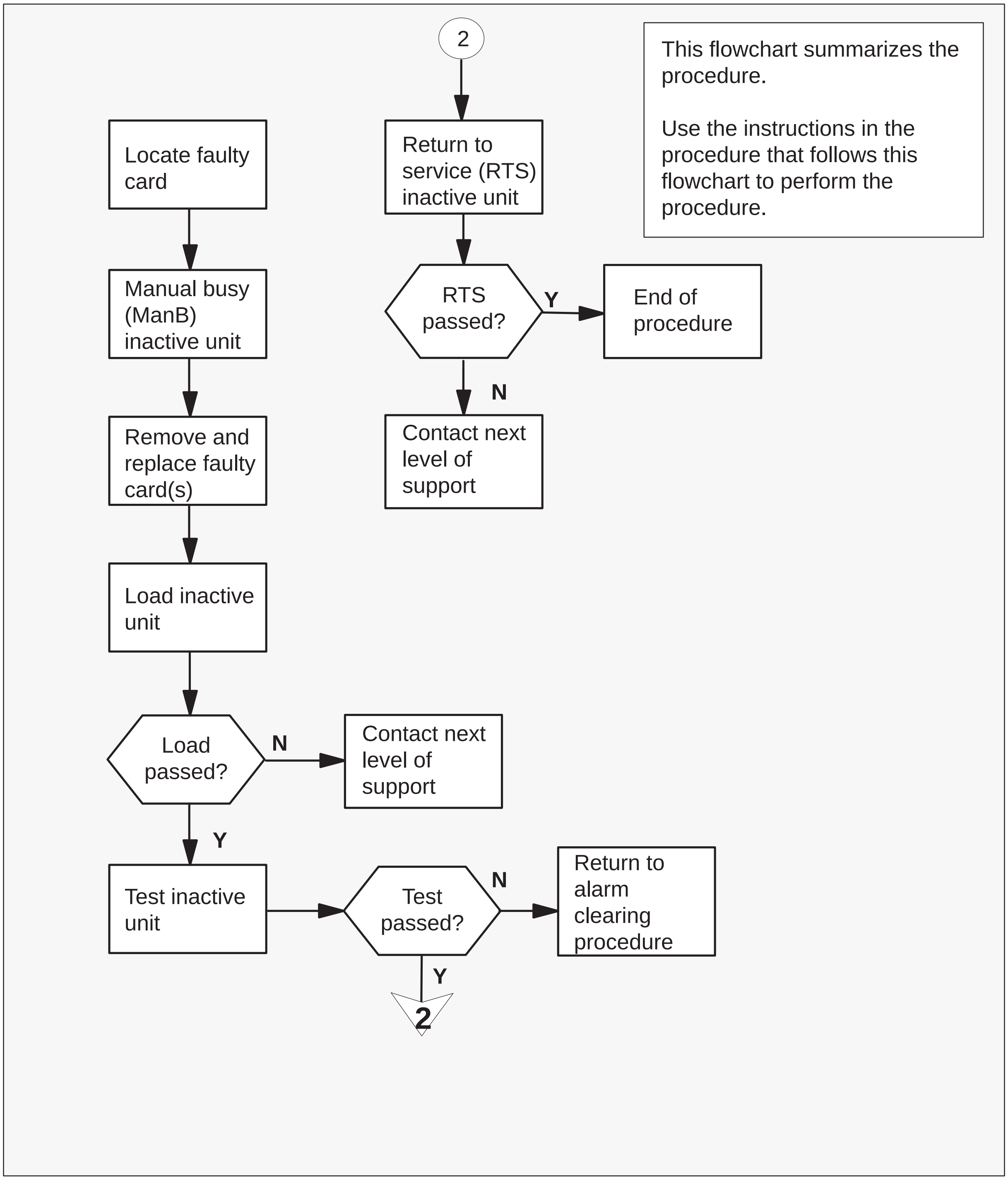
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT2X70
in an SMU (continued)

Summary of card replacement procedure for an NT2X70 card in an SMU



NT2X70
in an SMU (continued)

Replacing an NT2X70 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Ensure the PM level of the MAP terminal is currently displayed and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no   is the number of the SMU to be posted

Example of a MAP response:

```
SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM     3     0    1     0     2    13
    SMU    0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Inact SysB
Unit1:  Act   InSv
```

4 By observing the MAP display, ensure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 25

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine if the inactive unit can accept activity reliably.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

7 Return to *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. After the alarm is cleared, return to step 1 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NT2X70
in an SMU (continued)

At the MAP terminal:

9 Busy the inactive SMU unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

At the SME frame:

10 Put on a wrist strap.

11 Power down the unit by setting the ON/OFF switch on the power converter faceplate to the OFF position. The converter Fail light emitting diode (LED) is on and the Frame Fail lamp on the frame supervisory panel (FSP) is on. An audible alarm may sound.

If an alarm does sound, silence it by typing

>SIL
and pressing the Enter key.

12 Go to the common procedure “Removing and inserting cards,” then return to step 13 of this procedure.

13 Power up the inactive SMU unit as follows:

a. Ensure the power converter card (NT2X70) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

b. Set the Power switch to the On position.

If FSP is equipped with	Do
fuses	step 14
circuit breakers	step 15

14 Press and hold the Reset button for 1 s. Both the converter Fail LED and Frame fail lamp on the frame supervisory panel (FSP) will be On. Go to step 16.

15 If you are resetting a NT2X70AA or NT2X70AD card, press the Reset button while setting the circuit breaker to the On position. If you are resetting a NT2X70AE card, press the Reset button on the Power switch while setting the circuit breaker to the On position. The converter Fail LED is on, and the Frame Fail lamp on the frame supervisory panel is on.

NT2X70
in an SMU (continued)

Go to step 16.

16 Use the following information to determine where to go in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 20
other	step 17

At the MAP terminal:

17 Load the inactive SMU unit by typing

>LOADPM UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the SMU unit busied in step 9

If LOADPM	Do
passed	step 18
failed	step 21

18 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the SMU unit loaded in step 17

If TST	Do
passed	step 19
failed	step 21

19 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

NT2X70 in an SMU (end)

where

unit_no is the number of the SMU unit tested in step 18

If RTS	Do
passed	step 22
failed	step 21

20 Return to *Alarm Clearing Procedures*.

If necessary, go to the point where a faulty card list is initiated, identify the next faulty card on the list, and go to the appropriate card replacement procedure for that card.

21 Contact personnel responsible for higher level support and get further help to replace this card.

22 Send any faulty cards for repair according to local procedure.

23 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

24 You have successfully completed this procedure. Remove the sign from the active unit. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

25 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X40
in a SMU

Application

Use this procedure to replace the following cards in a Subcriber Carrier Module (SMU) as identified in the following table.

ATTENTION
Replacement restrictions apply to certain versions of the NT6X40 card. Carefully read the caution and note following the equipment chart before removing or installing any cards.

PEC	Suffixes	Name
NT6X40	AC, AD	DS30 C-sside interface card
NT6X40	FA, FB, FC	DS512 link controller card
NT6X40	GA	DS512 link paddle board

WARNING
Possible service disruption or loss of diagnostic functionality when installing or replacing NT6X40 cards versions AD, FB, or FC
NT6X40AD, FB, or FC cards must not be mismatched with other versions between the two units of an XPM if table LTCINV is datafilled with interface card types of NT6X40AD or NT6X40FB. A PM777 log is generated citing the mismatch and the XPM is put in an ISTb state. For example, you can not have an AC version of the card in unit 0 and an AD version in unit 1. For more information read the following notes.

Note: The NT6X40AD, NT6X40FB, and NT6X40FC cards provide enhanced diagnostic capabilities. If table LTCINV datafill is set to the NT6X40AC or NT6X40FA version of the card, cards can be mismatched but the new diagnostics capabilities will not be initiated. The CM will treat the interface as NT6X40AC/NT6X40FA regardless of the card installed. For more information see the section on datafilling table LTCINV in the data schema section of the *Translations Guide.*

NT6X40 in a SMU (continued)

Common procedures

The following common procedures are referenced:

- *Manually busying SMU C-side links*
- *Removing and replacing a card*
- *Returning a card for repair or replacement*

Do not go to a common procedure unless directed to do so in the step-action procedure.

Action

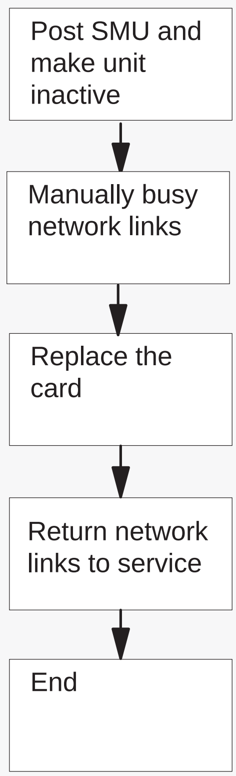
The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X40
in a SMU (continued)

Summary of Replacing NT6X40 in a SMU

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



NT6X40
in a SMU (continued)

Replacing an NT6X40 in a SMU

At your current location

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure the unit in which you are replacing the card is *inactive* and the mate unit is *active*.

Obtain an NT6X40 replacement circuit card. Ensure the replacement circuit card has the same product engineering code (PEC), including suffix, as the circuit card being removed.

At the MAP terminal

3 Access the peripheral module (PM) level of the MAP display and post the SMU with the faulty card by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no   is the PM number (0 to 255)

Example of a MAP response:

```
SMU              SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM      0        0        2       0        2          25
 2 Post_   SMU     0        0        0       0        1           1
 3 ListSet
 4         SMU   0 ISTb  Links_OOS:  CSide  1, PSide   1
 5 TRNSL   Unit0:   Inact ISTb
 6 TST     Unit1:   Act InSv
 7 BSY
 8 RTS
 9 OffL
10 LoadPM_
11 Disp_
12 Next_
```

NT6X40
in a SMU (continued)

4 Determine the location of the SMU containing the NT6X40 circuit card you are replacing by typing

>QUERYPM
and pressing the Enter key.

Example of a MAP response:

```
QueryPM
PM Type: SMU  PM No.: 0  PM Int. No.:11 Node_No.: 192
PMs Equipped: 139 Loadname: NSS05BC
WARM SWACT is supported and available.
SMU 0 is included in the REX schedule.
REX on SMU 0 has not been performed.
Node Status: {OK, FALSE}
Unit 0   Act, Status: {OK, FALSE}
Unit 1 Inact, Status: {OK, FALSE}
Site Flr RPos  Bay_id  Shf Description Slot EqPEC
HOST  01  E31  SME  01  18     SMU :   000  6X02AA
```

5 Determine the state and activity of the XPM unit in which the card you replacing is provisioned.

If the state of the PM unit is	Do
ISTb, InSv, SysB, or CBsy, and active	step 6
ISTb, InSv, SysB, or CBsy, and inactive	step 9
ManB	step 9
OffL	step 33

6 From the MAP display, determine the state of the mate PM unit.

If the SMU unit is	Do
ISTb or InSv	step 7
any other state	step 35

NT6X40
in a SMU (continued)

7 Switch activity by typing

>SWACT
and pressing the Enter key.

Example of a MAP response:

```
SMU 0     A Warm SwAct will be performed after
          data sync of active terminals.
Please confirm (”YES”, ”Y”, ”NO”, or ”N”):
```

If	Do
you are prompted to confirm a warm SWACT	step 8
the system rejects the SWACT	step 34

8 Confirm the command by typing

>YES
and pressing the Enter key.

Example of a MAP response:

```
Unit0:   Inact SysB  Mtce
Unit1:   Act   ISTb

SMU 0     SwAct Passed
```

Note: A maintenance flag (Mtce) may appear, indicating that system-initiated maintenance tasks are in progress. Wait until the flag disappears from the status lines for both PM units before proceeding to the next step.

If the MAP response is	Do
`SWACT passed`	step 9
anything else	step 35

9 A maintenance flag (Mtce) may appear, indicating that system-initiated maintenance tasks are in progress. Wait until the flag disappears from the status lines for both PM units before proceeding to the next step.

NT6X40
in a SMU (continued)

10 Manually busy all C-side links associated with the inactive PM unit you are working on using the procedure *Manually busying Series II PM and CPM C-side links* in this document. When you have completed the procedure, return to this point.

At the cabinet

11 Place a sign on the active unit bearing the words **Active unit–Do not touch.** This sign should not be attached by magnets or tape.

If you are replacing an	Do
NT6X40GA	step 12
NT6X40AC, AD, FA, FB, or FC	step 24

At the front of the shelf

12

WARNING
Static electricity damage
Wear a wrist strap connected to the wrist-strap grounding point of the modular supervisory panel (MSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Unseat the NT6X40 card in the inactive unit.

At the back plane of the shelf

13

DANGER
Risk of electrocution
Voltage is present on the back plane. Remove all jewelry before continuing with this procedure. Do not touch pins or terminals except as instructed.

Locate the circuit card to be replaced.

Note: NT6X40 circuit cards are located in slot 9 of unit 0, and slot 19 of unit 1.

14 Label each connector to the circuit card.

NT6X40
in a SMU (continued)

15

> **WARNING**
> **Avoid contaminating the fiber tip surface**
> Do not touch the tip of the fiber. Dirt or oil from the skin transferred to the fiber tip surface degrades fiber performance.

> **WARNING**
> **Fiber cable may become damaged**
> Take care when handling fiber cables. Do not crimp or bend fiber cables to a radius of less than 25 mm (1 in.).

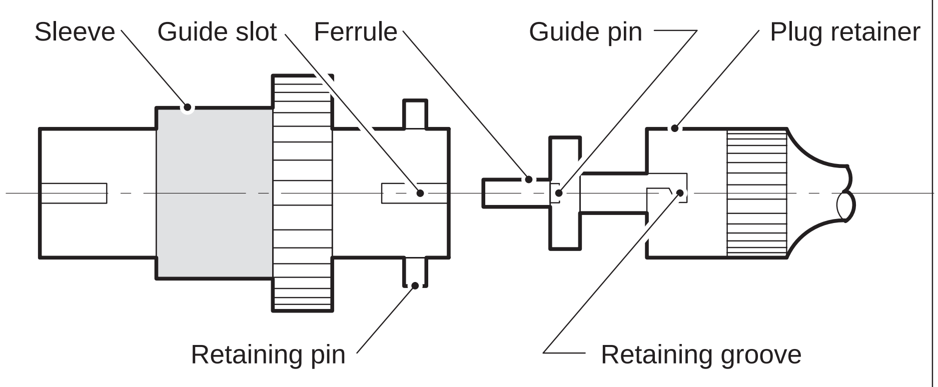
Disconnect the fiber optic cables.

a. Twist the plug retainer to unlock the retaining pin from the retaining groove

b. Rotate the plug retainer so the retaining pin enters the guide slot.

c. Gently pull on the plug retainers, moving the guide pin along the slot to remove the ferrule from the sleeve.

d. Fit dust caps to the open ends of the fiber links.



NT6X40
in a SMU (continued)

16

> **WARNING**
> **Protect back plane pins**
> Do not allow screws to drop onto or touch the back plane pins. When removing and replacing the screws for the card, the back plane pins above and below must be protected to prevent shorting out. Use of a magnetic screw or nut driver is recommended.

Protect exposed back plane pins in one of the following ways:

- Wrap electrical tape around a group of pins. Do not bend the pins.
- Cover the pins with NOMEX paper.

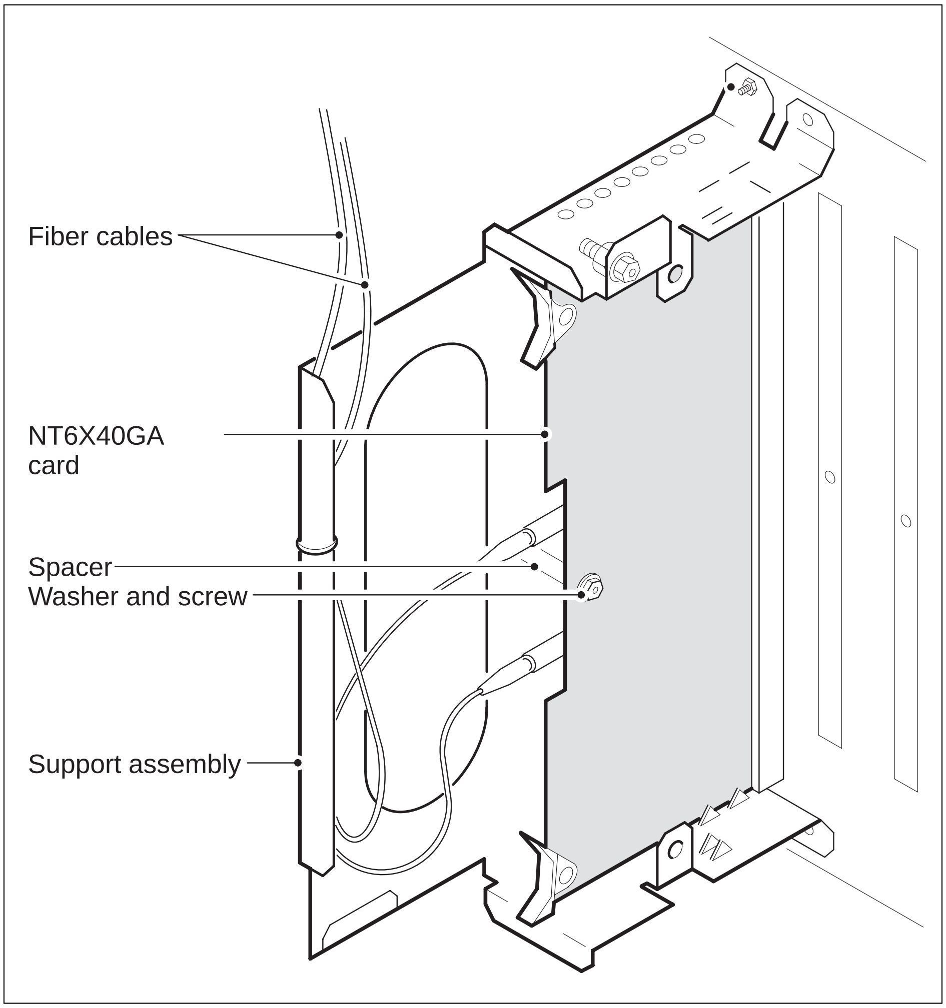
NT6X40
in a SMU (continued)

17 Remove the screw that holds the circuit card to the support assembly.

a. Locate the screw which is positioned half-way down the outer edge of the circuit card.

b. Remove the washer holding the screw in place.

c. Remove the screw and the spacer located between the circuit card and the support assembly.



18 Open the ejection levers on the 6X40 circuit card. Remove the card by firmly pulling horizontally until the connector pin socket on the card has cleared the connector pins on the backplane.

NT6X40
in a SMU (continued)

19 Place the circuit card just removed in an electrostatic discharge protective container.

Note: If the circuit card you are replacing has switches, ensure the switches on the replacement circuit card have the same settings.

20 Using the levers located at the top and bottom of the 6X40 circuit card firmly press the connector pin socket on the card onto the connector pins on the backplane.

21 Secure the circuit card to the support assembly.

a. Locate the screw hole which is positioned half-way down the outer edge of the card.

b. Position the spacer at the screw hole between the circuit card and the support assembly.

c. Insert the screw, moving it in the direction of the support assembly, through the spacer.

d. Fasten the washer to hold the screw in place.

22 Reconnect the fiber optic cables.

a. Remove the dust caps from the ends of the fiber links.

b. Gently insert the ferrule into the sleeve so the guide pin enters the guide slot.

c. Rotate the plug retainer so the retaining pin enters the retaining groove.

d. Push the connectors together and twist the plug retainer to lock the retaining pin into the retaining groove.

NT6X40
in a SMU (continued)

At the front of the shelf

23 Reseat the NT6X40 card unseated in step 12. Go to step 25.

24 Replace the card using the procedure "*Removng and replacing a card*" in this section. When you have completed the procedure, return to this point.

At the MAP terminal

25 The next action depends on the type of network in the office.

If you are working on	Do
JNET	step 26
ENET	step 28

26 Return to service one of the network links by typing

>RTS plane_no link_no
and pressing the Enter key.

where

plane_no is the number of the plane (0 or 1) for the link
link_no is the link number (0 to 63)

If the link	Do
returned to service and there are more manual-busy links	step 27
returned to service and there are no more manual-busy links	step 29
did not return to service	step 35

27 Repeat step 26 for each manually busy C-side link. When you have successfully returned all C-side links to service, go to step 29.

28 Return the network link to service by typing

>RTS plane_no LINK link_no
and pressing the Enter key.

where

plane_no is the number of the plane (0 or 1) for the link
link_no is the link number (0 to 3)

Example of a MAP response:

```
Request to RTS ENET Plane:0 Shelf:00 Slot:32 Link:01 submitted.
Request to RTS ENET Plane:0 Shelf:00 Slot:32 Link:01 passed.
```

If the link	Do
returned to service	step 29
did not return to service	step 35

29 Post the XPM you are working on by typing

>PM;POST pm_type pm_no
and pressing the Enter key.

where

pm_type the PM type (DTC, ILGC, LTCI, PDTC, SMU)
pm_no is the PM number (0 to 255)

NT6X40
in a SMU (continued)

30 Determine the status of the XPM unit containing the NT6X40 circuit card you replaced by typing

>QUERYPM

and pressing the Enter key.

```
SMU                        SysB    ManB    OffL    CBsy    ISTb    InSv
 0 Quit         PM            1       0      15       0       2     121
 2 Post_        SMU           0       0       0       0       0       3
 3 ListSet
 4           SMU     0 InSv  Links_OOS: CSide  0 , PSide  0
 5 Trnsl_    Unit0:   Inact InSv

 6 Tst_      Unit1:   Act   InSv

 7 Bsy_      QueryPM
 8 RTS_

            PM Type: SMU  PM No.: 0  PM Int. No.:11 Node_No.: 192
            PMs Equipped: 139 Loadname: NSS05BC
            WARM SWACT is supported and available.
            SMU 0 is included in the REX schedule.
            REX on SMU 0 has not been performed.
            Node Status: {OK, FALSE}
            Unit 0   Act, Status: {OK, FALSE}
            Unit 1 Inact, Status: {OK, FALSE}
            Site Flr RPos  Bay_id  Shf Description Slot EqPEC
            HOST  01  E31  SME  01  18     SMU :   000  6X02AA
```

If the inactive unit status is	Do
InSv	step 31
anything else	step 35

31 The next action depends on your reason for performing this procedure.

If you were	Do
directed to this procedure from a maintenance procedure	step 32
not directed to this procedure from a maintenance procedure	step 36

NT6X40
in a SMU (end)

32 Return to the maintenance procedure that sent you to this procedure and continue as directed.

33 Consult office personnel to determine why the component is offline. Continue as directed by office personnel.

34 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

35 For further assistance, contact the personnel responsible for the next level of support.

36 Go to the common procedure “Returning a card for repair or replacement” in this section.

37 You have completed this procedure.

NT6X41
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffix	Name
NT6X41	AA	Speech bus formatter

Common procedures

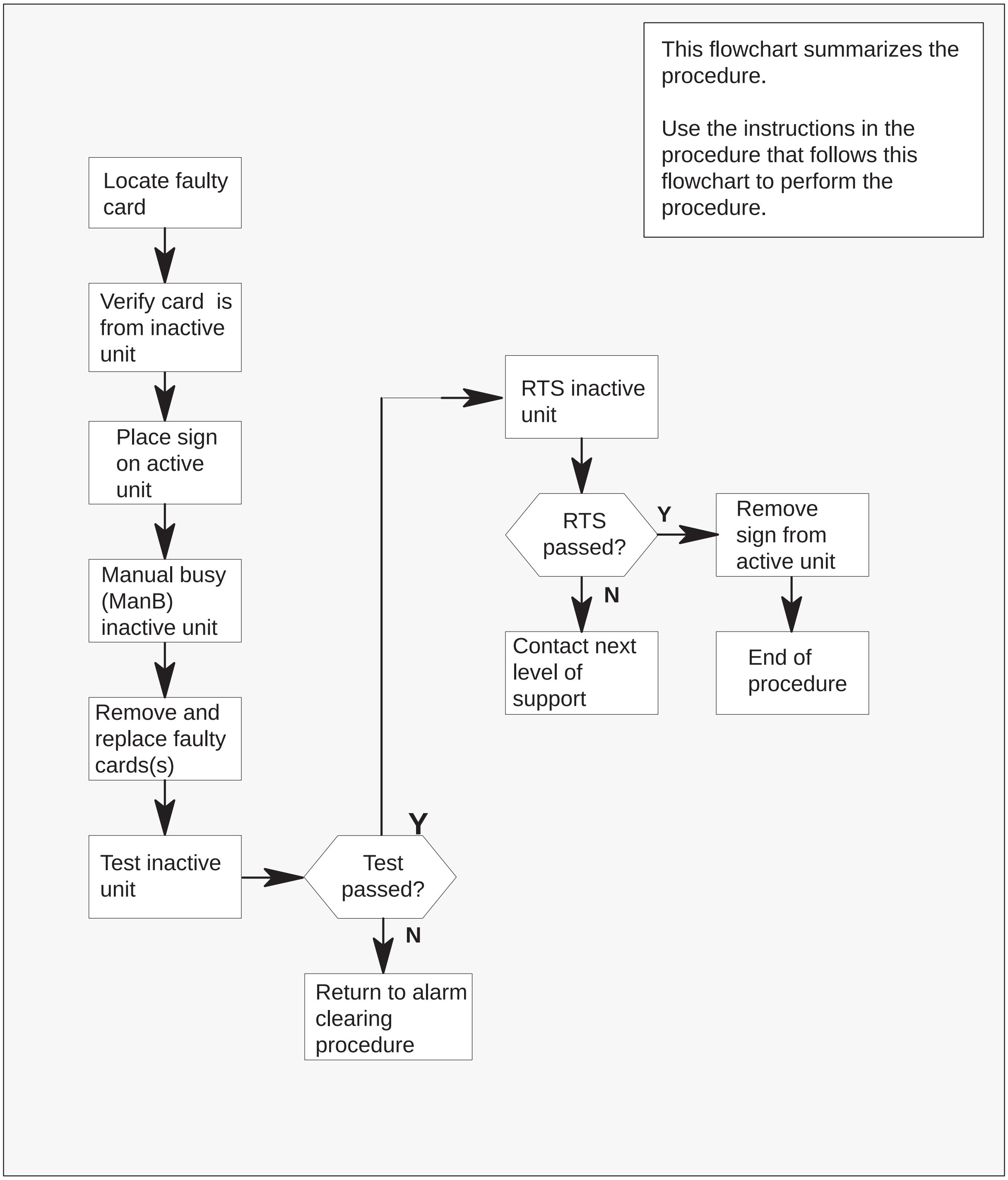
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X41
in an SMU (continued)

Summary of card replacement procedure for an NT6X41 card in an SMU



NT6X41
in an SMU (continued)

Replacing an NT6X41 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2 Get a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Access the PM level of the MAP terminal by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0    1     0     2    13
    SMU     0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

4 By observing the MAP display, be sure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NT6X41
in an SMU (continued)

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 21

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine if the inactive unit can accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NT6X41 in an SMU (continued)

At the MAP terminal:

9 Busy the inactive SMU unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the faulty SMU unit

10 Set the PM to the ROM level by typing

>PMRESET UNIT unit_no NORUN
and pressing the Enter key.

unit_no is the number of the SMU unit busied in step 9

11 Go to the common procedure “Removing and inserting cards.” Then return to step 12 of this procedure.

12 Use the following information to determine where to go next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 15
other	step 13

13 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step 9

If test	Do
passed	step 14
failed	step 16

14 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

NT6X41 in an SMU (end)

where

unit_no is   the number of the SMU unit tested in step 13

If RTS	**Do**
passes	step 18
fails	step 16

15 Return to the *Alarm Clearing Procedures*. At the point where a faulty card list is initiated, identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

16 Contact personnel responsible for higher level support and get further help to replace this card.

17 Remove the sign from the active SMU unit.

18 Send any faulty cards for repair according to local procedure.

19 Note the following in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

20 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

21 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X42
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffix	Name
NT6X42	AA	Channel supervision messaging card

Common procedures

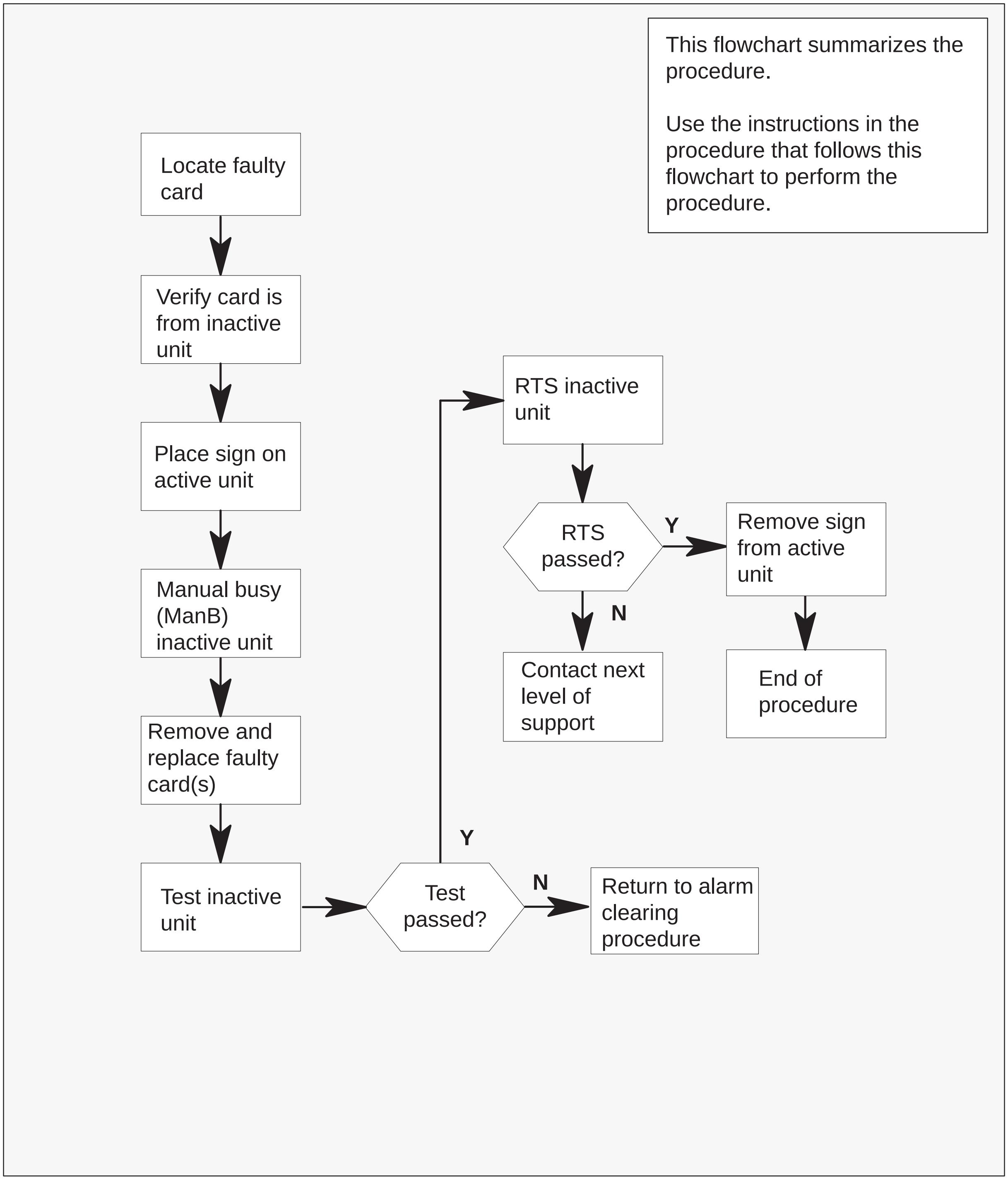
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X42
in an SMU (continued)

Summary of card replacement procedure for an NT6X42 card in an SMU



NT6X42
in an SMU (continued)

Replacing an NT6X42 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Verify the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Access the PM level of the MAP terminal by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      1     0    0     0     0    13
    SMU     1     0    0     0     1     7
SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   SysB
Unit1:  Inact InSv
```

4 By observing the MAP display, be sure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NT6X42
in an SMU (continued)

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 20

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`passed`	step 8
`failed`	step 7
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit.

After the alarm is cleared, return to step 1 of this procedure.

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NT6X42
in an SMU (continued)

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

10 Go to the common procedure“Removing and inserting cards,” then return to step 11 of this procedure.

11 Use the following information to determine where to go next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 14
other	step 12

12 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step 9

If TST	Do
passed	step 13
failed	step 15

13 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 12

NT6X42
in an SMU (end)

If RTS	Do
passed	step 16
failed	step 15

14 Return to the *Alarm Clearing Procedures*. At the point where a faulty card list is initiated, identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

15 Contact personnel responsible for higher level support and get further help to replace this card.

16 Remove the sign from the active SMU unit.

17 Send any faulty cards for repair according to local procedure.

18 Note the following in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

19 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

20 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X44 in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffix	Name
NT6X44	CA	Time switch

Common procedures

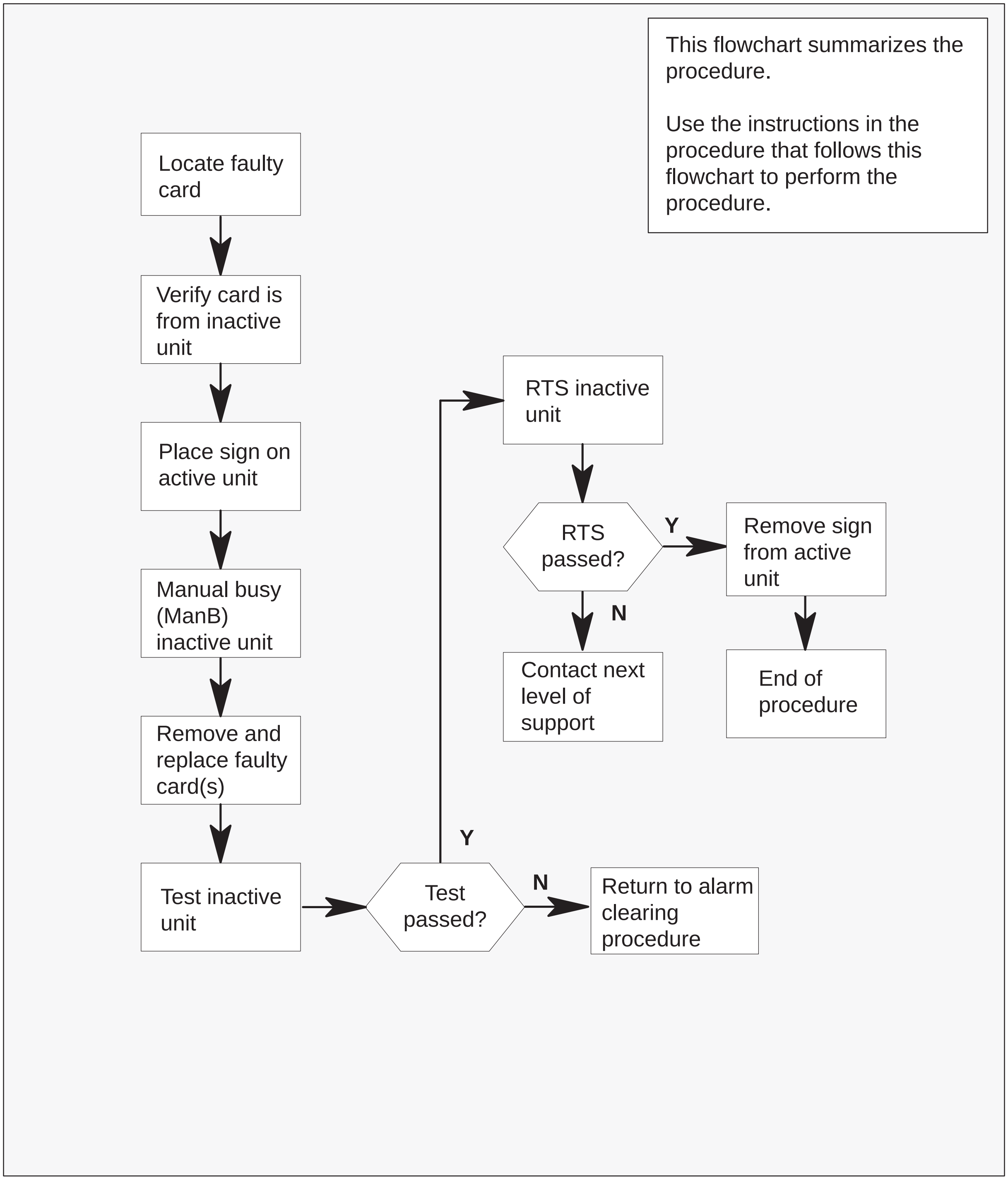
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X44
in an SMU (continued)

Summary of card replacement procedure for an NT6X44 card in an SMU



NT6X44
in an SMU (continued)

Replacing an NT6X44 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal:

3 Ensure that the PM level of the MAP terminal is currently displayed by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
   SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
   PM         3     0    1     0     2    13
   SMU        0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

4 By observing the MAP display, be sure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NT6X44
in an SMU (continued)

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 19

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`passed`	step 8
`failed`	step 7
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. After the alarm is cleared, return to step 1 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NT6X44
in an SMU (continued)

At the MAP terminal:

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

10 Go to the common procedure “Removing and inserting cards,” then return to step 11 of this procedure.

11 Use the following information to determine where to go in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 14
other	step 12

12 Test the inactive SMU unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step 9

If TST	Do
passed	step 13
failed	step 15

13 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 12

NT6X44
in an SMU (end)

If RTS	Do
passed	step 16
failed	step 15

14 Return to the *Alarm Clearing Procedures*.

If necessary, go to the point where a faulty card list is initiated and identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

15 Contact personnel responsible for higher level support and get further help to replace this card.

16 Send any faulty cards for repair according to local procedure.

17 Record the following items in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

18 You have successfully completed this procedure. Remove the sign from the active unit, return to the maintenance procedure that directed you to this card replacement procedure, and continue as directed.

19 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X50
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffix	Name
NT6X50	AB	DS-1 interface for SMU

Common procedures

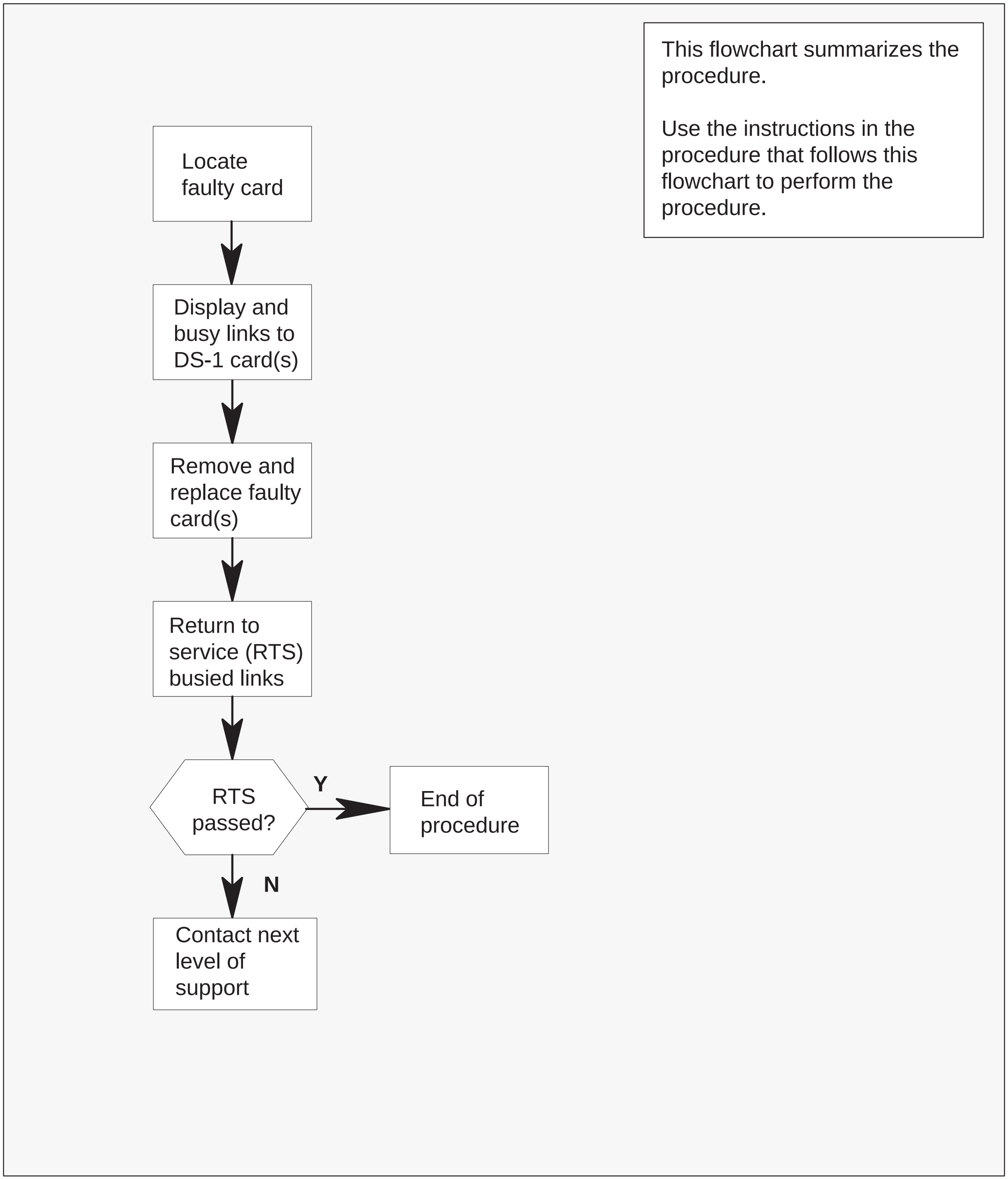
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X50
in an SMU (continued)

Summary of card replacement procedure for an NT6X50 card in an SMU



NT6X50
in an SMU (continued)

Replacing an NT6X50 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2 Get a replacement card. Ensure that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed and dual in-line package (DIP) switch setting are set to match the card being replaced.

At the MAP terminal:

3 Access the PM level of the MAP terminal by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
    SMU    SysB  ManB  Offl  CBsy  ISTb  InSv
     PM      3     0    1     0     2    13
     SMU     0     0    0     0     1     7

 SMU 0 ISTb  Links_OOS:  CSide 0, PSide 1
 Unit0:  Act   ISTb
 Unit1:  Inact InSv
```

4 Display the DS-1 links associated with the faulty DS-1 interface card by typing

>TRNSL P
and pressing the Enter key.

Example of a MAP response:

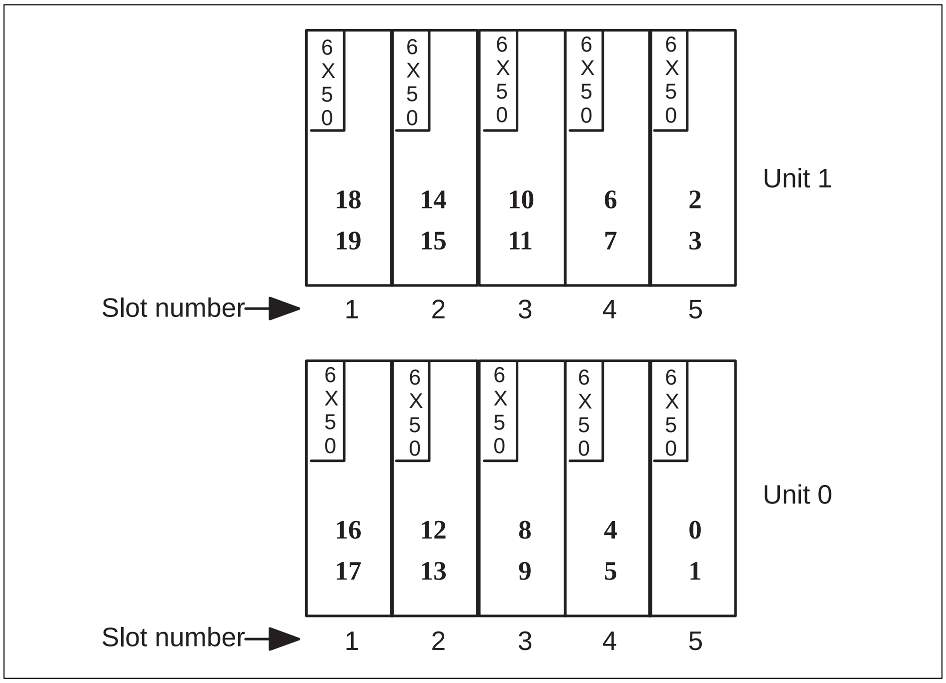
```
 LINK 0  RCU RCU0 01 0  1;CAP S;STATUS:  OK
 LINK 1  RCU RCU0 01 0  2;CAP S;STATUS:  OK
 LINK 2  RCU RCU0 01 0  3;CAP MS;STATUS:  OK  MSGCOND: OPN
 LINK 3  RCU RCU0 01 0  4;CAP MS;STATUS:  OK  MSGCOND: OPN
 LINK 4  RCU RCU0 01 0  5;CAP S;STATUS:  OK
 LINK 5  RCU RCU0 01 0  6;CAP S;STATUS:  OK
 LINK 6  RCU RCU0 01 0  7;CAP S;STATUS:  SBsy
```

Record the link number for each faulty link. For example, link 6 in this example is faulty.

NT6X50
in an SMU (continued)

5 Use the following diagram to determine which DS-1 interface card or cards correspond to the link or links identified as faulty in step 4. Note that each NT6X50 card is associated with two links (link numbers are shown in bold).

For example, the faulty link displayed in step 4 is link 6. Link 6 corresponds to the NT6X50 card in slot 4 of unit 1.



6 Busy both links connected to the faulty NT6X50 card by typing

>BSY LINK link_no
and pressing the Enter key.

where

link_no is the number of one of the 2 links associated with the faulty NT6X50 card

Repeat this command for the other link connected to the faulty card.

7 Go to the common procedure “Removing and inserting cards,” then return to step 8 of this procedure.

NT6X50 in an SMU (end)

8 Return all busied links to service by typing

>RTS LINK link_no
and pressing the Enter key.

where

link_no is the number of one of the 2 links associated with the new NT6X50 card

Repeat this command for the other link connected to the new card.

If RTS	Do
passed	step 10
failed	step 9

9 Contact personnel responsible for higher level support and get further help to replace this card.

10 Send any faulty cards for repair according to local procedure.

11 Note in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

12 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X69
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffixes	Name
NT6X69	AB, AC, AD, QA	Message protocol and tone card

Common procedures

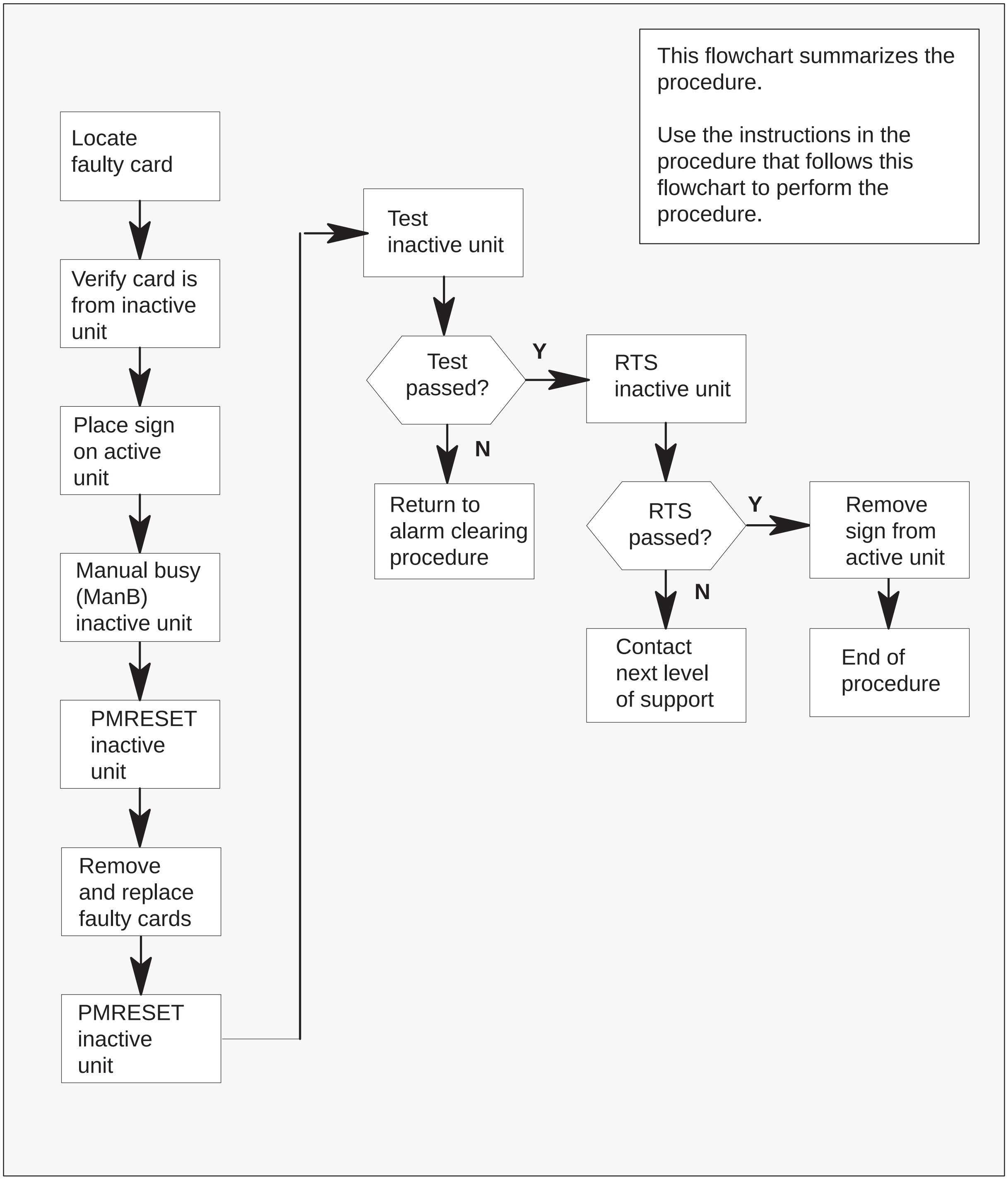
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X69
in an SMU (continued)

Summary of card replacement procedure for an NT6X69 card in an SMU



NT6X69 in an SMU (continued)

Replacing an NT6X69 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Ensure that the PM level of the MAP terminal is displayed and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
   SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM       3     0    1     0     2    13
    SMU      0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 2, PSide 0
Unit0:  Act   SysB
Unit1:  Inact InSv
```

4 By observing the MAP display, ensure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NT6X69
in an SMU (continued)

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 21

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed  Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. After the alarm is cleared, return to step 1 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NT6X69
in an SMU (continued)

At the MAP terminal:

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

10 Set the PM to the ROM level by typing

>PMRESET UNIT unit_no NORUN
and pressing the Enter key.

where

unit_no is the number of the SMU unit (0 or 1) busied in step 9

11 Go to the common procedure "Removing and inserting cards," then return to step 1 of this procedure.

12 Perform a full reset of the inactive unit of the PM by typing

>PMRESET UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

13 Use the following information to determine where to go next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 16
other	step 14

14 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

NT6X69 in an SMU (continued)

unit_no is the number of the SMU unit busied in step 9

If TST	Do
passes	step 15
fails	step 17

15 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 14

If RTS	Do
passed	step 18
failed	step 17

16 Return to the *Alarm Clearing Procedures*.

If necessary, go to the point where a faulty card list is initiated and identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

17 Contact personnel responsible for higher level support and get further help to replace this card.

18 Send any faulty cards for repair according to local procedure.

19 Record the following items in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

20 You have successfully completed this procedure. Remove the sign from the active unit and return to the maintenance procedure that directed you to this card replacement procedure. Continue as directed.

21 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

NT6X69
in an SMU (end)

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X78
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffixes	Name
NT6X78	AA, AB	CLASS modem resource

Common procedures

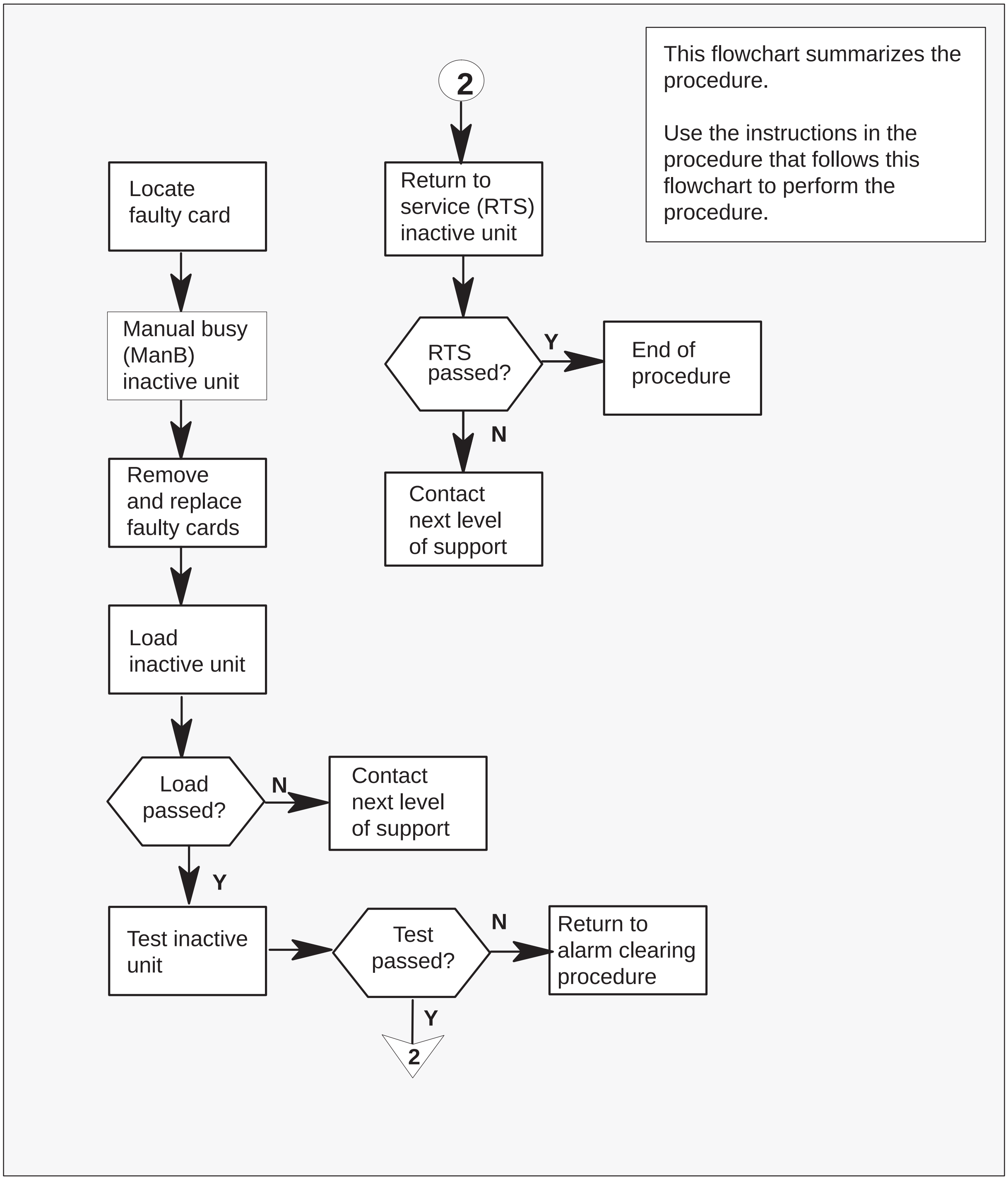
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X78
in an SMU (continued)

Summary of replacing an NT6X78 card in an SMU



NT6X78
in an SMU (continued)

Replacing an NT6X78 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Verify the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Access the PM level and find out which SMU is in-service trouble (ISTb) by typing

>MAPCI;MTC;PM;DISP STATE ISTB SMU
and pressing the Enter key.

Example of a MAP response:

```
ISTb SMU:  1
```

4 Access the ISTb SMU by typing

>POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0    1     0     2    13
    SMU     0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

NT6X78
in an SMU (continued)

5 Busy the CMR card by typing

>BSY UNIT unit_no CMR
and pressing the Enter key.

where

unit_no is the number of the unit containing the faulty CMR card

6 Go to the common procedure “Removing and inserting cards,” then return to step 7 of this procedure.

7 Use the following information to determine what step to go to next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 11
other	step 8

At the MAP terminal:

8 Load the CMR card by typing

>LOADPM UNIT unit_no CC CMR
and pressing the Enter key.

where

unit_no is the number of the unit containing the CMR card busied in step 5

If LOADPM	Do
passed	step 9
failed	step 12

NT6X78
in an SMU (continued)

9 Test the CMR card by typing

>TST UNIT unit_no CMR
and pressing the Enter key.

where

unit_no   is the number of the unit containing the CMR card loaded in step 8

If TST	Do
passed	step 10
failed	step 12

10 Return the CMR card to service by typing

>RTS UNIT unit_no CMR
and pressing the Enter key.

where

unit_no   is the number of the unit containing the CMR card tested in step 9

If RTS	Do
passes	step 13
fails	step 12

11 Return to the *Alarm Clearing Procedures*. At the point where a faulty card list is initiated, identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

12 Contact personnel responsible for higher level support and get further help to replace this card.

13 Send any faulty cards for repair according to local procedure.

14 Note the following in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

NT6X78
in an SMU (end)

15 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X80
in an SMU

Application

Use this procedure to replace the card in an SMU.

PEC	Suffix	Name
NT6X80	BB	Ring/pad

Common procedures

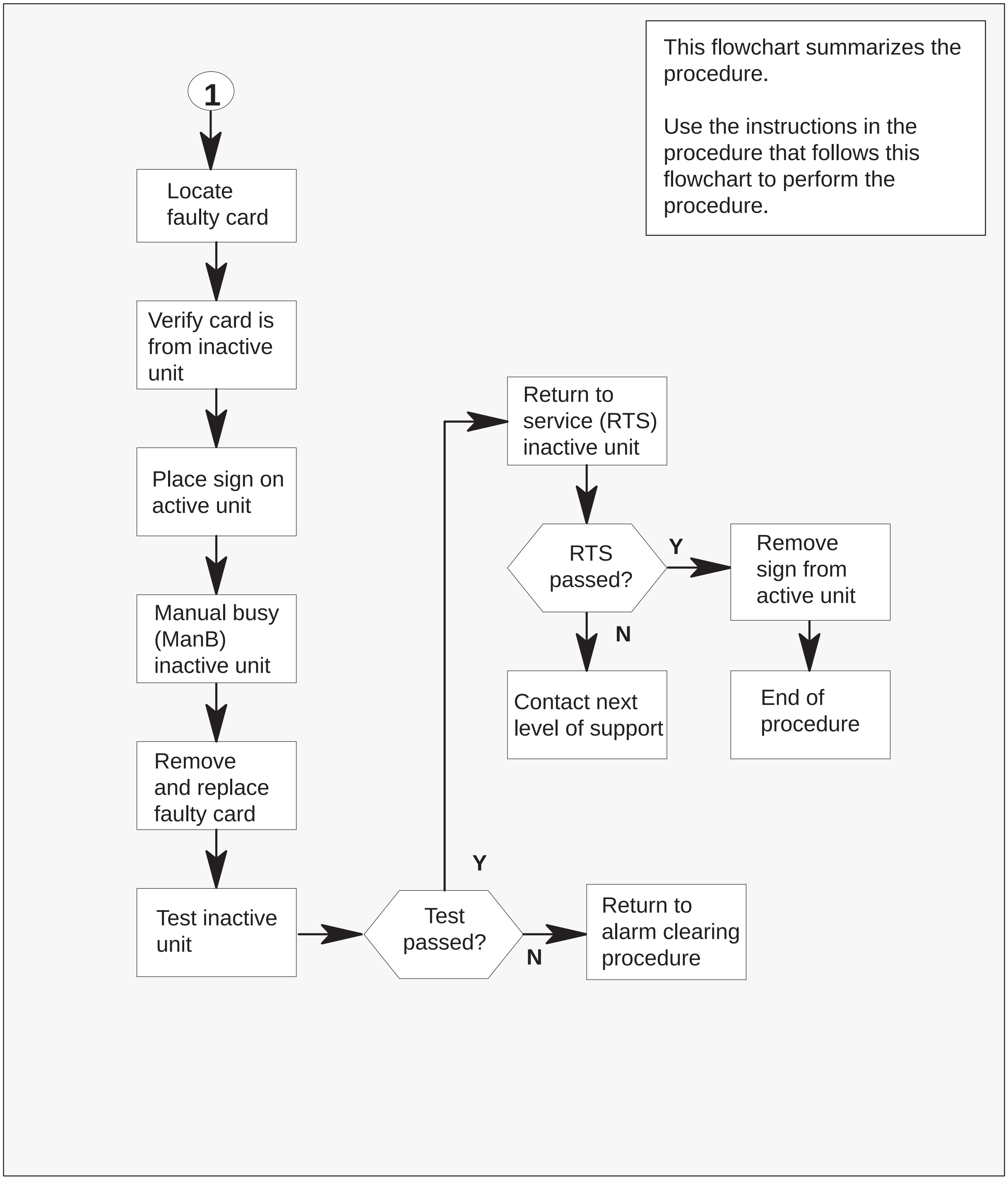
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X80
in an SMU (continued)

Summary of card replacement procedure for an NT6X80 card in an SMU



NT6X80
in an SMU (continued)

Replacing an NT6X80 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Verify the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Access the PM level of the MAP terminal by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM     3     0    1     0     2    13
    SMU    0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

4 By observing the MAP display, ensure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NT6X80
in an SMU (continued)

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 20

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed  Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. After the alarm is cleared, return to step 1 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NT6X80
in an SMU (continued)

At the MAP terminal:

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the faulty SMU unit

10 Go to the common procedure “Removing and inserting cards,” then return to step 11 of this procedure.

11 Use the following information to determine what step to go to next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 14
other	step 12

12 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step 9

If TST	Do
passed	step 13
failed	step 15

13 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 12

NT6X80
in an SMU (end)

If RTS	Do
passed	step 17
failed	step 15

14 Return to the *Alarm Clearing Procedures*. At the point where a faulty card list is initiated, identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

15 Contact personnel responsible for higher level support and get further help to replace this card.

16 Remove the sign from the active SMU unit.

17 Send any faulty cards for repair according to local procedure.

18 Note the following in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

19 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

20 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X85 in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffixes	Name
NT6X85	AA, AB, AC	DS-1 interface for SMU

Common procedures

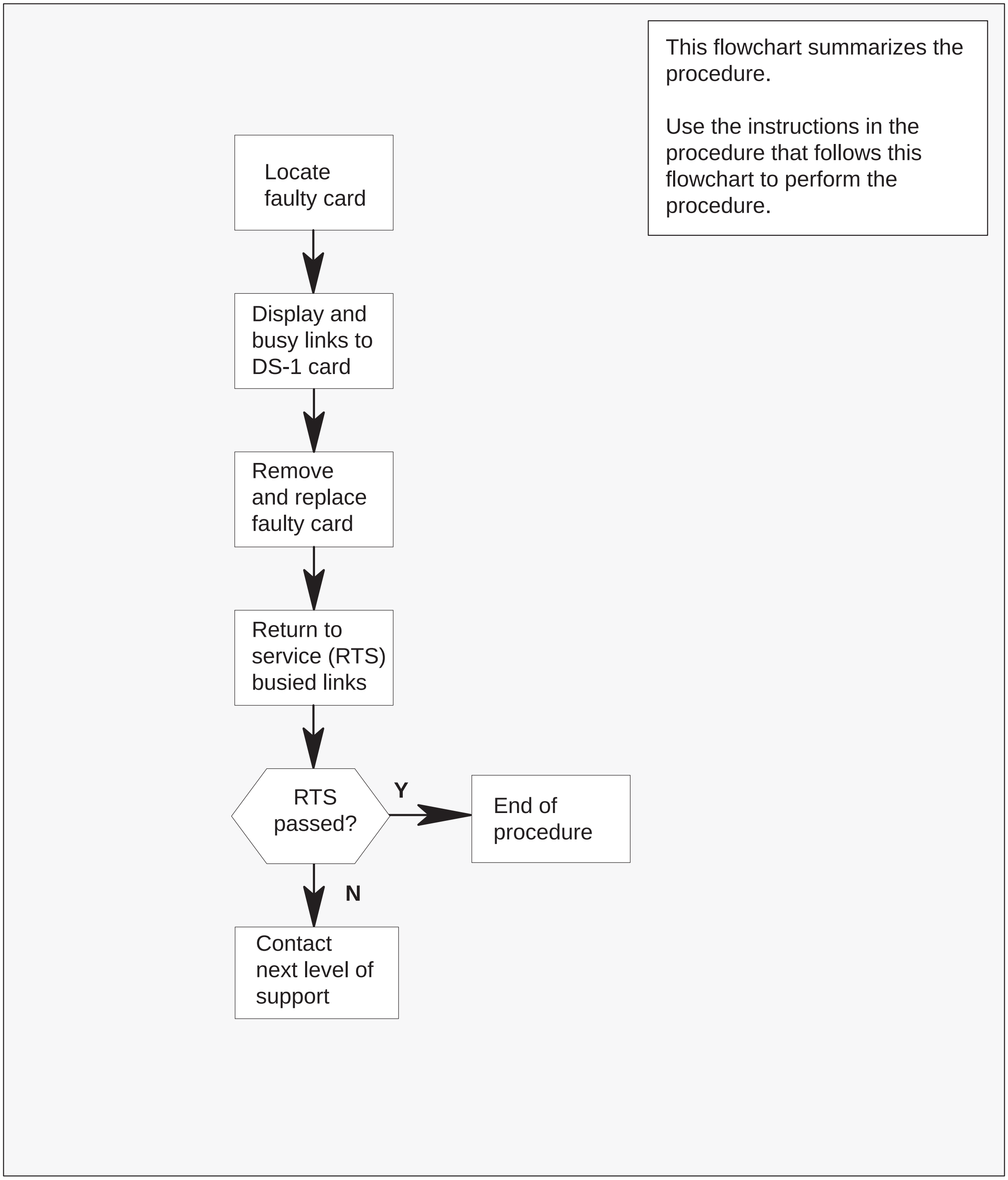
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X85
in an SMU (continued)

Summary of card replacement procedure for an NT6X85 card in an SMU



NT6X85
in an SMU (continued)

Replacing an NT6X85 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2 Get a replacement card. Ensure the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed and dual in-line pakage (DIP) switch setting are set to match the card being replced.

At the MAP terminal:

3 Access the PM level of the MAP terminal and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0    1     0     2    13
    SMU     0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 1
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

4 Display the DS-1 links associated with the faulty DS-1 interface card by typing

>TRNSL P
and pressing the Enter key.

Example of a MAP response:

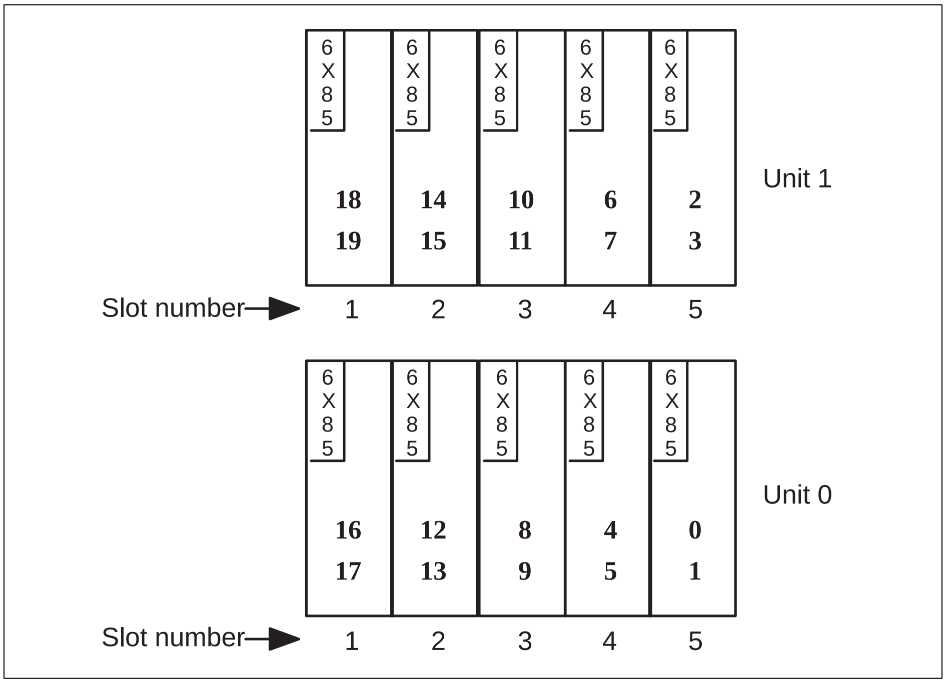
```
LINK 0  RCU RCU0 01 0  1;CAP S;STATUS:  OK
LINK 1  RCU RCU0 01 0  2;CAP S;STATUS:  OK
LINK 2  RCU RCU0 01 0  3;CAP MS;STATUS:  OK  MSGCOND: OPN
LINK 3  RCU RCU0 01 0  4;CAP MS;STATUS:  OK  MSGCOND: OPN
LINK 4  RCU RCU0 01 0  5;CAP S;STATUS:  OK
LINK 5  RCU RCU0 01 0  6;CAP S;STATUS:  OK
LINK 6  RCU RCU0 01 0  7;CAP S;STATUS:  SBsy
```

Record the link number for each faulty link. For example, link 6 in this example is faulty.

NT6X85
in an SMU (continued)

5 Use the following diagram to determine which DS-1 interface card or cards correspond to the link or links identified as faulty in step 4. Note that each NT6X85 card is associated with two links (link numbers are shown in bold).

For example, the faulty link displayed in step 4 is link 6. Link 6 corresponds to the NT6X85 card in slot 4 of unit 1.



6 Busy both links connected to the faulty NT6X85 card by typing

>BSY LINK link_no
and pressing the Enter key.

where

link_no is the number of one of the two links associated with the faulty NT6X85 card

Note: Repeat this command for the other link connected to the new card.

7 Go to the common procedure “Removing and inserting cards,” then return to step 8 of this procedure.

NT6X85
in an SMU (end)

8 Return all busied links to service by typing

>RTS LINK link_no
and pressing the Enter key.

where

link_no is the number of one of the links associated with the new NT6X85 card

Note: Repeat this command for the other link connected to the new card.

If RTS	Do
passed	step 10
failed	step 9

9 Contact personnel responsible for higher level support and get further help to replace this card.

10 Send any faulty cards for repair according to local procedure.

11 Note the following in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

12 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X92
in an SMU

Application

Use this procedure to replace the following card in an SMU shelf.

ATTENTION
To ensure peak performance, do not install the UTR and GTR on the same SMU. Presently, there is no way of knowing which receiver is used to interpret tones. Some call processing tones may be degraded if designed for use with a GTR.

PEC	Suffix	Name
NT6X92	BB, BC	Universal tone receiver (UTR)
NT6X92	EA	Global tone receiver (GTR)

Common procedures

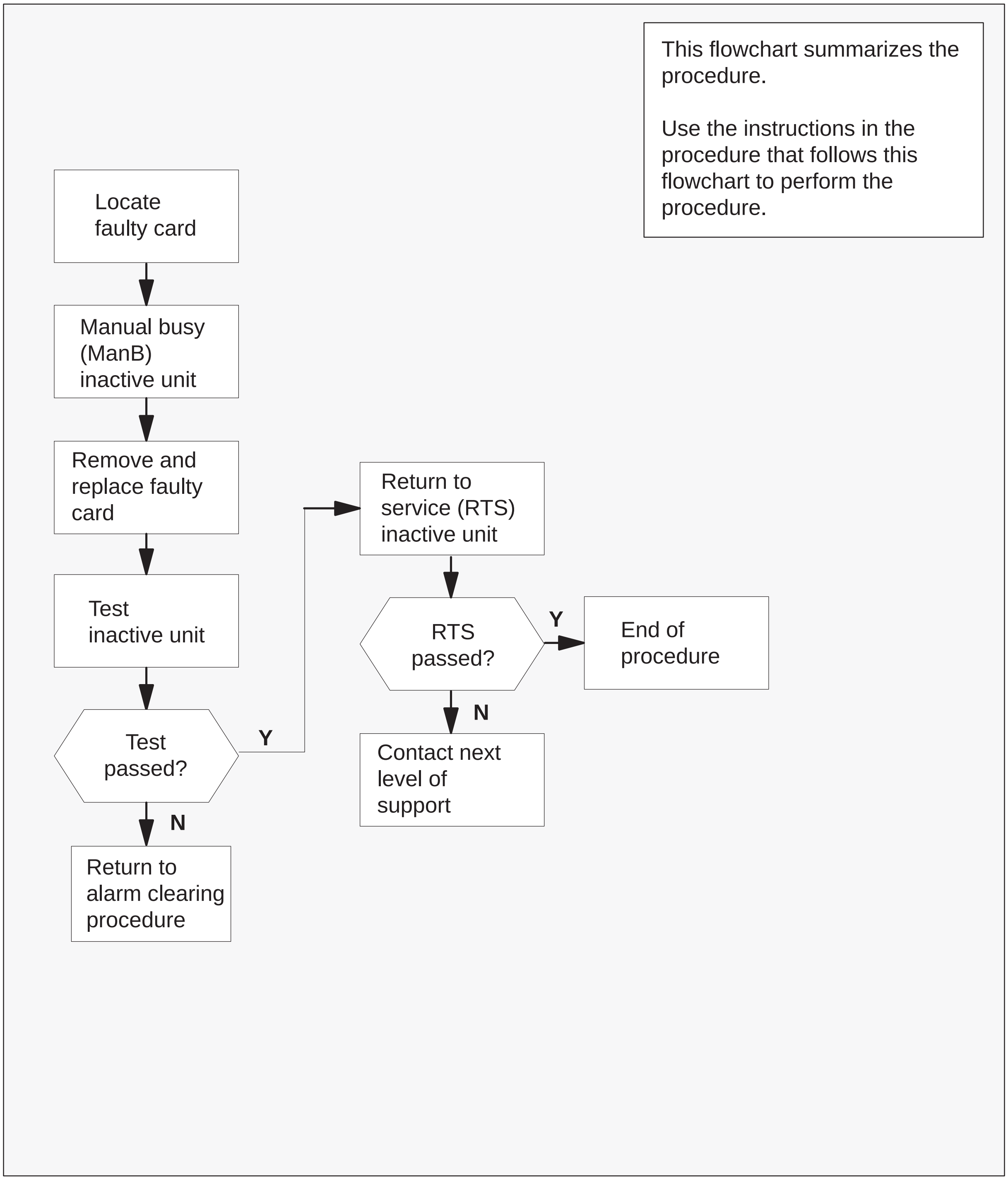
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X92
in an SMU (continued)

Summary of card replacement procedure for an NT6X92 card in an SMU



NT6X92
in an SMU (continued)

Replacing an NT6X92 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2

> **CAUTION**
> **Loss of service possible**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Ensure the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Access the PM level of the MAP terminal and post the faulty SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU

Example of a MAP display response:

```
SMU 3     INSV    LINKS_OOS    CSIDE     PSIDE 0
Unit0      Act     InSv
Unit1     Inact    SysB
```

4 By observing the MAP display, ensure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

NT6X92 in an SMU (continued)

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 20

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. After the alarm is cleared, return to step 1 of this procedure.

At the frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

At the MAP terminal:

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMU unit

NT6X92
in an SMU (continued)

10 Go to the common procedure “Removing and inserting cards,” then return to step 11 of this procedure.

11 Use the following information to determine what step to go to next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 14
other	step 12

12 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step 9

If TST	Do
passed	step 13
failed	step 15

13 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 12

If RTS	Do
passed	step 16
failed	step 15

14 Return to the *Alarm Clearing Procedures*. At the point where a faulty card list is initiated, identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

NT6X92
in an SMU (end)

15 Contact personnel responsible for higher level support and get further help to replace this card.

16 Remove the sign from the active SMU unit.

17 Send any faulty cards for repair according to local procedure.

18 Note in office records according to local policy:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

19 You have successfully completed this procedure. Remove the sign from the active unit, return to the maintenance procedure that directed you to this card replacement procedure, and continue as directed.

20 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT7X05
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffixes	Name
NT7X05	AA	Peripheral/Remote Loader-16

Common procedures

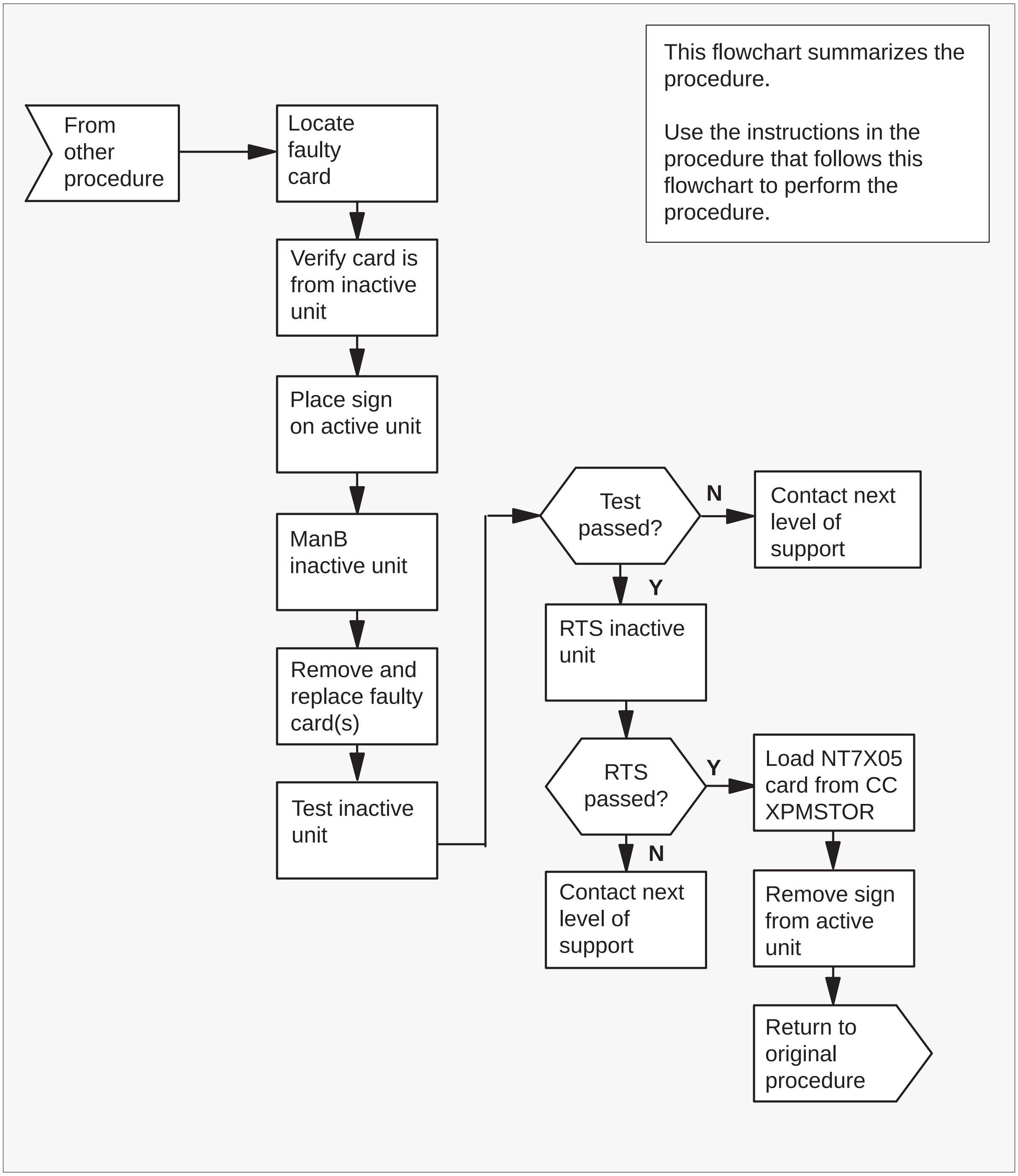
None

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT7X05
in an SMU (continued)

Summary of replacing an NT7X05 card in an SMU



NT7X05
in an SMU (continued)

Replacing an NT7X05 in an SMU

At your current location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU ensure the unit where you are replacing the card is INACTIVE and the mate unit is ACTIVE.

Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC) including suffix, as the card to be removed.

At the MAP display

3 Access the PM level and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

NT7X05
in an SMU (continued)

SMU_no is the number of the SMU to be busied

Example of a MAP display:

```
   CM    MS    IOD    Net    PM    CCS    LNS    Trks    Ext    APPL
   .     .      .      .    1SMU    .      .       .      .       .

SMU                 SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM        0        0        2        0        2         25
 2 Post_   SMU       0        0        0        0        1          1
 3 ListSet
 4          SMU      0 ISTb  Links_OOS:  CSide  0, PSide   0
 5 TRNSL_   Unit0:   Inact ISTb
 6 TST_     Unit1:   Act   InSv
 7 BSY_
 8 RTS_
 9 OffL
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16 IRLINK
17 Perform
18
```

4 By observing the MAP display, be sure the card to be removed is on the inactive unit.

If the faulty card is on an	Do
ACTIVE unit	step 5
INACTIVE unit	step 8

5 Switch the processing activity to the inactive unit by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 21

NT7X05
in an SMU (continued)

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
SWACT passed	step 8
SWACT failed	step 7
SWACT failed Reason: XPM SWACTback	step 7
SWACT refused by SWACT controller	step 7

7 Return to the *Alarm Clearing Procedure*, to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8 Put a sign on the active unit bearing the words **Active unit—Do not touch.**

At the MAP display

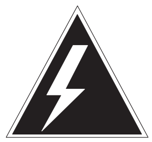
9 Busy the inactive SMU unit by typing

>BSY INACTIVE
and pressing the Enter key.

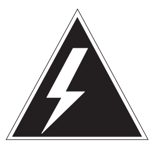
NT7X05 in an SMU (continued)

At the frame

10



WARNING
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMU. This protects the equipment against damage caused by static electricity.

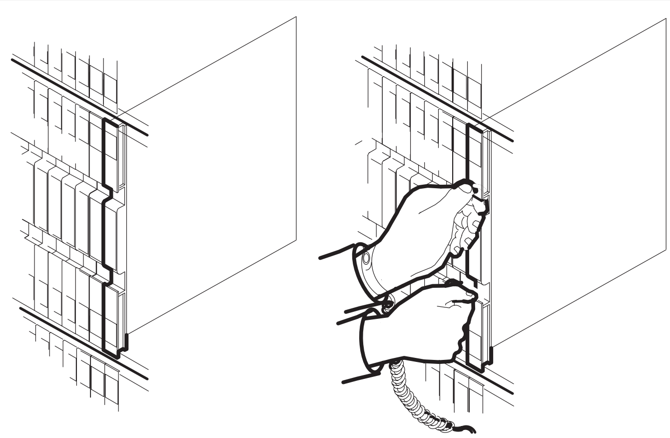


WARNING
Equipment damage
Take the following precautions when removing or inserting a card:
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

Put on a wrist strap.

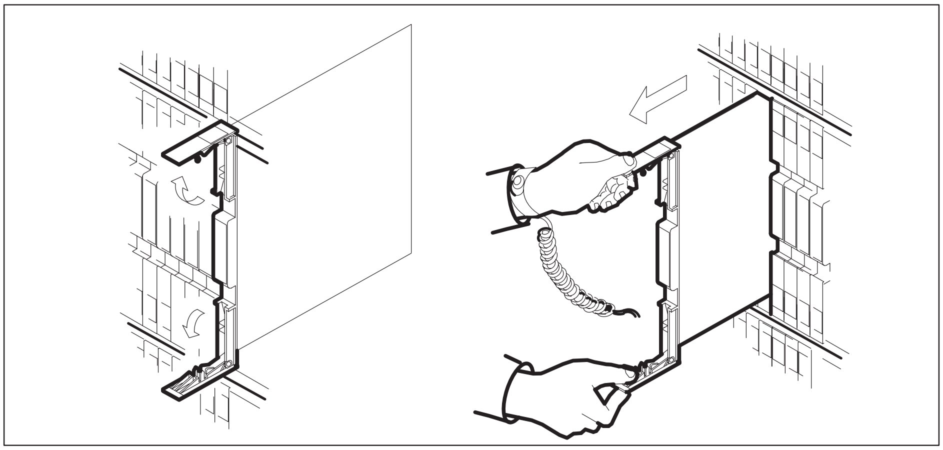
11 Remove the NT7X05 card as shown in the following figures.

a. Locate the card to be removed on the appropriate shelf.



NT7X05
in an SMU (continued)

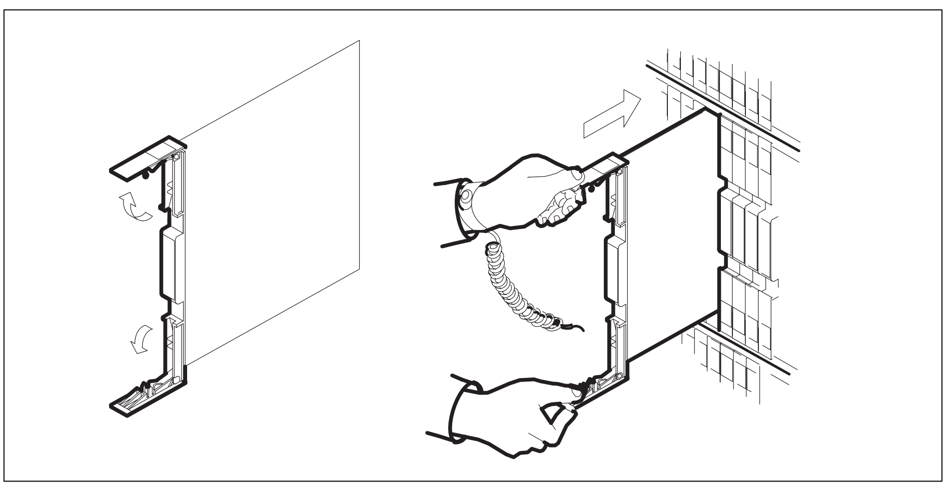
b. Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.



c. Ensure the replacement card has the same PEC, including suffix, as the card you just removed.

12 Open the locking levers on the replacement card.

a. Align the card with the slots in the shelf and gently slide the card into the shelf.

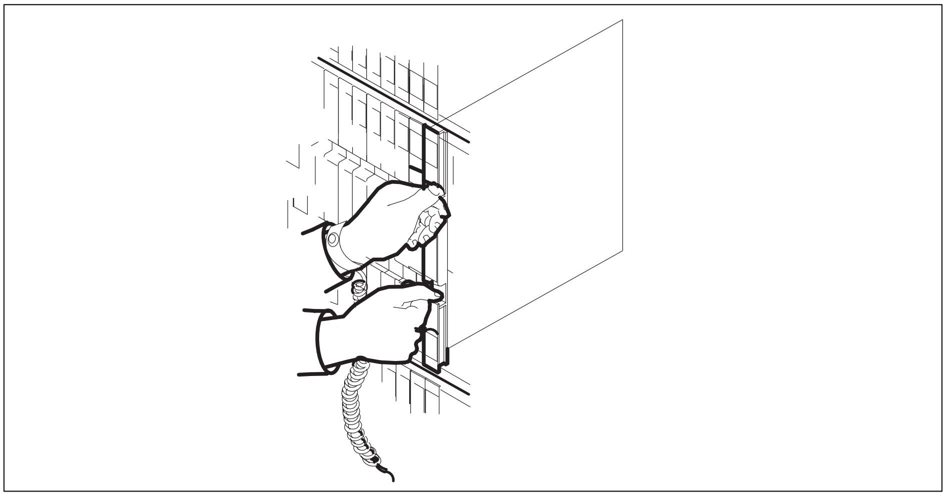


13 Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure the card is fully seated in the shelf.

NT7X05
in an SMU (continued)

b. Close the locking levers.



At the MAP display

14 Test the inactive SMU unit by typing

>TST UNIT SMU_unit_no
and pressing the Enter key.

where

SMU_unit_no   is the number of the inactive SMU unit

Example of a MAP response:

`Test Passed`
or

`Test Failed`

If TST	Do
passed	step 15
failed	step 19

15 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

NT7X05
in an SMU (end)

unit_no is the number of the SMU unit (0 or 1) tested in step 14

If load	Do
passed	step 16
failed	step 19

16 Load the inactive SMU unit by typing

>LOADPM INACTIVE CC XPMSTOR [file_name]
and pressing the Enter key.

where

file_name is the name of the file datafilled in field, LOAD, of the inventory table.

If load	Do
passed	step 17
failed	step 19

17 Send any faulty cards for repair according to local procedure.

18 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 20.

19 Obtain further assistance in replacing this card by contacting personnel responsible for higher level of support.

20 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

21 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NTAX78 in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffix	Name
NTAX78	AB	Time switch

Common procedures

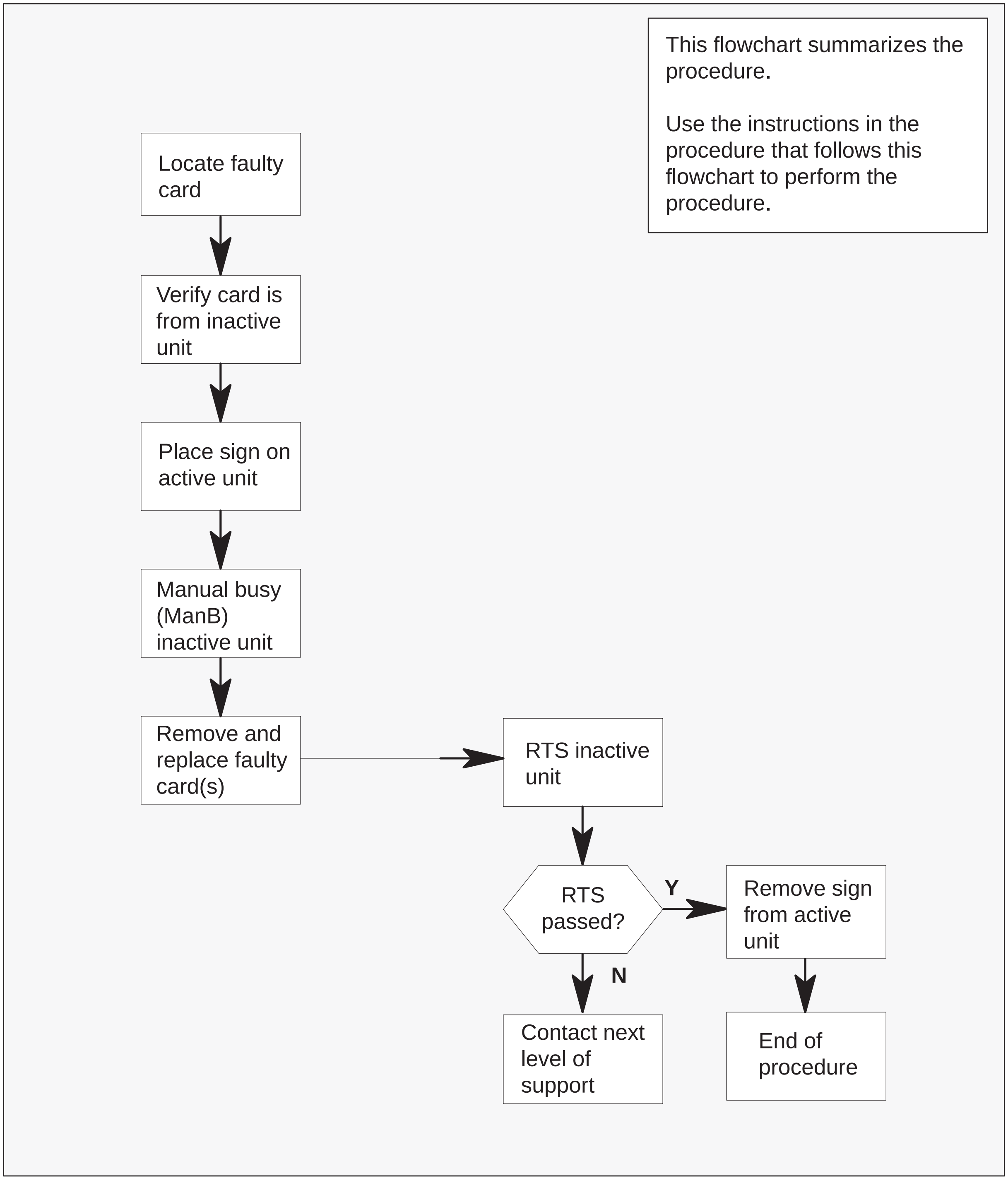
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NTAX78
in an SMU (continued)

Summary of card replacement procedure for an NTAX78 card in an SMU



NTAX78
in an SMU (continued)

Replacing an NTAX78 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal:

3 Ensure that the PM level of the MAP terminal is currently displayed by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted

Example of a MAP response:

```
   SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
   PM         0     0    0     0     1     0
   SMU        1     0    0     0     1     0

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   SysB
Unit1:  Inact InSv
```

4 By observing the MAP display, be sure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NTAX78
in an SMU (continued)

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 18

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`passed`	step 8
`failed`	step 7
`SwAct failed   Reason: XPM  SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. After the alarm is cleared, return to step 1 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

NTAX78
in an SMU (continued)

At the MAP terminal:

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

10 Go to the common procedure “Removing and inserting cards,” then return to step 11 of this procedure.

11 Use the following information to determine where to go in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 13
other	step 12

12 Test the inactive SMU unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step9

If TST	Do
passes	step 13
fails	step 13

13 Return to *Alarm Clearing Procedures.*

If necessary, go to the point where a faulty card list is initiated and identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

14 Contact personnel responsible for higher level support and get further help to replace this card.

15 Send any faulty cards for repair according to local procedure.

NTAX78
in an SMU (end)

16 Record the following items in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

17 You have successfully completed this procedure. Remove the sign from the active unit, return to the maintenance procedure that directed you to this card replacement procedure, and continue as directed.

18 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NTBX01
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffix	Name
NTBX01	AB	Enhanced ISDN pre-processor (EISP)

Common procedures

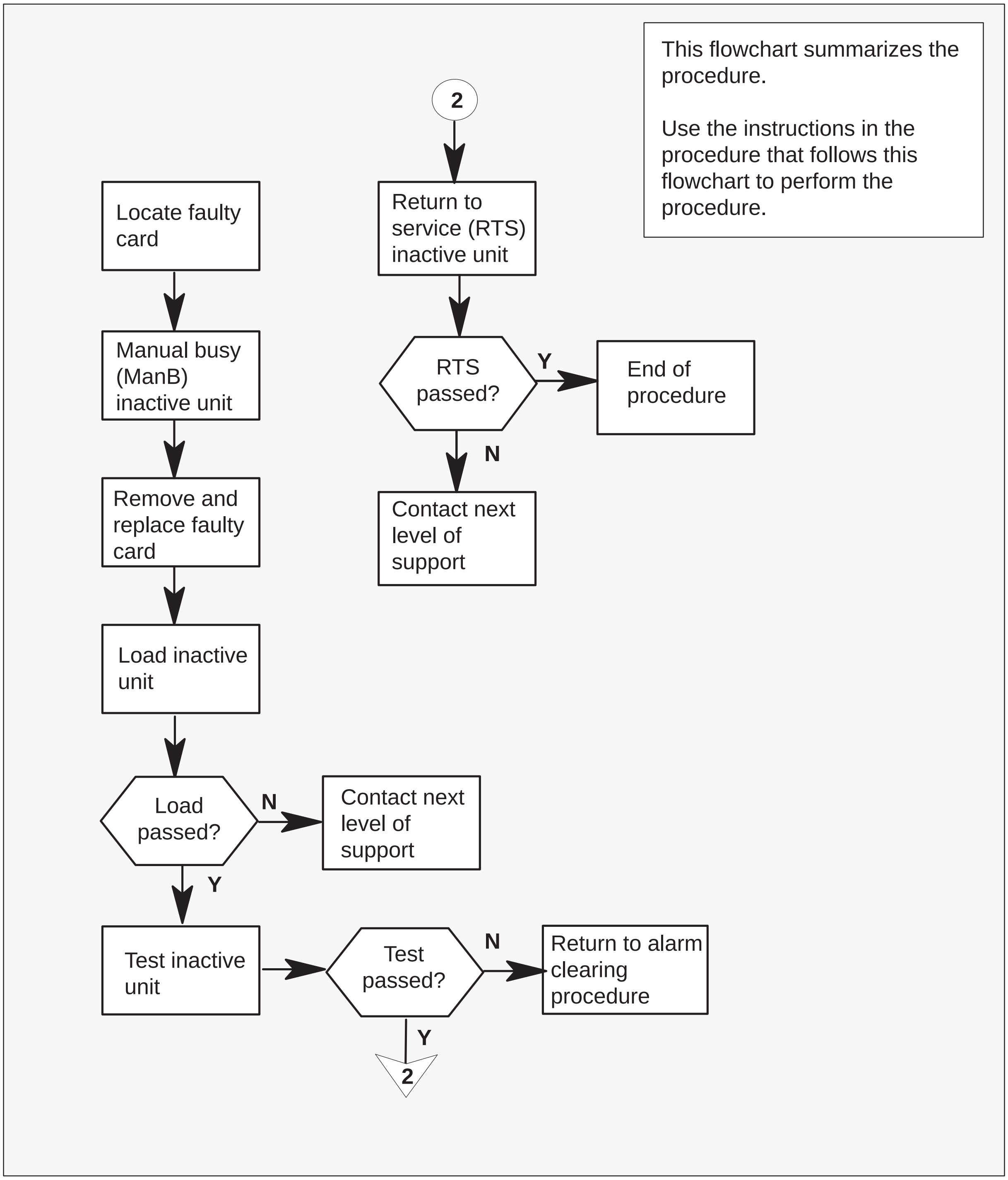
The common procedure “Removing and inserting cards” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NTBX01
in an SMU (continued)

Summary of replacing an NTBX01 card in an SMU



NTBX01
in an SMU (continued)

Replacing an NTBX01 card in an SMU

At your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Get a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP terminal:

3 Access the PM level of the MAP (maintenance and administration position) terminal and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU to be posted (0 or 1)

Example of a MAP response:

```
SMU 3     INSV    LINKS_OOS    CSIDE     PSIDE 0
Unit0      Act     InSv
Unit1     Inact    IsTb
```

4 By observing the MAP display, ensure the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SwAct it can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
can continue at this time	step 6
cannot continue at this time	step 20

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SwAct audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 8 of this procedure.

At the SME frame:

8 Put a sign on the active unit bearing the following words: “Active unit—Do not touch.”

At the MAP terminal:

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1)

NTBX01
in an SMU (continued)

10 Go to the common procedure “Removing and inserting cards,” then return to step 11 of this procedure.

11 Use the following information to determine where to go next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 17
other	step 12

12 After replacing the faulty card, load the inactive SMU unit by typing

>LOADPM UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit busied in step 9

If LOADPM	Do
passed	step 13
failed	step 18

13 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit loaded in step 12

If TST	Do
passes	step 14
fails	step 18

NTBX01
in an SMU (end)

14 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 13

If RTS	Do
passed	step 15
failed	step 18

15 Send any faulty cards for repair according to local procedure.

16 Record the following items in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 19.

17 Return to *Alarm Clearing Procedures*.

If necessary, go to the point where a faulty card list is initiated and identify the next faulty card on the list. Go to the appropriate card replacement procedure for that card.

18 Obtain further assistance in replacing this card by contacting the personnel responsible for a higher level of support.

19 You have successfully completed this procedure. Remove the sign from the active unit, return to the maintenance procedure that directed you to this card replacement procedure, and continue as directed.

20 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NTBX02
in an SMU

Application

Use this procedure to replace the following card in an SMU.

PEC	Suffixes	Name
NTBX02	AA, BA	D-Channel handler

If you cannot identify the PEC, suffix, and shelf or frame for the card you want to replace, refer to the Index for a list of cards, shelves, and frames discussed in this document.

Common procedure

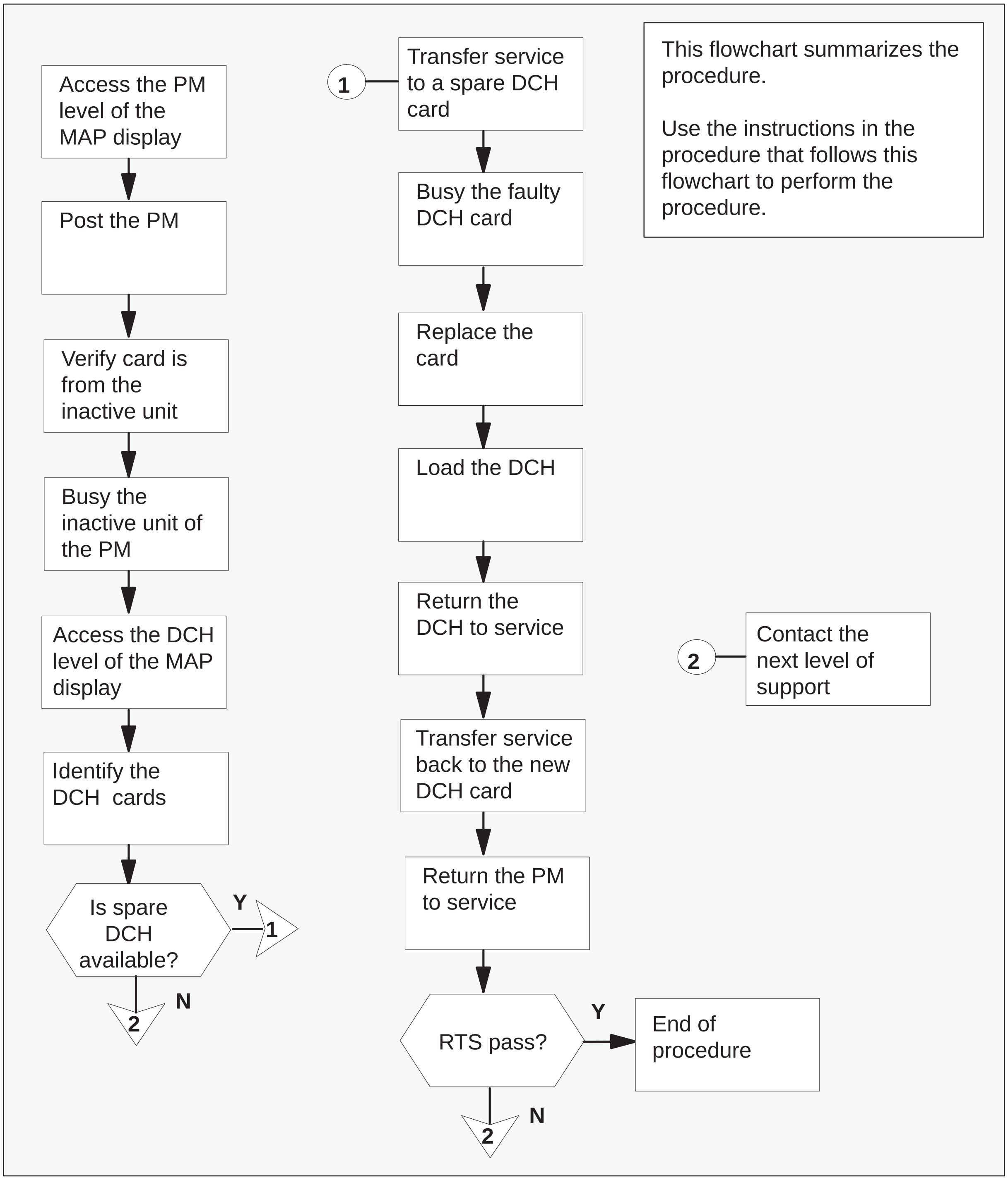
Removing and replacing cards is referenced in this procedure:

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NTBX02
in an SMU (continued)

Summary of Replacing an NTBX02 in an SMU



NTBX02
in an SMU (continued)

Replacing an NTBX02 in an SMU

At the your current location:

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure.

2

CAUTION
Loss of service
When replacing a card in the SMU, ensure that the unit where you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Ensure that the replacement card has the same PEC, including suffix, as the card being removed.

At the MAP terminal

3 Access the PM level of the MAP display by typing

>MAPCI;MTC;PM
and pressing the Enter key.

4 Post the SMU associated with the card you are replacing by typing

>POST SMU smu_no
and pressing the Enter key.

where

smu_no is the number of the SMU with the faulty card

Example of a MAP response:

```
SMU     SysB  ManB  Offl  CBsy  ISTb  InSv
    PM     3     0    1     0     2    13
    SMU    0     0    0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb
Unit1:  Inact InSv
```

NTBX02
in an SMU (continued)

5 Refer to the MAP display posted in step 4 to see if the faulty NTBX02 card is in the active or inactive unit.

If faulty card is in	Do
active unit	step 6
inactive unit	step 10

6 Switch the processing activity (SWACT) to the inactive unit by typing

>SWACT
and pressing the Enter key.

If SWACT	Do
cannot continue at this time	step 7
can continue at this time	step 8

7 Do not switch activity of the units. Reject the SWACT by typing

>NO
and pressing the Enter key.

The system discontinues the SWACT.

Return to step 6 during a period of low traffic.

8 Confirm the system prompt by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

NTBX02
in an SMU (continued)

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding to the next maintenance action.

If the message is	Do
SWACT passed	step 10
SWACT failed	step 9
SWACT refused by SWACT controller	step 9

9 Return to the *Alarm Clearing Procedures* to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame:

10 Put a sign on the active unit bearing the following words: “Active unit–Do not touch.”

At the MAP terminal:

11 Busy the inactive unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the inactive SMU unit (0 or 1) containing the faulty BX02 card

12 Access the DCH level of the MAP display by typing

>DCH
and pressing the Enter key.

13 Post all DCH cards by typing

>POST ALL
and pressing the Enter key

14 Identify the faulty DCH card by typing

>DISP ALL
and pressing the Enter key

Example of a MAP response:

```
DCH   8 ISG   4 CBsy SMU   1 port 17
DCH   9 spare   InSv SMU   1 port 19
```

15 Post the faulty DCH card by typing

>POST dch_card_state
and pressing the Enter key.

where

dch_card_state is Cbsy, SysB, or ISTb

Example of a MAP display:

```
DCH  8  ISG 1  CBSY SMU  1   PORT 17
```

Note: Record the number of the faulty DCH card for later use in this procedure.

16 Identify the DCH load file name by typing

>QUERYPM
and pressing the Enter key.

Example of a MAP response:

```
Site  Flr  RPos  Bay_id Shf  Description   Slot EqPEC
HOST  01    R09  SME 00  32   SMU : 002     02  BX02
Loadnames :  DCHINV – SCH36BT : INTL INDEX : 8
```

The DCH load file name in the example is *SCH36BT.* SCH is the load file name prefix for the DCH card. The enhanced DCH (EDCH) load file name prefix is ESH.

17 Identify available DCH cards by typing

>DISP ALL
and pressing the Enter key.

Example of a MAP response:

```
  DCH   8 ISG   4 CBsy SMU   1 port 17
  DCH   9 spare   InSv SMU   1 port 19
```

If	**Do**
spare DCH cards are available	step 18
there are no spare DCH cards	step 30

NTBX02
in an SMU (continued)

18 Transfer the service group to a spare DCH by typing

SWTCH spare_dch_no
and pressing the Enter key.

where

spare_dch_no	is a number from 0 to 9 of an in-service DCH card that will take over service

Example of a MAP response:

```
Takeover passed DCH 8 to DCH 9 ISG 4
```

Note: Record the number of the spare DCH that is taking over service for use later in this procedure.

19 Busy the faulty DCH by typing

>BSY
and pressing the Enter key.

At the shelf

20

WARNING
Static electricity damage
Wear a wrist strap connected to the wrist-strap grounding point of a frame supervisory panel (FSP) or a modular supervisory panel (MSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the card using the procedure *Removing and replacing a card* in this document. When you have completed the procedure, return to this point.

Note: If the card you are replacing has switches, ensure that the switches on the replacement card have the same settings.

NTBX02
in an SMU (continued)

21 The next action depends on your reason for performing this procedure.

If you were	Do
directed to this procedure from a maintenance procedure	step 22
not directed to this procedure from a maintenance procedure	step 23

22 Return to the maintenance procedure that sent you to this procedure and continue as directed.

At the MAP terminal

23 Load the DCH by typing

>LOADPM
and pressing the Enter key.

If the LOADPM command	Do
failed	step 30
passed	step 24

NTBX02
in an SMU (continued)

24 Return the DCH to service by typing

>RTS
and pressing the Enter key.

where

unit_no   is the PM unit number (0 or 1)

Example of a MAP response:

```
DCH 8   Out–of–service test initiated
DCH 8 Tst Passed
DCH 8 Rts Passed
```

If the RTS command	Do
failed	step 30
passed	step 25

25 Post the DCH card spared in step 18 by typing

>POST dch_card_no
and pressing the Enter key.

where

dch_card_no   is the spare DCH

Example of a MAP display:

```
DCH  9  ISG 1  InSv SMU  1   PORT 19
```

26 Transfer service back to the DCH card posted in step 15 by typing

>SWTCH spare_dch_no
and pressing the Enter key.

where

spare_dch_no   is the DCH card number from 0 to 9 identified in step 15

Example of a MAP response:

```
Takeover passed DCH 9 to DCH 8 ISG 4
```

NTBX02
in an SMU (end)

27 Post the new DCH card by typing

>POST dch_card_no
and pressing the Enter key.

where

dch_card_no   is the replacement DCH card

Example of a MAP display:

```
DCH  8  ISG 1  InSv SMU  1   PORT 17
```

28 Return to the PM level of the MAP display by typing

>QUIT
and pressing the Enter key.

29 Return the inactive unit of the PM to service by typing

RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the SMU unit (0 or 1) busied in step 11

If the RTS	Do
passed	step 31
failed	step 30

30 For further assistance, contact the personnel responsible for the next level of support.

31 You have completed this procedure.

NTMX71
in an SMU

Application

Use this procedure to replace a NTMX71 card in an SMU.

PEC	Suffixes	Name
NTMX71	AA	XPM Plus Terminator Paddleboard

Common procedures

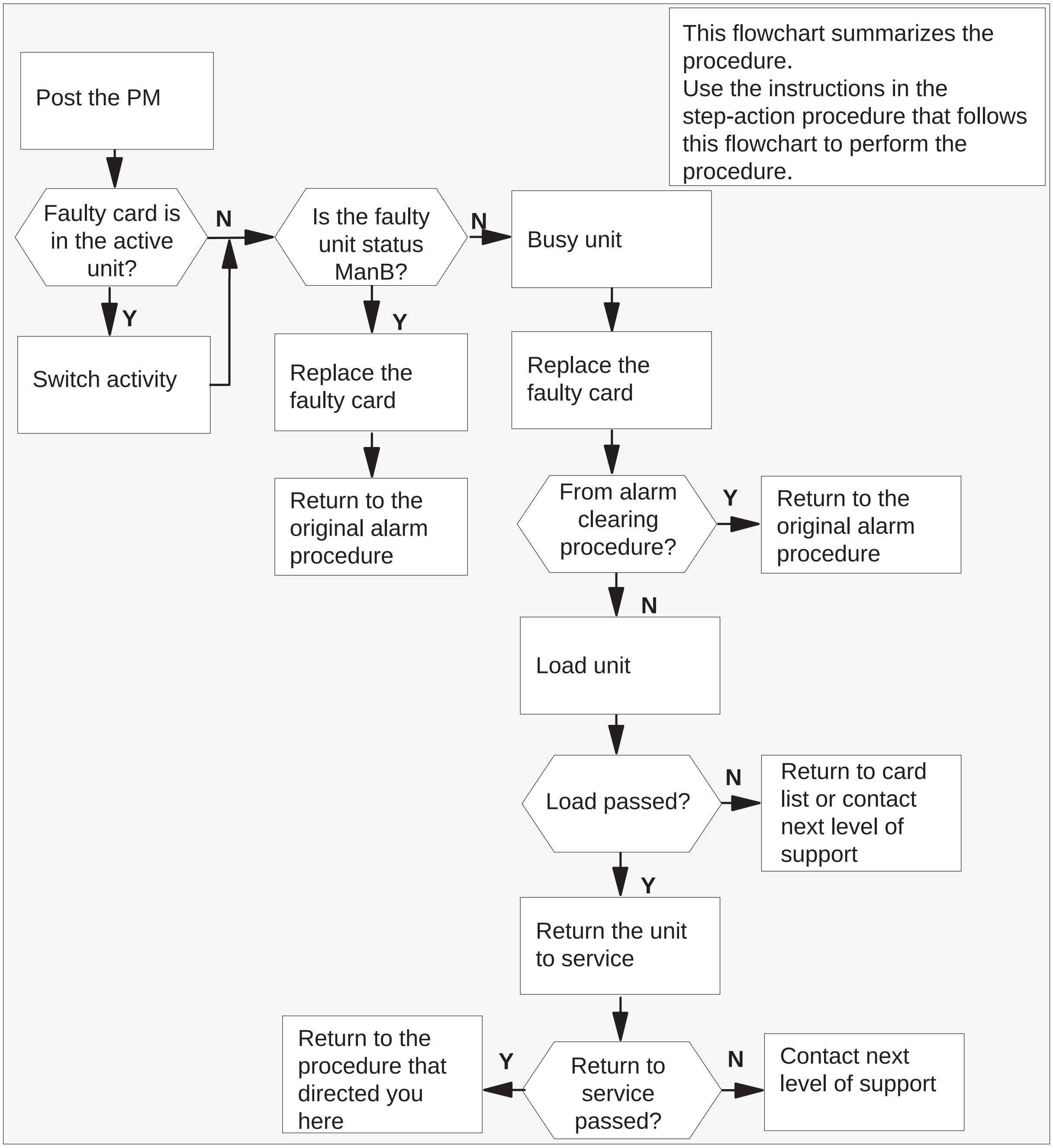
None

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NTMX71
in an SMU (continued)

Summary of card replacement procedure for a NTMX71 card in a in an SMU



NTMX71
in an SMU (continued)

Replacing a NTMX71 card in a SMU

At your Current Location

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure the replacement card has the same product engineering code (PEC), including suffix, as the card being removed.

At the MAP terminal

3 Ensure the current MAP display is at the PM level and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_no
and pressing the Enter key.

where

smu_no   is the number of the SMU being posted

Example of a MAP response

```
SMU      SysB  ManB  Offl  CBsy  ISTb  InSv
PM         3     0     1     0     2    13
SMU        0     0     0     0     1     7

SMU 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   InSv
Unit1:  Inact ISTb
```

4 Observe the MAP display and determine if the faulty card is in the active or the inactive unit. The example in step 3 shows the status of the PM as in-service (InSv) on the active unit and in-service trouble (ISTb) on the inactive unit.

If the faulty card is in the	Do
active unit	step 5
inactive unit	step 12

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 35

6 Confirm the system prompt by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SWACT passed`	step 12
`SWACT failed Reason: XPM SWACTback`	step 7
`SWACT refused by SWACT Controller`	step 8

7 The inactive unit could not establish two-way communication with the central control and has switched activity back to the originally active unit. You must clear all faults on the inactive unit before attempting to clear the alarm condition on the active unit.

Go to step 9.

8 The SWACT controller does not recommend a SWACT for one of the following reasons:

- IMC link failures
- message link failures
- parity audit failures
- superframe sync failures
- inactive unit was unable to keep activity last time
- dropping activity

NTMX71 in an SMU (continued)

- pre-SWACT query failure
- unit is jammed inactive
- unit is in overload
- pre-SWACT difficulties

You must clear all faults on the inactive unit and switch activity to the inactive unit before attempting to change the faulty card on the active unit.

9 A problem has been detected as a result of your attempt to SWACT to the inactive unit. Check the alarm banner for alarms.

If there is a	Do
new alarm	step 10
no new alarm	step 33

10 Go to the appropriate procedure in the *Alarm Clearing Procedures* to determine what steps to take to clear the problem on the inactive unit.

Clear the problem then return to this step.

11 When the trouble on the inactive unit is cleared, force a SWACT to the active unit by typing

>SWACT FORCE
and pressing the Enter key.

At the equipment frame

12 Hang a sign on the active unit bearing the words: **Active unit—Do not touch.** This sign should not be attached by magnets or tape.

At the MAP terminal

13 Observe the MAP display and determine the state of the inactive unit. The example in step 3 shows the status of the PM as in-service on the active unit and in-service trouble on the inactive unit.

If state is	Do
`ManB`	step 20
`SysB, CBsy, ISTb, or InSv`	step 14

NTMX71
in an SMU (continued)

14 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the inactive SMU unit (0 or 1)

15 Set the inactive unit to the ROM level by typing

>PMRESET UNIT smu_unit_no NORUN
and pressing the Enter key.

where

smu_unit_no   is the number of the inactive unit (0 or 1)

At the equipment frame

16

> **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMU. This protects the equipment against damage caused by static electricity.

> **WARNING**
> **Equipment damage**
> Take the following precautions when removing or inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Put on a wrist strap.

17 Unseat the NT6X41 card in slot 21.

18 Unseat the NTMX77 card in slot 13.

NTMX71
in an SMU (continued)

19

> **WARNING**
> **Personal injury**
> Take the following precautions when removing a backplane card:
> To prevent eye and facial injuries do not jerk the card from backplane pins. Gently rock the card off the backplane pins.

Using a slot screwdriver, loosen the screws from the two brackets that secure the card to the backplane at slot 19. Keep the screws in place on the backplane.

20 Remove the card.

21 Place the card you have removed in an electrostatic discharge (ESD) protective container.

22 Line up the holes on the brackets of the replacement card with the holes on the backplane of slot 19.

23 Using a slot screwdriver, secure the card to the backplane with the screws that were loosened in step 19. Ensure the fiber washer is between the brackets of the replacement card and the backplane before tightening the screws.

24 Reseat the NTMX77 card in slot 13.

25 Reseat the NT6X41 card in slot 21.

26 Use the following information to determine the next step.

If you were directed here from	Do
alarm and trouble clearing procedures	step 30
other	step 27

NTMX71
in an SMU (continued)

At the MAP terminal

27 Load the inactive SMU unit by typing

>LOADPM UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the busied SMU unit (0 or 1)

If load	Do
passed	step 28
failed	step 33

28 Test the inactive SMU unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit loaded in step 27

If TST	Do
passed	step 29
failed	step 33

29 Return the inactive SMU unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the SMU unit tested in step 28

If RTS	Do
passed	step 30
failed	step 33

NTMX71
in an SMU (end)

At the equipment frame

30 Remove the sign from the active SMU unit.

31 Send any faulty cards for repair according to local procedure.

32 Note the following in the office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 34.

33 For further assistance, contact the personnel responsible for the next level of support.

34 You have completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

35 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NTMX77
in an SMU

Application

Use this procedure to replace the following card in a host SMU.

PEC	Suffixes	Name
NTMX77	AA	Unified processor (UP)

Common procedures

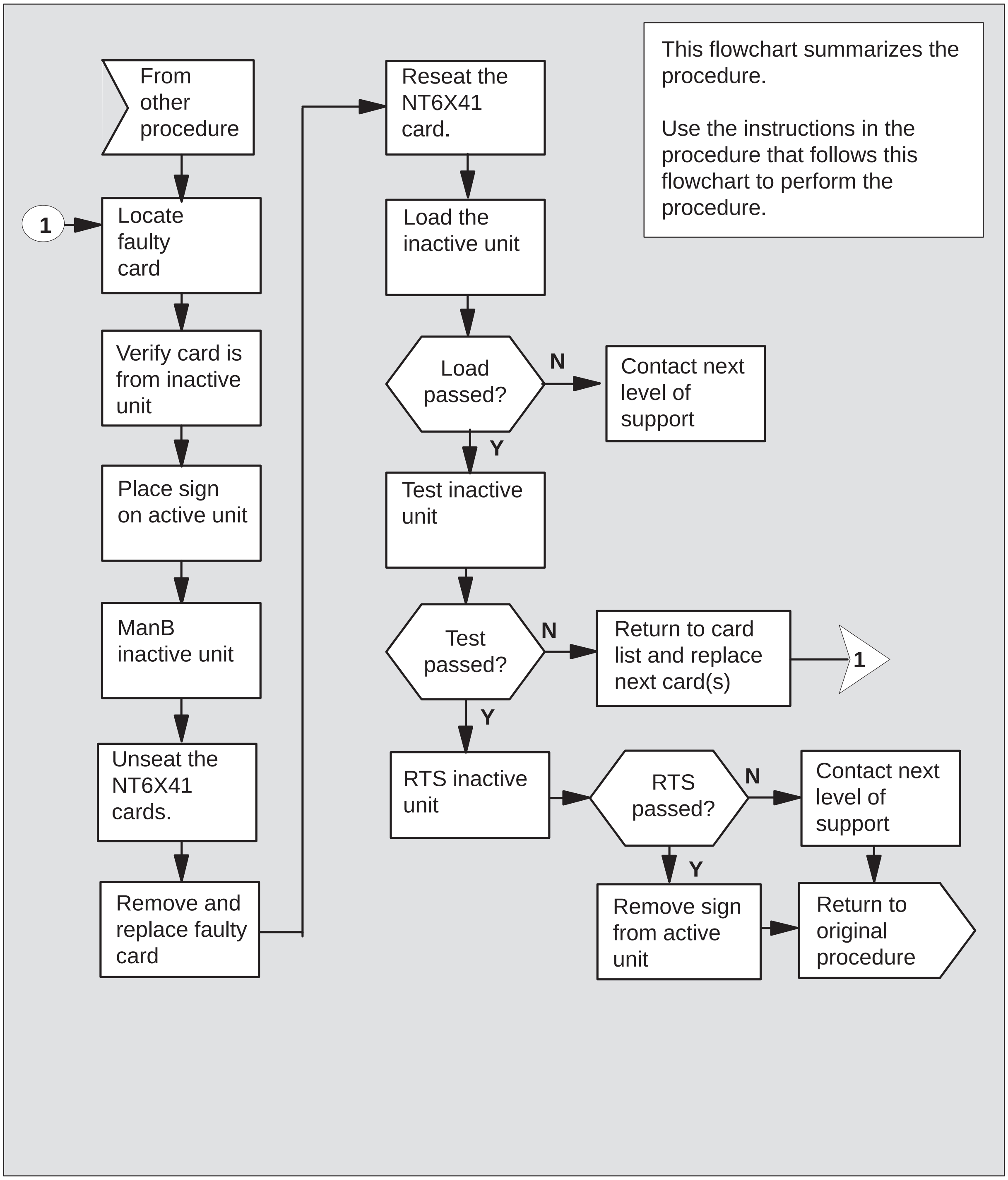
None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NTMX77
in an SMU (continued)

Summary of card replacement procedure for an NTMX77 card in an SMU



NTMX77
in an SMU (continued)

Replacing an NTMX77 card in an SMU

At your Current Location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

CAUTION
Loss of service
When replacing a card in the SMU ensure the unit where you are replacing the card is INACTIVE and the mate unit is ACTIVE.

Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC) including suffix, as the card to be removed.

NTMX77
in an SMU (continued)

At the MAP terminal

3 Access the PM level and post the SMU by typing

>MAPCI;MTC;PM;POST SMU smu_unit_no
and pressing the Enter key.

where

smu is the number of the host SMU
smu_unit_no is the number of the host SMU unit to be posted

Example of a MAP display:

```
   CM   MS   IOD     Net  PM     CCS     LNS    Trks   Ext    APPL
    .    .     .       .  1LTC    .       .      .      .       .
 SMU             SysB      ManB     OffL     CBsy     ISTb      InSv
 0 Quit      PM   0         0        2        0        2         25
 2 Post_     SMU  0         0        0        0        0          1
 3 ListSet
 4           SMU      0 ISTb  Links_OOS:  CSide  0,  PSide   0
 5 TRNSL_    Unit 0:  Inact SysB
 6 TST_      Unit 1:   Act  InSv
 7 BSY_
 8 RTS_
 9 OffL
10 LoadPM_
11 Disp_
12 Next_
13 SWACT
14 QueryPM
15
16
17 Perform
18
```

4 By observing the MAP display, be sure the card to be removed is on the inactive unit.

If the faulty card is on an	Do
ACTIVE unit	step 5
INACTIVE unit	step 8

NTMX77
in an SMU (continued)

5 Switch the processing activity to the inactive unit by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 50

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SWACT passed`	step 8
`SWACT failed`	step 7
`SWACT failed` `Reason: SMU SWACTback`	step 7
`SWACT refused by SWACT controller`	step 7

7 Return to the *Alarm Clearing Procedure* to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the SME frame

8 Put a sign on the active unit bearing the words **Active unit—Do not touch.**

NTMX77
in an SMU (continued)

At the MAP terminal

9 Busy the inactive unit by typing

>BSY UNIT SMU_unit_no
and pressing the Enter key.

where

smu_unit_no is the number of the inactive unit (0 or 1)

10 Set the inactive unit to the ROM level by typing

>PMRESET UNIT smu_unit_no NORUN
and pressing the Enter key.

where

smu_unit_no is the number of the inactive unit (0 or 1)

At the SME frame

11

WARNING
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMU. This protects the equipment against damage caused by static electricity.

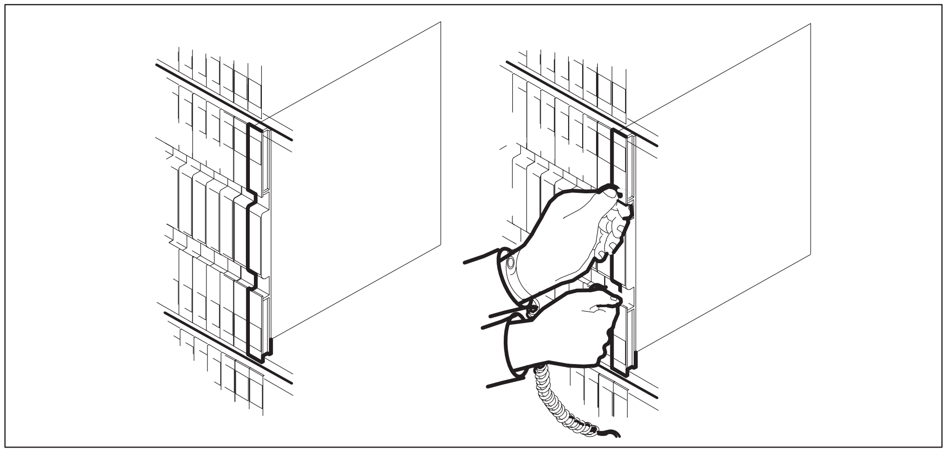
WARNING
Equipment damage
Take the following precautions when removing or inserting a card:
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

Put on a wrist strap.

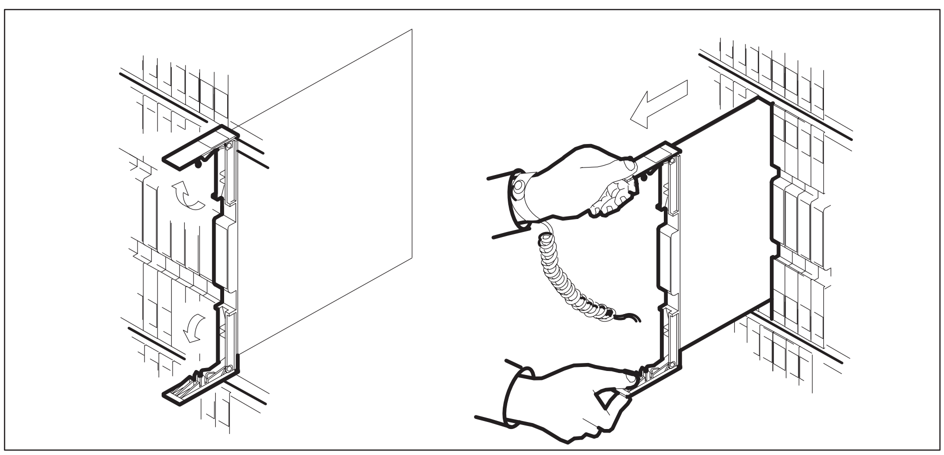
12 Unseat the NT6X41 card in slot 21.

13 Remove the NTMX77 card as shown in the following figures.

a. Locate the card to be removed on the appropriate shelf.



b. Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.



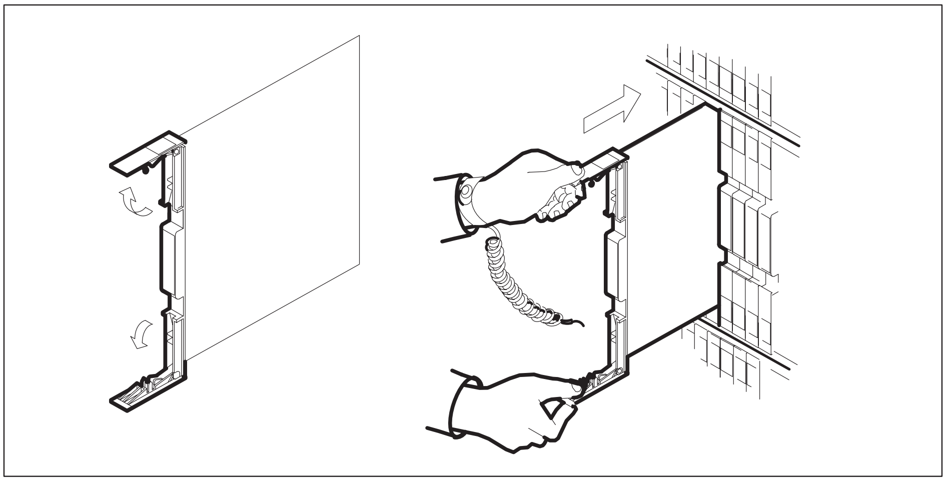
c. Ensure that the replacement card has the same PEC including suffix, as the card you just removed. Also ensure that all replacement card DIP switch settings match settings of the card just removed.

Note: If the NTMX77 has DIP switch S1, set DIP switch S1 to XPM.

14 Open the locking levers on the replacement card.

NTMX77
in an SMU (continued)

a. Align the card with the slots in the shelf and gently slide the card into the shelf.



15

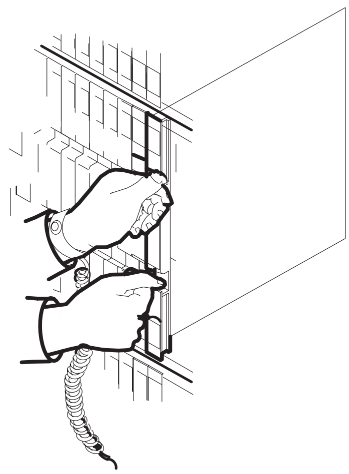
> **WARNING**
> **Possible loss of P-side nodes**
> Monitor the LEDs on the faceplate of the replacement NTMX77 when installing.
>
> 1. The INSV and ESA LEDs may come ON and must go OFF in less than 4 seconds.
>
> 2. The ACT LCD may come ON and light for less than 1 second. If the ACT LED remains ON for more than 1 second, immediately remove the NTMX77 card and return to step 13 c. with a new NTMX77 card. If the NTMX77 card is allowed to remain with both units having an active processor, this is a condition of dual activity, which will result in the loss of P-side nodes.

Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure the card is fully seated in the shelf.

NTMX77
in an SMU (continued)

b. Close the locking levers.



16 Reseat the NT6X41 card in slot 21.

17 Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
an alarm clearing procedure	step 47
other	step 21

NTMX77
in an SMU (continued)

At the MAP terminal

18 The peripheral loader card (NT7X05) allows local loading of the SMU data. Local data loading reduces recovery time. Determine if an NT7X05 is located in slot 12. Check if the NT7X05 card is provisioned by typing:

>QUERYPM FILES

and pressing the Enter key.

Example of a MAP display:

```
  CM   MS   IOD   Net    PM    CCS    LNS    Trks    Ext    APPL
   .    .     .    .    1SMU    .      .       .      .      .
                        *C*
 SMU             SysB     ManB     OffL     CBsy     ISTb     InSv
 0 Quit     PM     2        0        2        0        2        25
 2 Post     SMU    1        0        0        0        1         1
 3 ListSet
 4          SMU      0 ISTb  Links_OOS:  CSide  0,  PSide   0
 5 TRNSL_   Unit 0:  Inact ManB
 6 TST_     Unit 1:  Inact InSv
 7 BSY_
 8 RTS_     QUERYPM files
 9 OffL         Unit 0:
10 LoadPM_         NT7X05 load File: ESU06AZ
11 Disp_           NT7X05 Image File:
12 Next_        Unit 1:
13 SwAct           NT7X05 load File: ESU06AZ
14 QueryPM         NT7X05 Image File:
15
16 IRLINK
17 Perform
18
```

If the NT7X05 card is	Do
provisioned	step 19
not provisioned	step 21

Note: If the NT7X05 card is not provisioned the MAP response is:
`Nt7X05 not datafilled,  QueryPm files invalid`

NTMX77
in an SMU (continued)

19 Load the SMU from the local image by typing

>LOADPM UNIT unit_no LOCAL IMAGE
and pressing the Enter key.

where

SMU_unit_no   is the number of the inactive SMU unit

If the load	Do
passed	step 41
failed	step 20

20

WARNING
Possible service interruption
The LOADPM command, LOCAL LOADFILE option, parameter [<file> string}], will load the file_name from the parameter. The loadfile name will not be patched. Do not use this parameter unless the NOPATCH option of the loadfile is desired.

Load the SMU from the local loadfile by typing

>LOADPM UNIT unit_no LOCAL LOADFILE
and pressing the Enter key.

where

SMU_unit_no   is the number of the inactive SMU unit

If the load	Do
passed	step 41
failed	step 21

21 After replacing the faulty card, load the inactive unit by typing

>LOADPM UNIT smu_unit_no CC
and pressing the Enter key.

where

smu_unit_no   is the number of the inactive unit

If	Do
message `loadfile not found in directory` is received	step 22
load passes	step 41
load fails	step 48

22 Determine the type of device where the PM load files are located.

If load files are located on	Do
tape	step 23
IOC disk	step 29
SLM disk	step 34

23 Locate the tape that contains the PM load files.

24 Mount the tape on a magnetic tape drive.

At the MAP terminal

25 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape drive containing the PM load files

26 List the contents of the tape in your user directory by typing

>LIST T tape_no
and pressing the Enter key.

where

tape_no is the number of the tape drive containing the PM load files

27 Demount the tape drive by typing

>DEMOUNT T tape_no
and pressing the Enter key.

where

tape_no is the number of the tape drive containing the PM load files

28 Go to step 39.

29 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

30 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

31 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL
and pressing the Enter key.

where

volume_name is the name of the volume that contains the PM load files obtained in step 29.

32 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

33 Go to step 39.

34 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

NTMX77
in an SMU (continued)

35 Access the disk utility level of the MAP display by typing

>DISKUT
and pressing the Enter key.

36 List the SLM disk volumes by typing

>LV CM
and pressing the Enter key.

37 List the SLM file names into your user directory by typing

>LISTFL volume_name
and pressing the Enter key.

where

volume_name is the name of the volume that contains the PM load files, obtained in step 34.

38 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

39 After listing the PM load files, load the inactive SMU unit by typing

>LOADPM UNIT smu_unit_no
and pressing the Enter key.

where

smu_unit_no is the number of the inactive unit

If load	Do
passed	step 40
failed	step 48

40 Query the XPM countrs for the firmware load on the NTMX77 by typing:

>QUERYPM CNTRS
and pressing the Enter key.

Example of a MAP display:

```
Unsolicitited MSG limit = 250, Unit 0 = 0, Unit 1 = 0
Unit 0:
Ram Load: ESU05AW
EPRom Version: AB02
EEPRom Load: Loadable: MX77NG03, Executable: MX77NG03
CMR LOAD: CMR33A15
UP:MX77AA
IP:BX01
Unit 1:
Ram Load: ESU05AW
EPRom Version: AB02
EEPRom Load: Loadable: MX77NG03, Executable: MX77NG03
CMR LOAD: CMR33A15
UP:MX77AA
IP:BX01
```

If firmware is	Do
valid	step 43
invalid	step 41

41 To load the firmware on the inactive unit type

>LOADFW INACTIVE
and pressing the Enter key.

Note: If the firmware_file is not specified with the LOADFW command, the command applies the firmware_file datafilled in the appropriate inventory table.

If LOADFW	Do
passed	step 42
failed	step 48

NTMX77
in an SMU (continued)

42 To upgrade the firmware on the inactive unit type

>LOADFW INACTIVE UPGRADE
and pressing the Enter key.

If LOADFW UPGRADE	Do
passed	step 43
failed	step 48

43 Test the inactive unit by typing

>TST UNIT smu_unit_no
and pressing the Enter key.

where

smu_unit_no is the number of the inactive unit

If TST	Do
passed	step 44
failed	step 48

44 Return the inactive unit to service by typing

>RTS UNIT smu_unit_no
and pressing the Enter key.

where

smu_unit_no is the number of the inactive unit

If the RTS	Do
passed	step 45
failed	step 48

45 Send any faulty cards for repair according to local procedure.

46 Record the following items in office records:

- date the card was replaced
- serial number of the card

NTMX77
in an SMU (end)

- symptoms that prompted replacement of the card

Go to step 49.

47 Return to the *Alarm Clearning Procedure* or other procedure that directed you to this procedure. If necessary, go to the point where the faulty card list was produced, identify the next faulty card on the list, and go to the appropriate procedure for that card in this manual.

48 Obtain further assistance in replacing this card by contacting personnel responsible for higher level of support.

49 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

50 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

Manually busying SMU C-side links

Application

Use this procedure to remove from service C-side links between an XMS-based peripheral module (XPM) and the network. Use this procedure for both junctored networks (JNET) and enhanced networks (ENET).

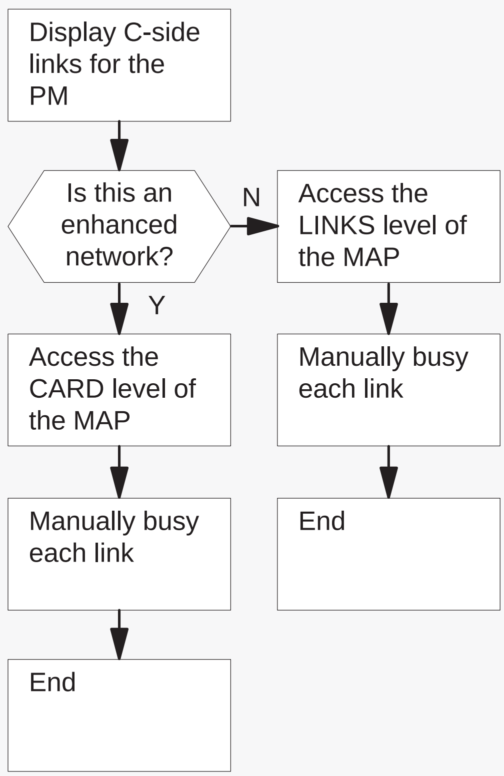
This procedure assumes that the user posted the peripheral module (PM) and the PM is available for query. Instructions in the main procedure direct you to post the PM again after you have completed this common procedure.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Manually busying SMU C-side links (continued)

Summary of Manually busying SMU C-side links



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Manually busying SMU C-side links (continued)

Manually busying SMU C-side links

> **CAUTION**
> **Loss of service.**
> Proceed only if you have been directed here from a step in a maintenance procedure. This procedure removes from service C-side links between the Series II PM and the network. This procedure can cause the system to drop calls.

At the MAP terminal

1 To display a list of C-side links, type

>TRNSL C
and press the Enter key.

Example #1 of a MAP response:

```
Link  0: NET 0  1 18;Cap MS;Status:OK      ;MsgCond:OPN,Unrestrict
Link  1: NET 1  1 18;Cap MS;Status:OK      ;MsgCond:OPN,Unrestrict
Link  2: NET 0  1 22;Cap  S;Status:OK
Link  3: NET 1  1 22;Cap  S;Status:OK
Link  4: NET 0  1 26;Cap MS;Status:OK      ;MsgCond:OPN,Restrict
Link  5: NET 1  1 26;Cap MS;Status:OK      ;MsgCond:OPN,Restrict
Link  6: NET 0  1 30;Cap  S;Status:OK
Link  7: NET 1  1 30;Cap  S;Status:OK
```

Example #2 of a MAP response:

```
Link  0: ENET 0  0 32 01  0;Cap MS;Status:OK    ;MsgCond:OPN,Restrict
Link  1: ENET 1  0 32 01  0;Cap MS;Status:OK    ;MsgCond:OPN,Restrict
Link  2: ENET 0  0 32 01  1;Cap  S;Status:OK
Link  3: ENET 1  0 32 01  1;Cap  S;Status:OK
Link  4: ENET 0  0 32 01  2;Cap MS;Status:OK    ;MsgCond:OPN,Unrestrict
Link  5: ENET 1  0 32 01  2;Cap MS;Status:OK    ;MsgCond:OPN,Unrestrict
Link  6: ENET 0  0 32 01  3;Cap  S;Status:OK
Link  7: ENET 1  0 32 01  3;Cap  S;Status:OK
```

If the network	Do
is a junctor network (JNET)	step 2
is an enhanced network (ENET)	step 7

2 Record the network plane, pair, and link for each C-side link for the XPM shelf associated with the card you are replacing.

Note 1: The C-side links for network plane 0 connect to the shelf for PM unit 0. The C-side links for network plane 1 connect to the shelf for PM unit 1. All C-side links interface to the active PM unit.

Manually busying SMU C-side links (continued)

Note 2: Columns 4, 5, and 6 of the response to a TRNSL command at the PM level list the network plane, pair, and link. In *Example #1 of a MAP response* in step 1: C-side link 7 is on network plane 1, pair 1, link 30.

3 To access the NET level of the MAP display, type

>NET
and press the Enter key.

Example of a MAP display:

```
Net                   11111  11111  22222  22222  33
Plane  01234  56789  01234  56789  01234  56789  01
   0    L..
   1    ...
```

4 To access the LINKS level of the MAP display, type

>LINKS pair_no
and press the Enter key.

where

pair_no is the number of the pair (0 to 31) to which the XPM C-side links are connected

Example of a MAP display:

```
Net                   11111  11111  22222  22222  33
 Plane  01234  56789  01234  56789  01234  56789  01
   0    L..
   1    ...
Net   1  Links              11  1111  1111  2222  2222  2233
       Plane   0123  4567  8901  2345  6789  0123  4567  8901
         0     ....  ....  ..P.  ....  .P..  .P..  .P..  .P..
         1     ....  ....  ..P.  ....  .P..  .P..  .P..  .P..
        Links  3333  3333  4444  4444  4455  5555  5555  6666
       Plane   2345  6789  0123  4567  8901  2345  6789  0123
         0     .P..  .P..  .P..  .P..  ..P.  ..-.  ..-.  ..-.
         1     .P..  .P..  .P..  .P..  ..P.  ..-.  ..-.  ..-.
```

5 To busy one of the links you recorded in step 2, type

>BSY plane_no link_no
and press the Enter key.

where

plane_no is the number of the plane for the link (0 or 1)
link_no is the link number (0 to 63)

Example of a MAP response:

```
BSY 0 30
OK
```

6 Repeat step 5 for all C-side links for the XPM unit on which you are working.

Go to step 13.

Manually busying SMU C-side links (continued)

7 Record the network plane, shelf, card, and link for the C-side links for the XPM shelf associated with the card you are replacing.

Note 3: The C-side links for network plane 0 connect to the shelf for PM unit 0. The C-side links for network plane 1 connect to the shelf for PM unit 1. All C-side links interface to the active PM unit.

Note 4: Columns 4, 5, 6, and 7 of the response to a TRNSL command at the PM level list the network plane, shelf, card, and link. In *Example #2 of a MAP response:* in step 1, C-side link 7 is on network plane 1, shelf 0, card 32, and link 1.

8 To access the NET level of the MAP display, type

>NET

and press the Enter key.

Example of a MAP display:

```
ENET     System   Matrix  Shelf 0 1 2 3
 Plane 0 CSLink     .           F – – –
 Plane 1 CSLink     .           F – – –

ENET:
```

9 To access the SHELF level of the MAP display, type

>SHELF shelf_no

and press the Enter key.

where

shelf_no is the number of the shelf (0 to 7) to which the XPM C-side links are connected

Example of a MAP display:

```
ENET     System   Matrix  Shelf 0 1 2 3
 Plane 0 CSLink     .           F – – –
 Plane 1 CSLink     .           F – – –

SHELF 00  Slot         1111111 11122222 22222333 333333
            123456 78 90123456 78901234 56789012 345678
Plane 0    .  .   IF ....---- -------- ----.... .  .
Plane 1    .  .   IF ....---- -------- ----.... .  .
```

10 To access the CARD level of the MAP display, type

>CARD card_no

and press the Enter key.

where

card_no is the number of the card (1 to 38) to which the XPM C-side links are connected

Example of a MAP display:

Manually busying SMU C-side links (end)

```
ENET     System   Matrix  Shelf 0 1 2 3
 Plane 0 CSLink     .           F – – –
 Plane 1 CSLink     .           F – – –

SHELF 00  Slot         1111111 11122222 22222333 333333
            123456 78 90123456 78901234 56789012 345678
Plane 0    .  .   IF ....–––– –––––––– ––––.... .  .
Plane 1    .  .   IF ....–––– –––––––– ––––.... .  .

 CARD 32   Front:     Back:   DS–512 Links
           Xpt        I/F    0 1 2 3
 Plane 0    .          .     . . . –
 Plane 1    .          .     . . . –
```

11 To busy the link you recorded in step 7, type

>BSY plane_no LINK link_no
and press the Enter key.

where

plane_no	is the number of the plane (0 or 1) for the link
link_no	is the link number (0 to 18 for DS512) or (0 to 15 for DS30)

Example of a MAP response:

```
Request to MAN BUSY ENET Plane:0 Shelf:00 Slot:32 Link:01 submitted.
Request to MAN BUSY ENET Plane:0 Shelf:00 Slot:32 Link:01 passed.
```

If	Do
the links are DS-30s and you have not manually busied all links	step 12
the links are DS-30s and you have manually busied all links	step 13
the link is a DS-512	step 13

12 Repeat step 11 for each DS-30 link recorded in step 7.

13 This procedure is complete. Return to the main procedure that directed you to this procedure and continue as directed.

Removing and replacing a card

Application

Use this procedure when removing a circuit card and inserting a replacement circuit card.

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

Summary of card replacement procedure for Removing and replacing a card

Removing and replacing a card
(continued)

Removing and replacing a card in a shelf

At the cabinet

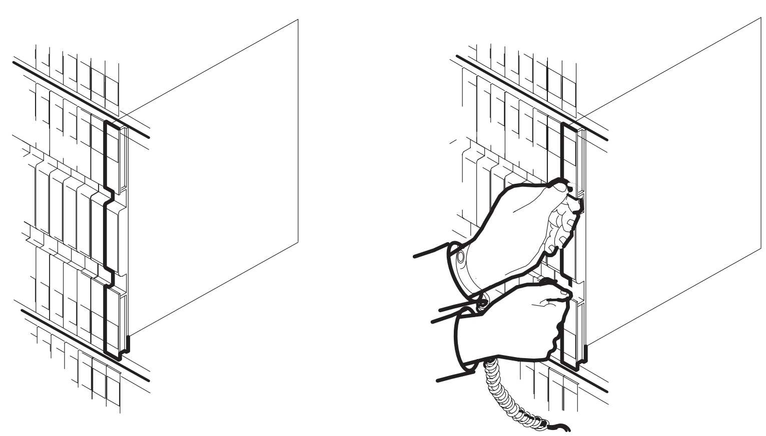
1

CAUTION
Equipment damage
Take the following precautions when removing or inserting a card:
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

WARNING
Static electricity damage
Wear a strap connected to the wrist strap grounding modular supervisory panel (MSP) or frame while handling cards. This strap protects the cards against damage caused by static electricity.

Put on a wrist strap.

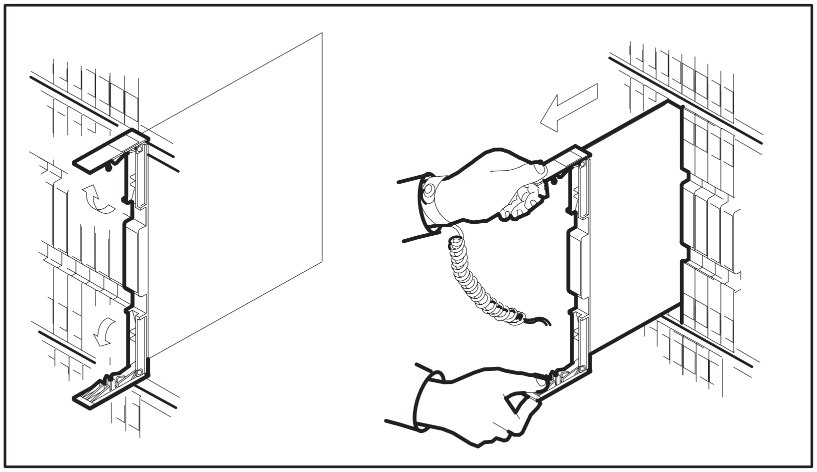
2 Locate the card to be removed on the appropriate shelf.



Removing and replacing a card
(continued)

3 Open the locking levers on the faulty circuit card. The top locking lever opens up and the bottom locking lever opens down.

Gently pull the circuit card toward you until it clears the shelf.



4 Place the circuit card you have removed in an electrostatic discharge (ESD) protective container.

If the card is	Do
NTMX77	step 5
any other	step 6

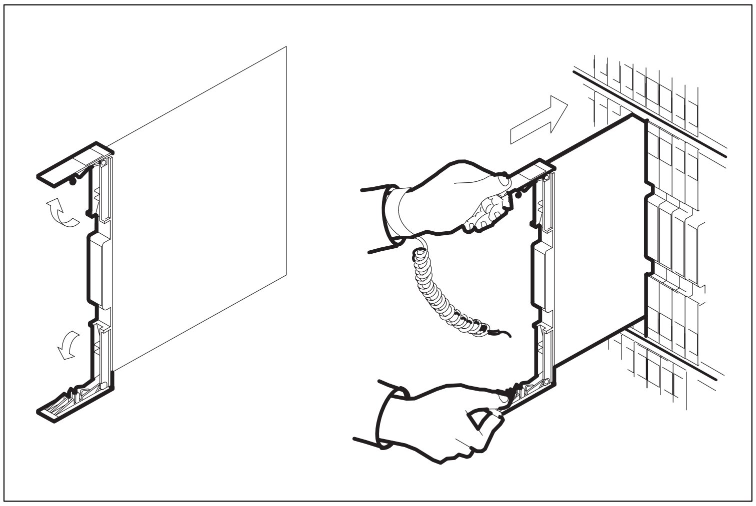
5 Return to the NTMX77 circuit card replacement procedures for switch setting information.

6 Ensure the replacement circuit card has the same PEC, including suffix, as the circuit card you just removed.

7 Ensure all the DIP switch settings are the same as those on the circuit card just removed.

Removing and replacing a card
(end)

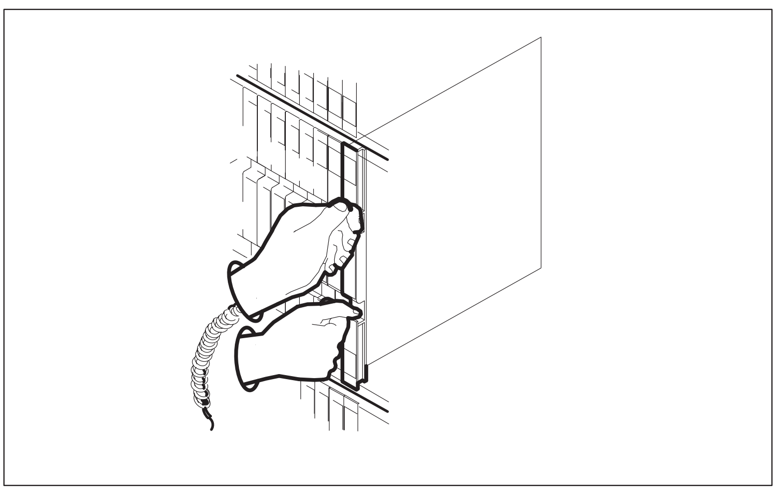
8 Open the locking levers on the replacement circuit card. Align the circuit card with the slots in the shelf and gently slide the circuit card into the shelf.



9 Seat and lock the circuit card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure the circuit card is fully seated in the shelf.

b. Close the locking levers.



10 You have successfully completed this common procedure. Return to the procedure that sent you to this procedure and continue as directed.

Removing and replacing a card

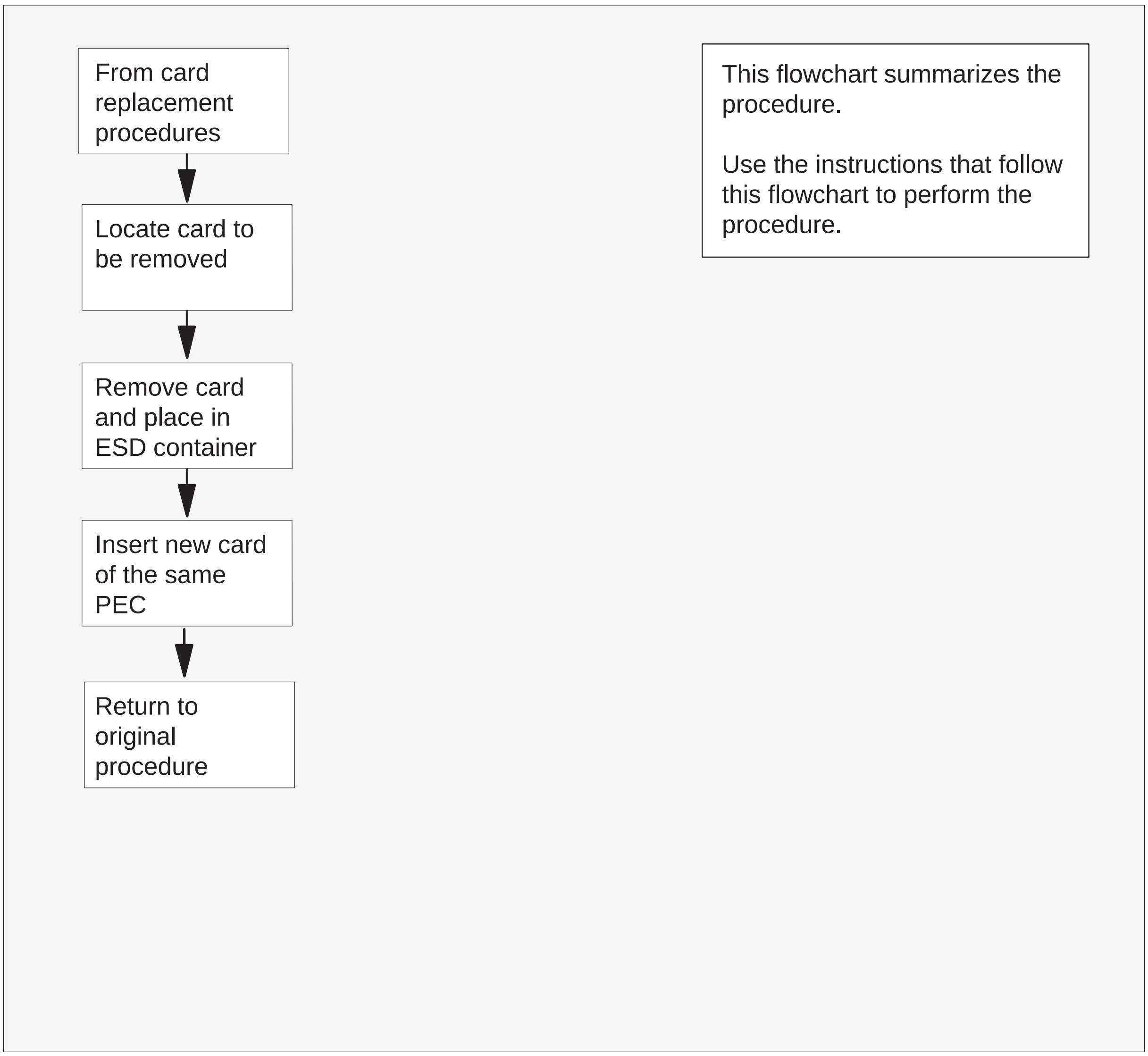
Application

Use this procedure when you remove a circuit card and insert a replacement circuit card.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Summary of card replacement procedure for Removing and replacing a card



Removing and replacing a card
(continued)

Removing and replacing a card in a shelf

At the cabinet

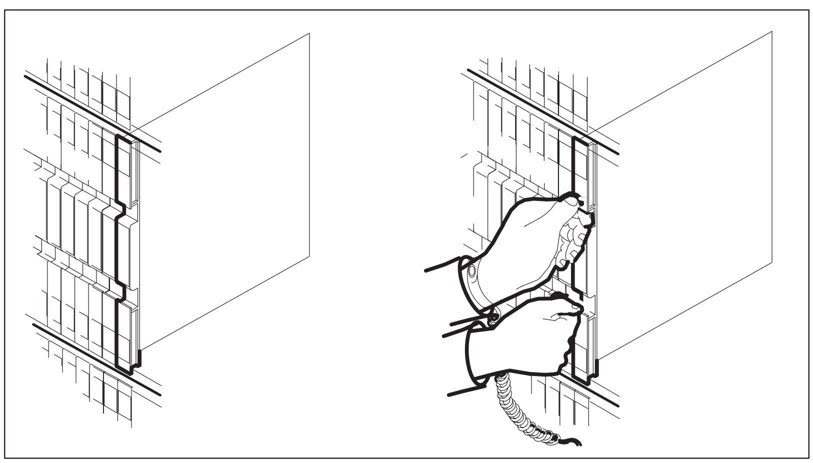
1

> **CAUTION**
> **Equipment damage**
> Take the following precautions when you remove or insert a card:
> 1. Make sure you do not apply direct pressure to the components.
> 2. Make sure you do not force the cards into the slots.

> **WARNING**
> **Static electricity damage**
> Make sure to wear a wrist strap that connects to the wrist strap grounding modular supervisory panel (MSP) or frame to handle cards. The wrist strap protects the cards against static electricity damage.

Put on a wrist strap.

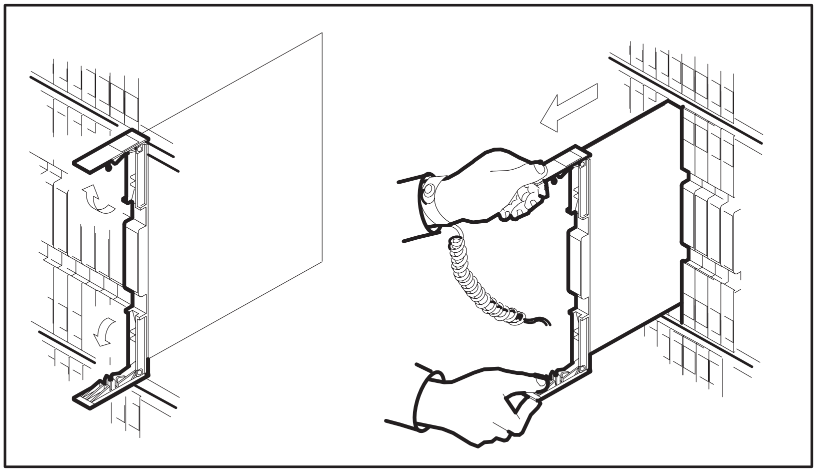
2 Locate the card to be removed on the appropriate shelf.



Removing and replacing a card
(continued)

3 Open the locking levers on the defective circuit card. The top locking lever opens up and the bottom locking lever opens down.

Carefully pull the circuit card toward you until the circuit card clears the shelf.



4 Place the circuit card you have removed in an electrostatic discharge (ESD) protective container.

If the card	**Do**
is NTMX77	step 5
is other than listed here	step 6

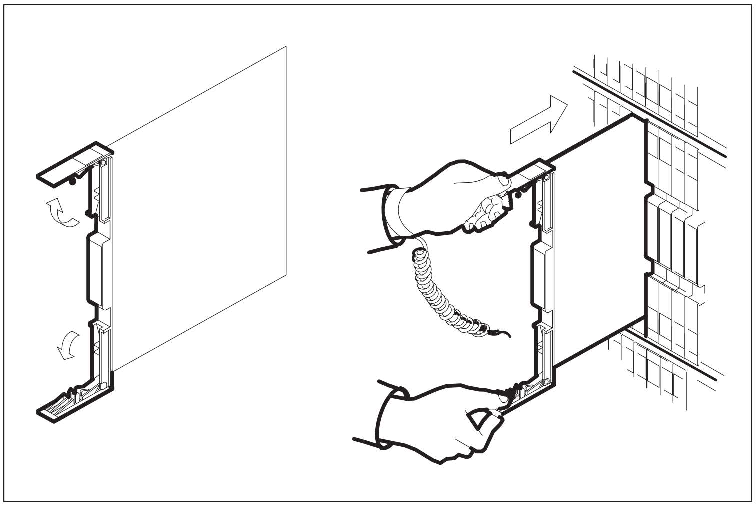
5 Return to the NTMX77 circuit card replacement procedures for switch setting information.

6 Make sure that the replacement circuit card has the same product engineering code (PEC), including suffix, as the circuit card removed.

7 Make sure all the DIP switch settings are the same as those on the circuit card removed.

Removing and replacing a card
(end)

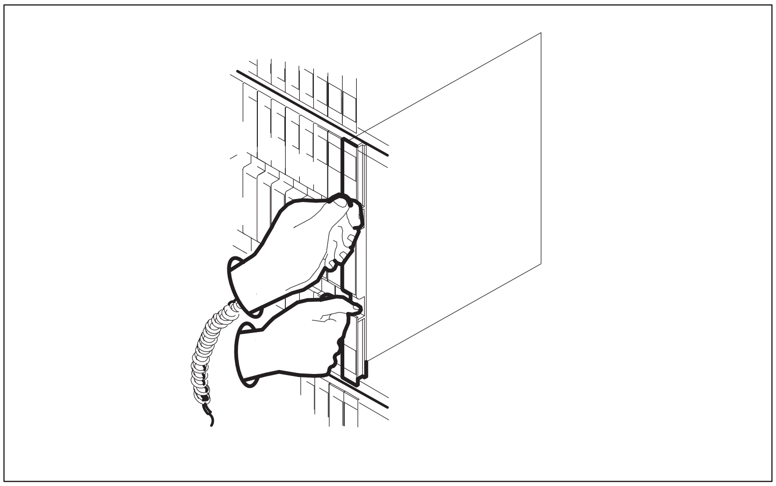
8 Open the locking levers on the replacement circuit card. Align the circuit card with the slots in the shelf and carefully slide the circuit card into the shelf.



9 Seat and lock the circuit card.

a. Use your fingers or thumbs to push on the upper and lower edges of the faceplate. Make sure the circuit card is fully seated in the shelf.

b. Close the locking levers.



10 This procedure is complete. Return to the procedure that directed you to this procedure and continue as directed.

Returning a card for repair or replacement

Application

Use this procedure to return a circuit card for repair or replacement. An example of a circuit card you might return is a power converter. Operating companies return the cards to different addresses that depend on the location of the company (Canada or the United States). Also, the documents personnel must fill out differ in both countries.

Interval

Perform this procedure as needed.

Common procedures

Does not apply

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

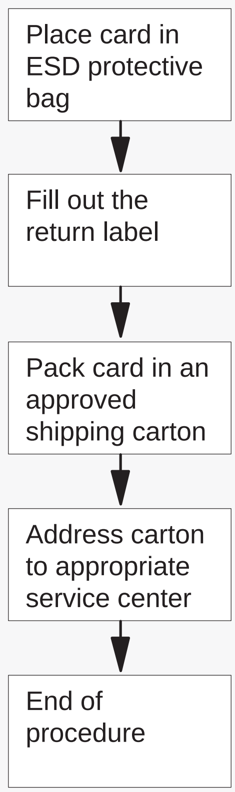
Returning a card for repair or replacement

(continued)

Summary of returning a card for repair or replacement

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Returning a card for repair or replacement
(continued)

Returning a card for repair or replacement

At your current location

1 Place the circuit card in an electrostatic discharge protective bag.

If your location	Do
is in Canada	step 6
is in the United States of America	step 2

2 Fill in the return label for each card you return. If you require help to fill out the tag, call 1-800-347-4850.

Make sure to include the following information:

- return authorization number from customer service
- NT product engineering code (PEC)
- serial number
- release number
- BCS release software used at the time of replacement
- peripheral module load name
- description of the failure and action taken to repair
- fault code that describes the defect (see the bottom of the tag)
- name of your company
- office identifier code
- your name
- site name

3 Pack the card or assembly in a Northern Telecom card shipping carton and seal the carton.

If a Northern Telecom shipping carton is not available, use another carton. Make sure that you

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secure each card or assembly in the carton so that the card or assembly cannot shift around

4 Address the carton to: Nortel Customer Service Center, 4600 Emperor Blvd., Morrisville, North Carolina, 27560

5 Go to step 11.

6 Fill in one return tag (form 24–115) for each card or assembly you return.

Returning a card for repair or replacement
(end)

Make sure to include the following information:

- return authorization number from customer service
- NT product engineering code (PEC)
- serial number
- release number
- BCS release software used at the time of replacement
- peripheral module load name
- description of the failure and action taken to repair
- fault code that describes the defect (see the bottom of the tag)
- name of your company
- office identifier code
- your name
- site name

If you require help to fill out the tag, call 905-454-2808. In the event of an emergency, call 905-457-9555.

7 Attach one copy of the card tag to a latch on the card.

8 Keep the other copies of the tag for your records.

9 Pack the card or assembly in a Northern Telecom shipping carton and seal the carton.

If a Northern Telecom shipping carton is not available, use another carton. Make sure that you

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secure each card or assembly in the carton so that the card or assembly cannot shift around

10 Address the carton to: Nortel Customer Operations, c/o Wesbell Transport, 1630 Trinity Road, Unit #3 Door #4, Mississauga, Ontario, L5T 1L6

11 This procedure is complete.

Locating and clearing SMU trouble

Maintenance engineering and field maintenance use this section. Personnel must have knowledge of the following:

- Subscriber Carrier Module-100 Urban (SMU) interface to the remote carrier urban (RCU), and the DS-1 links between the SMU and the RCU
- the subscriber loop

This section does not provide step-by-step procedures to perform maintenance tasks.

Trouble isolation and correction

Description of troubleshooting procedures

Trouble condition indicators

The following can indicate trouble conditions:

- operational measurements (OM)
- log reports
- alarms

Operational measurements

Operational measurements (OM) monitor and count events in the system. Use the OMs to detect possible system trouble and current problems. The OM thresholding feature monitors and reports important subscriber carrier module-100 urban (SMU) activity. The system must generate these reports one time each day or week. The OMs are the main method to detect trouble.

Log reports

Logs are an analysis tool that provide complete information on call errors, diagnostic results, and system status. Logs also indicate trouble if the conditions that follow occur:

- sudden increase in volume of logs
- message not printed reports
- large number of logs that are alike

Alarms

Audible and visual alarms indicate that a system component requires action to correct a problem. Correct performance of routine system maintenance and use of OMs and logs minimizes alarms.

The level of the alarm indicates how serious the alarm is and the need for action. The levels of alarms are minor, major, or critical. The following table describes alarm conditions.

Alarm description

Alarm	MAP display	Description
Minor	(blank)	Normally does not affect service
Major	(M)	Normally indicates a condition that degrades service
Critical	(*C*)	Normally indicates a service power failure or potential service power failure

Assessing alarms Different MAP terminal subsystems for the SMU configuration generate alarms.

Clearing alarms Follow these instructions to respond to alarms:

- When the MAP terminal shows more than one alarm of the same level, clear the alarms. Clear the alarms from left to right, on the screen.
- If alarm clearing is in progress and an alarm that is more serious occurs, respond to the more important alarm. Do not continue attempts to clear the less important alarm.

Locating and clearing faults

The following instructions are the standard troubleshooting steps to locate and clear faults:

1. Silence audible alarms that the system causes when alarm conditions are detected.
2. To isolate the fault, read status displays and trace fault codes to the menu level required to clear the fault.
3. Offstream (busy) the hardware to remove the system access to the defective component. This procedure allows you to perform maintenance activity without system interference.
4. Test the defective component and identify the card to replace. Replace the defective card and test the card again.
5. Return the hardware to service.

Fault isolation tests

When the system detects a fault condition in the SMU-remote carrier urban (RCU) subsystem, the fault requires maintenance action. The fault can occur in any SMU-RCU subsystem component.

Operating company personnel use procedures to isolate faults to determine the component that causes the fault. These procedures also remove the fault condition or report the condition to the next level of support.

Handling a system busy (SysB) SMU unit

When the system busies an SMU unit, the unit is not in-service and cannot process calls. If the unit is the active unit, a warm SWACT occurs.

The system can display the following reasons for the SysB SMU unit when the user enters the **>QUERYPM FLT** command:

- activity dropped
- CC audit
- diagnostic failed
- PM audit
- self test failed
- trap
- unsol (unsolicited messages) exceeded
- CS links
- reset
- C-side links

The peripheral module (PM) level maintenance procedures do not detect central-side (C-side) link problems.

Standard troubleshooting methods require that you test a specified unit of a SysB SMU. If the unit passes the tests and can return to service (RTS), the system clears the SysB fault.

The following example shows a list of possible defective SMU cards that the system displays when tests fail:

```
SMU 60 Unit 0 Tst Failed
Failed to open link
Site Flr RPos Bay_id Shf  Description     Slot   EqPEC
HOST 00  C05  SME 00 51   SMU : 60        :22    6X40
HOST 00  C05  SME 00 65   SMU : 60        :22    6X40
HOST 00  C05  SME 00 51   SMU : 60        :21    6X41
HOST 00  C05  SME 00 51   SMU : 60        :18    6X69
HOST 00  C05  SME 00 51   SMU : 60        :12    MX77
```

Replace one card at a time in the order listed. Continue to test the unit until the specified fault clears.

A message like `No Reply From PM`, can appear when the test fails. Use the PMRESET command to reset the SM and clear the fault. If the reset fails, the system displays a list of possible defective cards. Replace the cards one at a time. Replacement of a defective card can clear the SysB problem.

To clear faults in a SysB SMU can require a reload of software to the SMU.

If these procedures do not clear the alarm, the SMU can have a software problem. Contact the next level of support.

Handling an ISTb SMU unit

When an SMU is in-service trouble (ISTb), the unit has a fault but can process calls. When the user enters the **>QUERYPM FLT** command at the SMU level, the system responds with the following messages:

- `Data out of date` The PM requires a reload.
- `Static data mismatch with CC` The SMU requires a download of static data. Busy (BSY) and RTS the unit or use the NODATASYNC parameter to BSY and RTS the inactive unit.
- `P-side links out of service` The system requires DS-1 link maintenance.
- `Load mismatch with CC` Change the load entered in Table LTCINV to match the load that the SMU uses. Enter the command string **>QUERYPM CNTRS** to display the SMU load.

A unit of the SMU can require tests. Procedures to replace defective cards, reset the SMU, or reload the SMU can clear a fault in an ISTb SMU.

Handling data mismatch

ATTENTION

The following RTS procedures involve the NODATASYNC option. These procedures apply to an extended multiprocessor system (XMS)-based peripheral module (XPM) that is not converted to XPM configuration data table (CDT) management. Feature AF5678, XPM Node Table SYNC Redesign introduced CDT to improve synchronization of XPM units. The XPMs with software loads that contain this feature synchronize the nodes of both units and port tables with the CM. These XPMs do not synchronize unit to unit. Feature AF5678 eliminates out-of-synchronization causes except hardware failure. Clear an ISTb condition with configuration download and the synchronization of both units that follows. To clear the ISTb condition, the XPM must be BSY and RTS. Busy and RTS the XPM during periods of low traffic to minimize out-of-service impact. For a complete description of this feature, refer to the Maintenance summary section in this document.

When the SMU has data mismatch troubles, like a static data mismatch with the CM, BSY and RTS the SMU. Use the NODATASYNC parameter with RTS. This parameter minimizes the time required to have the correct data in both SMU units.

When you enter the command string RTS NODATASYNC for the inactive unit, the following events occurs:

1 The system blocks node translation table transfer from the active to the inactive unit. The system checks if the node tables match.

2 The system loads static data from the CM to the inactive unit.

3 The inactive unit returns to service. This action disables data synchronization between the active and inactive unit.

The following steps describe how to use the NODATASYNC option.

Assume a static data mismatch occurs for the SMU. Perform the following steps:

1 Busy the inactive unit (BSY UNIT n).

2 To RTS the inactive unit, use the NODATASYNC option (RTS UNIT n NODATASYNC).

   The inactive unit returns to service. If RTS static data changes, the system generates a PM128 log. The log contains the message `Mismatch found in node table between the two units`. Enter the command string **>QUERYPM FLT** for the SMU for an indication of a node table mismatch.

3 Perform SWACT.

Handling an IMC link fault

When the IMC link audit detects data loss or corruption of messages over IMC links, the SMU becomes ISTb. The system generates a PM128 log. When operating company personnel enter the command string **>QUERYPM FLT**, the response includes the following message:

```
NON-CRITICAL HARDWARE FAULT
```

Perform the following steps:

1 Perform a test on both units to confirm the audit result.

2 BSY and offline the inactive unit and replace the defective cards listed (NT6X69 or NMX77 or both).

3 Return the inactive unit to service.

If the node remains ISTb for a minimum of 5 min and the response to command string **>QUERYPM FLT** does not change, the fault is in the active unit. If the RTS of the inactive unit completes, perform the following steps:

1 Switch the activity of the units.

2 BSY the now inactive unit.

3 Test the inactive unit.

4 Offline the unit with the defective cards and replace the cards.

5 Return the inactive unit to service.

If card replacement does not clear the fault, the problem can be in the backplane.

Handling a parity error fault

You can correct most parity faults without a loss of service. This section describes the types of parity faults. This section provides a summary of the actions the CM takes to handle parity faults. This section also describes the actions that operating company personnel must perform.

The three types ofparity faults are as follows:

- An intermittent fault occurs when the system detects a fault. The system cannot detect an error during the read of the location again.
- A soft fault occurs when the system detects a parity error. The XPM detects an error when the XPM tries to reread the location. The XPM does not detect an error when the XPM attempts to write to the location. The error can occur in the program store or memory store.
- A hard fault occurs when an XPM detects a fault. The XPM procedures to replace the cannot read again or write to the memory location.

When a parity fault occurs, the CM determines the action to perform on the XPM unit. The status of the unit that reports the fault (active or inactive) determines the action of the CM. The CM handles all three types of faults in the same way.

When the CM detects a parity fault in the active unit of the XPM, the CM sets the unit ISTb. The CM sets the unit ISTb with a reason of parity. The CM recovers the unit during a maintenance window. The maintenance window to recover a parity fault on the active unit is the XPM routine exercise (REx) test window. The time for the XPM REx test window can be the same as the current time of the switch. When this condition occurs, an audit checks if the active unit of the XPM has an ISTb of parity. If an ISTb is present, the CM performs a SWACT and reloads the XPM if other requirements are not present. This action clears the ISTb parity fault and the short-term failure (STF) parity fault peg. This action also solves the parity fault in the XPM.

When the active unit reports the parity fault, the system generates a PM181 log. Log PM181 informs operating company personnel of the problem. The CM performs recovery actions that include a SWACT of the XPM. The CM also loads the unit that is now inactive with the XPM software load. The corresponding inventory table determines the XPM software load. The CM handles this load action as an autoload. A manual or CM or mate reload of the XPM software to the affected unit clears the ISTb.

The CM does not allow a REx test on the components that follow:

- a peripheral-side (P-side) or C-side node of the XPM that recovers from a parity fault
- the XPM, if a P-side or C-side of a node recovers from a parity fault

The CM does not allow two XPMs in the same configuration to perform a parity reload. A P-side node cannot perform a parity reload at the same time as the C-side node. A C-side parity reload cannot occur at the same time as the P-side node. This limit makes sure only one XPM in a configuration is in simplex at a time.

The CM generates PM181 log reports to inform operating company personnel of a parity fault. This log is the primary trouble indicator. Operating company personnel can check for associated logs, like the PM128, to determine what actions the CM performs. This section provides examples of the messages associated with the PM181 and PM128 logs.

The SMU unit can be set ISTB with several reasons at the same time. When you perform a QUERYPM FLT at the MAP level, the system displays all of the ISTb reasons. The system displays all ISTb reasons that occurred on the unit and are not cleared.

Hard parity fault

When the active unit of the XPM reports a hard parity fault to the CM, the system generates a PM181 log. Log PM181 is for information only. This log informs operating company personnel of the following conditions:

- a parity fault occurs on the active unit, and the unit becomes ISTb
- the CM reloads the unit during the next XPM REx test window

The user can perform a manual SWACT and reload to clear the ISTb and the parity fault.

An example of log report PM181 follows:

```
PM181 JUL23 23:29:16 7700 INFO SMU 0 Unit 0
Node: Istb, Unit0 Inact: ISTb, Unit1 Act: ISTb
Parity audit has detected a hard parity fault.
The system will autoload the unit during the next
XPM REX test window.
Monitor the system for maintenance and recovery.
Site Flr  RPos  Bay_id  Shf Description Slot  EqPEC
RAL1 00   C05   CMVI 00  18  SMU  : 000   3    MX77
```

When a unit changes state to ISTb of UP RAM parity fault, the system generates a PM128 log. This log informs operating company personnel that the unit changes status.

An example of log report PM128 follows:

```
*PM128 MAY09 09:49:56 9000 TBL ISTB SMU 1
 Node: ISTb (Unit ISTb)
 Unit0 Inact: InSv
 Unit1   Act: ISTb (UP RAM Parity)
```

Enter the command string QUERYPM FLT to display the faults on a posted XPM. The following example of a MAP response indicates that unit 1 of the posted XPM has a hard parity fault:

```
>querypm flt
Node is ISTb
    One or both Units inservice trouble
Unit 0
    no fault exists
Unit 1
    The following inservice troubles exists:
        Parity audit has detected a hard parity fault.
        A reload is required to clear this fault.
        The system will autoload this unit during the next
        XPM REX test window.
```

Action by the CM: The CM performs a SWACT and reloads the XPM during the next XPM REx test window. After the reload, this ISTb fault clears.

User action: There is no action required. Operating company personnel can initiate a manual SWACT and reload to clear the parity fault.

Handling a SysB RCU

The following four conditions can cause the RCU to be SysB:

- A cold or reload restart occurs on the CM.
- Both message links go out of service. One or both message links become SysB.
- The RCU sends the SMU a minimum of 200 alarm reports (unsolicited messages) in 10 min.
- The RCU sends the SMU a minimum of 20 initialization reports in 10 min.

The following table is an example of a MAP display. This example displays the reasons that a posted RCU is SysB.

The QUERYPM FLT display for SysB RCU

```
   CM     MS      IOD     Net     PM     CCS     Lns     Trks     Ext
   .      .       .       .      1RCU     .       .       .        .
                                  *C*
    RCU
 0  Quit                  SysB     ManB      Offl    CBsy   ISTb  InSv
 2  Post_           PM       0        0         0       0      1     12
 3  Listset         RCU      1        0         0       0      1     17
 4
 5  Trnsl_          RCU REM1 04 0 SysB     LINKS_OOS:    CSIDE 4
 6  Tst_
 7  Bsy_            QUERYPM FLT    SysB reason:  LINK AUDIT
 8  RTS_
 9  Offl
 10
 11 Disp_
 12 Next
 13
 14 QueryPM_
 15 BckpSel
 16 Status
 17
 18
          userid
    TIME   hh : mm>
```

The user enters the **>QUERYPM FLT** command with the FLT parameter when the posted RCU is SysB. The LINK AUDIT indicates that both DS-1 message links between the SMU and RCU are out of service (OOS). One or both DS-1 message links are SysB. This condition causes the RCU to become SysB.

Four other conditions can cause the RCU to be SysB. These conditions and the messages that appear at the MAP display are as follows:

- `CC restart has occurred` This message indicates that a cold restart or reload restart occurs on the CM.
- `Initialization limit exceeded` This message indicates that the Digital Multiplex System (DMS) places the RCU OOS because of initializations. A minimum of 20 initializations occurred in 10 min at the RCU.
- `Unsolicited message limit exceeded` This message indicates that the RCU sent a minimum of 200 unsolicited messages to the SMU in 10 min.
- `Messaging failure` This message indicates a failure in the RCU does not allow the RCU to communicate with the SMU.

For LINK AUDIT, enter the TRNSL command with the RCU posted. Use this command to verify that both DS-1 message links are OOS. To return the RCU to service, RTS one or both of these links.

Correct faults on the DS-1 links to return the links to service. To check the links at CARRIER level of the MAP display, post the SMU where the links attach. At the CARRIER level, the system displays the SMU and the DS-1 links. Link faults appear in the MAP display under the fields ALARM, SLIP, BPV, and FRAME.

Check log reports. The MAP displays and log reports help to isolate the fault. The fault can be in the SMU DS-1 interface card, RCU digroup card, or DS-1 line that includes repeaters.

The types of alarms raised determine the action to correct messages that are not solicited that exceed the limit. To list these alarms, enter the **>QUERYPM FLT** command with the FLT parameter.

> ***Note:*** For initializations that exceed the limit, check alarms and logs for the RCU.

Defective RCU common equipment (CE) cards or software cause messaging failure. Check the RCU for alarms. If all CE cards operate, refer to log reports for software problems.

Handling an ISTb RCU

The reasons an RCU is ISTb are as follows:

- Type 1-4 alarm: These alarm types indicate that a line card failed or is missing. Type 1 alarm identifies the top line card in the carrier. Types 2, 3, and 4 alarms identify the second, third, and fourth line cards.

- Type 5 alarm: This alarm type indicates that a line card carrier failed or all four line cards in line card carrier failed. The alarm type also can indicate that a CE card failed at the RCU.
- Type 6 alarm: This alarm type indicates that hardware equipped on the RCU and the datafill for the hardware do not match.
- Type 7 alarm: This alarm type indicates that a digital line (DS-1 line) between the SMU and RCU failed.
- Type 8 alarm: This alarm type indicates a coded alarm. A coded alarm covers faults that range from blown fuses to bipolar violations.

The following table is an example of a MAP display. This example displays the reasons that a posted RCU is ISTb.

The QUERYPM FLT display for ISTb RCU

```
   CM    MS     IOD    Net    PM    CCS    Lns    Trks    Ext
    .     .      .      .    1RCU    .      .      .       .
                              M
    RCU
 0  Quit                 SysB     ManB      Offl    CBsy   ISTb  InSv
 2  Post_       PM        0        0         0        0      1     12
 3  Listset     RCU       0        0         0        0      1     17
 4
 5  Trnsl_      RCU REM1 04 0 ISTb     LINKS_OOS:    CSIDE 1
 6  Tst_
 7  Bsy_        QUERYPM FLT
 8  RTS_
 9  Offl
10
11  Disp_     Alarm Code Shelf Slot Ckt Description
12  Next      Major  001                    Digital Line Failure
13            Minor        5    01          Line Card Carrier Failure
14  QueryPM_  Minor        2    13          Configuration
15  BckpSel   Major  103                    Blown Fuse
16  Status    Minor        4    01   0      Line card 2 ISDN NT1 sync loss
17            Minor        2    01   0      Line card 2 ISDN NT1 sync loss
18                                          with dying gasp
          userid
     TIME   hh : mm>
```

The user entered command string **>QUERYPM FLT** for a posted RCU that is ISTb. Faults are present on DS-1 line 1 that connects to line shelf 1 and on a line card carrier on shelf 5 (line shelf 1).

The configuration fault indicates a difference between the hardware on the RCU shelves and the datafill for this hardware in Table RCUINV. Alarm code 103 indicates a blown fuse in the talk battery filter or fuse and alarm card. The ISDN alarm on shelf 4 indicates the NT1 has a frame synchronization loss condition. The ISDN alarm on shelf 2 indicates that the NT1 does not have power.

Enter the command string **<QUERYPM FLT** to display alarm types 1 through 8 and coded alarms.

To clear configuration alarms, change datafill to match the hardware present or change hardware to match datafill.

Minor and major alarms cause the RCU to become ISTb. If the RCU initializes, the RCU becomes ISTb. The following text appears on the MAP display when the user enters the command string **>QUERYPM FLT**:

```
RCU INITIALIZATION IN PROGRESS
```

If you enter a maintenance command like BSY, TST, BCKPSEL, STATUS, PMRESET, or ACO when the RCU initializes, the following appears:

```
NO ACTION TAKEN:  RCU REM1 04 0 INITIALIZATION IN PROGRESS
```

Enter the ABTK command at the MAP terminal during initialization to allow a maintenance command. The system does not perform the commands until initialization completes.

Clearing type 1–4 alarms

These alarm types indicate that a line card fails or is missing. To clear type 1-4 alarms, perform the following steps:

1. Identify the shelf and slot of the card that failed or is missing.

   At the remote site, the shelf and slot appears in the digital alarm display. At the central office (CO) the information appears in the PM128 log report. The information also appears at the MAP terminal when the user enters the command string **>QUERYPM FLT** for a posted ISTb RCU.

2. Make sure that other cards on the line card carrier do not have associated alarms. If the other cards have alarms, the line card carrier can be defective.
3. Replace the card.
4. Use the L-mode command at the remote site or the DIAG command at the MAP terminal to test the new card. If the card fails, test the other cards on the line card carrier.

5 If all cards fail, replace the line card carrier. Test the cards again to make sure the cards pass diagnostics.

6 If only the original card fails, replace the card.

Type 5 RCU card failure alarms

The RCU raises a type 5 alarm when failure of one of the following occurs:

- a CE card
- a line card carrier (LCC)
- all four line cards in an LCC

This alarm causes the DMS switch to generate a PM128 log. The following is an example of log report PM128:

```
PM128 JAN01 22:53:02 9830 TBL  ISTB  RCU RCU0 00 1
FROM: INSV Min loc=3,7 Card failure
remote alarm received
```

This alarm also appears in the digital display of the ALARMS section of the maintenance card faceplate. The figure on page 7-16 describes the maintenance card faceplate and the digital display that the alarm causes. This example display is easy to read. On a faceplate, the display reads as one string R375. Card failure alarms always show 5 under the type section of the digital display.

To clear a type 5 alarm, perform the following steps:

1 Identify the shelf and slot of the card or line concentrating module (LCM) that fails.

At the remote site, the shelf and slot appear in the digital alarm display. At the CO, the information appears in the PM128 log report. This information appears at the MAP terminal when the user enters the command string **>QUERYPM FLT** for a posted ISTb RCU.

2 Replace the card or LCM.

3 Run an L-mode test at the RCU on one of the carrier or enter the command string **>DIAG LC** at the MAP terminal.

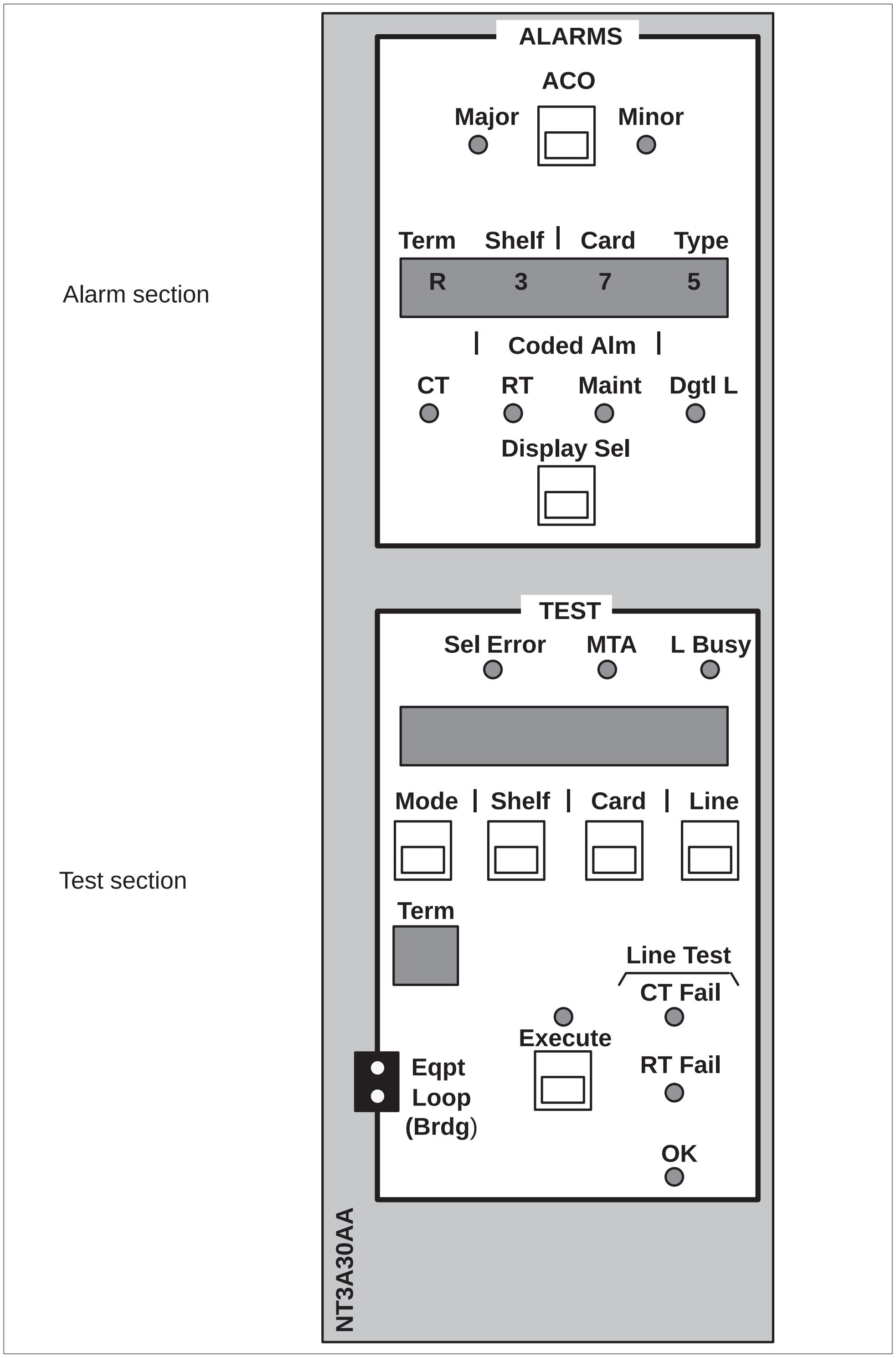
Type 7 digital line alarm (DS-1)

When framing on a DS-1 link fails, the system raises a type 7 digital line alarm. This alarm causes the DMS to generate a PM128 log, as follows:

```
PM128 JAN01 22:53:02 9830 TBL  ISTB  RCU RCU0 00 1
FROM: INSV Min loc=0,1 Digital line failure
remote alarm received
```

The alarm also appears in the digital display of the ALARMS section of the maintenance card faceplate. For a digital line alarm, the digit 7 appears under the type field on the faceplate of the maintenance card.

Maintenance card faceplate



To clear a digital line alarm, perform the following steps:

1 The line number appears on the faceplate of the maintenance card at the RCU (for example, 001 = line 1, 002 = line 2). The line number also appears on PM128 logs or the user can access the line number at the MAP terminal. To access the line number, enter the command string **>QUERYPM FLT** with the associated RCU posted.

2 Defective or missing SMU DS-1 interface and RCU digroup cards can cause type 7 digital line alarms. A defective digroup card causes a type-5 card failure alarm. A missing digroup card causes a type-6 configuration alarm. A missing or defective DS-1 interface card causes the system to generate PM log reports. Check for these additional indications that associate with the type 7 alarm. Type 7 digital line alarms also can result from the following:
   - a defective DS-1 line or repeaters that occur at the CO
   - a defective DS-1 line or repeaters that occur at the RCU
   - a defective DS-1 line or repeaters that occur on the line

Follow standard operating company procedures to test the DS-1 line and associated repeaters. These procedures apply to associated repeaters on the CO, the RCU, and the line.

Type 8 coded alarm (RCU)

Coded alarms indicate different faults at the RCU. These alarms cause the DMS-100 switch to generate a PM128 log. The following is an example of log report PM128:

```
M128 JAN01 22:53:02 9830 TBL  ISTB  RCU RCU0 00 1
ROM: INSV Maj code=312 group not operational: lack
quipment
emote alarm received
```

The alarm also appears in the digital display of the alarms section of the maintenance card faceplate. The figure on page 7-16 indicates the maintenance card faceplate. For a digital line alarm, the digit 8 appears under the *type* field. A three-digit code precedes the digit 8.

How alarm conditions affect ISDN special connections

When alarm conditions are present at the RCU, the SMU takes down special connections associated with integrated-services digital network (ISDN) calls. The SMU again establishes these connections when the system clears the alarm conditions.

The system can take down B-channel special connections on the affected line card for the following reasons:

- line card alarms 1-4
- alarm types 5 and 6
- some coded alarms

The system also takes time-division multiplex (TDM) D-channel special connections down. This action occurs if alarm types 5 and 6 and some coded alarms are present at the RCU. The following table lists the coded alarms that affect ISDN special connections:

The RCU coded alarms that affect ISDN special connections

Coded alarm	Alarm description
Group 1 alarms:	
190	Defective line cards or supervisory
306	Line card power failure
311	Group 1 does not operate as a result of CE
344	All line cards fail AST
Group 2 alarms:	
191	Defective line cards or supervisory
307	Line card power failure
312	Group 2 does not operate as a result of CE
345	All line cards fail AST
Shelf 5 alarms:	
192	Defective line cards or supervisory
340	All line cards fail
Shelf 4 alarms:	
193	Defective line cards or supervisory
341	All line cards fail
Shelf 2 alarms:	
194	Defective line cards or supervisory
342	All line cards fail

—continued—

The RCU coded alarms that affect ISDN special connections (continued)

Coded alarm	Alarm description
Shelf 1 alarms:	
195	Defective line cards or supervisory
343	All line cards fail
—end—	

Note: The system generates log report SCSS104 when the system takes down a virtual endpoint because of an alarm condition. The text reason reads as follows:

```
Disconnected VEP:  Endpt1 is out of service
```

Handling DS-1 link faults

When a link is SysB because of defective operation, isolate the fault to the RCU, SMU, or DS-1 line.

Use fault indicators, like log reports, MAP displays, and RCU maintenance card displays to isolate faults. The type of indications raised determine the steps to clear a DS-1 link fault.

The following steps are an example of a possible method to clear a DS-1 link fault.

1 Make sure the RCU does not have faults.

   a. At the remote site, check the alarm display on the maintenance card faceplate. Record any faults.

   b. At the CO, post the associated RCU. Enter the command string **>QUERYPM FLT** to list the faults at the RCU. The RCU faults that appear at the MAP display also appear on the RCU maintenance card faceplate. The DMS-100 switch generates PM128 logs for all RCU alarms.

   RCU faults that can cause a DS-1 link problem are as follows:

   — Defective digroup card or time switch card (type 5 alarm). Defective or missing digroup card also causes a type 7 digital line alarm.

   — A digroup card or time switch card that is not configured correctly (type 6 alarm). A missing digroup card also causes a type 7 alarm.

   — Defective digital line (type 7 alarm). If only a type 7 alarm is present, refer to step 3.

   — Type 8 coded alarms (161–168). These alarms indicate a high BpV rate on a DS-1 link.

   — Defective RCU repeater card.

   c. Check log reports. The DMS-100 switch generates PM128 log reports when faults occur at the RCU. These logs must match the faults at the MAP display and maintenance card faceplate.

   d. The RCU maintenance card faceplate display, the MAP display in the CO, or log reports list defective cards. Defective cards appear according to RCU shelf and slot. Replace defective RCU cards.

   e. For type 6 configuration alarms, datafill and hardware must match. A link removed from service indicates a missing digroup card. Install the card.

f. An excess of BpVs normally indicate a DS-1 line, DS-1 repeater, office repeater, or RCU repeater fault. Operating company personnel can isolate the fault to a specified repeater or section of DS-1 line. This procedure requires to loop a pulse code modulation (PCM) signal and pull the signal off at specified places in the DS-1 link path. Follow standard operating company procedures to isolate the fault.

g. Make sure that all alarms clear at the RCU.

2 If the RCU does not have faults, post the associated SMU. To check the SMU for faults, enter the command string **>QUERYPM FLT**. The SMU faults appear on the MAP display. The DMS-100 switch generates log reports.

A missing or defective SMU DS-1 interface card can cause the system to remove a DS-1 link from service.

Replace defective SMU cards or install missing cards.

3 If the RCU and SMU do not have faults, the DS-1 line normally contains the problem. A type 7 alarm causes the Dgtl light at the maintenance card faceplate to light. The DMS-100 switch also generates a PM128 log.

A repeater can be defective. Outside interference or a defect in one or more of the wires also can cause the DS-1 problem. Isolate the fault to the RCU repeater, CO office repeaters, DS-1 line, or DS-1 line repeaters. To check each component, loop a signal up to the equipment. Follow standard operating company procedures to isolate the fault.

Note 1: Operating company personnel can test an SMU or RCU from the PM level. Post the module to test and enter the TST command. The SMU or RCU diagnostics check common equipment for correct operation. The test of an RCU inhibits new calls for a maximum of 30 s.

Note 2: The DMS-100 switch generates a type 7 digital line alarm when a DS-1 link is ManB or SysB. The system clears the alarm when the system returns the link to service.

The following section describes how to isolate faults for specified DS-1 fault conditions.

BpVs at the maintenance limit toward the SMU

The BpVs at the maintenance limit indicate that a DS-1 link degrades. The maintenance limit for BpVs must be set at 1 error in 10^6 bits. Set this limit in Table CARRMTC. When BpVs exceed this limit, the system raises warnings. The following events indicate that BpVs exceed the error limit:

- An ML warning appears under ALRM field. Refer to the following table.
- The DMS-100 switch generates a PM110 log. Refer to the following example.

```
PM110 MAY17 09:27:33 4899 INFO CARRIER SMU 60
P-side
CARRIER–NO: 3, REASON: CARRIER BPV MTCE LIMIT SET
```

The causes of BpVs follow:

- outside interference
- defective DS-1 line repeaters
- defective DS-1 line
- defective office repeaters
- defective DS-1 interface card
- defective RCU repeater card
- defective RCU digroup card

To clear an ML warning, the BpVs must equal a specified value. The BpVs must be a maximum of 1 error in 10^6 bits, or the value in Table CARRMTC. If the quality of service is not acceptable because of the BpVs, isolate the problem. The procedure on page 7-24 describes isolation of the problem.

Enter the DETAIL 3 REM command at the Carrier level 0 (circuit 0) after the Carrier level 0 connects to the SMU. This process causes the MAP display in the following example. The command syntax is MAPCI; MTC; TRKS; CARRIER; POST SMU 0; DETAIL 3 REM. Data for the RCU is near the bottom of the MAP display.

The field *CK* refers to the carrier circuit in use. The field *D* indicates the direction of the carrier in relation to the carrier span. The field *P* indicates peripheral-side (P-side) or away from the switch. The field *C* indicates central-side (C-side) or toward the switch. If an *ALRM* field datafill is present, the datafill indicates the exceeded error or maintenance limit. Refer to table Status of an ISDN line and the importance of the ISDN line, on page 7-41.

The fields *SLIP* and *FRAME* track the number of minor frame slips or complete frame losses that occur. An exponential number in the *BER* field indicates the bit error rate (BER) during the audit cycle. The bit error rate of –5.2 in this example is less than 1 error in $10^{5.2}$ bits. A bit error rate of less than –7 indicates less than 1 BpV in a stream of 10^{7} bits. The fields *ES* and *SES* total errored seconds and important errored seconds counts.

Instead of problem counts, all fault fields can also indicate the over limit flags instead of the actual problem counts. The over limit flags are maintenance limit exceeded (ML) or out-of-service limit exceeded (OS). The *STATE* field indicates the status of the link.

CARRIER-level MAP display that indicates ML for SMU

```
   CC    CMC     IOD     Net     PM     CCS     Lns    Trks    Ext   APPL
    .      .      .       .       .       .      .       .       .    .

    DETAIL   CLASS    ML OS   Alarm  SysB  ManB  Uneq  Offl CBsy PBsy InSv
 0  Quit_    TRUNKS    9  0      50    42     2     0    0     4    0   31
 2  Post_    REMOTE    4  0      10     6     0     0    0     0   27    4
 3           TIMING    0  0       0     0     0     0    0     0    0    2
 4             DS1
 5  Loop_    N CLASS SITE SMU CK  D ALRM SLIP FRME BER ES SES STATE PROT
 6  Tst_     0 REMOTE HOST 0  0   C SLIP   ML   0  <–7.110  0  INSV
 7  Bsy_     1 REMOTE HOST 0  2   C  BER    0   0   ML   2  0  SYSB–T
 8  RTS_     2 REMOTE HOST 0  3   C         0   0  <–7.  0  0  PBSY
 9  Offl_    3 REMOTE HOST 0  4   C LCGA    0   0  –6.3  0  0  SYSB
 10 DispOpt_
 11 Disp_    SIZE OF POSTED SET  :  4
 12 Next     N CLASS SITE RCU CK  D ALRM SLIP FRME BER ES SES STATE
 13          3 REMOTE KRCS 0–0 4  P RCGA  0    0    OS 0   0   SYSB
 14 Detail_  DETAIL:
 15
 16
 17
 18
     userid
  TIME hh:mm>
```

Fault isolation of an excess of BpVs

At your current location:

1 Check for RCU faults.

At the CO, post the RCU and the command string **>QUERYPM FLT**. The MAP display indicates RCU faults. Normally, RCU faults cause more important problems than an ML warning.

At the remote site, check the faceplate of the maintenance card for fault indications.

2 Replace defective RCU cards.

3 Make sure that the SMU DS-1 interface card is present and operates correctly.

Test the DMS-1 interface card from the CARRIER level to make sure the card operates correctly.

4 If the SMU and RCU do not have faults, follow standard procedures. These procedures isolate the fault to the RCU repeater, CO office repeater, or a section of DS-1 line and associated repeaters.

The BpV ML clears when BpVs equal or drop below 1 error in 10^6 bits or the limit set in Table CARRMTC. The following example describes when the DMS-100 switch generates a PM110 log. This condition occurs when the fault clears and removes the ML warning from carrier level MAP displays.

```
PM110 MAY17 09:27:33 4899 INFO CARRIER SMU 60
P-side
CARRIER–NO: 2, REASON: CARRIER BPV MTCE LIMIT CLEARED
```

BpVs at the ML toward the RCU

The BpVs at the ML indicate a loss of a DS-1 link. The ML for BpVs is set in Table CARRMTC. An example is one bit error in 10^6 bits. When BpVs exceed the ML, warnings occur.

Indications of this condition are as follow:

- The BpV ML warning appears under the BER field. This condition occurs when the connected SMU is posted and the user enters the command DETAIL with a posted carrier and REM parameter. Refer to figure 8–4 for a display that the DETAIL 3 REM command causes. The REM parameter indicates BpV counts at the RCU end.
- The DMS-100 switch generates a PM110 log.

When the BpV ML clears, the DMS-100 switch generates a PM110 log. The DMS-100 switch clears the ML indicator from the CARRIER level MAP display.

Follow the procedure on the earlier page to isolate this fault.

BpVs at the OL toward the SMU

The BpV OOS limit for BpVs on a DS-1 link must be set at 1 error in 10^4 bits. Set this limit in Table CARRMTC. When BpVs exceed this count, the system displays warnings and removes the DS-1 link from service.

The following conditions indicate this fault:

- The affected link is SysB.
- A type 8 coded alarm (numbers 161–168) appears on the RCU maintenance card faceplate.
- A type 7 digital line alarm appears on the RCU maintenance card faceplate.
- The DMS-100 switch generates a PM128 log for the coded alarm. The following is an example of log report PM128. Refer to this example and the example that follows.

```
PM128 MAY17 09:23:56 5111 TBL ISTb RCU RCU0 01 0
FROM: InSv  Maj loc=165 BPV Threshold exceeded on digroup
remote alarm received
```

- The SMU is ISTb for a P-side link removed from service. The following is an example of log report PM128 with SMU set to ISTb.

```
PM128 MAY17 09:24:15 5998 TBL ISTB SMU 0
Node       : ISTb (PSLink OOS) From InSv
Unit0   Act: InSv
Unit1 Inact: InSv
```

- The MAP display that the command string **>QUERYPM FLT** causes (RCU posted) indicates the coded alarm. Refer to the following figure.
- The DMS-100 switch generates the following PM109 and PM183 logs:

```
PM109 MAY 17 09:24:44 8098 PBSY CARRIER SMU 0
P-side
CARRIER–NO: 5, REASON: CARRIER LOCAL ALARM SET
PM183 MAY17 09:25:50 4677 SYSB SMU 0  P-side LINK: 5,
FROM: InSv
```

- Posting the SMU that associates with the defective link at the CARRIER level causes the system to generate a MAP display. The MAP display indicates the level of the BpV faults under the BER field near the defective DS-1 link. Refer to figure CARRIER-level MAP display with SMU 0 posted on page 7-25.

To isolate this fault, follow the procedure for fault isolation of an excess of BpVs in this document.

A BpV problem clears when BpVs equal or drop below the limit set in Table CARRMTC. For example, The BpV problem clears when the level drops below 1 error in 10^6 bits.

QUERYPM FLT display for ISTb RCU

```
   CM     MS     IOD     Net     PM     CCS     Lns     Trks     Ext
    .      .      .       .     1RCU     .       .       .        .
                                  M
    RCU
 0  Quit               SysB     ManB      Offl     CBsy    ISTb  InSv
 2  Post_     PM        0         0         0        0       1     12
 3  Listset   RCU       0         0         0        0       1     17
 4
 5  Trnsl_    RCU REM1 04 0 ISTb     LINKS_OOS:    CSIDE 1
 6  Tst_
 7  Bsy_      QUERYPM FLT
 8  RTS_
 9  Offl
10
11  Disp_      Alarm  Code  Shelf  Slot Description
12  Next       Minor          1      2    Digital Line Failure
13             Minor          5      01   Line Card Carrier Failure
14  QueryPM_   Minor          2      13   Configuration
15             Major  103                 Blown Fuse
16  BckpSel    Major  165                 BpV Threshold Exceeded On Digroup
17  Status
18
         userid
    TIME   hh : mm>
```

When the BpV fault clears, the system updates MAP displays to remove the fault indications. The DMS-100 switch generates PM111, PM184, and, if the fault is the last alarm at the RCU, PM106 logs. The DMS-100 switch generates PM128 logs if more alarms are present at the RCU. Examples of log report PM128 follow:

```
PM184 MAY16 09:33:00 7677 RTS SMU 0  P-side LINK: 5, FROM:
SysB
PM106 MAY16 09:33:15 7678 RTS SMU 0
Node        : InSv From ISTb
            : ISTb Cleared (PSLink OOS)
Unit0   Act: InSv
Unit1 Inact: InSv

PM106 MAY16 09:23:56 5111 RTS RCU RCU0 01 0  FROM: ISTB
REASON: alarm clear, Major, code=165 BPV threshold exceedec
on digroup

PM111 MAY 25 09:19:12 8098 RTS CARRIER SMU 60
P-side
CARRIER–NO: 5, REASON: CARRIER LOCAL ALARM CLEARED
```

CARRIER-level MAP display with SMU 0 posted

```
    CM    MS     IOD     Net     PM     CCS     Lns    Trks    Ext   APPL
    .     .      .       .       .      .       .      .       .     .

    POST      CLASS    ML OS    Alarm  SysB  ManB  Uneq  Offl CBsy PBsy InSv
 0  Quit_     TRUNKS    9  0       50    42     2     0     0     4    0   31
 2  Post_     REMOTE    4  0       10     6     0     0     0     0   27    4
 3            TIMING    0  0        0     0     0     0     0     0    0    2
 4              DS1
 5  Loop_     N CLASS SITE SMU CK  D ALRM SLIP FRME BER ES SES STATE PROT
 6  Tst_      0 REMOTE HOST 0  0   C         0   0 <–7.   5  0  INSV
 7  Bsy_      1 REMOTE HOST 0  2   C         0   0 <–7.   2  0  SYSB–T
 8  RTS_      2 REMOTE HOST 0  3   C         0   0 <–7.   0  0  PBSY
 9  Offl_     3 REMOTE HOST 0  4   C  LCGA   0   0  OS    0  0  SYSB
10  DispOpt_
11  Disp_     SIZE OF POSTED SET  :  4
12  Next      POST:
13
14  Detail_
15
16
17

      userid
   TIME hh:mm>
```

BpVs at out-of-service limit (OL) toward the RCU

When an excess of BpVs occur on a DS-1 link toward an RCU, the fault indications are the same. The LAR fault indicator appears in place of LCGA at the CARRIER level for faults toward an SMU.

> ***Note 1:*** The RCU digroup card detects BpVs. To obtain counts of BpVs on the MAP display at the RCU end, post the appropriate SMU. Enter the command **>DETAIL <carrier number> REM**. Refer to the following figure.
>
> ***Note 2:*** An excess of BpVs toward the RCU cause an RCGA alarm. An excess of BpVs in both directions also cause an LCGA alarm. Refer to the following figure for an example of an RCGA alarm.

To isolate this fault, follow the procedure to isolate faults of an excess of BpVs in this document.

CARRIER-level POST MAP display that indicates RCGA

```
   CC    CMC    IOD     Net     PM     CCS     Lns    Trks    Ext   APPL
   .      .      .       .       .      .       .      .       .     .

    DETAIL   CLASS    ML OS   Alarm  SysB  ManB  Uneq  Offl CBsy PBsy InSv
 0  Quit_    TRUNKS    9  0      50    42     2     0    0     4    0  31
 2  Post_    REMOTE    4  0      10     6     0     0    0     0   27   4
 3           TIMING    0  0       0     0     0     0    0     0    0   2
 4             DS1
 5  Loop_    N CLASS SITE SMU CK  D ALRM SLIP FRME BER ES SES STATE PROT
 6  Tst_     0 REMOTE HOST 0  0   C SLIP   ML   0  <–7.110  0  INSV
 7  Bsy_     1 REMOTE HOST 0  2   C  BER    0   0   ML   2  0  SYSB–T
 8  RTS_     2 REMOTE HOST 0  3   C         0   0  <–7.  0  0  PBSY
 9  Offl_    3 REMOTE HOST 0  4   C LCGA    0   0  –6.3  0  0  SYSB
 10 DispOpt_
 11 Disp_    SIZE OF POSTED SET  :  4
 12 Next     N CLASS SITE RCU CK  D ALRM SLIP FRME BER ES SES STATE
 13          3 REMOTE KRCS 0–0 4  P RCGA  0    0     OS 0   0  SYSB
 14 Detail_  DETAIL:
 15
 16
 17
 18
     userid
  TIME hh:mm>
```

Frame loss at ML toward the SMU

Data in Table CARRMTC can define the ML for frame loss hits. When frame losses exceed the value entered in the FRAME ML field of Table CARRMTC, the system raises an ML warning.

The following conditions indicate high frame loss:

- The system updates the FRAME field at CARRIER level for the associated DS-1 link to indicate ML warning.
- The DMS-100 switch generates a PM110 log. An example of log report PM110 follows:

```
PM110 MAY22 09:27:33 4899 INFO CARRIER SMU 0
P-side
CARRIER–NO: 3, REASON: CARRIER LOF MTCE LIMIT SET
```

The same events that cause BpVs also cause frame loss hits. Follow the procedure, fault isolation of an excess of BpVs, in this document to isolate this fault.

When the frame loss ML clears, the system removes the ML warning at the MAP display. The DMS-100 switch generates a PM110 log. An example of log report PM110 follows:

```
PM110 MAY17 09:27:33 4899 INFO CARRIER SMU 0
P-side
CARRIER–NO: 3, REASON: CARRIER LOF MTCE LIMIT CLEARED
```

Frame loss at maintenance limit toward the RCU

The RCU does not count the number frame loss events. The MAP displays for the RCU end always indicate 0 under the FRAME field.

A link can have frame loss toward the RCU and the RCU does not detect the problem. The RCU can detect two-way frame loss better than one-way frame loss. If frame loss increases or BpVs occur, the RCU detects a link problem.

Steady frame loss toward the SMU

If the SMU detects steady frame loss for a minimum of 2.5 s, the DMS-100 switch removes the link from service. The recommended value for Table CARRMTC is 2.5 s.

When frame loss occurs on a DS-1 link, the system raises a type 7 alarm.

If the RCU digroup card is missing or defective, the system raises a type 5 or 6 alarm. A type 5 alarm indicates defective digroup. A type 6 alarm is a configuration alarm that indicates a missing digroup card or card that contains improper data.

If the SMU DS-1 interface card is missing or defective, the DMS-100 switch generates the appropriate logs. The DMS-100 switch also raises a type 7 digital line alarm.

The following conditions indicate that a defective DS-1 line causes steady frame loss toward the SMU:

- A DS-1 link is removed from service.
- A type 7 digital line alarm appears on the faceplate of the maintenance card at the RCU.
- The DgtL light on the RCU maintenance card faceplate lights up.
- The DMS-100 switch generates PM109 and PM183 logs. Examples of log reports PM109 and PM183 appear on page and PM128 logs. An example of log report PM128 follows:

```
PM128 MAY30 09:23:56 5111 TBL ISTb RCU RCU0 01 0
FROM: InSv  Min loc=0,2 Digital Line Failure
remote alarm received
PM128 MAY17 09:24:15 5998 TBL ISTB SMU 0
Node       : ISTb (PSLink OOS) From InSv
Unit0   Act: InSv
Unit1 Inact: InSv
```

- The text `LCGA` appears under the ALARM field for the defective carrier when the associated SMU is posted at the CARRIER level. Refer to the figure CARRIER-level MAP display with SMU 0 posted on page 7-25.
- A type 7 digital line alarm appears on the MAP display for the associated RCU when the user enters command string **>QUERYPM FLT**. Refer to figure on page 7-26.

Follow standard procedures to clear the fault on the DS-1 line.

If the SMU detects correct framing for 10 s, the DMS-100 switch clears the frame loss fault. The recommended value in Table CARRMTC is 10 s. When the fault clears, the DMS-100 switch generates PM111, PM184, and PM128 logs. The switch clears MAP displays of fault indications. Refer to page 7-27 for examples of PM111 and PM184 logs. An example of log report PM128 follows:

```
PM128 MAY30 09:23:56 5111 TBL ISTb RCU RCU0 01 0
FROM: InSv  Min loc=0,2 Digital Line Failure
remote alarm cleared
```

The following conditions indicate that a missing SMU DS-1 interface card causes steady frame loss toward the SMU.

- The system removes the affected DS-1 link from service.
- A type 7 digital line alarm appears at the faceplate of the maintenance card.
- The DMS-100 switch generates PM109 and PM183 logs.

```
PM109 MAY19 09:27:33 4899 PBSY CARRIER SMU 60
P–side
CARRIER–NO: 4, REASON: CARRIER CARD REMOVED
```

- The text “CARD” appears under the ALARM field at the CARRIER POST level of the MAP display for the DS-1 link. Refer to the following figure.
- The DMS-100 switch generates a PM128 log for the digital line alarm.

CARRIER-level MAP display that indicates CARD alarm

```
   CM    MS    IOD     Net     PM     CCS     Lns    Trks    Ext   APPL
    .     .      .       .      .       .       .      .       .     .

    POST      CLASS    ML OS   Alarm  SysB  ManB  Uneq  Offl CBsy PBsy InSv
 0  Quit_     TRUNKS    9  0      50    42     2     0    0     4    0  31
 2  Post_     REMOTE    4  0      10     6     0     0    0     0   27   4
 3            TIMING    0  0       0     0     0     0    0     0    0   2
 4              DS1
 5  Loop_     N CLASS SITE SMU CK  D ALRM SLIP FRME BER ES SES STATE PROT
 6  Tst_      0 REMOTE HOST 0  0   C         0   0  <-7.110  0  INSV
 7  Bsy_      1 REMOTE HOST 0  2   C         0   0  <-7.   2  0  SYSB-T
 8  RTS_      2 REMOTE HOST 0  3   C         0   0  <-7.   0  0  PBSY
 9  Offl_     3 REMOTE HOST 0  4   C CARD    0   0  -6.3   0  0  SYSB-T
10  DispOpt_
11  Disp_     SIZE OF POSTED SET  :  4
12  Next      POST:
13
14  Detail_
15
16
17
18
      userid
   TIME hh:mm>
```

Use the following steps to isolate the fault for a missing DS-1 interface card.

1 The PM109 log lists the carrier affected by the missing DS-1 card. Table RCUINV against an SMU P-side port displays this carrier. The P-side ports are assigned on DS-1 interface cards on shelf 0 in the following order: 0, 1, 4, 5, 8, 9, 12, 13, 16, 17.

   The P-side ports are assigned on DS-1 interface cards on shelf 1 in the following order: 2, 3, 6, 7, 10, 11, 14, 15, 18, 19.

   Compare the ports assigned to the DS-1 interface cards with the ports datafilled in Table RCUINV against DS-1 links. Compare the ports to locate the defective card.

2 Insert a DS-1 interface card in the empty slot.

After you replaced the card, the DMS-100 switch removes the CARD fault indication from the CARRIER-level MAP display. The DMS-100 switch generates a PM110 log. An example of log report PM110 follows:

```
PM110 MAY18 09:29:33 4999 INFO CARRIER SMU 0
P-side
CARRIER-NO: 4, REASON: CARRIER CARD REPLACED
```

The following conditions indicate that a defective SMU DS-1 interface card causes steady frame loss toward the SMU.

- The DMS-100 switch generates a PM109.
- The DMS-100 switch generates a type 7 digital line alarm and associated PM128 log report.
- To post the associated SMU at the CARRIER level of the MAP display, indicate the text `LCGA` under the ALARM field of the affected DS-1 carrier.
- The DMS-100 switch generates a PM181 log for the defective DS-1 interface card and a PM128 log for the type 7 alarm. An example of log report PM181 follows:

```
PM181 MAY20 15:33:12 0987 INFO SMU 0
Node: ISTb, Unit0 Inact, ManB, Unit1 Act: InSv
Test Failed : DS-1 Card : NT6X85
```

To isolate a defective DS-1 interface card, determine which DS-1 link failed. Replace the associated DS-1 card.

The following conditions indicate that a defective digroup card causes steady frame loss toward the SMU.

- The associated DS-1 link is SysB.
- The associated SMU is ISTb.
- Type 5 card failure and type 7 digital line alarms appear at the faceplate of the maintenance card.
- The DMS-100 switch generates PM109, PM183, and PM128 logs. One PM128 log is for the defective digroup card. An example of log report PM128 follows:

```
PM128 MAY30 09:23:56 5111 TBL ISTb RCU RCU0 01 0
FROM: InSv  Min loc=4,21 Card failure
remote alarm received
```

- The DMS–100 switch generates another PM128 log for a type 7 digital line alarm. The DMS–100 switch generates a third PM128 log for the SMU set ISTb, as described earlier in this section.
- The text `LCGA` appears under the ALARM field at the CARRIER level of the MAP display for the affected DS-1 carrier. This condition occurs when the user enters the POST SMU command or DETAIL command with the REM parameter.

- Post the associated RCU. Enter the command string **>QUERYPM FLT** to list a digroup card that fails tests as a fault. Refer to the following figure.

QUERYPM FLT display for digroup card failure

```
    CM     MS      IOD     Net     PM     CCS     Lns     Trks     Ext
    .      .       .       .      1RCU     .       .       .        .
                                   M
     RCU
 0  Quit
 2  Post_              SysB     ManB      Offl     CBsy    ISTb   InSv
 3  Listset_     PM      0         0         0         0       1     12
 4               RCU     0         0         0         0       1     17
 5  Trnsl_
 6  Tst_         RCU REM1 04 0 ISTb     LINKS_OOS:    CSIDE 1
 7  Bsy_
 8  RTS_         QUERYPM FLT
 9  Offl
 10
 11 Disp_         Alarm     Code     Shelf     Slot       Description
 12 Next          Minor                5        21         Card Failure
 13               Minor                4        21         Configuration
 14 QueryPM_
 15
 16 BckpSel
 17 Status
 18
          userid
     TIME   hh : mm>
```

Use the following steps to isolate this defective digroup card:

1 The PM128 log and the maintenance card faceplate list the location of the defective digroup card.

2 Replace the defective digroup card.

The following conditions indicate steady frame loss toward the SMU that a missing digroup card causes:

- The associated DS-1 link is SysB.
- The associated SMU is ISTb.
- The DMS-100 switch generates PM109, PM183, and PM128 logs. One PM128 log indicates the missing digroup card (refer to the following example). Another PM128 log is for a type 7 digital line alarm. Types 6 and 7 alarms appear on the faceplate of the RCU maintenance card.

```
PM128 MAY30 09:23:56 5111 TBL ISTb RCU RCU0 01 0
FROM: InSv  Min loc=4,22 Configuration Alarm
remote alarm received
```

- The text LCGA appears under the ALARM field at the CARRIER level for the affected DS-1 carrier. This condition occurs when the user enters the POST or DETAIL commands with the REM parameter.
- Post the associated RCU. Enter the command string **>QUERYPM FLT** to list a digroup card that fails tests as a fault. Refer to the figure on page 7-34.
- Post the associated RCU. Enter the command string **>QUERYPM FLT**. The system response lists configuration alarm as one of the faults. Refer to the figure on page 7-34.
- The maintenance card faceplate shows a type 6 configuration alarm for the missing digroup card.

Use the following steps to isolate the missing digroup card:

1 The PM128 log and the maintenance card faceplate list the location of the missing digroup card.

2 Replace the missing digroup card.

Datafill that is not correct causes configuration alarms. If a card is present on the RCU shelf, make sure that Table RCUINV contains the correct data.

When the digroup card is on control shelf 2, make sure that the value of control shelf 2 is Y [yes]. Make sure the value is Y in Table RCUINV.

Steady frame loss toward the RCU

When the RCU detects steady frame loss for a minimum of 220 ms, the DMS-100 switch removes the defective DS-1 link from service. The value 220 ms overrides datafill in Table CARRMTC.

When frame loss occurs on a DS-1 link, SMU software checks the SMU DS-1 interface and RCU digroup cards. If these cards function correctly, the system raises a type 7 digital line alarm.

The system can raise a type 5 or type 6 alarm with a type 7 digital line alarm. The system raises these alarms if the RCU card is not present or is defective. A type 5 alarm indicates a defective digroup. A type 6 alarm is a configuration alarm that indicates a missing digroup card or card that does not contain correct data.

If the SMU DS-1 interface card is missing or defective, the DMS-100 switch generates logs.

If frame loss toward the RCU causes faults in a DS-1 line, the system displays an RCGA alarm at the carrier level.

Use standard procedures to troubleshoot the DS-1 line.

If the RCU must detect correct framing for 5 s, the RCU clears the frame loss fault. The value of 5 s overrides the value entered in Table CARRMTC.

When the fault clears, the DMS switch clears the text `LAR or RCGA` and generates log reports PM111 and PM184. The system also generates log report PM106 (last alarm present at RCU) or PM128.

Frame loss at OL toward the SMU

Table CARRMTC can contain the OOS limit to frame loss hits. When frame losses exceed the value filled in the FRAME OL field of Table CARRMTC, the system removes the corresponding DS-1 link from service. This action occurs when the user enters the SETACTION command with the REMOVE parameter at the CARRIER level with a posted SMU.

The following conditions indicate frame loss at OL toward the SMU:

- The associated link is SysB.
- The associated SMU is ISTb.
- The DMS-100 switch generates PM109, PM183, and PM128 logs.
- Post the SMU associated with the defective link at the CARRIER level. The system displays a MAP display with the text `LCGA` under the ALARM field for the defective DS-1 link.

To isolate this fault, follow the procedure for fault isolation of an excess of BpV in this document.

Frame loss at OL toward the RCU

The RCU does not count frame loss hits. The FRAME field for the RCU at the CARRIER level always displays a zero (0).

Slips at ML toward the SMU

Enter the frame slip ML in Table CARRMTC in the field SLIP ML.

A mismatch between system clocks cause slips. The RCU shelf clock can be out of synchronization with the receive clock. The receive clock derives timing from the incoming signal from the SMU.

One port sends information faster than the second port expects the information. When the clocks exceed one-half frame out of synchronization, a slip occurred.

To handle slips, one port discards the additional data the port receives or copies the earlier frame.

The following conditions indicate slips at ML toward the SMU:

- The SLIP field in the MAP display indicates an ML warning. Refer to the figure on page 7-23.
- The DMS-100 switch generates a PM110 log. An example of log report PM110 follows:

```
PM110 MAY22 09:27:33 4899 INFO CARRIER SMU
60
P-side
CARRIER–NO: 2, REASON: CARRIER SLIP MTCE
LIMIT SET
```

Slips accompany other types of DS-1 faults. Other sections described actions to clear other types of faults.

When the system clears a slip problem, the DMS-100 switch generates a PM110 log. An example of log report PM110 follows:

```
PM110 MAY22 09:27:33 4899 INFO CARRIER SMU 60
P-side
CARRIER–NO: 2, REASON: CARRIER SLIP MTCE LIMIT CLEARED
```

Slips at ML toward the RCU

The RCU does not count slips. The count under the SLIP field is zero (0) for RCU modules.

Slips at OL toward the SMU

Enter the frame slip OL in Table CARRMTC in the field SLIP OL.

The following conditions indicate this fault:

- The affected DS-1 link is SysB. Normally another DS-1 link problem causes the link to be SysB.
- A type 7 digital line alarm appears at the faceplate of the maintenance card at the RCU.
- The DMS generates PM109, PM183, and PM128 logs.
- Post the SMU associated with the defective link at the CARRIER level. The system displays a response at the MAP level with the text `LCGA` under the ALARM field for the defective DS-1 link.

Slips occur with other DS-1 link problems.

When the system clears a slip problem and associated faults, the DMS-100 switch generates PM110, PM184, and PM106 or PM128 logs.

Slips at OL toward the RCU

The RCU does not count slips.

Handling DCH and ISG faults

Problems in the SMU, RCU, DS-1 link, DCH card, or ISDN service group (ISG) can cause fault conditions associated with BRI lines. Faults associated with the SMU, RCU, and DS-1 link are already described. Fault conditions associated with the DCH or the ISG are as follows:

- DCH – overloaded, ISG channel out of service, SMU out of service, datafill that is not correct, and hardware or software failure
- ISG – overloaded, SMU out of service, defective DCH, datafill that is not correct, and system detected fault

The DCH and ISG fault conditions are grouped in the following types:

- hardware faults
- software errors
- datafill problems
- cabling errors
- provisioning issues

This section describes the different types of fault conditions.

Hardware faults

A hardware fault requires physical control to correct the problem. This fault can require operating company personnel to replace a board, solder a wire, or set a switch. Hardware faults can be hard faults or occasional faults. A normal hardware fault includes a parity error fault.

For information on parity error faults, refer in this section to How to handle a parity error fault. The following table describes other hardware fault conditions.

Other hardware fault conditions

Fault condition	Description
Activity timeout	The C-side message links are broken, so that messaging cannot occur.
Duplicate fault	A critical hardware fault occurs.
Jammed	The unit is jammed. The unit cannot change status.
Static data corruption	A checksum error is present in the static data.
Hardware trap	Parity, bus error or memory management causes processor trap.

Software errors

Software errors occur when a program performs one of the following actions:

- provides the result that is not correct
- performs the action that is not correct
- stops the complete operation

Errors that produce a wrong result are difficult to detect. These errors can depend on data and appear to be occasional errors. These errors can relate to traffic loading, processor loading, datafill, or other factors.

Software traps occur when a program cannot continue. Restart the program task or restart the complete processor.

Datafill errors

A datafill error can affect service and can generate an alarm. Human error causes datafill errors. Datafill errors normally occur when the user adds new circuits or services.

Use one of the following methods to enter data in BRI tables:

- the table editor commands
- the service order subsystem (ServOrd) commands

Errors can occur in tables when the user does not use ServOrd commands to change datafill parameters. To change information with the service order subsystem, enter the information and move the information to all tables that the change affects.

Operating company personnel do not always install the service, but operating company personnel must understand DMS-100 translations. Operating company personnel must understand when to use service order commands to correct a problem. Operating company personnel must also know when to manually edit separate tables to correct a problem.

For more information on datafill and service orders, refer to the *Translations Guide*. For information on how to use the table editor commands, refer to the *Translations Guide*.

Cabling problems

Cabling is difficult and depends on the site. Cabling errors can include the following:

- cable that is not correct is used
- cable connects to the place that is not correct
- connector contact can be defective
- cable can be defective

A cabling problem generates an alarm or does not allow an alarm to clear. Circuit cards with front connectors and cables require additional caution during replacement.

Handling procedures that are not correct can cause defective cables or connector surfaces. *Card Replacement Procedures* , describes how to handle cards and cables.

Provisioning issues

A parameter that is too low or too high can cause maintenance problems in load changes. For example, an overloaded RCU can cause a shortage of switching paths and affect service.

Fault condition results

Faults can generate alarms, logs, or OMs. Customer complaints can also indicate faults. Refer to the chapter “Trouble Isolation and correction” in this document for information on the test tools that can diagnose and clear faults.

ISDN line faults

The following faults can cause an ISDN line to enter a trouble state:

- cut line, ground defective, open pair
- defective NT1 (not powered up or defective power supply)
- noise, bad transmission quality
- high protocol abnormalities and errors (NT7A31AA in the RCU)
- defective or overloaded SMU or RCU
- defective or overloaded DCH or ISG
- missing datafill or datafill that is not correct
- defective line card

ISDN line states

The following table describes the ISDN line states and the faults that associate with those line states.

Status of an ISDN line and the importance of the status

Status	Significance
***	Invalid state – correct type and connection status in Table SPECCONN do not correspond.
CMB	Connection maintenance busy – one or more modes required for this special connection are busy.

—continued—

Status of an ISDN line and the importance of the status (continued)

Status	Significance
CMT	Connection maintenance – maintenance activities occur on the special connection.
CNA	Connection not active – one or more paths of the special connection are currently not active.
CON	Connection connected – connection is active.
CPB	Call processing busy – processing circuit-switched calls.
CPD	Call processing deload – processing circuit-switched calls, pending manual maintenance.
CUT	CUTOFF relay operates and cuts the ISDN line card off from the subscriber.
DEL	Deloaded – state between CPB and MB after a request to manual busy was entered.
DMB	D-channel maintenance busy – the path between the DCH card and the ISDN line does not work for one of the following reasons: • DCH is out of service • RCU is defective • DCH and line card cannot connect • incoming message overflow fault was detected, I-flag is set
IDL	Idle – customers have access to circuit-switched and packet-data services.
INB	Installation busy – ISDN line is out of service for one of the following reasons: • line data is not assigned in tables • a data change occurred • can be set to MB by BSY command
LMB	Line module busy – RCU or SMU is out of service.
LO	Lock out – loss of synchronization between the ISDN line card and the NT1. This condition does not apply to the S/T-line card.
MB	Manual busy maintenance activity. An operator at a line test position (LTP) tests the line.
NEQ	Not equipped (Table LNINV does not contain the line).

—end—

The following table describes the causes of ISDN line states on services.

Effects of ISDN line status on services and equipment

Status of ISDN line	Equipment affected	Service access	Explanation
CPB	–	Yes	Call in progress
CPD	ISDN line card		Line waits for maintenance action
DMB	DCH Link	Denied	Path between DCH card and ISDN line has faults
Idle	–	Yes	All equipment in service
INB	ISDN line card	Denied	Installation is not complete
LMB	SMU, DS-1 link or RCU	Denied	Controlling equipment out of service
LO	NT1	Denied	Synchronization is lost
MB	ISDN line card	Denied	System or manual maintenance in progress
NEQ	ISDN line card	Denied	ISDN line is not entered

DCH faults

The following conditions can cause a DCH fault:

- defective circuit card – DCH card is defective
- defective SMU – the C-side peripheral is overloaded or is out of service
- overloaded DCH – DCH cannot process all data the DCH receives in a specified time period. The SAPI 16 (packet-switched) service normally causes high-volume traffic. Normally, DCH overload control balances the traffic load when the DCH enters in congestion state.

DCH maintenance states

The status of a DCH and the importance of the status appear in the following table. When the DCH is defective, the DCH changes to CBsy, IsTb, or SysB.

Status of a DCH

Status	Significance
CBsy	Control-side busy – The LGC to which the DCH card connects is out of service.
InSv	In service – The DCH card operates.

—continued—

Status of a DCH (continued)

Status	Significance
IsTb	In-service trouble – The DCH card operates. The ISTb does not affect service but a fault is present. Or the DCH is overloaded and affects or shuts down packet-switched calls (SAPI 16 service) for a short time.
ManB	Manual busy – Commands remove the DCH card from service for maintenance.
OffL	Offline – The DCH card contains data but the switch does not recognize the DCH card. A manual action normally places the card in this condition during office data modification.
SysB	System busy –The system detects a fault associated with the DCH card and removes the card from service.

—end—

ISG faults

The ISDN service group (ISG) defines the services that a DCH provides and assigns channels to these services. An example of this service is channel 1 for BRA and channel 30 for Bd. An ISG is a service group that can move from one DCH to another DCH. The ISG does not have hardware requirements. Each ISG contains 32 communications channels that operate at 64-kbit/s. Channel 0 is reserved for communication with the ISP card, located in the LGC.

An ISG can have faults that relate to overload and datafill problems.

ISG maintenance states

The status of an ISG channel and the value of the status appear in the following table. When an ISG becomes defective, the ISG state changes to CBsy, IsTb, or SysB.

Status of an ISG channel

Status	Significance
CBsy	Control-side busy – The LGC to which the ISG channel connects is out of service.
InSv	In service – The ISG channel operates.

—continued—

Status of an ISG channel (continued)

Status	Significance
IsTb	In-service trouble – The ISG channel operates but a logical loopback on the channel can be present. The ISTb does not affect service but the system detects a fault. Or the DCH is in overload and affects or shuts down packet-switched calls (SAPI 16 service) for a short time.
ManB	Manual busy – Commands remove the ISG channel from service for maintenance.
OffL	Offline – The ISG channel does not have connection information. A Bd channel entry is not present in Table SPECCONN. The LENs or BRI channels are not assigned. A channel is normally placed in this condition before data is entered, or by manual action during office data modifications.
SysB	System busy –The system detects a fault associated with the ISG channel and removes the channel from service.
—end—	

Fault isolation for lines

Test abort messages

The following pages describe messages that appear when the system stops tests during the following commands:

- TSTRING
- LNTST
- VDC
- VAC
- CAP
- RES
- DIAG
- SDIAG

These messages can appear as part of LINE101 logs and as part of MAP displays.

`MTC BUS UNAVAILABLE`

The maintenance bus can also help isolate faults. Examples of maintenance bus tests are system verification tests and maintenance card tests. The command string MAP TST or the maintenance card P6044 command can start system verification tests. The command string MAP TST MTCE or the maintenance card command P6033 starts maintenance card tests.

To clear this fault, perform the following steps:

1 Enter the required test command again. The maintenance bus is normally busy for a short period of time. For example, the TST or P6044 commands require approximately 30 s to complete.

2 If the maintenance bus remains occupied for an extended period of time, check the maintenance card faceplate for alarms. Or check for PM128 logs at the CO. At the CO, enter the command string **>QUERYPM FLT** for the specific RCU. A defective maintenance card can cause the maintenance bus to not be available. Check for a type 5 alarm on shelf 3, slot 13. This alarm indicates a defective maintenance card.

Check for coded alarms 101 and 208. Coded alarm 101 indicates a power fuse for the maintenance card blows. Coded alarm 208 indicates a maintenance bus failure occurs.

Replace the maintenance card or fuse.

This message indicates the multiline test access network is already in use and connects to a maintenance bus. The multiline test access network can connect to the line card or connect to the subscriber loop.

```
BYPASS ACTIVE
```

To clear this fault, perform the following steps:

1 Make sure another MAP position or remote site does not perform tests. If tests occur, enter the required command again.

2 If a bypass is active for an extended period, the system generates a PM180 log. Enter the MTCBUS command from the PM MAP level or the H command from the faceplate of the maintenance card at the RCU. These commands indicate which line card accesses the maintenance bus. This information is important if the bus cannot be removed from a card.

3 Check for alarms at the maintenance card faceplate or at the PM MAP level. To check for alarms, enter the command string **>QUERYPM FLT** with the RCU posted. A defective maintenance card can prevent the release of the bus. A defective maintenance card raises a type 5 alarm on shelf 3, slot 13.

4 The fault normally clears if the user replaces the maintenance card.

The following message indicates the maintenance card is missing:

```
NO MTC CARD
```

To clear this fault, perform the following steps:

1 A missing maintenance card causes a configuration alarm. This alarm appears at the faceplate of the maintenance card at the RCU or at the PM MAP level. To display this alarm, enter the command string **>QUERYPM FLT** with the RCU posted. The system also generates a PM128 log.

2 Install a maintenance card in shelf 3, slot 13 of the RCU.

In this example, the line card to test is missing. If a single line card is missing, another indication does not appear. The system can generate a configuration alarm and PM128 logs. The system generates the alarm and logs if all four line cards are missing in a line card carrier. The system also generates the alarm and logs if the line card carrier is missing.

```
NO LINE CARD
```

To clear the fault, perform the following steps:

1 If you know the location of the missing line card, replace the card.

2 If you know the LEN or DN, post the line at the LTP MAP level. Enter the CKTLOC command. The MAP display indicates the physical shelf, slot, and line numbers of the line under the SLOT field. Replace the card in the specified location. Lines are numbered 1 through 8 and start at the top of a slot.

The following message appears only for the DIAG command.

```
NO LTA CARD
```

To clear this fault, install an LTA card in slot 10 of shelf 3 (the power shelf). The LTA card must contain the data specified in Table RCUINV. If the LTA card contains data that Table RCUINV does not contain, do not install the card on shelf 3.

Use the L-mode command to initiate local tests at the faceplate of the maintenance card at the RCU. Local tests use the same maintenance card that the LTP and level commands that connect described earlier require.

The following message appears when the local tests begin:

```
LOCAL TESTING ACTIVE
```

This message also appears when the improved AST is active on the RCU. This test runs diagnostics on common equipment cards, line cards, and subscriber loops. This test also uses the maintenance bus.

An L-mode command takes 5 s to complete. Make sure that L-mode tests are complete. Enter the LTP or level command that connects again.

Plan tasks to prevent interference between CO and remote sites.

Use the J-mode command to initiate each access at the faceplate of the maintenance card at the RCU. Jack access uses jacks on the maintenance card and prevents some LTP or level commands that connect to perform. The following message appears:

```
JACK ACCESS ACTIVE
```

To clear the fault, make sure that jack access testing is complete at the remote site. Enter the LTP or level command that connects again.

Plan tasks to prevent interference between CO and remote sites.

In this example, the RCU cannot process test requests. This response can occur when the user enters two commands at the same time. One request proceeds and the other request aborts.

```
PM NOT READY
```

Enter the aborted command again.

The following display indicates messaging cannot proceed between the SMU and the RCU. This message can appear when the system processes a PM-level command that requires a line test. This condition normally occurs during a switchover of common equipment at the RCU.

```
MESSAGING INHIBITED
```

The following commands can also inhibit messaging:

- BCKPSEL
- TST
- P6011
- P6022
- P6044
- P6055
- P6077

> ***Note:*** Commands P6055 and P6077 do not cause a switchover.

A switchover takes 30 s. Enter the aborted command again after the switchover is complete. The system generates a PM106 or PM128 log when a switchover is complete.

Channels on the DS-1 link between the SMU and RCU are not available for the test. An all-channels-busy condition causes this message. This message also appears when the DS-1 link is ManB or fails, with all calls dropped. The channel passes test results.

```
NO SMU P-side CHANNEL
```

Enter the aborted command again. When a free channel is available on a DS-1 link, the test proceeds normally.

This message indicates that one of the following occurs:

- the SMU does not respond to a CM request to test the RCU
- the SMU does not return test results in a specified length of time
- the RCU does not respond to an SMU test request
- the RCU does not return test results in a specified length of time

```
PM REPLY TIMEOUT
```

To clear the fault, perform the following steps:

1 Enter the aborted command again.

2 If the fault continues, check the RCU at the faceplate of the maintenance card or at the PM level of the MAP display. The RCU must not have faults. Several RCU common equipment cards required for the message path, and the MP and CP, can be defective.

   Replace defective cards that the maintenance card faceplate display, PM128 log reports, or the PM-level MAP display indicate.

3 If the RCU does not have faults, post the associated SMU. Make sure that the SMU does not have faults. If the SMU is ISTb, enter the command string:

   >QUERYPM FLT.

   All SMU cards involved in the message path can have faults. The Unified Processor (UP), formatter, CSM, time switch, and DS30 or DS512 interface can also have faults.

   Software problems can cause a PM reply timeout. Collect PM180 and SWERR logs. Contact the next level of support.

The following message indicates the SMU or the RCU sends a message that the DMS-100 switch does not understand. The SMU or RCU send the message during the test sequence.

```
UNEXPECTED PM REPLY
```

To clear the fault, perform the following steps:

1 Enter the aborted command again.

2 If the fault continues, the fault indicates a software error in the SMU or RCU. Collect PM180 logs and SWERR reports. Contact the next level of support.

The following message indicates a line test request was made after the system returns an RCU to service. Line test software does not proceed until the line card audit is complete. The audit can require several minutes to complete. The DMS-100 switch waits 20 s for the testing process to return results.

```
AUDIT IN PROGRESS
```

To clear the fault, enter the aborted command again.

The following message indicates the line card carrier that holds the tested line card can have a fault.

```
SUSPECTED LCC FAULT
```

To clear the fault, perform the following steps:

1 If the line card carrier is defective, a type 5 alarm appears on the faceplate of the maintenance card at the RCU. Enter the command string **>QUERYPM FLT** at the MAP terminal with the RCU posted to display a defective line card carrier. The DMS-100 switch also generates a PM128 log report for the defective line card carrier.

   Line tests on all cards held by the defective line card carrier must fail.

2 Replace the defective line card carrier at the location specified in the alarm at the faceplate, MAP, or in the PM128 log.

3 Perform a DIAG on the cards in the new line card carrier to make sure the cards pass.

Failures during the LTP and level commands that connect that follow can indicate one of the following:

- system faults
- failure to set up test paths
- problems in the subscriber station or loop
- line card faults

```
LINE TEST IN PROGRESS
```

This message indicates a line test is in progress on the RCU. Attempt the test again after a few minutes.

LNTST, VDC, VAC, CAP, RES, and LIT commands

These commands test on subscriber loops. The tests use an LTU card that connects to an RCU maintenance card through an MTA network. A loop test bus leads from the maintenance card (out) to the subscriber loop to test. Problems with the loop test bus, maintenance card, or LTU interfere with the tests.

If the tests indicate that subscriber loops have faults, troubleshoot the subscriber loop..

TSTRING command

This command tests the ringing relay in the line card. The TSTRING uses an LTU card on an MTM that connects to the equipment test bus of the RCU maintenance card. The MTL connects to the equipment test bus through an MTA network. The equipment test bus accesses the line card.

Equipment problems and problems setting up the path interfere with the test.

If ringing voltage is not detected at the card after the supply of ringing voltage, replace the line card. If voltage is detected before the supply of ringing voltage, troubleshoot the loop.

RING command

This command places ringing voltage on the subscriber loop. Use a headset circuit on a TM connected through the digital network to the SMU to establish a talking path. Establish a talking path before the test begins and after the test is complete. Use this path at the MAP terminal and at the station to coordinate activities.

For example, after the test is complete, operating company personnel at the MAP terminal can check with personnel at the station. Operating company personnel can make sure that ringing occurred.

The test path travels from the SMU over a DS-1 channel to the RCU line card to the subscriber station.

Problems that occur on this path interfere with the test. Equipment shortages, like a headset circuit shortage, also interfere with the test.

If the RING command fails, troubleshoot the subscriber loop. The MAP display can indicate telephone rings when the telephone does not ring. Check the volume of the telephone to make sure that volume is loud enough. A defective telephone can cause ringing to fail.

DGTTST command

This command tests the Digitone pad or rotary dial of a subscriber station. The test uses the same configuration as the ring test.

A defective Digitone pad or rotary dial can cause this test to fail.

TONEGEN command

This command transmits a tone on a subscriber loop. The test uses a transmission test set that connects to a subscriber loop. The path continues from the loop to the RCU line card, over the DS-1 link to the SMU. The path continues into the digital network. From the digital network, the path ends at a transmission termination test trunk on a TM.

System faults can interfere with this test. A TTS or TTT with faults or a TTT that is not available can interfere with this test.

If the path is not broken and all equipment operates correctly, and tone is not detected, troubleshoot the subscriber loop.

LOSS command

This command measures insertion loss of a test tone that the subscriber end of a loop sends to the line card. This test path is the same as the test path for the ToneGen command.

A system fault or defective measuring equipment can prevent the test from running correctly. If the measured loss is not acceptable, troubleshoot the subscriber loop.

NOISE command

This command measures C-message weighted noise on a subscriber loop. The test path is the same as for the TONEGEN command.

A system fault or defective measuring equipment can prevent the test from running correctly. If the measured noise is not acceptable, troubleshoot the subscriber loop.

ORIG command

This command checks the ability of a line card to detect and report on-hook, off-hooks, and digits. The test path uses a headset circuit on a TM that connected to an MTA network through an incoming or outgoing test trunk. The path continues from the MTA to the RCU maintenance card and line card. An LTU card connects through the MTA to the line card.

The test can fail, abort, or not run for different reasons.

- The line card can fail to detect off-hook. This failure occurs when the resistance the LTU applies and the resistance of the multiline test pair exceeds the loop resistance specified for the line card. The resistance the LTU applies simulates an off-hook (900 Ω).
- defective LTU
- LTU not available
- talk connection to the subscriber line is not present
- MTA busy
- headset not available
- path connections are not set up. For example, failure to connect the headset to the test trunk.

Failure responses for DIAG command

The following errors can occur when an extended diagnostic fails:

- RCU single-end test fails.
- RCU end-to-end test fails on
  - off-hook
  - on-hook
  - single-party ringing
  - idle channel noise
  - echo return loss
  - carrier channel loss
  - tip party ringing and ANI ground
  - coin collect
  - positive coin control off-hook
  - coin presence
  - coin return
  - negative coin control off-hook
  - reverse battery.

When a failure occurs, the switch operator must test the line card again. If the card fails again, test the other line cards in the LCC. If these line cards fail, replace the LCC. If one card fails the test, replace that card.

Fault isolation for special-service lines

Fault isolation for special service lines is the same as for other lines off the RCU. The following special considerations apply.

- A line tested from the LTP level must be made busy.
- The BSY command parameters IDL and INB (installation busy) are not valid for special-service lines.
- Automatic line testing (ALT) includes FXBO and FXBS lines in special service connections. When ALT runs, the ALT does not test the FXBO or FXBS lines.
- Do not use a test desk or mechanized loop tester to test special service lines.
- After a test, special service lines are returned to service and the state of the lines becomes INB.
- Service orders cannot run on special service lines because the DMS-100 switch does not run call processing on these lines. Service orders cannot run on FXBO lines because station equipment is not present at the end of the loop.
- Lines on which service order operations are present cannot participate in special service connections until the service orders are deleted. For example, lines with a DN assigned cannot participate in special service connections.
- You can initiate jack access or local line tests at the faceplate of the maintenance card at the RCU. Perform these tests for FXB line cards that are part of a special-service connection. In this event, update the status of the connection in Table SPECCONN to MTC. The state of the line at the LTP level remains the same.
- The following table lists the line tests from the LTP and the MAP levels that connect that can run on FXBS and FXBO lines. The letter X indicates the test is available.

Line tests available on FXB cards

Test	FXBS not in SPECCONN	FXBS in SPECCONN	FXBO in or not in SPECCONN
DIAG	X	X	X
TSTRING	X	X	
LOSS	X	X	X

—continued—

Line tests available on FXB cards (continued)

Test	FXBS not in SPECCONN	FXBS in SPECCONN	FXBO in or not in SPECCONN
NOISE	X	X	X
TONEGEN	X	X	X
JACK	X	X	X
TALKLTA	X		
ORIG	X		
LNTST	X	X	X
VDC	X	X	X
VAC	X	X	X
RES	X	X	X
CAP	X	X	X
RING	X		
ORIG	X	X	

—end—

Diagnostic tests

Diagnostic tests determine hardware faults to the card that requires replacement. The diagnostic tests can be system or manually initiated.

When internal counters exceed fixed levels, the system initiates diagnostics.

Use manually initiated diagnostics when the following occur:

- log reports indicate a common equipment problem
- system-detected alarms are generated
- the OMs indicate high error counts

XPM diagnostic history

Note: Feature AF5006 does not support SMUs with ISDN or MBS ability.

Extended Peripheral Modules Diagnostics History, feature number AF5006, provides a resident database to record selected diagnostic results of XPMs. This feature captures diagnostic results that indicate the sanity of the SMU.

The data in this database can influence DMS-100 maintenance activities. This database provides operating company personnel with MAP command access to data on the accumulated results of diagnostics.

Data in the history database is retained over warm, cold, and reload restarts. This feature is part of software package New Peripheral Maintenance (NTX270AA), and is not an option.

An SMU can run diagnostics to test the functionality of SMU hardware. Requests from the CM or SMU run the diagnostics. Diagnostics the SMU performs are normally part of SMU audits. Use the diagnostic results that feature AF5006 provides for analysis.

Operating company personnel analysis

Feature AF5006 provides data on the failure history of diagnostics. Feature AF5006 provides the number of failures that occur and the cards that have the faults. The MAP commands display data for a specified XPM or for all XPMs that this feature support. The MAP commands can list short-term failure counts or long-term failure counts.

Short-term failure counts Short-term failure counts accumulate from the last time a unit was active. Operating company personnel use this data for maintenance and power failure analysis. If a power failure occurs, include XPM Diagnostic History data for the peripheral with other required data.

Long-term failure counts Long-term failure counts accumulate from the last time a manual action or BCS application reset the long-term failure counts. Long-term failure counts are intended to last for the life of the BCS. Use this information to provide data for additional diagnostic system improvements.

SuperNode and BNR Reduced Instruction Set Computing (BRISC) platforms use the functionality of this feature. For the NT-40 platform, the diagnostic results and suspect cards captured are smaller than the SuperNode or BRISC platforms. NT-40 data store requirements cause this restriction.

Description of diagnostics

Different PMs contain different hardware. Different diagnostics run on each type of PM. Only a subset of the 75 diagnostics available runs on any PM. This feature captures failures for the following types of diagnostics:

- in service
- out of service
- single diagnostic

- facility audit
- other audits

The SMU determines the number of cards the diagnostic indicates. The CM can generate a card list at the MAP terminal or in logs. The list of card failures includes cards that an XPM diagnostic or audit indicates and reports to the CM.

Note: Feature AF5006 records only the cards that an SMU indicates and not cards on the list the CM generates.

Diagnostics can be grouped together and run as a set of diagnostics or run as a single test. The following are standard sets of diagnostics:

- in-service tests
- out of service tests
- facility audit tests
- mate diagnostics
- ROM diagnostics

In-service and out of service tests

In-service and out of service tests run when the CM requests the tests. When the CM requests, the SMU runs a set of diagnostics. The following CM commands request an SMU unit test:

- manual TST, RTS, SWACT, BSY or REX
- system RTS, SWACT, BSY or REX

The state of the SMU unit and the activity of the SMU unit determine the diagnostics included in the test.

If the unit is in service, the SMU runs a set of in-service diagnostics. If the unit is out of service, the SMU runs a set of out of service diagnostics.

The SMU returns the results of each diagnostic to the CM along with a final result for the complete set. If cards are defective, the system generates a card list. The system transfers the card list to the CM when the set of tests completes.

Facility audit

The facility audit is a set of diagnostics the SMU runs on a periodic basis as a self-check. If the audit detects problems, the SMU sends a message to the CM that indicates the problem and lists the defective cards.

Mate diagnostics

If one unit loses communication, the mate unit can diagnose that unit. The mate unit sends the results to the CM.

ROM diagnostics

If the SMU is at ROM level, use a set of ROM diagnostics.

This feature does not capture failures or the cards that the mate and ROM diagnostics indicate. For each diagnostic, the system generates a card list or at the MAP terminal. The diagnostic history does not record the card list or the diagnostic failures.

The following table lists and describes diagnostics that this feature supports. The diagnostics types are *solicited*, *audit*, or *both*.

Diagnostics supported

Diagnostic name	Description	Type
AB DIAG	A/B Bits	Solicited
AMUDIAG	6X50 External Loop	Solicited
CMRDIAG	CMR card	Both
CONT DG	Continuity Diag	Solicited
CSMDIAG	CSM Diag	Solicited
CS SPCH	Network Links	Solicited
DCHIALB	DCH Inactive Loopback	Solicited
DS1DIAG	P-Side DS-1	Solicited
FAC AUD	Facility Audit	Audit
FORMATR	Local Formatter	Solicited
MSGDIAG	6X69 Messaging Card	Solicited
MSG IMC	IMC Link	Both
PADRING	6X80 Pad/Ring	Solicited
PARITY	Parity Audit	Audit
PS LOOP	P-Side Loops	Solicited
PS SPCH	P-Side Speech Links	Solicited
SCM MSG	SCM A/B DDL Msg	Solicited

—continued—

Diagnostics supported (continued)

Diagnostic name	Description	Type
SPCH DG	Speech Path	Solicited
STRDIAG	Special Tone Receiver	Solicited
SYNC DG	Sync Diag	Both
TONES DG	Tone Diag	Both
TS DIAG	Time Switch Diag	Solicited
UTRDIAG	UTR Card	Solicited
—end—		

The following table lists the cards that this feature supports.

Supported cards

Card name	Description
NT6X40	Net interface link
NT6X41	Speech bus formatter and clock
NT6X42	CSM
NT6X44	Timeswitch and A/B bit logic
NT6X50	DS-1 interface
NT6X69	Messaging card
NT6X78	CLASS modem resource (CMR)
NT6X80	SCM pad/ring
NT6X85	SCM DS1
NT6X92	Universal tone receiver (UTR)
NTBX01	Enhanced ISDN signaling processor (EISP)
NTBX02	D-channel handler (DCH) and enhanced DCH
NTMX77	Unified processor

How diagnostics are stored

This feature stores diagnostic results in the form of counters. Each unit of each peripheral that this feature supports has a set of counters. The system records counters for diagnostic failures and for defective cards. The system records three types of counters:

- *diag* counts the number of times a diagnostic fails
- *card* counts the number of times that diagnostics report defective
- *diag and card combination* counts the number of times a diagnostic and card group occurs

Each of the three counters contains two subcounters. The two subcounters are a short-term failure counter and a long-term failure counter. Short-term failure counters reset during the BCS cycle often. Long-term failure counters record the diagnostic history of a peripheral or office over an extended period of time. The command string **>QUERYPM DIAGHIST RESET** or a BCS application can reset long-term failure counters.

A single test failure reports one or more diagnostic failures and zero (0) or more defective cards. A diagnostic that runs in one unit can report cards in the unit and also the mate unit. Only certain diagnostics report failures on the mate unit. When a diagnostic fails, the diagnostic sends the failure information to the history database.

Resets and timestamps

The history database stores five timestamps for every peripheral for the following:

- node
  - — the time when long-term failure counters are last reset
- unit 0
  - — the time when short-term failure counters for unit 0 are last reset
  - — the time when the last diagnostic failure occurred on unit 0
- unit 1
  - — the time when short-term failure counters for unit 1 are last reset
  - — the time when the last diagnostic failure occurred on unit 1

The short-term counters reset to zero (0) internally for each unit when a unit gains activity. An RTS or SWACT command causes this gain of activity. Long-term counters are reset for each node from an SMU posted at the MAP terminal. When long-term counters are reset, the system generates a log with a summary of the data collected before the node reset.

A BCS application resets all diagnostic history data. This data includes short-term and long-term failure counts. In this event, the system does not generate a log with long-term failure counts.

ROM diagnostic

The read-only-memory (ROM) diagnostic detects faults in the processor and memory cards. The system initiates this diagnostic when the XPM unit is in the who-am-I (WAI) state.

The ROM diagnostic tests the following memory card circuits:

- memory circuits
- parity circuits
- DMA circuits
- activity circuits
- holding registers

The ROM diagnostics tests the following processor card circuits:

- memory mapper unit
- universal synchronous/asynchronous receive/transmit (USART) integrated circuits
- programmable timers (integrated circuits)

Note: Reload this unit after this diagnostic completes.

A-bit and B-bit diagnostic

The purpose of this diagnostic is to test the A-bit and B-bit circuits on the NT6X44 timeswitch card. The diagnostic tests the global loop-around of the timeswitch card. The diagnostic tests also test the channel supervision message (CSM) loop-around of the NT6X41 formatter card.

This diagnostic performs the following operations:

- ready access memory (RAM) tests on the AB transmit and receive memories
- tests the time switching function of the timeswitch
- tests the generation and reception of A-bit and B-bits
- tests of the enable-disable function of the AB bit receive memory

This diagnostic uses the following XPM hardware components:

- NT6X85 DS-1 interface card
- NT6X44 timeswitch card

- NT6X69 message card (an NT6X69AD application-specific integrated circuit [ASIC] version is available if UTR is present)
- NT6X41 formatter card
- speech bus

CSM diagnostic

The CSM diagnostic tests the hardware that transmits, receives, and uses the channel supervision message (CSM). Most of this hardware is on the NT6X42 CSM card.

The CSM diagnostic tests the following:

- all memories on the NT6X42 card memory on the NT6X41 formatter card
- integrity match-mismatch logic
- the speech bus parity error generation (NT6X41 formatter card). detection (NT6X42 CSM card) logic
- the channel data byte (CDB) transmission and reception logic
- actions between bits of the parity error RAM
- correct action between the integrity match-mismatch and CDB update logic
- correct operation of the CSM loop on the NT6X41 formatter card

This diagnostic involves the following XPM hardware components:

- NT6X42 CSM card
- NT6X41 formatter card
- speech bus

Formatter diagnostic

The formatter diagnostic tests the NT6X41 formatter card, the control RAM and the C-side loop enable-disable function. This diagnostic checks the network framing interrupts, C-side messaging, and P-side messaging.

The formatter diagnostic checks the integrity of the speech bus connection and message memories. The NT6X69 message card contains the speech bus connection and message memories.

This diagnostic involves the following XPM hardware components:

- NT6X41 formatter card
- NT6X69 message card

- NT6X44 timeswitch card
- speech bus

Message diagnostic

The message diagnostic tests the hardware of the NT6X69 message card. The diagnostic checks the function of the following components:

- the on-board processor time slice processes
- the speech bus interface
- the intermodule communication (IMC) link
- the cyclic redundancy check (CRC) ROM

The diagnostic verifies the integrity of the message buffer memory and P-side and C-side messaging.

This diagnostic involves the following XPM hardware components:

- NT6X69 message card (an NT6X69AD ASIC version is available if UTR is present)
- NT6X44 timeswitch card
- NT6X41 formatter card
- NT6X85 DS-1 interface cards
- speech bus

Tones diagnostic

The tones diagnostic has two functions. The first function runs pulse coded modulation (PCM) checksums on the tones of ports 16 and 17. Ports 16 and 17 are phantom ports. The PCM makes sure the checksums agree with the checksums in the tone ROM. The NT6X69 message card contains the tone ROM.

The second function of this diagnostic checks the speech bus connection memory for all channels of ports 16 and 17. The diagnostic does not check ports 16 and 17. The diagnostic makes sure that the tones on the speech bus are enabled.

This diagnostic involves the following XPM hardware components:

- NT6X69 message and tone card (NT6X69AD ASIC version is available if UTR is present)
- speech bus

Speech path diagnostic

The speech path diagnostic checks all of the XPM speech channels for data integrity. The diagnostic checks all C-side and P-side loop-arounds and all time slots of the speech bus. The diagnostic also tests the highway mux and the PCM enable-disable gates.

This diagnostic involves the following XPM hardware components:

- NT6X41 formatter card
- NT6X69 message and tones card (an NT6X69AD ASIC version is available if UTR is present)
- NT6X44 timeswitch card
- NT6X85 DS-1 interface cards
- speech bus

Time switch card diagnostic

The SMU time switch card switches speech, control, and supervisory signals from the C-side to the P-side of the SMU.

The NT6X44CA version of the time switch card allows SMU software to read signaling bits incoming from the P-side. The SMU software can read the bits without a P-side to C-side speech connection.

The A-bit and B-bit signaling diagnostic (ABDIAG) verifies the signaling bit control circuits in the SMU operates correctly. This diagnostic runs as part of CM link audits and when you test or RTS the SMU from the MAP terminal. The diagnostics are more complete if the SMU is out of service. Diagnostics are also more complete for inactive units.

This diagnostic involves the following hardware components:

- NT6X44
- NT6X69 (an NT6X69AD ASIC version is available if UTR is present)

Ring/pad card diagnostic

The ring/pad card diagnostic tests the hardware and functionality of the NT6X80 ring/pad card. The diagnostic performs a card reset test, memory tests, and verifies the ring/pad interrupt. The diagnostic also tests the pad ROM and dc voltages. The diagnostic tests only the NT6X80 card on the XPM hardware.

DS-1 card diagnostic

The DS-1 card diagnostic verifies that DS-1 cards operate correctly. The method used to involve the diagnostics determines if the DS-1 link can be verified during diagnostics. The DS-1 card diagnostic runs when one of the following occurs:

- CM link audits
- an RTS of the SMU or a DS-1 link from the MAP terminal
- a test of a DS-1 link from the MAP terminal

PCM looping tests run during the test of the DS-1 link from the MAP terminal.

Two link audits exist. The in-service audit tests all in-service DS-1 links. The out of service audit tests all system busy DS-1 links.

P-side link diagnostic

To test a DS-1 link at the PM level, post the associated SMU. Make sure the SMU and the associated RCU are InSv. Enter the command string:

>TST LINK <number>

When a link is InSv, the TST command causes the SMU to run a PCM loopback test on the link. The SMU sends a specified PCM pattern over the DS-1 link to the RCU. The RCU loops the pattern in the time switch card and returns the pattern to the SMU. The SMU compares the samples sent and the samples received.

If the PCM loopback test fails, the DMS-100 switch generates PM181, PM183, and PM128 log reports. The system busies the failed link and the associated SMU and RCU become ISTb.

```
PM181 MAY16 09:22:12 4588 INFO SMU 60
Node:  ISTb, Unit0 Inact: InSv,  Unit1 Act:  ISTb
PCM Loopback test failed on P-side link 5

PM183 MAY16 09:23:00 4677 SYSB SMU 60  P-side LINK:
2, FROM:
InSv

PM128 MAY16 09:23:33 4877 TBL ISTb SMU 60
Node       : ISTb (PSLink OOS) From InSv
Unit0 Inact: InSv
Unit1   Act: InSv
```

When a system audit detects a SysB link, the DMS-100 switch generates the following PM110 log:

```
PM110 MAY16 09:27:33 4899 INFO CARRIER SMU 60
CARRIER–NO: 8, REASON: REMOTE LINK SYSBSY
```

When a link returns to service, the SMU and RCU change states from ISTb to the InSv. The SMU and RCU change states when other faults are not present. The DMS-100 switch generates a PM106 log if other faults are not present.

If other faults are not present, the DMS-100 switch generates a PM128 log report. The DMS-100 switch generates a PM184 log report when a link returns to service.

```
PM106 MAY16 11:23:33 4877 RTS SMU 60
Node       : InSv From ISTb
           : ISTb Cleared (PSLink OOS)
Unit0   Act: InSv
Unit1 Inact: InSv
PM184 MAY16 09:33:00 7677 RTS SMU 60  P-side LINK: 2,
              FROM: SysB
```

For out of service links, the TST command causes the RCU to perform a common equipment digroup loopback test. This test checks the ability of the RCU to assign channels on a link through the time switch card. The test checks all RCU common equipment involved in the PCM path: maintenance, supervisory, switch, and digroup cards.

EDCH ROM level diagnostic

To run the ROM level diagnostic, post the EDCH card you must test. Enter the command string TST ROM at the DCH level.

This diagnostic tests the R66 chip, the 4 Mbyte memory, write protect memory, and the R8071A chip.

EDCH RAM level diagnostic

To run the RAM level diagnostic, post the EDCH card you must test. Enter the TST command.

> ***Note:*** When you enter the command string RTS FORCED for a posted EDCH card, the card is reset. The system does not run diagnostics. If you enter the RTS command, the system runs diagnostics.

EISP diagnostic

The ROM and RAM diagnostics comprise diagnostics for the enhanced ISDN signaling preprocessor (EISP) card. The ROM and RAM diagnostics detect and isolate defective hardware.

This diagnostic determines if the EISP functions correctly and can be downloaded. This diagnostic also tests write protection circuits.

The EISP diagnostic set runs when the processor is reset.

UTR diagnostics

The UTR diagnostic tests the 6X92 universal tone receiver (UTR) card. This diagnostic tests the following:

- the dual port RAM interface between the Unified processor and the UTR main processor
- the sanity of the UTR main processor
- the checksum of ROM and of the UTR main processor
- the code map RAM and RAM of the UTR main processor
- the sanity of the sorter processor the tone detection the continuity circuit

This diagnostic uses the following components for the SMU hardware:

- NT6X92 UTR card
- NT6X44 timeswitch card
- NT6X69 message card
- NT6X48 or NT6X50 P-side interface card
- speech bus

Product-specified test tools

Product-specified test tools are not used to test the SMU-RCU configuration. The RCU maintenance card faceplate provides a user interface from the remote site for line testing, metallic bypass, and jack access.

Problem solving chart

The following chart provides operating company personnel with problem solving procedures for Subscriber Carrier Module-100 Urban (SMU) alarms. Refer to *Clearing an Alarm Procedures* for complete procedures.

Clearing an SMU alarm

Alarm condition	Possible cause	Action
Critical	Both C-side cards are defective	Proceed as follows: 1 Identify SMU module in critical state. 2 Post the SMU module in the critical state. 3 Identify problems with the posted SMU. 4 Proceed to SMU recovery procedure document.
	Both C-side (DS30) message links are defective	Proceed as follows: 1 Identify SMU module in critical state. 2 Post the SMU module in the critical state. 3 Identify problems with the posted SMU. 4 Proceed to SMU recovery procedure document.

—continued—

Clearing an SMU alarm (continued)

Alarm condition	Possible cause	Action
	Both power converter cards are defective	Proceed as follows: 1 Identify SMU module in critical state. 2 Post the SMU module in the critical state. 3 Identify problems with the posted SMU. 4 Proceed to SMU recovery procedure document.
Major	C-side card is defective	Proceed as follows: 1 Silence the alarm. 2 Identify the SMU unit in an SysB condition. 3 Post the SMU unit in the SysB condition. 4 Identify the problems with the posted SMU unit. 5 Busy and test the posted SMU unit. 6 Return to service the posted SMU unit.
	Power converter card is defective	Proceed as follows: 1 Silence the alarm. 2 Identify the SMU unit in an SysB condition. 3 Post the SMU unit in the SysB condition. 4 Identify the problems with the posted SMU unit. 5 Busy and test the posted SMU unit. 6 Return to service the posted SMU unit.

—continued—

Clearing an SMU alarm (continued)

Alarm condition	Possible cause	Action
	Unified processor is defective	Proceed as follows: 1 Silence the alarm. 2 Identify the SMU unit in an SysB condition. 3 Post the SMU unit in the SysB condition. 4 Identify the problems with the posted SMU unit. 5 Busy and test the posted SMU unit. 6 Return to service the posted SMU unit.
Minor	Non-software cards are defective	Proceed as follows: 1 Silence the alarm. 2 Identify the SMU unit in an ISTb condition. 3 Post the SMU unit in the ISTb condition. 4 Identify the problems with the posted SMU unit. 5 Busy and test the posted SMU unit. 6 Return to service the posted SMU unit.
	A DS30 link is defective	Proceed as follows: 1 Silence the alarm. 2 Identify the SMU unit in an ISTb condition. 3 Post the SMU unit in the ISTb condition. 4 Identify the problems with the posted SMU unit. 5 Busy and test the posted SMU unit. 6 Return to service the posted SMU unit.

—end—

Advanced troubleshooting procedures

Advanced trouble locating procedures

Under normal conditions, a defective component is busied and tested. This test causes the maintenance and administration position (MAP) terminal to display a list of cards. The card at the top of the list often causes the component problem.

After operating company personnel replaces the problem card, operating company personnel must test the originally defective component again. If the component passes the test, operating company personnel returns the component to service and the troubleshooting procedure is complete.

If normal troubleshooting procedures do not restore a component to service, the problem can require advanced troubleshooting procedures. Operating company personnel with experience can use the MAP display responses from failed troubleshooting attempts. These responses help formulate a maintenance method. Operating company personnel can use more advanced step action procedures to repair the fault in a component.

Using the XPM footprint tool

How the footprint tool operates

The footprint tool collects data when key events occur in the subscriber carrier module-100 urban (SMU) unit. The data can determine the cause of failures. The buffers that survive all SMU restarts, resets and program reloads store the data. The data is available for retrieval after an SMU outage. The memory buffers are a circular queue of events that contain information on different SMU operations and results. These buffers can be output in a hexadecimal format or a format that is easier to read.

The XMS-based peripheral module (XPM) footprint tool has two event storage buffers. These buffers are the active buffer and the holding buffer. The active and holding buffers avoids the overwrite of data saved from the previous outage.

When an outage occurs, the footprint tool swaps the active and holding buffers. The XPM tool locks the buffer that was active before the outage.

The system locks the active buffer to prevent the overwrite of the buffer when the SMU unit experiences multiple initializations.

> ***Note:*** The footprint tool does not lock the buffers for planned SMU outages, like manual SWACTs, REX tests, and BSY operations. If the XPM tool already locked one holding buffer, the tool does not lock other buffers.

The XPM footprint tool records critical events in the SMU unit during its normal operation. When the active buffer is full, the buffer wraps to the beginning of the data area. At the beginning of the data area, the buffer begins to overwrite earlier captured data and events. This action ensures the latest events are present in the footprint area. When the active buffer wraps to the beginning of the data area, a loss of important data can occur.

The types of events that the XPM footprint tool stores occur in the following SMU classes:

- maintenance
- synchronization
- activity
- diagnostics
- audits
- messaging
- patcher
- call processing
- PMDEBUG
- static data

Selective use of these classes of events adjusts the data that the active buffer collects. The selection and omission of classes can prevent the overflow of data in the buffers. For example, if the suspected cause of an outage is a specified diagnostic, this class can be enabled, and all other classes omitted. This action focuses data collection on the diagnostics.

Before the SMU unit initializes again, the XPM tool records another set of event on the type of failure and the cause. The XPM tool saves specified system variables. Before deactivation of the SMU unit, the footprint tool either locks the active buffer or not, based on the following items:

- If the central control (CC) sends the drop request, and the request is not a system request, the footprint tool does not lock the buffers.

- If the CC sends the drop request, and the request is a system request, the footprint tool locks the buffers.
- If an internal SMU decision causes the drop request, the footprint tool locks the buffers.

A footprint information area indicates the following:

- if a wrap occurs
- the size of the footprint area
- the location of the last used buffer

This information is useful when the SMU unit cannot return to task level and the read-only memory (ROM) firmware must dump the data.

An audit is added that unlocks the footprint tool after 24 h to prevent loss of data from additional SMU unit outages. The system generates a PM189 log when the active buffer locks or freezes.

The following examples show the type of information that the buffers collect:

- The buffer stores defective commands that the user enters from the PMDEBUG. This information helps determine if a user entered this type of command and caused an SMU outage.
- The buffer records the start and completion of a patch applied or removed. This information helps determine if the wrong application or removal of a patch caused an SMU outage.

Limits

The following conditions can cause the loss of data that the XPM footprint tool collects:

- A power loss causes SMU outages.
- The data is not accessed in 24 h after the buffer is locked.
- A REX test, a manual switch of activity (SWACT), or a busy (BSY) operation causes the initialization of the SMU unit again.
- The MAP display pulls any card from the shelf of the SMU unit that drops activity.

- The size of the footprint tool data area changes in size. A change in size occurs if the SMU unit reloads a load different from the load that captured the data. For example, a batch change supplement (BCS) n load can drop activity after seconds in service. The BCSn-1 can be loaded in the SMU unit to retrieve the data. The footprint tool data area in the BCSn-1 load must be as large or larger than the data area in the BCSn load. If the data area is smaller, the operating system overwrites some of the data when the SMU unit reloads. The footprint tool cannot read the overwritten data.

Accessing the data the XPM footprint tool collects

The PMDEBUG tool allows the selection of the classes of data and the access to the collected data. The BIGFOOT command allows access to commands that select and display data.

The Bigfoot utility stores information on passed and failed tests. With the installation of feature AF5008, XPM REX Control and Trouble Notification Improvements, the Bigfoot utility only maintains information on failed tests. Failed test information appears in the form of error log information. Error log information helps in the isolation and removal of bugs.

In addition to error log information, the diagnostics code maintains a graph of results for each set of tests. The results graph contains data on each diagnostic test in a diagnostics run. The results graph identifies a diagnostic as one of the following:

- passed
- failed
- not run
- test undefined

The three main sublevels for these functions follow:

- A selection menu to select, delete, and query the classes of events to capture.
- A hexadecimal dump command that displays the collected data in a hexadecimal format. The footprint tool does not explain the data. The hexadecimal format quickly displays the data. The hexadecimal format helps describe loads that do not have decoding routines.
- A dump routine to display formatted data. If a format routine is not present, the hexadecimal format appears.

Note: Feature AF5008 does not apply to SMUs that support integrated services digital network (ISDN) or Meridian business set (MBS).

The Display_data command displays data if the SMU unit is at ROM level.

The following table shows the commands provided as part of the PMDEBUG user interface to the XPM footprint tool.

XPM footprint commands

Command	Use
Display_data	Displays formatted data. Data saved is formatted if a display routine is bound. only.
Dump_data	Displays data that is not formatted. Data appears in hexadecimal format (16 bytes).
Query_status	Displays the state of the active and holding data areas. The XPM footprint ID area contains the type of information provided.
Class	Enables, disables, and queries event classes. The state, enabled or disabled, appears for the queried (or ALL) classes.
Survive	Enables, disables, and queries the ability of class settings to survive a program restart.
Clear	Clears the data areas to the first state. This command sets the XPM footprint ID area to its first state.
Lock	Locks the active or holding data area. This command is for field personnel and operating company personnel that want to keep collected data when the tool did not automatically lock the buffers.
Unlock	Unlocks the active or holding data area. This command is used if the collected data already appeared or the data is not needed.
Help	Provides the syntax for the previous commands.

The standard header for the output routines is:

```
<nnn>        CLASS          EVENT          CC TIME OF EVENT
          MAINTENANCE (#xx)    #yy        01:13:19:12.52


<nnn>        CLASS          EVENT          CC TIME OF EVENT
          MAINTENANCE (#xx)    #yy        01:13:19:12.52
```

where

Where *nnn* is the buffer number, *xx* is the hexadecimal value for the given class, and *yy* is the event number of the given class.

Maintenance class output

Examples of stored maintenance data follow:

- activity drop

FW-xxxxx

```
<000>          CLASS         EVENT         CC TIME OF EVENT
         MAINTENANCE (#00)    #00           01:13:19:12.52
Dropped Activity.
Parml = SWACT_when_ready.
Drop source = cc_manual.
```

- jam

FW-xxxxx

```
<000>          CLASS         EVENT         CC TIME OF EVENT
         MAINTENANCE (#00)    #03           01:13:19:12.52
Unit Has Received A Jam Inactive Message.
Jam Source = #CC.
Jam Result = mrs_ok.

Unit Is Jammed Inactive.
```

- failed pre-SWACT audit

FW-xxxxx

```
<000>          CLASS         EVENT         CC TIME OF EVENT
         MAINTENANCE (#00)    #04           01:13:19:12.52
Pre–SwAct Audit Failed.

Failure Reasons Are:
The unit needs to be reloaded.
The unit is jammed inactive.
```

- reception of pre-SWACT audit fail message

FW-xxxxx

```
<000>          CLASS         EVENT         CC TIME OF EVENT
         MAINTENANCE (#00)    #04           01:13:19:12.52

Pre–SWACT Audit Fail Message Received
```

Operational faults

Examples of stored operational fault data follow:

```
<003>          CLASS          EVENT          CC TIME OF
EVENT
          MAINTENANCE (#00)    #08          01:13:19:12.52

Operational Fault Data Continued.
Rec_data 0 through 6”:  #00 #00 #00 #00 #00 #00
<002>          CLASS          EVENT          CC TIME OF
EVENT
          MAINTENANCE (#00)    #07          01:13:19:12.52

Operational Fault Data Continued.
R_list  4 through 7”:  #0000 #0000 #0000 #0000
<001>          CLASS          EVENT          CC TIME OF
EVENT
          MAINTENANCE (#00)    #06         01:13:19:12.52

Operational Fault Data Continued.
R_list  0 through 3”:  #0000  #0000 #0000 #0000
<000>          CLASS          EVENT          CC TIME OF
EVENT
          MAINTENANCE (#00)    #05         01:13:19:12.52

An Operational Fault Message Has Been Received.
Source = #D6.
R_action = rr_localize – only tries to localize the fault.
R_component = #D6.
R_count = #00.
```

Activity class output

An example of stored activity data follows:

```
<000>          CLASS          EVENT          CC TIME OF EVENT
          MAINTENANCE (#01)    #00         01:13:19:12.52

Dropped Activity.
Drop reason = dr request.
Drop cid = #CC
Drop source = cc manual.
```

Diagnostic class output

An example of stored diagnostic data follows:

```
<000>          CLASS          EVENT          CC TIME OF EVENT
          MAINTENANCE (#02)    #00         00:00:03:20.84

Diag_id = did_tone_diag{#B5} – Tone Diagnostic.
Loc_msw = #0011.
Loc_lsw = #001F.
Expected = #48.
Received = #41.
Qualifier = #12.
```

Patcher class output

An example of stored patcher data follows:

```
<000>          CLASS          EVENT          CC TIME OF EVENT
         MAINTENANCE (#08)    #00         01:12:03:20.84

Patch Action Started.
Patchid = XAN13X31
Patch action = remove.
Patch result = mrs_ok.
```

PMDEBUG class output

An example of stored PMDEBUG data follows:

```
<000>          CLASS          EVENT          CC TIME OF EVENT
         MAINTENANCE (#0B)    #00         01:12:03:20.84

Directory:  bigfoot
Command:  class
```

Static data class output

An example of stored static data follows:

```
<000>          CLASS          EVENT          CC TIME OF EVENT
          MAINTENANCE (#0C)    #00         01:12:03:20.84

Number of data bytes = 4.
Fiat byte = #02.
Oper byte = updtuple.
Sol byte = #08.
Tblid byte = #1F.
Data bytes 0 to 4 are:  F0 03 07 00 01
```

Diagnostics results graph output

An example of the diagnostics results graph display output follows:

```
<001>       CLASS   EVENT       CC TIME OF EVENT
   DIAG GRAPH (#0F)     #00     00:00:06:34:58
Diag_id =did_cmr_diag(#7) – CMR Card Diagnostics.
res_num=FF(P=Pass,F=Fail,N=Not Run|Test Undefined,O=Other)
Diag Results Graph: PFNNNNNNNNNNNNNNNNNN
```

Note: This example does not apply to SMUs that support ISDN or MBS.

Powering up the SMU unit

The SMU unit is part of the host office. The general host office power–up procedure describes powering up the SMU unit. The following steps are necessary to power up the SMU only.

1 Set the switch on the power converter to the ON position.

2 Hold the RESET button on the power converter in. Flip the matching circuit breaker up, but do *not* hold the circuit breaker up. If power initiates in the SMU unit, the circuit breaker remains in the UP position. If a power problem is present, the breaker flips to the OFF position. Release the RESET button.

3 Repeat Steps 1 and 2 for the other SMU unit.

4 To post the SMU unit that must power-up, type

>MAPCI;MTC;PM;POST SMU <SMU number>

and press the Enter key.

Note: The POST command displays a remote carrier urban (RCU) line to which Digitone service is provided. The string `UTR` appears when the RCU line connects to a universal tone receiver (UTR). For example, the `UTR` string can appear during the dialing phase of a call that originates from the RCU line. The `UTR` string only appears if the RCU line attaches to an SMU with a UTR pack.

5 To busy both of the SMU units, type

>BSY PM

and press the Enter key.

6 To discover the name of the PM load data file, type

>QUERYPM

and press the Enter key.

Note: The display provides the name of the load file. Cross-reference the name of the load file to the disk volume name on the PMLoad File in table PMLOADS.

7 To load the SMU unit, type

>LOADPM UNIT <unit number> CC
and press the Enter key.

8 Repeat Step 7 for the other SMU unit.

9 When the SMU unit is loaded, test the SMU. To test the SMU unit, type

>TST PM
and press the Enter key.

10 If the test passed, return to service (RTS) the SMU unit. To RTS the SMU unit, type

>RTS PM
and press the Enter key.

Powering down the SMU unit

The following steps are necessary to power down the SMU unit only:

1 To post the SMU unit that must power down, type

>MAPCI;MTC;PM;POST SMU <SMU number>
and press the Enter key.

2 To identify the RCU or RCUs that connect to the SMU unit, type

>TRNSL P
and press the Enter key.

3 To post an RCU unit that connects to the SMU unit, type

>POST RCU <site number frame number unit number>
and press the Enter key.

4 To busy the RCU unit posted in Step 3, type

>BSY
and press the Enter key.

Note: A warning message appears and a confirmation is requested. Enter Yes to confirm.

5 To offline the RCU unit busied in Step 4, type

>OFFL PM
and press the Enter key.

6 Repeat Steps 3-5 for each RCU unit that connects to the SMU unit that must power down.

7 To identify the network links to the DS30 network interface cards in the SMU unit, type

>TRNSL C
and press the Enter key.

8 To access the links level of the network, type

>NET;LINKS <network module pair number>
and press the Enter key.

9 To busy the network ports associated with the network module accessed in Step 8, type

>BSY<plane number> <port number>
and press the Enter key.

Note 1: Repeat this step for all ports associated with the network module pair accessed in Step 8.

Note 2: A warning message appears and a confirmation is requested. Enter Yes to confirm.

10 Repeat Steps 8-9 for all network module pairs that terminate DS30 links from the SMU unit.

11 To return to the PM level of the MAP display and post the SMU unit, type

>MAPCI;MTC;PM;POST SMU <SMU number>
and press the Enter key.

12 To check that all C-side links are busy, type

>TRNSL C
and press the Enter key.

13 To busy the SMU unit, type

>BSY PM
and press the Enter key.

14 To offline the SMU busied in Step 13, type

>OFFL
and press the Enter key.

15 Set the switch on the power converters in both units to OFF to remove the power from the SMU unit.

16 The power down procedure for the SMU unit is complete.

Common procedures

There are no common procedures.

SMU routine maintenance procedures

This chapter contains routine procedures for the Subscriber Carrier Module-100 Urban (SMU). These procedures cover preventive tasks that maintenance engineering and field maintenance personnel must perform at normal intervals.

Inspecting and cleaning cooling unit filters SMU

Application

Use the following procedure to inspect and clean cooling unit filters in frame cooling units.

Interval

Perform this procedure every two weeks.

Common procedures

There are no common procedures.

Action

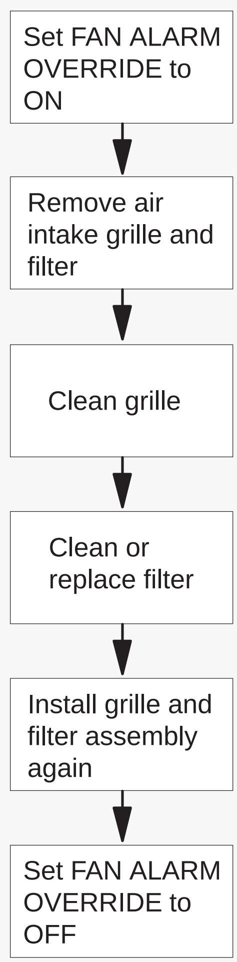
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Inspecting and cleaning cooling unit filters
SMU (continued)

Summary of Inspecting and cleaning cooling unit filters

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Inspecting and cleaning cooling unit filters
SMU (continued)

Inspecting and cleaning cooling unit filters

At your Current Location

1 On the frame supervisory panel (FSP), set the FAN ALARM OVERRIDE switch to ON.

2

DANGER
Rotating fan blades
Do not reach more than 6 in. beyond the upper lip of the air intake grille. You risk injury because your fingers can contact the rotating blades of the cooling unit fans.

Remove the frame trim panels.

If frame trim panels	Do
overlap the side edges of air intake grille	step 3
do not overlap the side edges of air intake grille	step 4

3 To remove the grille from the magnetic catches, grip both sides of the grille and pull the grill toward you. Go to step 5.

4 To remove the grille, pry the upper half of the grille away from the frame .

5 Go to a work area outside the room that contains the switching system. To clean the grille, use a dust cloth or a vacuum cleaner.

If filter surfaces	Do
appear dirty	step 8
appear clean	step 6

Inspecting and cleaning cooling unit filters SMU (end)

6 Shine a trouble light through the filter.

If light	Do
is visible through the filter	step 7
is not visible through the filter	step 8

7 Install the filter in the grille again.

8 Install the filter and grille assembly in the frame again. Go to step 17.

If filter part number	Do
is A0344437	step 9
is P0558302	step 12
is P0623539	step 14

9 Obtain replacement filter material.

10 Use the old filter as a guide. Trim a new filter to fit around the magnetic catches.

11 Install the filter and grille on the frame. Go to step 17.

12 Vacuum the filter in an area outside the room that contains the switching system.

13 Remove the excess dirt and lint in an area outside the room that contains the switching system. To remove the excess dirt and lint, rap dirty side down or vacuum.

14 Wash the filter in soap and water.

15 Before you install the filter, rinse and dry the filter completely.

16 Install the filter and grille on the frame. Go to step 17.

17 On the front of the FSP, set the FAN ALARM OVERRIDE switch to OFF.

18 The procedure is complete.

Replacing cooling unit filters SMU

Application

Use this procedure to replace cooling unit filters in frame cooling units.

Interval

Perform this procedure at intervals of three months.

Common procedures

There are no common procedures.

Action

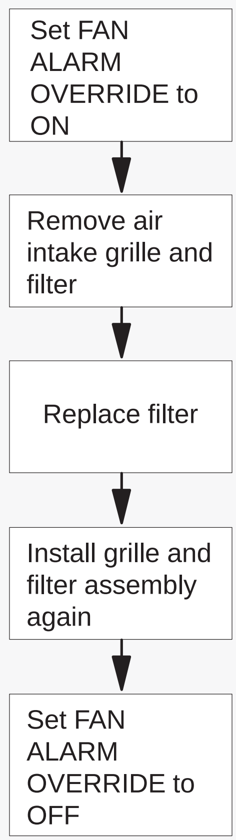
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Replacing cooling unit filters
SMU (continued)

Summary of Replacing cooling unit filters

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Replacing cooling unit filters
SMU (end)

Replacing cooling unit filters

At your Current Location

1. On the frame supervisory panel (FSP), set the FAN ALARM OVERRIDE switch to ON.

2. 

   DANGER
   Rotating fan blades
   Do not reach in more than 6 in. beyond the upper lip of the air intake grille. If you reach beyond 6 in., your fingers can contact the rotating blades of the cooling unit fans.

   Remove the frame trim panels.

If frame trim panels	Do
overlap side edges of air intake grille	step 3
do not overlap side edges of air intake grille	step 4

3. Grip the two sides of the grille. Pull the grille toward you to remove the grille from the magnetic catche.

   Go to step 5.

4. Carefully pry the upper half of the grille away from the frame to remove the grille.

5. Go to a work area outside the room that contains the switching system. Remove the filter from the grille.

6. Use the old filter as a pattern to trim the new filter to fit around the magnetic catches.

7. Install the grille and new filter on the cooling unit.

8. On the front of the FSP, set the FAN ALARM OVERRIDE switch to OFF.

9. The procedure is complete.

Returning a card for repair or replacement SMU

Application

Use this procedure to return a circuit card (like a power converter) to Northern Telecom for repair or replacement. Your location, Canada or the United States, determines the documents you must complete. You location determines to which address you must return the card.

Interval

Perform this procedure as needed.

Common procedures

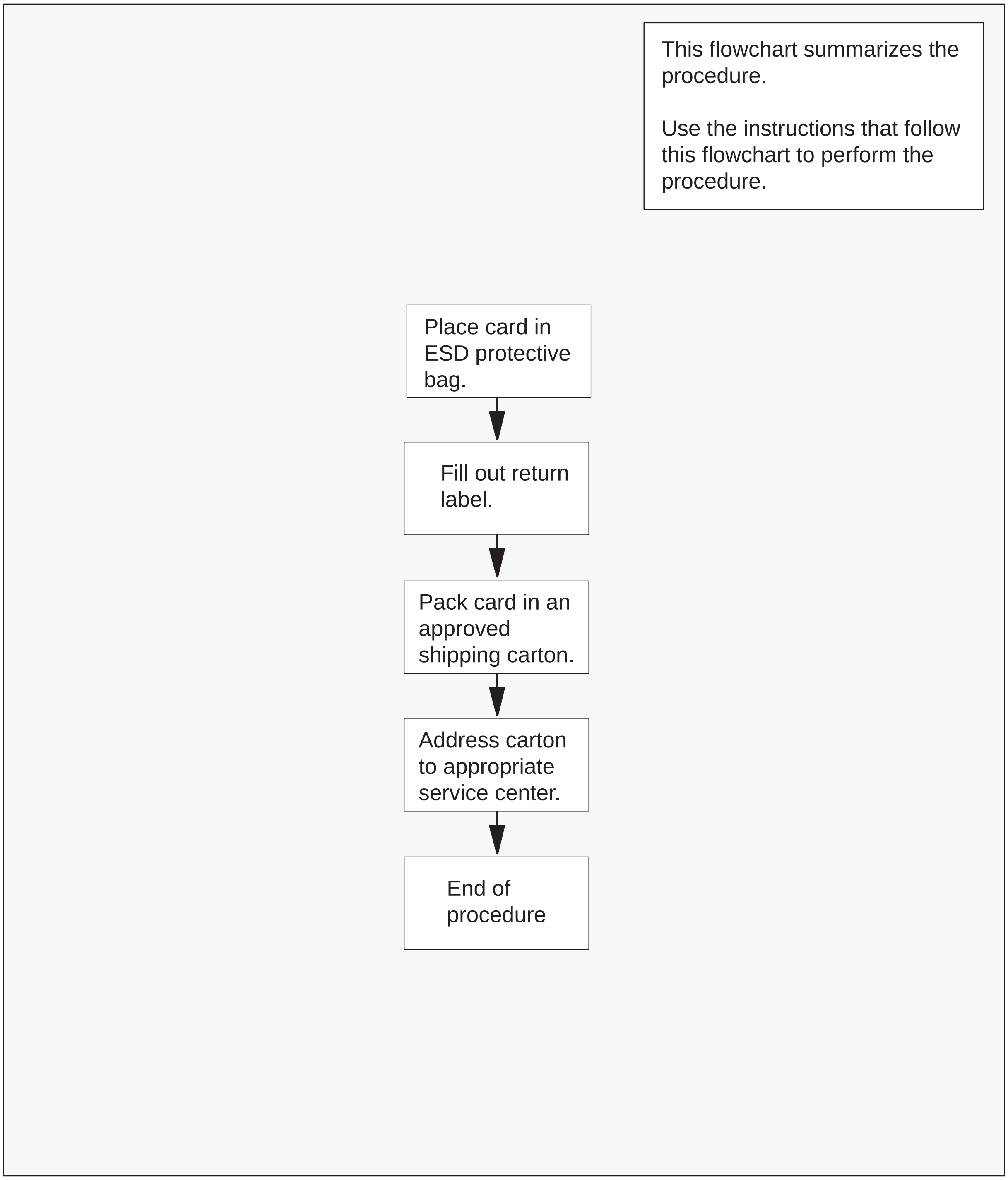
Common procedures do not apply.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Returning a card for repair or replacement
SMU (continued)

Summary of Returning a card for repair or replacement



Returning a card for repair or replacement
SMU (continued)

Returning a card for repair or replacement

At your Current Location

1 Place the card in an electrostatic-discharge (ESD) protective bag.

If your location	Do
is in Canada	step 7
is in the United States	step 2

2 Fill in the return label for each card you return. If you require help to fill out the label, call the Northern Telecom Service Center at 1-800-347-4850.

3 Pack the card or assembly in a Northern Telecom card shipping carton and seal the carton.

If a Northern Telecom card shipping carton is not available, use any carton. Make sure that you perform the following actions:

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secure each card or assembly in the carton so that no card or assembly can shift around

4 Send defective cards to the following address:

Northern Telecom Plaza Service Center

4600 Emperor Blvd.

Morrisville, North Carolina 27560

Attention: Repair and return

5 If you use the Northern Telecom Mail-in Repair Service, send defective cards to the following address:

Northern Telecom Plaza Service Center, Dept. 6677

4600 Emperor Blvd.

Morrisville, North Carolina 27560

Attention: Mail-In Repair Service

6 Go to step 12.

Returning a card for repair or replacement

SMU (continued)

7 Fill in one return label (form 24-115) for each card or assembly you return.

Make sure that you include the following information:

- return authorization number from customer service
- NT product engineering code (PEC)
- serial number
- release number
- BCS release software used at the time of replacement
- peripheral module load name
- description of the failure and action taken to repair
- fault code that describes the fault best (see the bottom of the label)
- name of your company
- office identifier code
- your name
- site name

If you need help to fill out the label, call Customer Service Operations at 1-800-668-5511.

8 Attach one copy of the card label to a card latch.

9 Keep the other copies of the label for your records.

10 Pack the card or assembly in a Nortel card shipping carton and seal the carton.

If a Northern Telecom card shipping carton is not available, use any carton. Make sure that you perform the following actions:

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secured each card or assembly in the carton so that no card or assembly can shift around

11 Use the following address on the carton:

Bell Canada customers:

Northern Telecom Canada Limited

8200 Dixie Road, Door 1617

Bramalea, Ontario, L6V 2M6

Other customers:

Northern Telecom Canada Limited

Customer Service Operations

Returning a card for repair or replacement
SMU (end)

C/O Wesbell Transport

5925 Tomken Road, Unit 13–16

Mississauga, Ontario, L4W 4L3

12 This procedure is complete.

Testing power converter voltages
SMU

Application

Use this procedure to test power converter voltages for all power converters in the subscriber module equipment (SME) frame.

Interval

Perform this procedure every six months.

Common procedures

There are no common procedures

Action

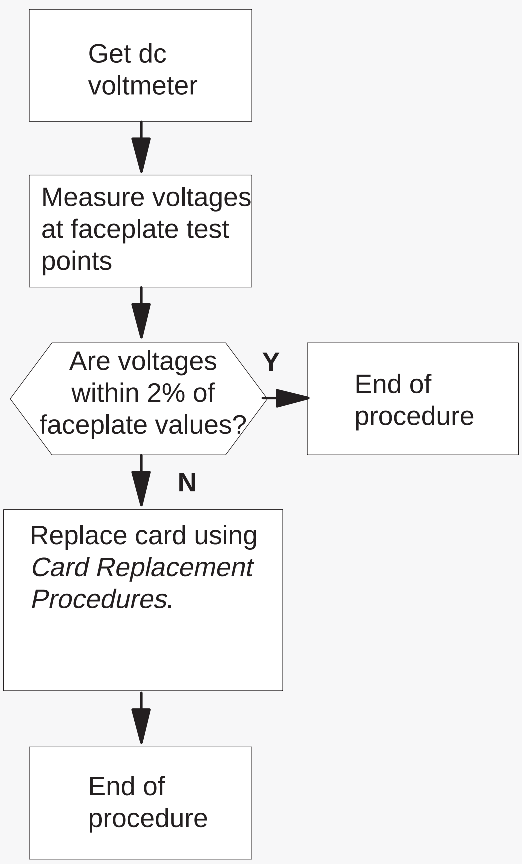
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing power converter voltages
SMU (continued)

Summary of Testing power converter voltages

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Testing power converter voltages
SMU (end)

Testing power converter voltages

At your current location:

1 Get a dc voltmeter.

2 Measure the voltage at the test points on the faceplates of all NT2X70 power converters in the SME frame.

3 The voltages must be within 2 percent of the nominal values printed on the NT2X70 faceplate. Compare the voltage measured in step 2 to the following acceptable voltage ranges.

Test point voltage	Acceptable range
+12V	+ 11.76V to + 12.24V
–12 V	–12.24V to –11.76V
+ 5V	+ 4.9V to + 5.1V
– 5V	– 5.1V to –4.9V

If test point voltages are	Do
within acceptable range	step 5
not within acceptable range	step 4

4 Replace the NT2X70 power converter as directed in *Card Replacement Procedures*. After you return to this procedure, go to step 2.

5 The procedure is complete

Testing the dead system alarm SMU

Application

Use this procedure to verify that the dead system alarm is operating correctly.

Interval

Perform this procedure every month.

Common procedures

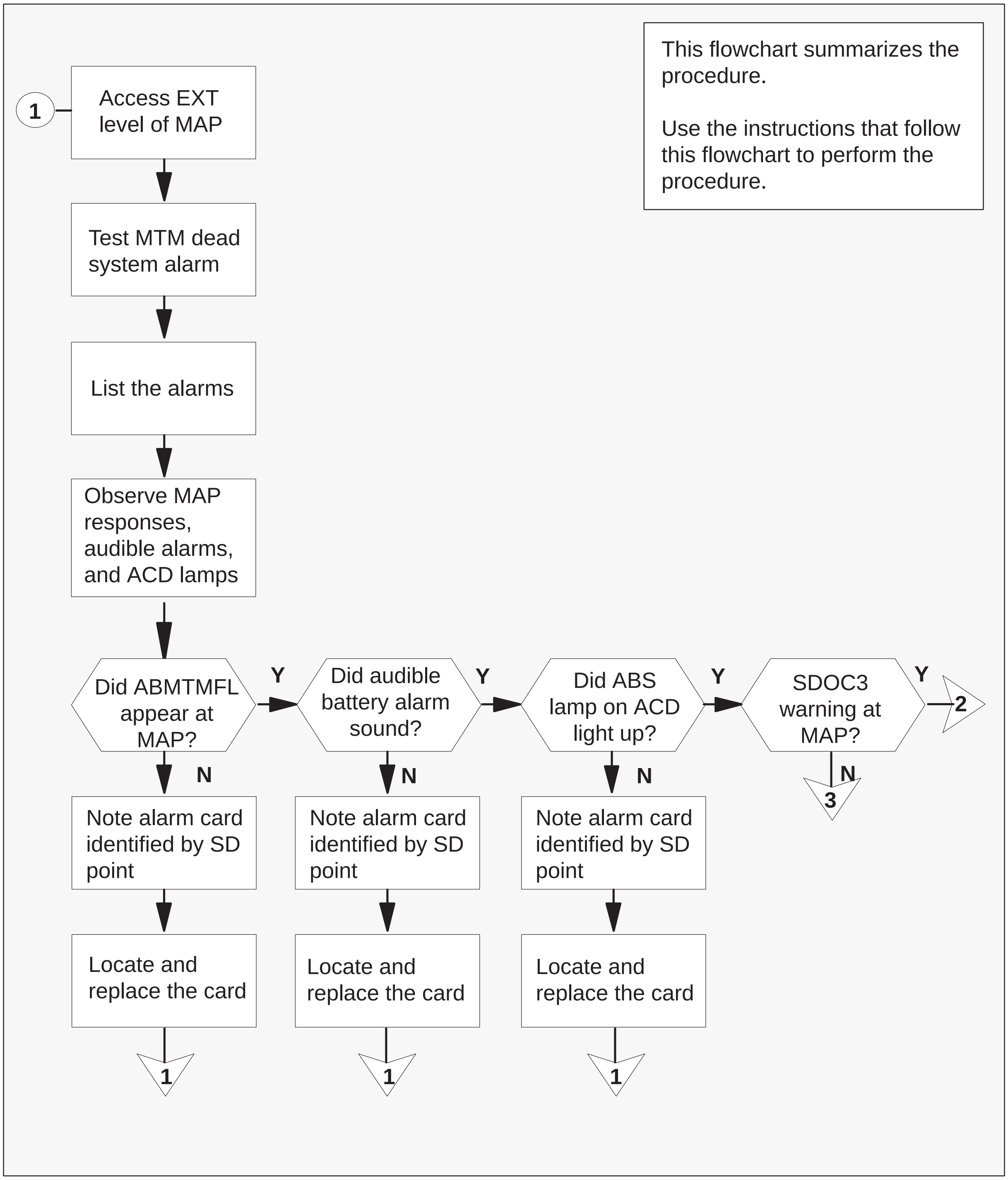
There are no common procedures

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

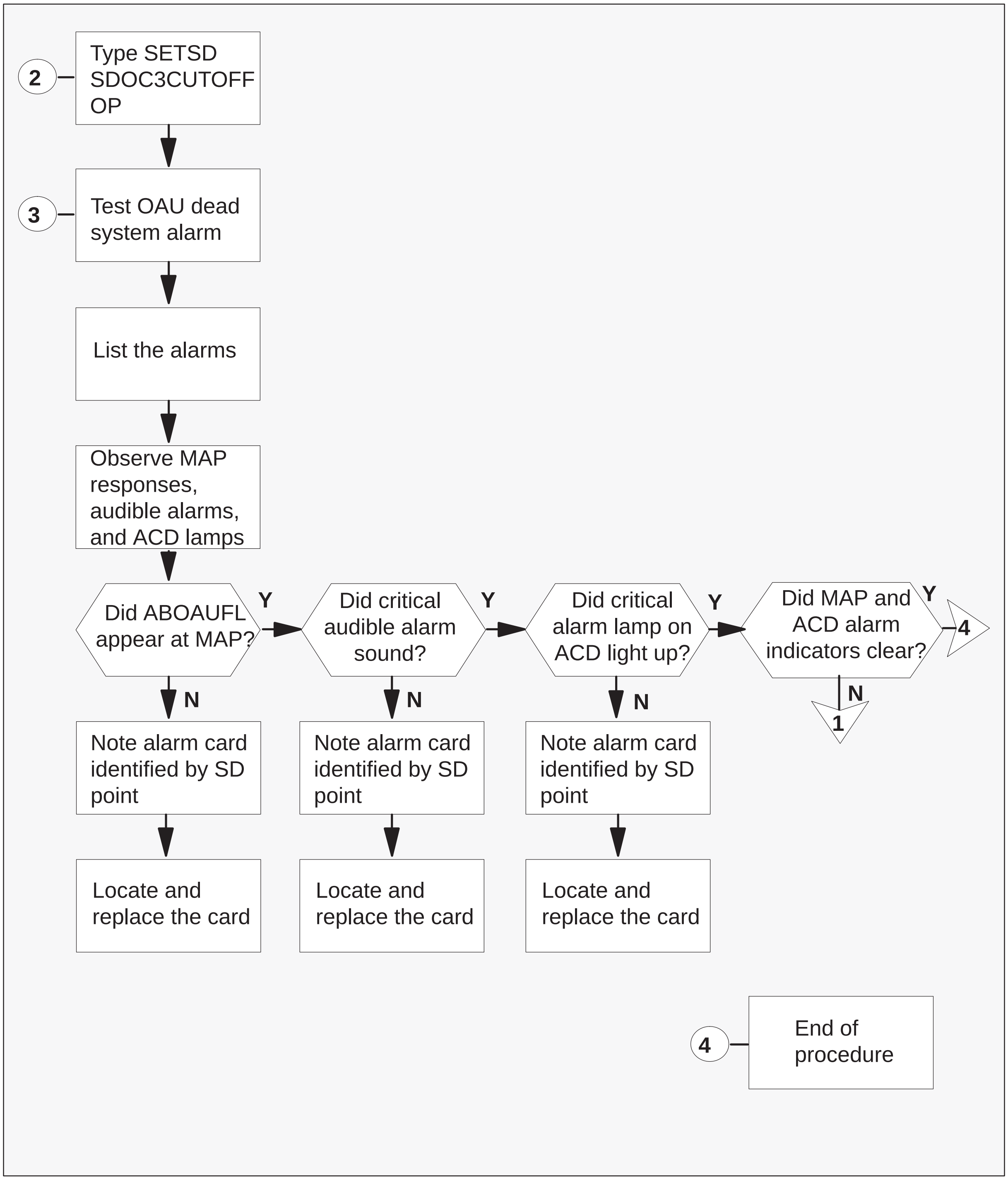
Testing the dead system alarm
SMU (continued)

Summary of How to test the dead system



Testing the dead system alarm
SMU (continued)

Summary of How to test the dead system



Testing the dead system alarm
SMU (continued)

How to test the dead system alarm

At your Current Location

1 In offices equipped with NT0X63 alarm control and display panels (ACD), ensure that the AUDIBLE ALARM DISABLE switch is set downward.

2 To access the EXT level of the MAP (maintenance and administration position), type

>MAPCI;MTC;EXT
and press the Enter key.

3 To test the dead system alarm, type

>TSTDSALM MTMFAIL 12
and press the Enter key.

4 Wait 15 seconds. To get a list of alarms, type

>LIST MAJ;LIST MIN
and press the Enter key.

5 Look at the responses on the MAP and listen for audible alarms. Examine the lamps on the alarm and control display panel.

If	Do
ABMTMFL was not displayed at MAP	step 6
audible battery alarm did not sound	step 6
ABS lamp on ACD panel did not activate	step 6
the system displays `WARNING––SDOC3 SENT ON DEAD SYSTEM passed` on the MAP	step 18
you did not observe any of the above indications	step 19

6 Note the alarm card identified by one of the following SD points:

- MTMFAIL
- OAUFAIL
- CRALMAUD
- CRALMVIS

Go to step 7 to locate the card.

Testing the dead system alarm
SMU (continued)

7 To access the system table ALMSD, type

>TABLEALMSD
and press the Enter key.

8 To position on the field bearing the name of the SD group, type

>POSsd_group
and press the Enter key.

where

sd_group is the SD group name identified in step 5 or step 21; for example, MTMFAIL

9 To list the table, type

>LIST
and press the Enter key.

10 Note the entry under SDGROUP.

11 To exit from the table, type

>QUIT
and press the Enter key.

12 To access system table ALMSDGRP, type

>TABLEALMSDGRP
and press the Enter key.

13 To position on the field noted in step 10, type

>POSsd_group
and press the Enter key.

where

sd_group is the SD group noted in step 10.

14 To list the entries, type

>LIST
and press the Enter key.

15 Note the entries under TMTYPE, TMNO, and CARDCODE. This information identifies the location of the card.

16 To exit the table, type

>QUIT
and press the Enter key.

Testing the dead system alarm

SMU (continued)

17 Replace the card. Teturn to step 1 of this procedure.

18 To respond to the warning, type

>SETSDSDOC3CUTOFF OP
and press the Enter key.

19 To test the dead system alarm, type

>TSTDSALM OAUFAIL 12
and press the Enter key.

20 Wait 15 seconds. To get a list of alarms, type

>LISTMAJ;LIST MIN
and press the Enter key.

21 Look at the responses on the MAP and listen for audible alarms. Examine the lamps on alarm and control display panel.

If	Do
ABOAUFL was not displayed at MAP	step 6
the critical audible alarm did not sound	step 6
the critical alarm lamp on ACD panel did not activate	step 6
you did not observe any of the above indications	step 22

22 Wait 60 seconds. Note any changes on the MAP and the ACD panel. The following changes should occur:

- On the MAP, the alarm under the Ext header will disappears.
- On the ACD panel, the critical alarm lamp will turn off.
- On the MAP, the ACD lamp will turn off.

If above changes	Do
occurred	step 24
did not occur	step 23

23 It is possible that you missed an indication. Return to step 1 and repeat this procedure.

Testing the dead system alarm
SMU (end)

24 The dead system alarm is correct. The procedure is complete

Testing wrist strap grounding cords SMU

Application

Use this procedure to verify that the resistance of wrist strap grounding cords is at the correct level. These resistance must be low enough to allow static electricity to discharge from a person. The resistance must also be high enough to protect the wearer from electrocution if the equipment develops a short circuit.

Interval

Perform this procedure each month.

Common procedures

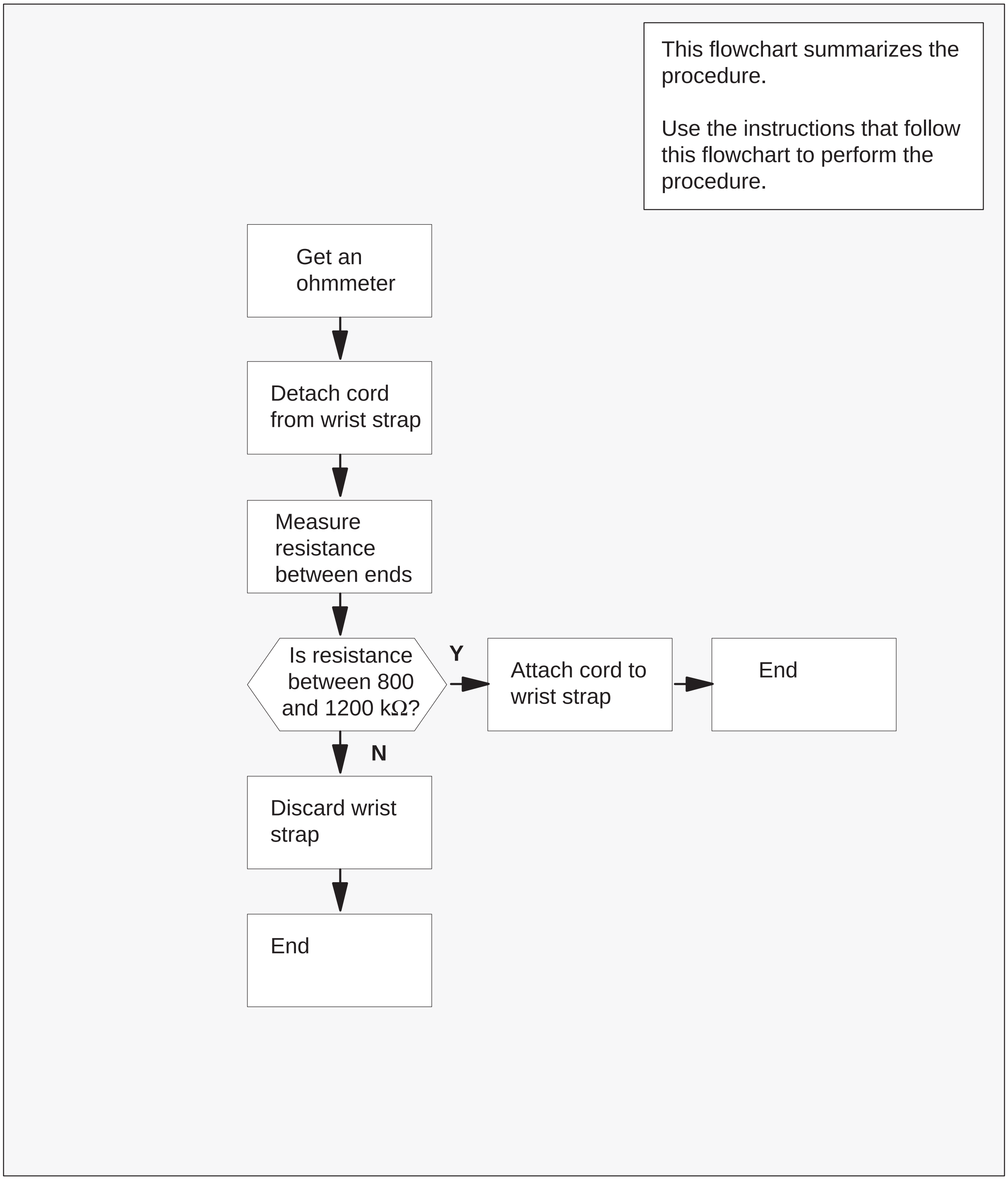
Does not apply

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing wrist strap grounding cords
SMU (continued)

Summary of Testing wrist strap grounding cords



Testing wrist strap grounding cords
SMU (end)

Testing wrist strap grounding cords

At your current location:

1 Get an ohmmeter.

2 Detach the grounding cord from the wrist strap.

3 Use the ohmmeter to measure the resistance between opposite ends of the grounding cord.

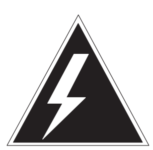
If resistance	Do
is between 800 kΩ and 1200 kΩ	step 4
is not between 800 kΩ and 1200 kΩ	step 5

4 Use the grounding cord and wrist strap assembly. Assemble the wrist strap to the grounding cord.

Go to step 6.

5

DANGER
Risk of electrocution
The grounding cord is safe to use if resistance measures higher than 800 kΩ. A lower resistance can expose the wearer to the risk of electrocution if equipment short-circuits.



WARNING
Damage to electronic equipment
A grounding cord that has a resistance higher than 1200 kΩ cannot conduct static charges to ground adequately. The cord does not protect sensitive electronic equipment against buildups of static charges that can cause damage.

Discard the assembly. **DO NOT USE THE ASSEMBLY.**

6 The procedure is complete.

SMU recovery procedures

This chapter contains the recovery procedures for the DMS-100 Subscriber Carrier Module-100 Urban (SMU) and the remote carrier urban (RCU). Maintenance personnel use these procedures to return to service (RTS) a SMU and a RCU from an out-of-service condition.

Recovering an out-of-service SMU

Application

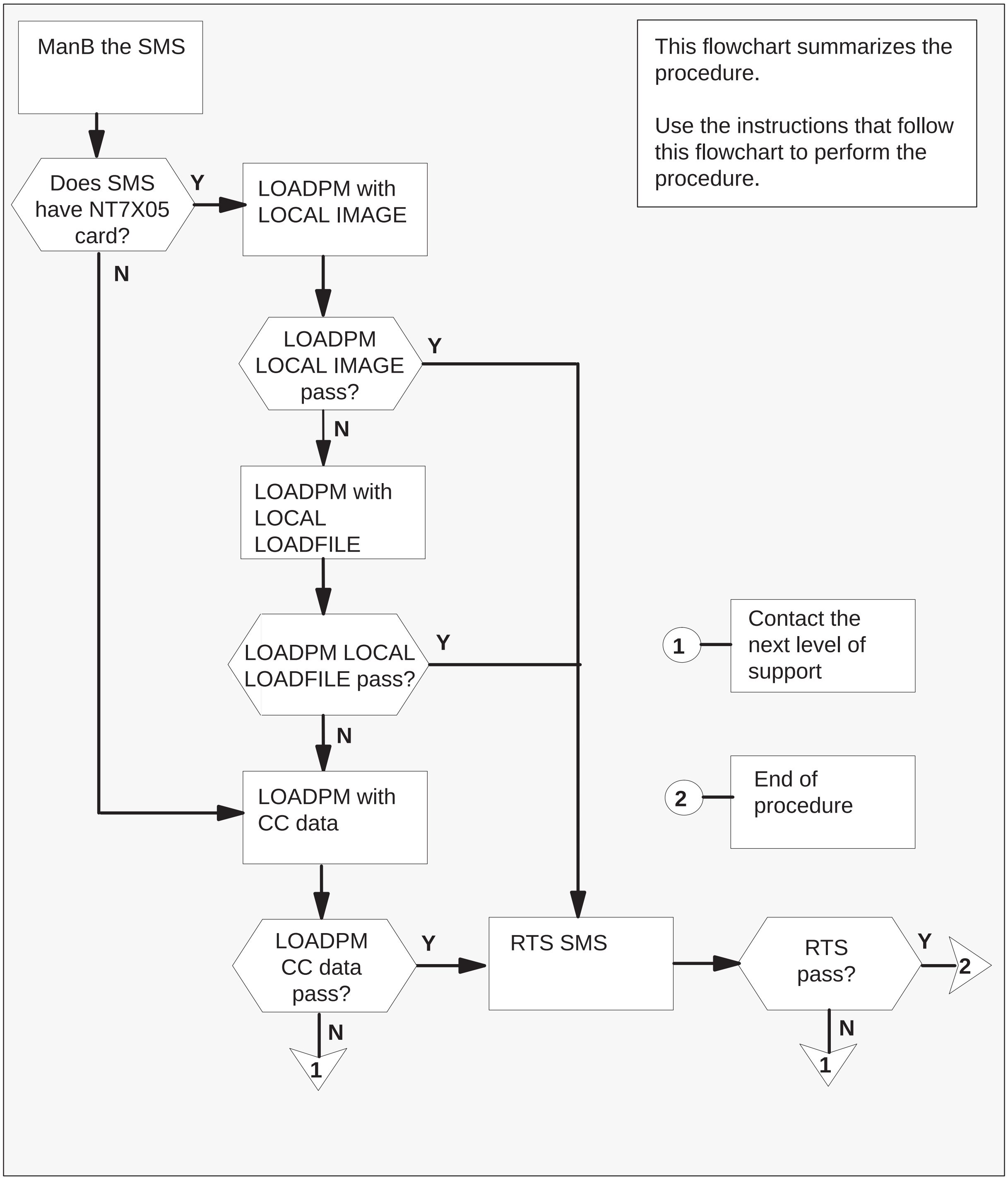
Use this procedure to return an SMU to service.

Action

This section provides a summary flowchart of the procedure to recover an out-of-service SMU. A detailed step–action plan follows the flowchart.

Recovering
an out-of-service SMU (continued)

Summary of recovering an SMS



Recovering an out-of-service SMU (continued)

Recovering an SMU

At the MAP terminal

1 Enter this recovery procedure when:

- a MAP display indicates both units of a posted SMU are out-of-service and
- a critical alarm is present

1 To manually busy (ManB) the SMU, type

>BSY PM
and press the Enter key.

2 The peripheral loader card (NT7X05) allows the user to perform a local load of the SMU data. A local data load reduces recovery time. Determine if an NT7X05 is in slot 13,15,16,17 or 19. To check if the NT7X05 card is provisioned, type:

>QUERYPM FILES
and press the Enter key.

Example of a MAP display:

```
   CM   MS   IOD   Net   PM   CCS   LNS   Trks   Ext   APPL
    .    .     .      .  1 SMU    .        .       .
 .                        *C*
 SMU            SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit     PM     2        0        2        0        2        25
 2 Post     SMU    1        0        0        0        0         1
 3 ListSet
 4                    SMU    0 ISTb  Links_OOS:  CSide  0,  PSide   0
 5 TRNSL_              Unit 0:  Inact SysB
 6 TST_                Unit 1:  Inact SysB
 7 BSY_
 8 RTS_             QUERYPM files
 9 OffL              Unit 0
10 LoadPM_
11 Disp_    NT7X05   Load File:  ESU05AW
12 Next_    NT7X05   Image File:
13 SwAct      CMR Load: CMR03A
14 QueryPM Unit 1
15            NT7X05 load file:  ESU05AW
16 IRLINK     NT7X05 image file:
17 Perform    CMR Load: CMR03A
18
```

Note: If the NT7X05 card is not provisioned the MAP response is:

```
Nt7X05 not datafilled,  QueryPM files invalid
```

Recovering an out-of-service SMU (continued)

If the NT7X05 card is	Do
provisioned	step 3
not provisioned	step 5

3 To load the SMU from the local image, type

>LOADPM PM LOCAL IMAGE
and press the Enter key.

If the load	Do
passes	step 6
fails	step 4

4 To load the SMU from the local loadfile, type

>LOADPM PM LOCAL LOADFILE
and press the Enter key.

If the load	Do
passes	step6
fails	step 5

5 To load the SMU from the CC, type

>LOADPM PM
and press the Enter key.

If the load	Do
passes	step 6
fails	step 11

Recovering an out-of-service SMU (continued)

6 To return the PM to service, type

>RTS PM
and press the Enter key.

If system response	Do
is `RTS PASSED` on both units	step 12
is `RTS FAILED` on one unit	step 7
is `RTS FAILED` on both units	step 11

7 To test the ManB unit, type

>TST UNIT unit_no
and press the Enter key.

where

unit_no is the number of the SMU unit (0 or 1) to test

If the system response	Do
is `TST PASSED`	step 8
is `TST FAILED`	step 11
is `TST FAILED` with card list	step 10

8 To return the ManB unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no is the number of the SMU unit (0 or 1) to test

9

CAUTION
Data match in progress
An ISTb alarm appears after an RTS passes on both units. Wait 3-5 min for the system to clear this alarm. This action allows a dynamic data match between active and inactive units.

Recovering an out-of-service SMU (end)

To determine where to proceed, use the following information:

If the system response	Do
is `RTS PASSED`	step 12
is `RTS FAILED`	step 11

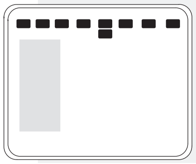
10 Go to the *Card Replacement Procedures* in this document and replace the cards on the list that have faults. Return to this procedure at step 7.

11 For additional help, contact the next level of support.

12 This procedure is complete. When other alarms are displayed, refer to the appropriate procedure in *Clearing alarms Procedures*.

Recovering an out-of-service RCU

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nRCU**	.	.	.	.	.
				C					

Application

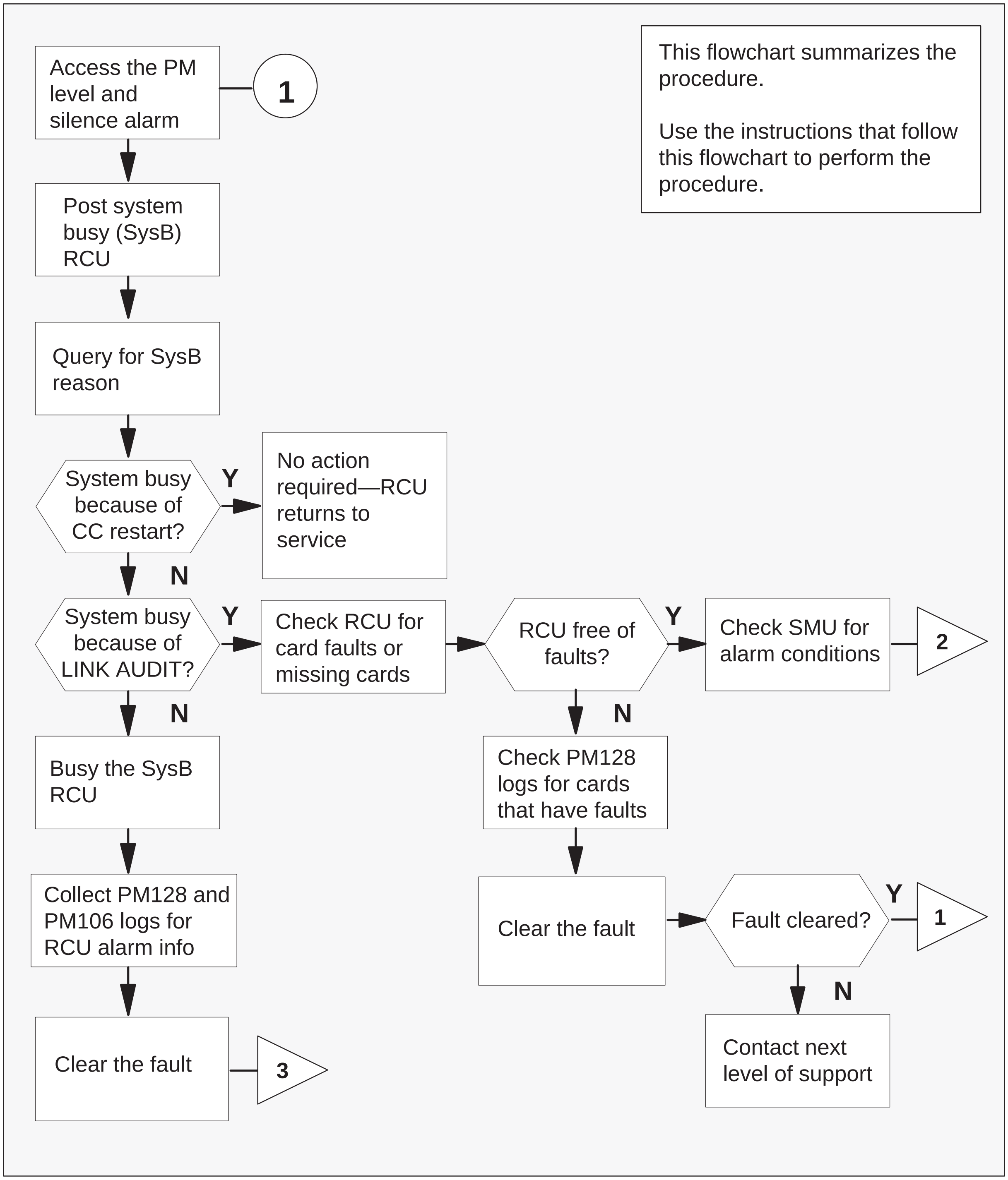
Use this procedure to return to service (RTS) an RCU busied by the system (SysB).

Action

This section provides a summary flowchart of the procedure to recover an out-of-service RCU. A detailed step-action plan follows the flowchart.

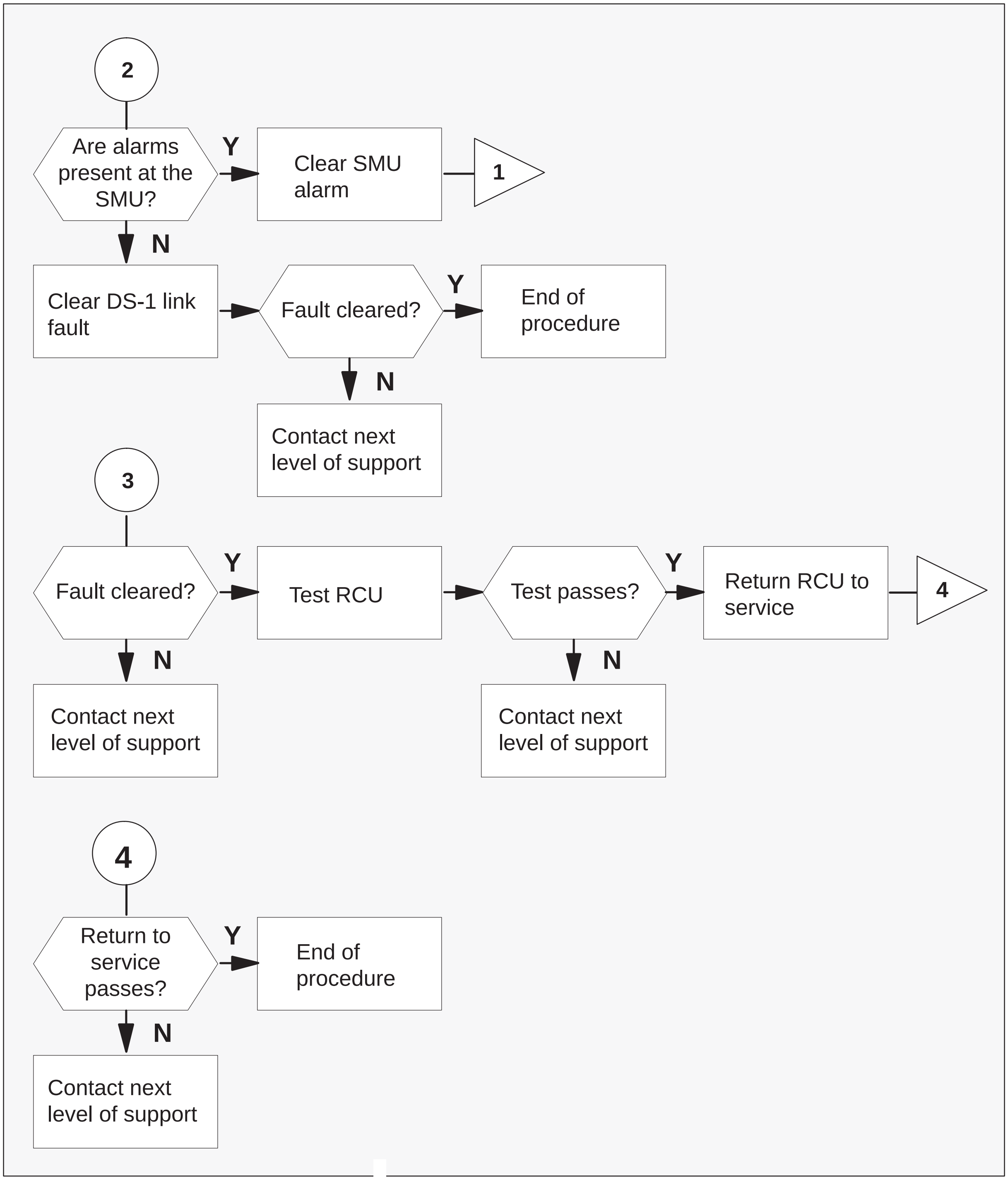
Recovering an out-of-service RCU (continued)

Summary of Recovering an out-of-service RCU



Recovering an out-of-service RCU (continued)

Summary of Recovering an out-of-service RCU (continued)



Recovering an out-of-service RCU (continued)

Recovering an out-of-service RCU

At the MAP terminal

1 When the system detects a fault, the system can trigger an audible alarm. Access the MTC level of the MAP (maintenance and administration position) terminal. To silence the alarm, type.

>MAPCI;MTC;SIL
and press the Enter key.

2 To display the RCU or RCUs that are SysB, type

>PM;DISP STATE SYSB RCU
and press the Enter key.

Example of a MAP response:

```
SysB RCU : RCU0 00 0
```

Note: When more than one RCU is SysB, select one. When no RCU is SysB, go to step 16.

3 To access the SysB RCU, type

>POST RCU site_name frame_no unit_no
and press the Enter key.

where

site_name is the name of the remote site that displays in step 2, for example, RCU0
frame_no is the frame number of the RCU that displays in step 2
unit_no is the unit number of the RCU that displays in step 2

Example of a MAP response:

```
RCU     SysB   ManB   Offl   CBsy   ISTb   InSv
    PM     1      4      0      0      3     28
   RCU     1      0      0      0      2      0

RCU RCU0 00 0  SysB        Links_OOS: Cside 4
```

Recovering an out-of-service RCU (continued)

4 To determine the system busy reason, type

>QUERYPM FLT
and press the Enter key.

Example of a MAP response:

```
SysB reason: LINK AUDIT
```

Note: The system can display additional alarms.

If SysB reason is	Do
LINK AUDIT	step 5
CC restart occurs	step 9
initialization limit exceeded	step 10
unsolicited message limit exceeded	step 10
message failure	step 10

5 To verify that links 3 and 4 are out of service, type

>TRNSL
and press the Enter key.

Example of a MAP response:

```
LINK1: SMU 2  2;CAP; S;STATUS:  OK
LINK2: SMU 2  4;CAP; S;STATUS:  OK
LINK3: SMU 2 19;CAP; MS;STATUS:  SysB;MSGCOND: CLS
LINK4: SMU 2  7;CAP; MS;STATUS:  SysB;MSGCOND: CLS
```

Note: In this example, messaging links 3 and 4 that connect to ports 7 and 19 of SMU 2 are out of service.

6 Check PM128 log reports for alarms that indicate a RCU digroup that is missing, has faults or is incorrectly configured. Check log report PM128 for alarms that indicate a time switch or RCU repeater card that has faults.

If	Do
digroup, time switch or repeater card is indicated	Replace card. Return to step 1 of this procedure.
RCU is free of faults	step 7

Recovering an out-of-service RCU (continued)

7 Observe the peripheral module (PM) header in the MAP subsystem display.

If SMU alarm	Do
displays	Clearing alarm procedure for the indicated SMU alarm. Return to step 1 of this procedure.
does not display	step 8

8 Use DS-1 link fault locating procedures to isolate fault to a section of DS-1 line or to a DS-1 repeater.

If fault is	Do
not found and alarm persists	step 15
found and alarm clears	step 16

9 There is no action required. After restart is complete, the RCU returns to service. Go to step 16.

10 To manually busy (ManB) the posted RCU, type

>BSY
and press the Enter key.

Example of a MAP response:

```
RCU RCU0 00 0 Bsy Passed
```

11 Collect the PM128 and PM106 log reports that occur 10 min before the RCU goes system busy. Note the coded RCU alarms in the log information. Go to step 12.

12 Identify and replace the component that has faults. After you replace the component that has faults, go to step 13 of this procedure.

Recovering an out-of-service RCU (end)

13 To test the RCU, type

>TST
and press the Enter key.

Example of a MAP response:

```
OSvce Tests Initiated
RCU RCU0 00 0 Tst COMPLETED NO FAULT DETECTED
```

If test	Do
passes	step 14
fails	step 15

14 To return the RCU to service, type

>RTS
and press the Enter key.

Example of a MAP response:

```
RCU RCU0 00 0 Rts Passed
```

If RTS	Do
passes	step 16
fails	step 15

15 Contact the next level support for additional help to clear this alarm.

16 This procedure is complete. If other alarms display, refer to the appropriate clearing alarms procedures for the indicated alarms.

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S

U

W

DMS-100 Family

Subscriber Carrier Module-100 Urban

Maintenance Manual

Product Documentation—Dept 3423
Northern Telecom
P.O. Box 13010
RTP, NC 27709–3010
1-877-662-5669, Option 4 + 1

Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant.This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user’s own expense

Allowing this equipment to be operated in such a manner as to not provide for proper answer supervision is a violation of Part 68 of FCC Rules, Docket No. 89-114, 55FR46066

This equipment is capable of providing users with access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities is a violation of the Telephone Operator Consumer Service Improvement Act of 1990 and Part 68 of the FCC Rules

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NORTHERN TELECOM