Critical Release Notice

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

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

Bookmark Color Legend

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

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

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

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297-8211-550

DMS-100 Family

Outside Plant Access Cabinet (OPAC)

Maintenance Manual

XPM12 and up Standard 05.01 August 1999

NORTEL NETWORKS
How the world shares ideas.

DMS-100 Family

Outside Plant Access Cabinet (OPAC)

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Publication number: 297-8211-550
Product release: XPM12 and up
Document release: Standard 05.01
Date: August 1999

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Contents

About this document

When to use this document

This Outside Plant Access Cabinet (OPAC) maintenance reference manual provides: overview, signaling, and hardware information for understanding the OPAC product and operation; recovery procedure for returning to service an OPAC from a completely out-of-service condition; alarm clearing procedures for clearing an OPAC alarm condition at the MAP; card replacement procedures for removing and replacing hardware modules in the OPAC as part of maintenance, verification, or acceptance procedures; trouble locating and clearing information for locating and clearing problems beyond the scope of other maintenance procedures; and routine maintenance procedures for performing scheduled routine and preventive maintenance tasks.

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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.

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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 the *DMS-10 and DMS-100 Family 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 the *DMS-10 and DMS-100 Family Product Documentation Directory*, 297-8991-001.

References in this document

The following documents are referred to in this document:

- *DMS-100 Family Guide to Northern Telecom Publications*, 297-8991-001
- *Input/Output System Reference Manual*, 297-1001-129
- *Extended Peripheral Module Operational Measurements Reference Manual*
- *Extended Peripheral Module Logs Report Reference Manual*
- *Extended Peripheral Module Translations Reference Manual*

What precautionary messages mean

The types of precautionary messages used in Nortel Networks 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.
```

OPAC maintenance overview

Functional overview

The Outside Plant Access Cabinet (OPAC) offers the enhanced capacity and versatility necessary for increased service delivery. The OPAC incorporates the functions of multiple outside plant enclosures. The OPAC can address a wide range of application requirements in present and future access networks.

The OPAC is a remote peripheral that provides the extended geographic coverage for the DMS-100 switch. The OPAC is configured to operate at a maximum distance of 160.93 km (100 mi) from the host office.

This guide describes the OPAC and provides information on the operation, user interface, alarms, and logs required for maintenance.

The OPAC contains hardware and software maintenance components that perform routine audits and identify failures in the following:

- the OPAC
- the DS-1 links that connect the OPAC to the host controller
- the subscriber lines
- the Series 800E Cabinet

The OPAC provides an interface for two to six DS-1 links from a line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC). The OPAC also provides a maximum of 640 subscriber lines with local connections.

The OPAC is a reconfigured Remote Line Concentrating Module (RLCM) designed for outside use. The OPAC has additional equipment that provides temperature control in the Series 800E Cabinet. The OPAC is available in a configuration that supports 256 lines.

The size of the OPAC cabinet allows the operating company to provision other equipment.

Note 1: This guide uses the names RLCM and Outside Plant Module (OPM) with the OPAC. The OPM is a reconfigured RLCM packaged in a cabinet that protects the OPM from the environment.

Note 2: An OPM packaged in the Series 800E Cabinet is an OPAC. The OPAC replaces the frame supervisory panel (FSP) with a modular supervisory panel (MSP).

Note 3: There are no software changes as part of the OPAC. Original design names, like RLCM, OPM, and FSP, continue to identify some features. These features include feature packages, office parameters, translations datafill, software module names and functions, and MAP levels and commands.

Note 4: The name PES (power and environmental system) applies to the OPM. The name PES also applies to the environmental control and alarms features of the Series 800E Cabinet integrated with the OPAC.

This chapter contains a hardware and software overview of the OPAC configuration. Another section discusses the Series 800E Cabinet.

FCC statement

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. 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 his own expense.

General configuration

This section describes how the different hardware components of the OPAC interact for maintenance troubleshooting.

The OPAC is packaged in the Series 800E Cabinet. The Series 800E Cabinet is an environmentally-controlled cabinet that consists of three compartments The compartments house the following:

- electronics and batteries
- ac power distribution
- cable and wire termination, protection, and cross-connections

The OPAC consists of:

- a line concentrating module (LCM)
- host interface equipment (HIE)
- a remote maintenance module (RMM)

The OPAC supports all line features available at the host. These features include the following line features:

- plain old telephone service (POTS)
- party lines
- coin lines
- Meridian Digital Centrex (MDC) stations
- Meridian business sets (MBS)
- data units
- attendant consoles
- Datapath

The OPAC requires the following software feature packages:

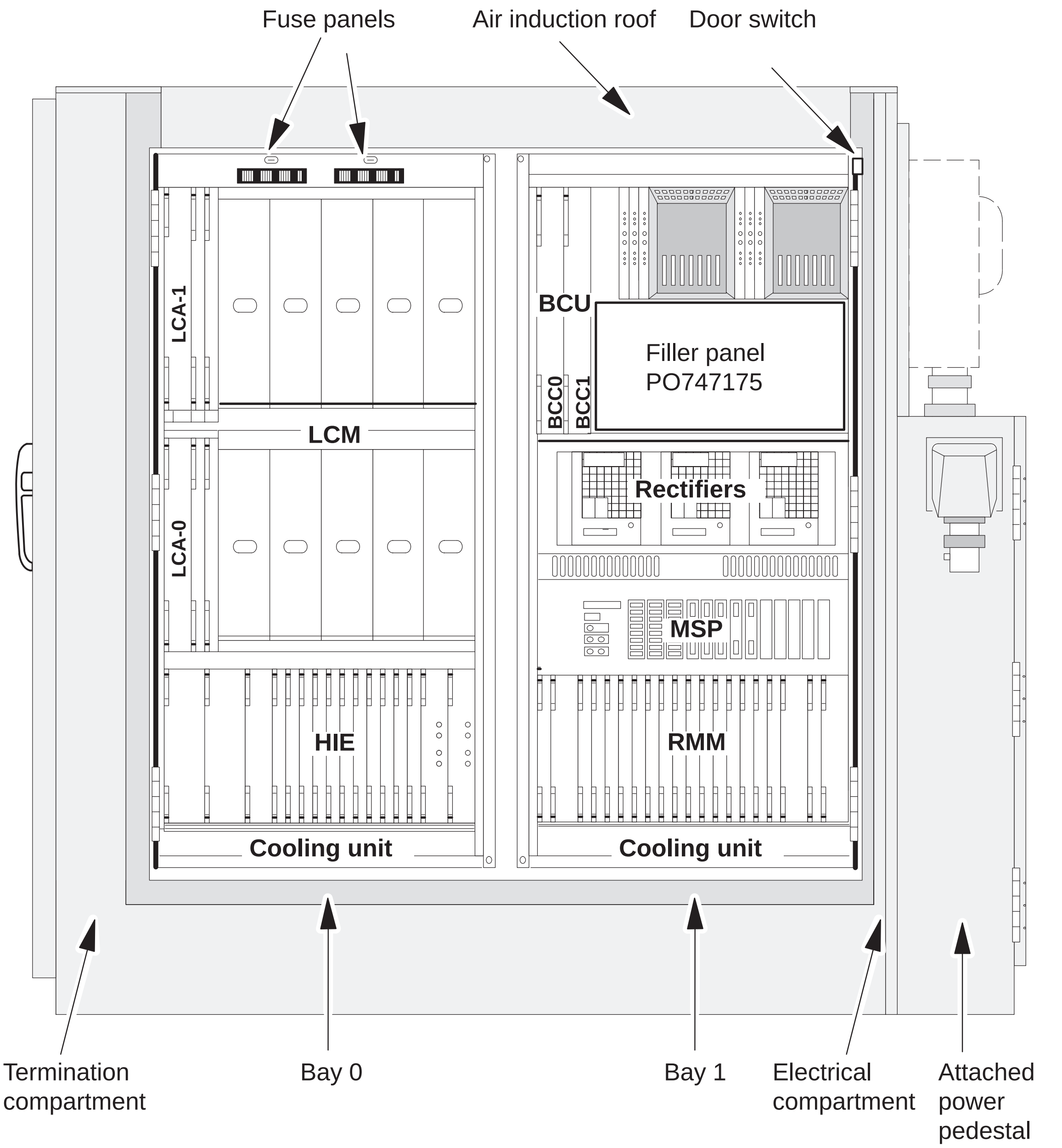
- Remote Line Concentrating Module (NTX146AA)
- Outside Plant Module Maintenance (NTX147AA)

The following optional feature packages are also available with the OPAC:

- Intracalling (NTX156AA)
- Emergency Stand-Alone (ESA) Operation (NTX154AA)

The following figure illustrates the OPAC arrangement in the Series 800E Cabinet.

OPAC arrangement



Line concentrating module

The LCM occupies two shelf positions in the OPAC cabinet. The two unit LCM contains two line concentrating array (LCA) shelves. The LCA-0 is the bottom shelf. The LCA-1 is the top shelf of the LCM.

Fuse panels above the LCM carry sets of five +5 V and –48 V fuses for the line drawers These fuse panels also carry a pair of fuses for the ringing voltage outputs (RA and RB). Each LCA shelf is equipped with a processor, controller, power converter, and five line drawers.

Each line drawer connects a maximum of 64 line cards, one card for each analog subscriber line that the OPAC services. The 64 line cards divide into two groups of 32. Each group of 32 line cards is a line subgroup (LSG).

The following figure identifies ten line drawers and 20 LSGs in the two LCA shelves.

The maximum number of lines that can connect to an OPAC is 640. This maximum number results from the number of line drawers (10), times the number of line cards for each drawer (64).

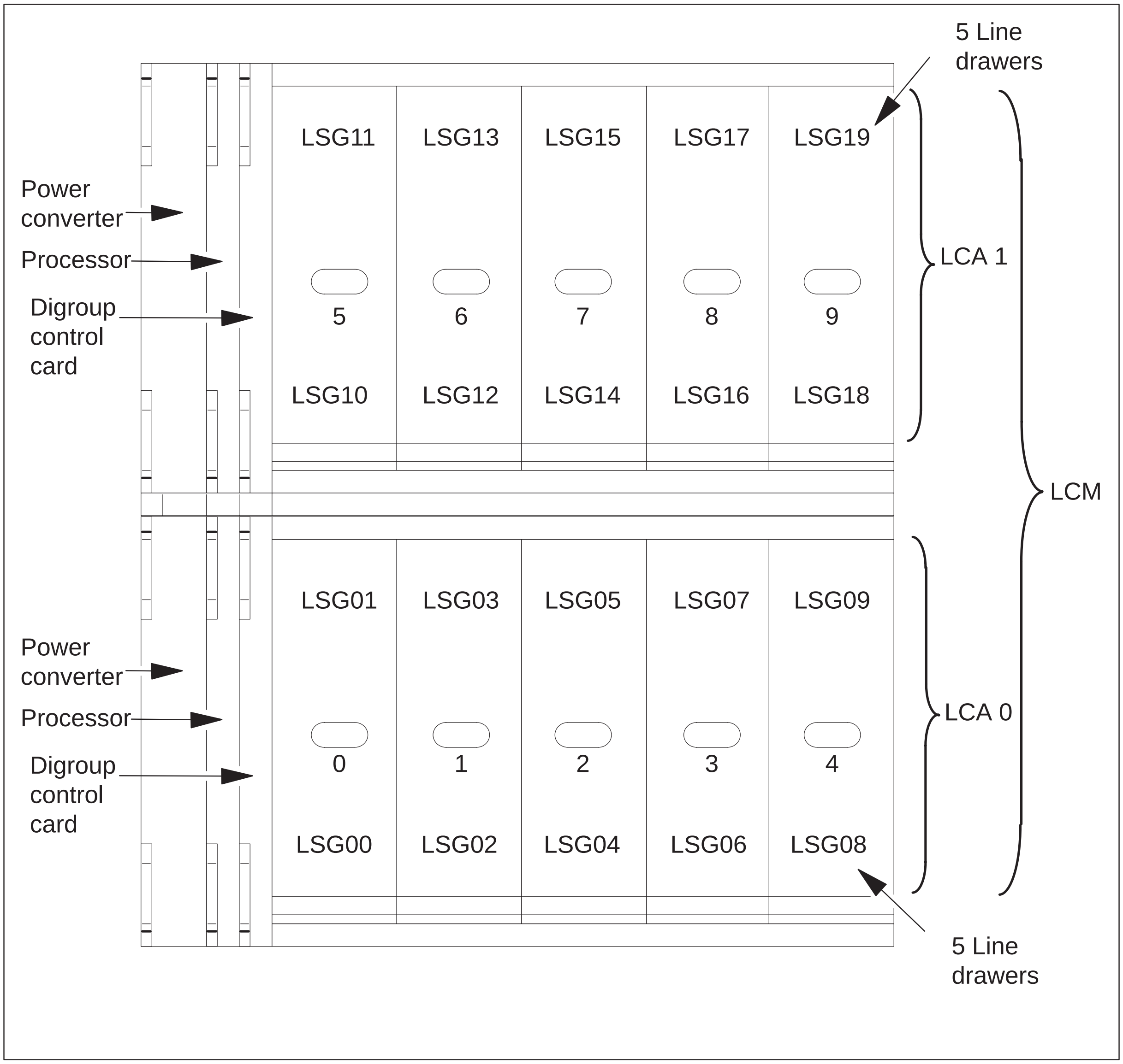
In the OPAC, the LCM connects from two to six DS-1 control-side (C-side) links to the 640 subscriber lines. The LCM components that make this interface are the following:

- two power converters
- two control complexes, the LCM processor and the digroup control card (DCC)
- twenty LSGs

The OPAC has a minimum of two DS-1 link. This number occurs because each primary link carries one message channel to the LGC, LTC or RCC. Each DS-1 link carries 24 speech channels that provide 48 to 144 available channels. Two of these speech channels are always nailed up to the host controller.

The OPAC can accommodate a maximum of six ports. The number of ports accomodated depends on traffic capacity and the required concentration ratio.

LCM arrangement



LCA shelf configuration

The layout of the LCA shelves and line drawers of the OPAC appears in the following figure.

An LCA shelf contains the following parts:

- one power converter
- one control complex
- five line drawers

The power converter card is at the far left of the LCA shelf (slots 01–03). The control complex cards occupy slots 04 and 05. The five line drawers fill the remainder of the shelf.

Power converter card

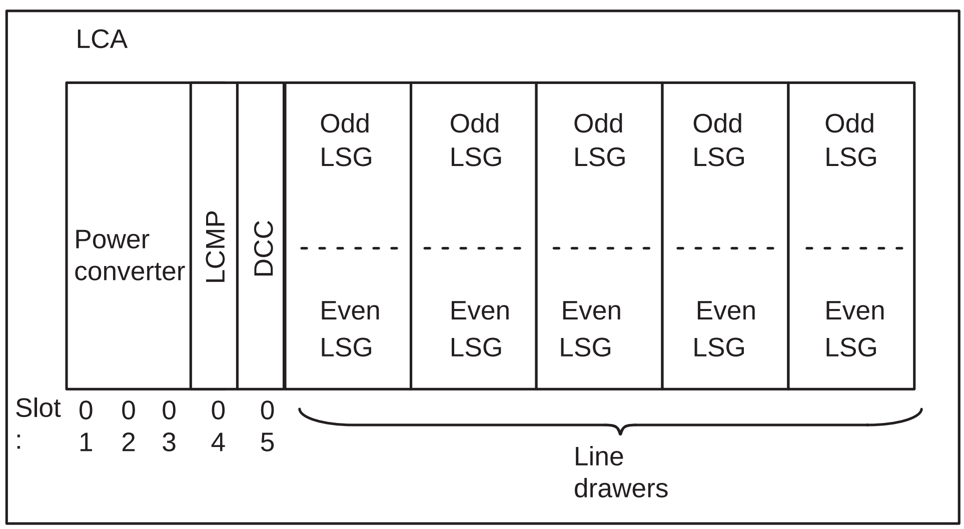
The power converter card (NT6X53) is in slots 01–03 of the LCA. This card contains circuits that convert a –48V office battery to regulated +5V and +15V outputs for shelf circuits.

The power converter contains relay circuits that control the application of the following from the ringing generator to the LCM line circuits:

- ringing
- automatic number identification (ANI)
- coin voltages

One power converter can supply power to both shelves of the LCM if the mate converter fails.

Line concentrating array (LCA) shelf layout



Host interface equipment shelf layout

Slot	Abbreviation	NT PEC	Remarks
01–03		NT6X53AA	Power converter. Also contains ringing and ANI voltage switching circuits.
04	LCMP	NT6X51AB	XLCM processor card (see note)
05	DCC	NT6X52AA	Digroup control card
–	–	NT6X05AA	Line drawer
–	LSG	–	Line subgroup

Note: The LCA contains the NT6X51AB 256 Kbyte processor card. This card requires the extended memory line concentrating module (XLCM) software load.

LCM control complex cards

The LCM processor (LCMP) card and DCC are common cards in the LCA. In each LCA, the common cards function identically and are always provided. A description of the functions of these cards follows.

XLCM processor card

The extended-memory line concentrating module (XLCM) processor card (NT6X51AB) is in slot 04 of each LCA shelf. The XLCM processor card connects with the DCC to form the control complex for the LCA. The XLCM processor card checks sanity and monitors activity. The XLCM processor also monitors the power and ringing generator functions of the OPAC.

The XLCM contains 256 kBytes of random access memory (RAM) storage. The XLCM collects dial pulse digits from subscriber lines. The XLCM handles messages to and from the host LTC, LGC, or RCC. The maximum number of lines is 640. The NT6X51AB requires XLCM software loads.

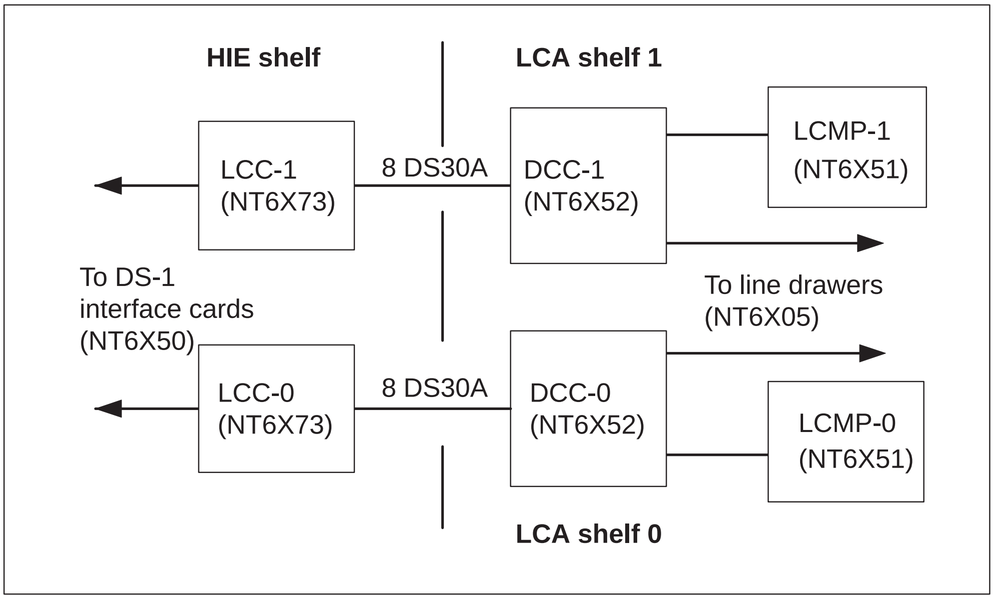
Digroup control card

The DCC (NT6X52) is in slot 05 of the LCA shelf. The DCC allows the LCA and HIE shelves to communicate.

The DCC provides an interface between the equivalent LCM processor in the LCA and one link control card (LCC) in the HIE. The DCC provides this interface through eight DS30A links. The following figure shows this interface.

The DCC provides time switching to associate a line card to a given channel on a DS30A link. The DCC provides digital loop-around paths for fault isolation.

OPAC DS30A to DS-1 interface

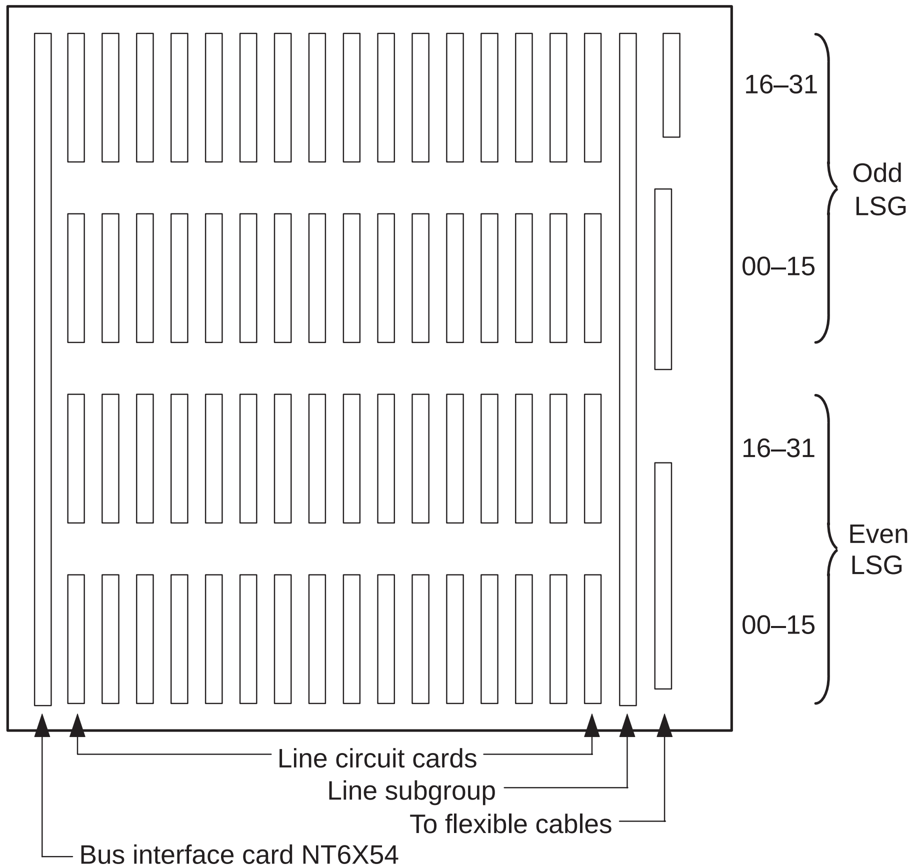


Line drawers

Each line drawer (NT6X05) in the LCA shelf has one bus interface card (BIC) (NT6X54AA) with a maximum of 64 line cards of different types. The following figure shows the side view of a normal LCA line drawer.

The line drawer can be removed from the frame to access line circuit cards while the drawer continues to operate. Flexible cables that connect to the back receptacles allow this condition.

LCA line drawer NT6X05AA, circuit card location



Drawer state display

The following table lists codes that display line drawer states at the MAP terminal. This text uses standard abbreviations instead of codes to describe line drawer states.

At the LCM level of the MAP display, drawers statuses display under the statuses of the LCM units. The drawers have numbers from 0 through 19. The drawers are in pairs to show that the drawers share the same BIC card.

The following display shows an example of drawer statuses:

```
                                11  11  11  11  11
DRWR: 01  23  45  67  89  01  23  45  67  89
      ..  SS  ..  MM  MM  OO  ..  --  SS  I.
```

When the state of a drawer changes, the system updates the status display. The system can change the state, or the user can change the state manually.

LCM drawer states

Code	Definition (abbreviation)
• (dot)	In service (InSv)
I	In-service trouble (ISTb)
M	Manual busy (ManB)
O	Offline (OffL)
S	System busy (SysB)
–	Not equipped

Bus interface card

The BIC (NT6X54) is at the front of the line drawer, behind the front faceplate. The BIC connects to the two LSGs (64 line cards) in the BIC drawer.

The BIC connects the two 32-channel LSGs to both LCAs. The BIC also performs the following functions:

- scans line circuits for presence of a hook switch change or message (description of dialed digits)
- sends signals through a ringing multiplexer to control the relays in the power converter to select ringing and ANI/coin voltages
- monitors line drawer activity for maintenance
- performs digital loop-around on command from the maintenance system

The system accomplishes communication between LCA-0 and LCA-1 or between two LSGs through the single BIC in each drawer.

Line cards

The line cards are behind the BIC in four rows of a maximum of 16 line cards. The top two rows of line cards form the odd-numbered LSG, and the bottom two rows form the even-numbered LSG.

The LCA-1 control complex controls the odd LSG of both LCAs. This control complex normally uses the ten 32-channel peripheral-side (P-side) ports available on the DCC of LCA-1 to perform this action.

The LSGs and each line card in the LSGs have numbers. The LSG numbers in an OPAC range from LSG-00 through LSG-19. Line card numbers range from 00 through 31.

The system uses these numbers to identify and inventory each line card in the DMS-100 switch by line equipment number (LEN).

Parts of LEN for OPAC

Part	Description
Site	Four-character alphanumeric name that identifies the remote site of the OPAC. The LEN for a line configured in the host office has a site name of HOST.
Frame	Numbers 00–99 identify the OPAC frame that contains the line card.
LCM	Number 0 identifies the LCM in the frame that contains the line card. The OPAC contains one LCM. This LCM is LCM-0.
LSG	Numbers 00–19 identify the line subgroup of the LCM that contains the line card.
Circuit	Numbers 00–31 identify the position of the line card in the LSG. The following figure shows the numbering of line cards for identification in an LSG.

A complete LEN for an OPAC line card consists of five units of information, as the following table describes. The LENs for line cards in a normal office appear in the following table. The two LENs that appear are for OPAC-supported lines.

Example LENs for line cards

Site	Frame	LCM	LSG	LC
HOST	08	1	14	06
REM1	00	0	07	30
REM2	00	0	18	26

Line cards are available in several types. The OPAC can support different types of analog or digital telephone equipment.

The OPAC supports the following line cards:

- Standard line circuit card type A (NT6X17AA, AB, AC, AD)

- Line card type B coin (NT6X18AA, AB, BA)
- Message waiting line card (NT6X19AA)
- Message-waiting converter card (NT6X20AA)
- Meridian Business Set (MBS) line card 15KFT MDC Business Set (NT6X21AA, AB, AC, AD)

Standard line circuit card type A (NT6X17AA, AB, AC, AD). This card is the plain old telephone service (POTS) card. This card supports single-party, two-party, and PBX analog telephone sets (type 500 or 2500). The type A card supports loop start, superimposed ringing, and frequency-selective ringing with bridged ringers. The type A card supports the cutover control circuit.

Note: The position for LC-00 is assigned to a type A line circuit. The system uses circuit LC-00 to test analog ringing. Circuit LC-00 is not available for assignment to a subscriber line.

Line card type B coin (NT6X18AA, AB, BA). This card provides all features of type A and multiparty lines. The type B card supports coded ringing, private branch exchange (PBX) ground start and hotel/motel. The type B card supports analog pay telephone sets that require coin control.

If the suffix of the NT6X18 card is -AA or -AB and the line is ground start (GND=Y in table LNINV), run diagnostics again if initial diagnostics fail. To perform this action, add the Service order (SERVORD) option NPGD, Negate Partial Ground Start Diagnostics. This option allows the system to test the line against a smaller subset of ground start diagnostics. When you set option NPGD in table LENLINES, the system skips loop detector, reversal relay, and ground start relay tests.

Message waiting line card (NT6X19AA) provides the features of the type A line circuit and a message-waiting lamp driver circuit. When the circuit becomes active, this circuit causes the message waiting lamp on the associated telephone set to flash at 1Hz. The flashing lamp informs the subscriber that the system holds a message.

Message-waiting converter card (NT6X20AA) provides –150 V synchronized pulse for the message-waiting lamp circuit. This card is synchronized from the 2.56-MHz clock pulse in the OPAC. Install this card in slot positions 00 and 16 of the odd LSG for the card to function correctly.

Meridian Business Set (MBS) line card 15KFT MDC Business Set (NT6X21AA, AB, AC, AD) supports MDC-related electronic multiline telephone sets and operator consoles.

The NT6X21AD line card provides a voice and signaling interface between the following line and channel:

- a 2-wire, analog subscriber line
- one channel of the 4-wire, a 32-channel 2.56 Mb/s bit stream of the DMS-100 Family of Digital Multiplex Switching Systems

The card occupies one slot in the line drawer of the LCM for use with a P-phone telephone set. This telephone set connects to the line card with a non-loaded (NL) pair of metal conductors. Simultaneous voice and extended signaling services are provided on the same loop.

The transmission bandwidth on the loop divides into two frequency bands:

1 Voice channel, 300–3400Hz

2 Low level signals replace signaling channel, 6–10kHz, normal high-voltage signaling (ringing).

The NT6X21AD is a single line circuit line card that is hardware backward compatible with the NT6X21AC line card. This card must have correct DIP switch settings for this capability. The card provides enhanced features such as the following:

- the reduced messaging noise
- the DIP switch selectable balance impedance
- the UDLC (universal digital loop carrier) optimized operation
- the DIP switch selectable (0 or –3.5dB) gain in the D/A (digital to analog) direction
- the DIP switch selectable short-loop/long-loop (slp/llp), signaling levels

The system requires feature AE1516 to allow datafill of the NT6X21AD card code. The system requires this feature for maintenance and diagnostics on the following:

- the new selectable signaling level
- selectable voice receive D/A level
- selectable balance impedance

The following table lists the recommended DIP switch settings.

Recommended NT6X21AD S1 DIP switch settings

Recommended application	D/A voice S1		Balance S2		Signaling level S3 and S4			
	switch position ON	OFF	switch position ON	OFF	Both ON	Only S4 ON	Only S3 ON	Both OFF
	0dB	–3.5dB	NL	9+2	1.3Vpp	0.8Vpp	0.6Vpp	0.14Vpp
P-phone sets long loop: 19–24dB EML	X		X		X			
P-phone sets medium loop: 17–19dB EML	X		X			X		
P-phone sets medium loop: 4–17dB EML		X		X			X	
P-phone sets short loops: 0–4dB EML		X		X				X
Northern Telecom UDLCs		X	X					X
Other vendors UDLCs	X			X			X	
6X21AC equivalent mode		X	X		X			

Note: dB=decibel
NL = non-loaded
9+2=loaded (900 ohm + 2.16 micro-farads) network
Vpp=voltage peak to peak
EML= estimated measured loss, as defined in NTP 297-2011-180 BCS35 version 01.02

The following two tables list the two acceptable limits for transhybrid loss (THL) that depend on the D/A level selected. The NT6X21AD uses the same diagnostics as the NT6X21AC. This use causes the modification of the THL limits for diagnostic purposes. The first table is for the NT6X21AC line card and the second table is for the NT6X21AD line card.

NT6X21AC THL Limits

Frequency	304	704	1505	3204
Minimum	–6.2	–6.2	–6.2	–7.2
Maximum	+1.3	+0.8	+0.8	+0.7

NT6X21AD THL Limits

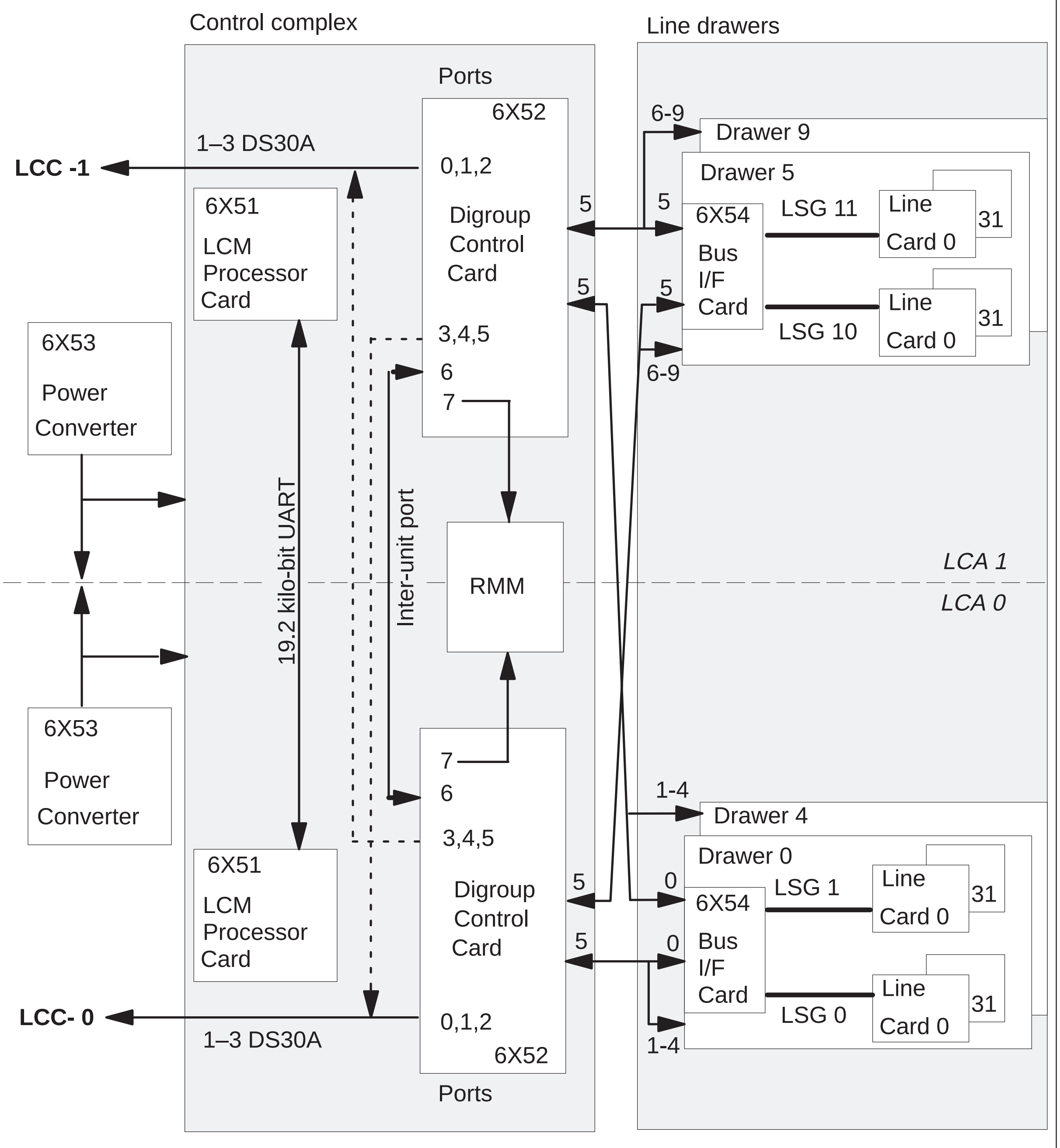
Frequency	304	704	1505	3204
Minimum	–2.7	–2.7	–2.7	–3.7
Maximum	+4.8	+4.3	+4.3	+4.2

System software requires the two limits to determine which D/A gain is selected on the line card. System software requires the two to compare THL test results against both possible limits.

- Data line card (DLC) DMS-100/200 (NT6X71AC) provides data transmission interfaces for operation with computer terminals.
- Datapath bit error rate tester line card (NT6X99AA). This line card provides bit error rate performance (BERP) testing transmission paths to access bit error performance of OPAC hardware components.

Refer to the figure “LCA block diagram” for a functional view of the OPAC LCA shelves. This description includes the components of the following figure.

LCA block diagram



Note: Ports 3, 4, and 5 are active through the backplane wiring in the takeover mode only.

HIE description

The HIE occupies a single shelf position in the OPAC frame. The HIE allows LCA shelves of the OPAC to connect to the RMM and host office. The HIE shelf contains the following components:

- two ringing generators
- two LCCs
- two to three DS-1 interface cards
- two power converters
- one ESA control complex (optional)

The following sections describe these components.

HIE shelf configuration

As the following figure shows, two ringing generators occupy slots 01–08 in the HIE. Each generator is four slots wide. When provisioned, the optional ESA control complex occupies slots 14 through 16.

The LCCs occupy slots 17 and 18 of the HIE shelf.

Two power converters occupy the far right of the HIE shelf in slots 22 to 24 and 25, in that order. Slot 25, the slot the most near the right on the shelf, is as wide as three normal HIE slots.

Figure “HIE shelf layout” and table “Host interface equipment shelf layout” describe the cards in the host interface equipment shelf.

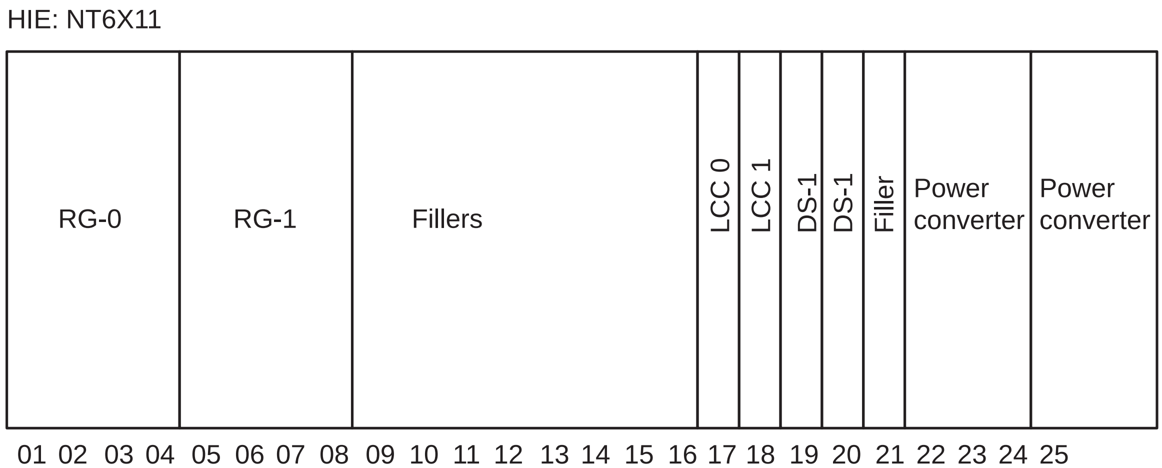
Ringing generators

The North American ringing generators (RG) (NT6X60) contain frequency circuits that generate ringing signals to subscriber line cards on the LCA shelves. Ringing patterns meet requirements set by Bell Canada and Telcordia Technologies. Ringing generators support coded, superimposed and frequency selective ringing.

The ringing generators contain ANI and coin generator circuits. These circuits check for two-party or four-party ANI, and for coin presence in prepay coin telephones.

The ringing generators produce voltages required for ANI and coin control (48 V dc and 130 V dc). The ringing generators monitor ANI and coin voltages and ring bus outputs for failure.

HIE shelf layout



Host interface equipment shelf layout

Slot	Abbreviation	NT PEC	Remarks
01–04	RG-0	6X60	North American ringing generator
05–08	RG-1	6X60	North American ringing generator
09–13		0X50	Filler panel
14–16	ESA	(Note 1)	(Note 1)
17, 18	LCC	6X73	Link control card (LCC-0, LCC-1)
19, 20	DS-1	6X50	DS-1 interface (2 DS-1 links for each card)
21		0X50	Filler panel (Note 2)

Note 1: When ESA is not provisioned, these card slots have filler panels (NT0X50AA). When selected, the ESA package has two possible configurations. Refer to sections “ESA hardware” and “ESA control complex” in this document.

Note 2: If additional DS-1 links are required to total six DS-1 links, NT6X50 replaces the filler panel in slot 21.

—continued—

Host interface equipment shelf layout (continued)

Slot	Abbreviation	NT PEC	Remarks
22–24		2X70	Power converter
25–27		2X70	Power converter

Note 1: When ESA is not provisioned, these card slots have filler panels (NT0X50AA). When selected, the ESA package has two possible configurations. Refer to sections “ESA hardware” and “ESA control complex” in this document.

Note 2: If additional DS-1 links are required to total six DS-1 links, NT6X50 replaces the filler panel in slot 21.

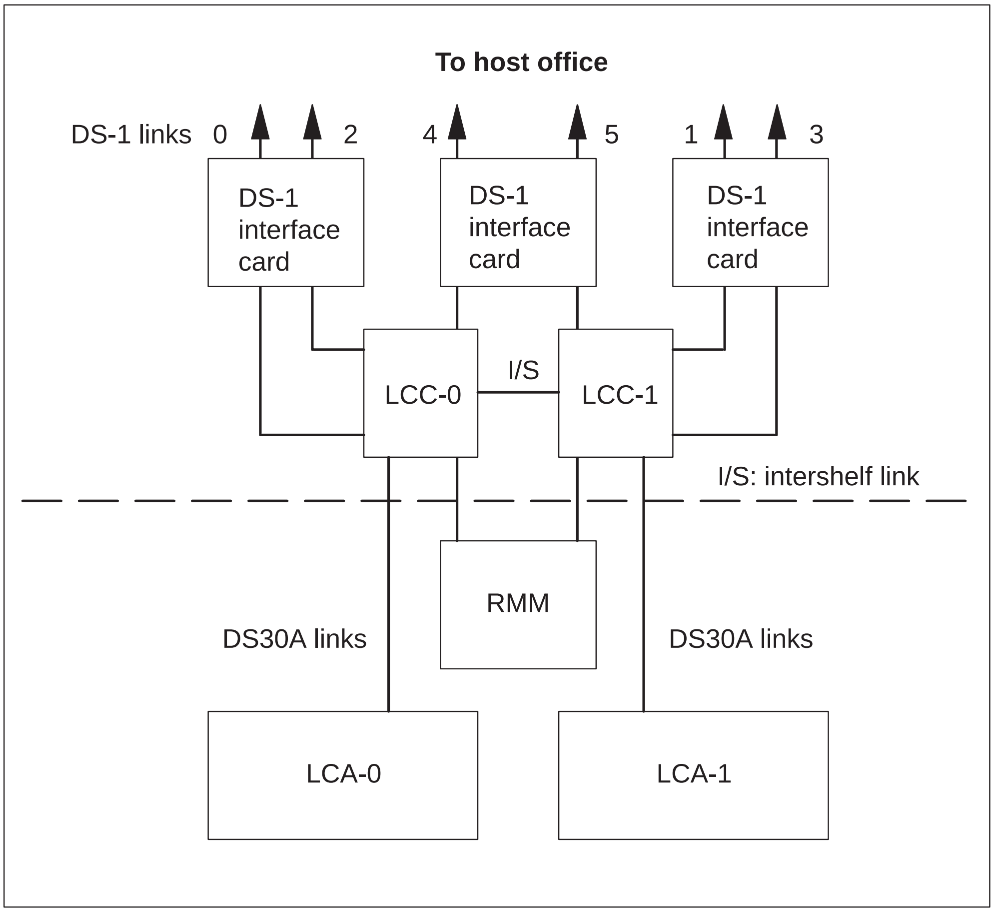
—end—

Link control cards

The two LCC cards (NT6X73) fill slots 17 and 18 of the HIE. Each LCC provides an interface between eight DS30A ports from an OPAC LCA shelf and DS-1 links to the host office. The LCCs provide an interface between the ESA processor, if provisioned, and the LCM.

The following figure shows how the DS-1 links terminate on the LCC and in the LCA.

LCC interface to DS–1 interface cards



In normal conditions, when both are active, LCC-0 connects LCA-0, and LCC-1 connects LCA-1. The LCC-0 serves even-numbered DS-1 links (0, 2, 4) from the DS-1 interface cards. The LCC-1 serves odd-numbered DS-1 links (1, 3, 5). The previous figure shows the configuration of the LCCs.

One-to-one mapping of LCA primary ports can occur with the DS-1 links. In this condition, all 24 DS-1 link channels come from one 32-channel DS30A port. The system uses additional channels for control and signaling from the host and for intraspeech and interspeech channels.

The LCC accepts eight DS30A links from the LCA of the LCC. Through the LCC, these links provide the following:

- message and speech paths to the host
- connection to the RMM
- link-sharing resources for each LCA

The DS30A ports in the LCA have numbers 0 to 7. The following table lists DS30A port functions.

LCA port assignments and use

Number	Port type	Functions
0, 1, 2	Primary	Carries three message channels for the LCA shelf. Message channels map to channels 1, 2, and 3 of each of the two primary DS-1 links to the host office. Other channels that carry speech map to channels 4 through 24 of the primary DS-1 links.
3, 4, 5	Image	Normally inactive, these ports become active if the mate LCA and LCC are inactive and takeover occurs. Port 3 takes over mate port 0 and port 4 takes over mate port 1 of the mate LCA. Port 5 takes over mate port 2 of the mate LCA. The system maintains mapping of all channels to the DS-1 links. The active LCC takes control of all DS-1 links.
6	Interlink	Provides a DS30A link for connections between shelves. The following action occurs during call processing. The channels on this port allow a subscriber line on one LCA to connect to a subscriber line in the mate LCA. This action leaves DS-1 channels to the host office free.
7	Maintenance	Provides the LCA access to the RMM through the LCCs. Selection of separate line circuits can occur through RMM ports. Metallic test access (MTA) connections can connect to the tip and ring leads for tests.

The LCC provides system clocks for the DCC, RMM, and LCM. When both units of the LCM are active, LCC-0 is frequency-locked to the primary DS-1 link of the LCC-0. The LCC-1 clock is locked to LCC-0. Both LCC clocks get timing from the host LTC.

DS-1 interface cards

The DS-1 interface cards (NT6X50) are in slots 19 and 20 of the HIE shelf. An additional card can be provisioned in slot 21 in place of the filler panel. Each DS-1 interface card accepts two DS-1 links from the host office LGC/LTC. Each DS-1 interface card connects the two DS-1 links to the LCC on a maximum of six links.

The system requires a minimum of two DS-1 cards for the two primary message channels from the LCM. The system carries these two message channels on different cards for reliability.

The addition of an optional third DS-1 card only occurs in the following condition. The system must require DS-1 links to handle the traffic load of the OPAC.

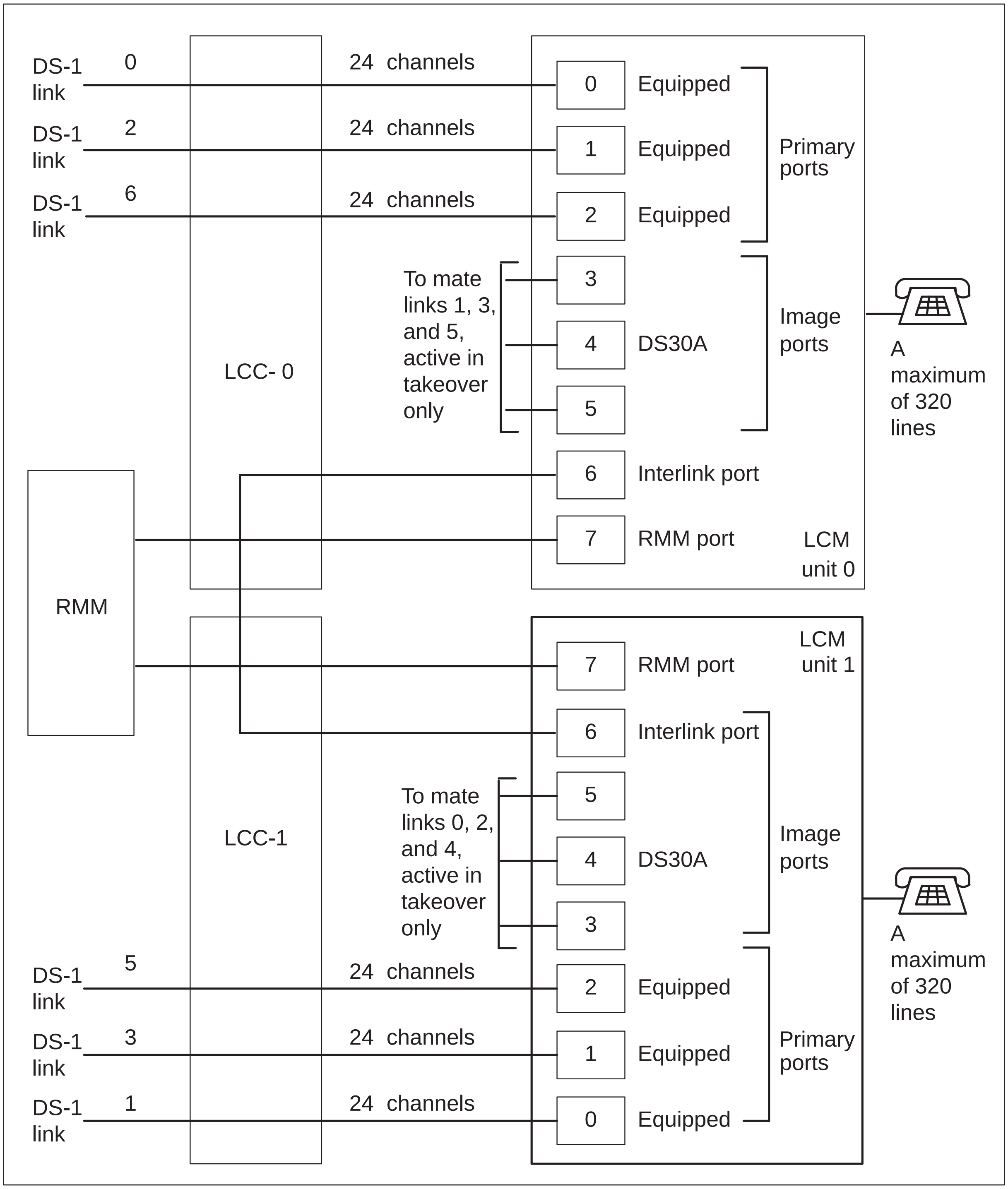
The DS-1 ports are not duplicated. Each processor in the LCA shelves of the OPAC can control all six DS-1 ports.

Primary ports that map one-to-one with DS-1 links are equipped ports. The number of equipped ports in an LCA depends on the number of DS-1 interface cards provisioned in the HIE.

If three DS-1 cards are provisioned, all three primary ports (0, 1, and 2) for each LCA are equipped. If a port is not equipped, the system does not use the port. The system can use the port for features that additional OPAC feature packages contain.

The figure on page 1-24 shows the OPAC link, port, and channel structure.

OPAC link, port, and channel structure



Power converter card

Two HIE power converter supply necessary shelf voltages (5 V, 12 V) for the HIE shelf. These power converters are in slots 22 to 24, and 25 to 27.

ESA control complex

If the user selects the ESA feature package, two configurations are possible.

The NT6X45AF based ESA package consists of three pieces of equipment:

- one ESA memory card (NT6X47AC), slot 14
- one ESA processor card (NT6X45AF), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

The NTMX45AA based ESA package consists of two pieces of equipment. This package includes an ESA processor that enables duplicate Nxx in ESA mode and provides firmware downloads. This card has 8 Mbytes of on-card memory. With this package, the ESA memory card is not needed and slot 14 has a filler plate.

- one ESA processor card (NTMX45AA), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

Remote maintenance module

The following paragraphs describe the remote maintenance module (RMM).

RMM description

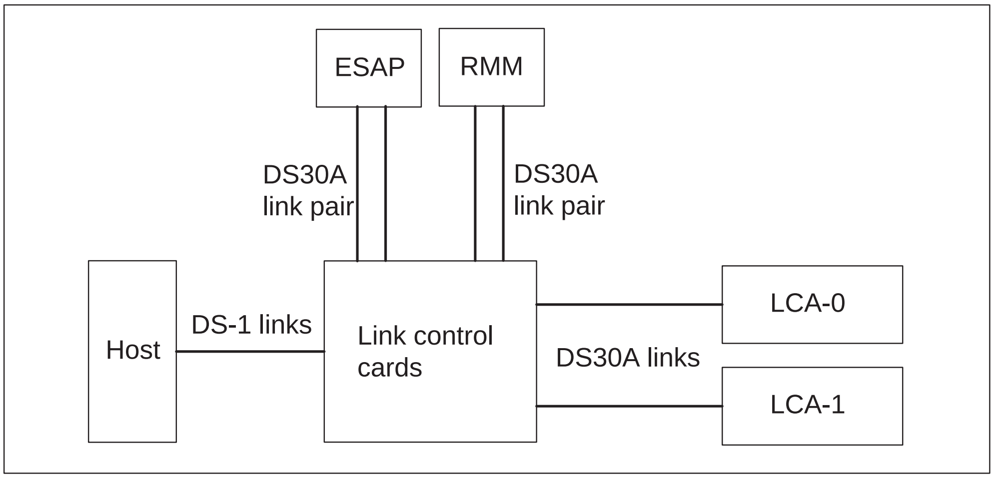
The RMM occupies one shelf in the OPAC The RMM is a modified form of the maintenance trunk module (MTM) with reduced cost. The RMM contains a processor for the RMM. This processor scans service circuits and digit collection during ESA.

The RMM C-side interface uses a pair of DS30A links, one to each LCC, in the HIE shelf. The DS30A links make sure that the RMM can operate when any LCC is active. The LCC passes maintenance requests from the host to the RMM. The LCC provides a link between the RMM and line circuits in the LCA.

At the host office, operating company personnel use the MAP terminal to direct OPAC maintenance to the RMM. The following figure shows how the RMM communicates with the host and the LCA through the LCC. The RMM uses DMS-X protocol to communicate with the host in a reliable method. The RMM uses the LCC interface to the DS-1 links.

The RMM can accommodate a maximum of 14 maintenance and service circuit cards. These cards vary in type and meet different provisioning requirements.

RMM connection with host and LCA through LCC



RMM shelf configuration

The RMM shelf has 20 slots. The HIE has 25 slots. The two slots on the far left of the RMM (01, 02) are assigned to the DS30A interface and control cards. Slots 17, 18 and 20 are on the far right of the shelf. These slots contain two types of power converters required in the RMM.

The remainder of the shelf (slots 02 to 16) are assigned to service circuit cards provisioned to meet office engineering requirements. The following figure is an example of card selections for a normal RMM.

RMM control card

The RMM control card (NT6X74AB), located in slot 02, is required in the RMM. The RMM control card acts as an interface between the LCA shelves and the following:

- test trunks of the RMM
- service circuits of the RMM
- alarm circuits of the RMM

The RMM control card processes DMS-X messages, trunk messages, and pulse code modulation (PCM) data.

Power converters

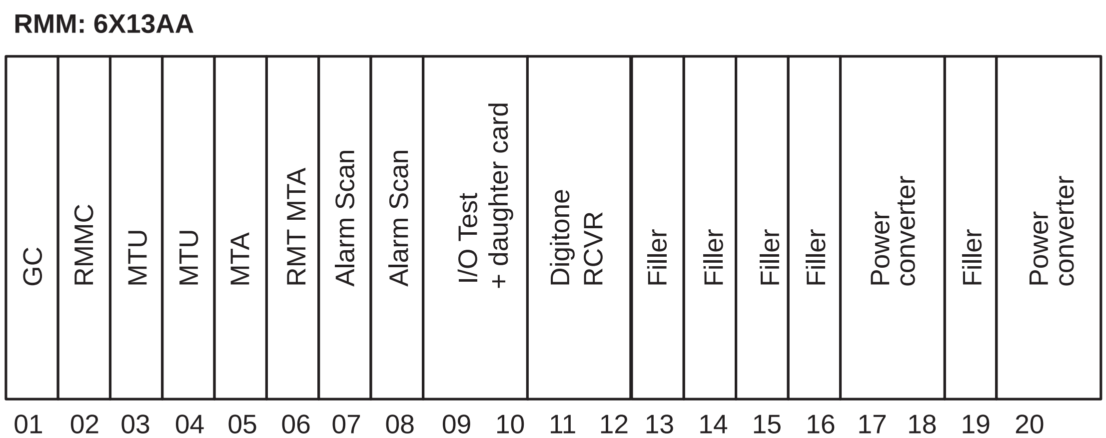
Two types of power converters are required in the RMM shelf:

- multioutput power converter (NT2X09)

- 5 V/40 A power converter common features (NT2X06)

The multioutput power converter occupies slots 17 and 18 of the RMM. This converter provides a regulated, common-ground dc power supply with five different outputs (+24 V, +12 V, +5 V, -15 V, and -5 V). The other power converter occupies slot 20, the slot to the far right of the RMM. This converter provides a regulated 5 V/40 A power supply to the RMM shelf.

Remote maintenance module shelf



RMM equipment shelf layout

Slot	Abbreviation	NT PEC	Remarks
01	GC	NT2X59AA	Group CODEC DMS-100/200
02	RMMC	NT6X74AB	RMM control card
03	MTU	NT2X10BA	Multiline test unit analog
04	MTU	NT2X11BA	Multiline test unit digital
05	MTA	NT3X09BA	Metallic test access(8X8)
06	RMT MTA	NT3X09AA	Remote metallic test access (4X8)
07–08	Alarm scan	NT0X10AA	Miscellaneous scan card

Note: The NT2X48AB card is part of the ESA hardware package. Requirement of this card occurs when the ESA option is provisioned.

—continued—

RMM equipment shelf layout (continued)

Slot	Abbreviation	NT PEC	Remarks
09–10	I/O test	NT2X90AD	Input/output test card with NT2X77AA daughter board
11–12	Digitone RCVR	NT2X48AB	Digitone receiver
13–16		NT0X50AC	Filler panel
17, 18		NT2X09AA	Multioutput power converter
19		NT0X50AC	Filler panel
20		NT2X06AB	Power converter common features

Note: The NT2X48AB card is part of the ESA hardware package. Requirement of this card occurs when the ESA option is provisioned.

—end—

The group coder/decoder (CODEC) card NT2X59AA, located at the far left of the RMM shelf in slot 01, is required. This card codes analog samples from the RMM trunk circuits into PCM code words. This card decodes the PCM words from the host or OPAC lines into analog samples.

Provisionable maintenance and service cards

Slots 03–16 of the RMM can be provisioned with various maintenance, test, and service circuits. The number and types of these cards depend on engineering needs. These provisionable cards follow:

- The remote metallic test access (RMTA) card (NT3X09AA) provides metal connections between test access points in the line circuits and testing equipment. This card consists of a two-wire metal matrix with four vertical buses and eight horizontal buses. One vertical bus connects to the MTA bus for the 320 line circuits in LCA-0. The other vertical bus connects to a similar MTA bus in LCA-1. Two vertical buses are not used. The horizontal buses connect to service circuits or spare line circuits. Host office circuits provide MTA functions during normal OPAC operation.
- The 8x8 metallic test access (MTA) card (NT3X09BA) performs the same functions as the 3X09AA. This card has eight vertical buses and eight horizontal buses.

- The miscellaneous scan (SC) card (NT0X10AA) provides an interface where the DMS-100 alarm system software can monitor the state of the OPAC hardware. The system monitors the OPAC hardware state to detect alarm conditions or manually controlled operations. The SC card divides into two circuits. Each circuit is an SC group. Each SC group contains seven SC points. Each SC point connects one circuit to monitor for a change in state.
- The Digitone Receiver (DTR) Card (NT2X48AB) contains four Digitone Receivers to collect digits during OPAC ESA.
- The multiline test unit (MTU) card (NT2X10BA, NT2X11BA) is a testing facility that can connect to a selected line circuit through the remote MTA. The MTU contains two cards, an analog test and measurement card (NT2X10BA) and a control card (NT2X11BA). The two cards must be side by side, and the NT2X10BA must be in an odd-numbered slot. The MTU performs tests and measurements on a subscriber loop or line card circuit. The MTU can test MBS lines and OPAC battery maintenance. The NT2X11BA control card is an interface between the MTU analog card and the RMM. The MTU contains two internal test units.
- The incoming/outgoing test trunk card (NT2X90AC) provides an interface between external test equipment (like the number 14 line test desk) and the RMM. The test trunk card provides monitoring and speech circuits to subscriber lines. The test trunk enables operator calls that verify through a VER90 trunk.

Modular supervisory panel

The NTRX40AA MSP contains the following:

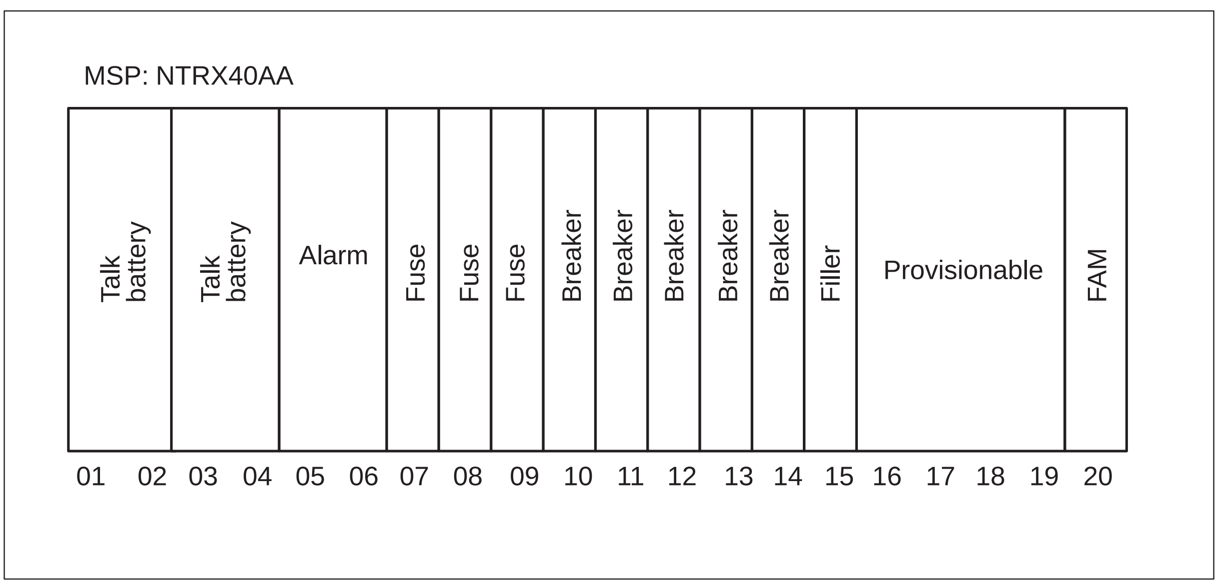
- two talk battery filter (NTRX44AA) modules that provide filtered power feed and inrush current protection
- one alarm module (NTRX41AA) that performs the following:
  - monitors and detects faults
  - provides maintenance facilities in the form of telephone, data, and alarm battery supply (ABS) jacks
- three fuse modules (NTRX43AA) that perform the following:
  - act as termination points for power feeds
  - supply current-limited outputs for miscellaneous circuits
  - report fuse and breaker failures to the NTRX41AA alarm module
- one fan alarm module (NTRX66AA) to monitor fans in the roof and auxiliary cooling units and determine if any fans failed

- ten dc circuit breakers on five circuit breaker modules (NTRX42AA, EA) to control power distribution to each electronic unit. Refer to the following table for breaker assignments.

Circuit breaker assignment for MSP in OPAC

Circuit breaker	Assignment	Location in OPAC
CB01	LCA power converter	LCA 0
CB02	talk battery	LCA 0 talk battery/RMM talk battery
CB03	LCA power converter	LCA 1
CB04	talk battery	LCA 1 talk battery
CB05	HIE power converter	HIE slot 22
CB06	RG 0	HIE slot 01
CB07	HIE power converter	HIE slot 25
CB08	RG 1	HIE slot 05
CB09	RMM power converter	RMM slot 17
CB10		Main breaker for equipment in slots 16–19

MSP shelf



MSP equipment shelf layout

Slot	Abbreviation	NT PEC	Remarks
01–02	Talk battery	NTRX44AA	Talk battery filter
03–04	Talk battery	NTRX44AA	Talk battery filter
05–06	Alarm	NTRX41AA	Alarm module
07–09	Fuse	NTRX43AA	Fuse module
10	CB	NTRX42EA	Circuit breaker module
11	CB	NTRX42EA	Circuit breaker module
12	CB	NTRX42AA	Circuit breaker module
13	CB	NTRX42AA	Circuit breaker module
14	CB	NTRX42EA	Circuit breaker module
15	–	P0734476	Filler panel
16–19	–		Provisionable
20	FAM	NTRX66AA	Fan alarm module

Software description

The following paragraphs describe the software operation of the Remote Line Concentrating Module feature package NTX146AA. This package provides the base software for the OPAC.

Interface to DS-1 links

The OPAC connects to the host controller through DS-1 links. The LCCs assign data again. This data is data carried over the 32 channels of a DS30A link to 24 channels of a corresponding DS-1 link. The system uses six additional channels for intraswitching, where installed and signaling.

LCC control data

When a unit of the OPAC must be INSV, the LCC for that unit receives control data from the LCM. This data indicates the number of DS-1 cards equipped and which clock source to use.

The LCM receives this data from the host LTC/LGC. The host sends messages to the LCM unit

- during the return to service (RTS) of the host
- when the computing module (CM) attempts to switch the LCM clock source from one LCC to the other

The LCC clock source is frequency-locked to the primary DS-1 links. The OPAC software controls the LCC clock source with one exception. This exception occurs when both units of the LCM are inactive. In this condition, LCM hardware forces each LCM unit to take the clock source from the LCC of that LCM unit.

Other host office functions

The software of the host DMS-100 Family office controls the following functions:

- class of service
- code interpretation
- screening
- routing
- billing

Signaling and supervision

Signaling allows the DMS-100 to communicate with the DMS-100 stations or other switching offices. The OPAC uses DMS-X protocol to communicate over OPAC DS-1 links with the host office.

The DMS-X is a half-duplex, byte-oriented protocol like DS30. The DMS-X receives and transmits message data over full-duplex media like the DS-1 links. The DMS-X is a state-driven code that requires handshake messaging between the OPAC and host at each data transfer stage.

The byte transfer rate over DS-1 channels is 1.44 Mbyte/s.

Subscriber tones

The host LTC/LGC provides cadenced tones that the OPAC applies as required to subscriber lines. The host LTC/LGC supports and the OPAC applies the following tones:

- dial tone
- audible ringing
- warble (MBS ringing)
- busy tone
- reorder tone
- receiver off-hook (ROH) tone

The DMS-100 switch CM has power over the OPAC. The OPAC is not involved in signaling between the host office and other systems.

Intracalling capability

Intracalling capability is provided for the OPAC with feature package NTX156AA. The intracalling feature distributes the OPAC traffic load again to enable DS-1 links to the host to handle external calls. This feature package allows interswitching of calls between subscribers on the same LCM unit the OPAC serves.

Interswitching occurs when calls connect between subscribers on different LCM units of the OPAC. Intraswitched and interswitched calls are accomplished through the LCCs in the HIE shelf. The LCCs connect in a serial method to the DS30A ports of the LCM.

Fault conditions

Faults can occur in the components of the OPAC. In the host office, the C-side links from the OPAC to the host LTC, LGC, or RCC can have faults. If these network links have faults, the system can lose messaging from the CM. The system can lose subscriber service.

A circuit card that has faults in the OPAC, including the power converter card, can affect subscriber service. The OPAC equipment, other than circuit cards, can have faults.

The OPAC P-side links toward the subscriber carry messages important to the maintenance of subscriber service. A P-side link that has faults can impact subscriber service.

The following paragraphs discuss specified fault conditions that can occur in OPAC components and the interfaces between OPAC components.

LCA shelf failure

A fault condition can cause one of the LCA units in the LCM to go out-of-service (OOS). When this event occurs, the INSV unit controls the lines of the INSV unit and the lines of the other unit. This function, called takeover, is an automatic maintenance feature of the LCM configuration. Refer to “Takeover capability” on page 1-45.

The LCA shelf goes into takeover if any of the following components fail:

- the mate processor
- the DCC in the mate unit
- the power converter in the mate unit
- the ANI and coin voltages in the mate ringing generator
- the mate LCC in the HIE shelf

Line drawer faults

A BIC or line card that has faults causes a fault condition in a line drawer. This fault does not cause a takeover.

Link failure

DS-1 links

Link failures normally associate with the DS-1 interface cards in the host controller or DS-1 link. Link failures also associate with the DS-1 interface cards in the OPAC. The system monitors through operational measurements (OM), which indicate when maintenance or OOS thresholds are exceeded.

The host controller performs the following actions:

- maintains and tests the DS-1 links
- generates alarms for link faults
- reassigns channels when faults occur on these links

Operating company personnel can perform the following actions to obtain the bit error rate (BER) count at the OPAC:

- post the host multiprocessor system-based peripheral module (XPM) like the LGC or LTC
- enter the command string POST REMOTE at the CARRIER level of the MAP display

The BER identifies the number of bipolar violations (BpV). The BpVs do not raise an alarm but can signal link wear.

The signals on a DS-1 link travel in two directions. This condition allows the host controller or the OPAC to detect faults like BpVs. The OPAC notifies the host controller when the BpV count exceeds the threshold of 1 BpV per 10^3 bits.

The OPAC monitors the loss of frame indicator for the DS-1 links. The OPAC turns on an outgoing alarm for any frame loss of more than 2.5 s. The system removes the outgoing alarm when the frame restores for 10 s.

Frame loss at the OOS limit occurs in one of the following events:

- the OPAC detects loss of the framing pattern for 2.5 s or more
- the host XPM detects loss of the framing pattern for 220 ms

A local carrier group alarm (LCGA) appears at the CARRIER level of the MAP display if the host XPM detects loss of frame.

A remote carrier group alarm (RCGA) appears if the OPAC detects the loss of frame.

DS30A links

The DS30A links on the P-side of the OPAC can fail. These links connect to an RMM or ESA module**.** Faults on these links can affect associated modules.

Load file mismatch

A load file mismatch fault condition occurs when a load in the LCM does not match the load specified in table LCMINV.

Automatic maintenance

The DMS-100 switch Family of peripheral modules (PM) are reliable in different fault conditions.

The PMs contain several hardware redundancies backup operations for module, card, and link failures. Some fault conditions do not require intervention.

When fault conditions occur, the DMS-100 switch and the OPAC initiate audits or other system actions. These audits and actions attempt to find and automatically correct the fault.

The following sections discuss the types of automatic maintenance:

- OPAC audits
- checksums
- overload resources
- takeover capability
- ESA capability
- OPAC RMM maintenance
- drawer testing
- BIC relay testing (BRT)
- subscriber line automatic maintenance
- LCM routine exercise (REx) tests

OPAC audits

Audits run in the OPAC each 5 s to refresh the control data for DS-1 and LCC circuits. Audits monitor the LCC for faults. A second audit runs each 500 ms to monitor DS-1 interface cards for faults.

The following paragraphs describe the functions of these system audits as the functions affect LCC and DS-1 circuits.

Link control card maintenance

The OPAC monitors the status of the LCC of the OPAC. The OPAC performs this action to make sure of the following:

- the system correctly transmits control data to the LCC
- an inactive LCC clock runs fault free

The system rewrites control data at normal intervals.

DS-1 interface card maintenance

For each DS-1 interface card of the OPAC, the OPAC automatically monitors the BpV counter. The OPAC notifies the CM when the count exceeds the threshold of 1 BpV per 10^3 bits (10 kb).

The OPAC monitors the loss of frame indicator for the DS-1 links. The OPAC turns on an outgoing alarm for any frame loss of more than 2.5 s. The system removes the outgoing alarm when frame restores for 10 s.

When the OPAC detects DS-1 slips, the OPAC increases a slip counter. The OPAC provides a message-driven interface to allow the host office to query the counter from the CARRIER MAP level. The system rewrites control data to the DS-1 cards at normal intervals.

LCM drawer maintenance

A system audit runs each 10 min for each LCM and attempts to RTS any drawers in the SysB state. If the system detects any faults, the system tests and handles drawers in the ISTb state.

The following table notes LCM unit states and corresponding tests.

Full in-service tests

State	In-service tests	Busy
InSv	In-service tests	Out-of-service tests
Bsy, Sane	In-service tests	Full (all) tests
Bsy, Insane	Stand-alone in-service tests	Stand-alone out-of-service tests

Checksums

For the DMS-100 Family of PMs, a number calculates the checksum (CHKSUM) for each software load. After you load and test the PM, the system compares the checksum total with the expected checksum total. If the totals match, the load is correct.

If a mismatch is present, use the LOADPM command to load the PM again. Each PM type has a different checksum value for each load. The command QUERYPM displays a checksum value for the load of the PM.

Overload resources

When the OPAC processes calls, the OPAC queues call requests. The OPAC assigns priorities to the call requests in the OPAC data store. The OPAC overload controls react as the data store fills close to capacity. The OPAC overload controls slow the rate of load acceptance or halt the call process until store is available.

The amount of call processing can be greater than the LCM processor cards can handle. In this event, the OPAC accepts calls at a slower rate until the overload clears.

Overload control in the OPAC occurs for C-side communication and line scanning.

When LCM processor cards slow or stop C-side communication, LCM processor cards scan for messages on the C-side at a decreased rate. The need for data store decreases when LCM processor cards slow the incoming work load. The LCM processor cards slow MAP terminal queries of OPAC status and C-side responses to OPAC-supported terminals.

During overload, the LCM processor cards do not scan the BIC until enough data store is available. When LCM processor cards do not scan the BIC, LCM processor cards prevent incoming work from the P-side. The LCM processor cards queue incoming work in the output buffers of the BIC.

When the buffers are full and the system does not accept more work, partial dials or ignored keys on business sets result.

Display of overload state

When the OPAC overloads, the LCM status display of the OPAC changes to ISTb while both units show INSV. When you enter the command string QUERYPM FLT at the LCM level, the response `LCM Overloaded.` appears with the response.

Log reports PM128 and PM181 indicate the overload condition in the OPAC. When call processing resumes, the system generates PM128 with the `LCM Out of Overload` response.

Overload control

Overload control maintains system sanity and component sanity during overload conditions. Flow control provides overload control. Flow control provides a use trigger to regulate the basic flow task to the central processing unit (CPU). Flow control regulation begins when the CP level tasks use a specified percentage threshold of available CP level real time. When CP level tasks use a lesser percentage of available CP level real time, flow tasks send another message. This message indicates that the overload condition passed.

Current XLCM overload controls

The extended memory line concentrating module (XLCM) has 256 kbytes of memory and a known number of small, medium and large memory blocks. Each block is a fixed size. Domestic LCMs and XLCMs use only small and large memory blocks to receive external messages and to send messages. The system also uses small memory blocks (SMB) for utility purposes like timer control blocks. The system uses medium memory blocks (MMB) for Call Data Blocks (CDB). The CDBs hold associated data for active lines.

In the current XLCM application, the system reports overload when the XLCM cannot receive an external message, DMSX or Inter-Unit Communication (IUC). The XLCM cannot receive these messages because not enough small or large memory blocks are available. Service degradation can occur before the system enters overload.

The XLCM has four levels of throttling to prevent overload. Three levels are based on the number of available SMBs, and conserve SMBs. These levels of throttling give terminating calls priority over originations.

The following paragraphs describe the four levels of throttling.

1. The XPM throttles messages to the XLCM to a maximum of two messages every 50 ms. This action helps to control small peaks of very heavy traffic. Sustained messaging at this rate can drive the XLCM far into overload.
2. The XLCM appends the number of available SMBs for external messages to each POTS origination message. The XLCM appends this available number of SMBs to all messages that originate from P-phones. This number equals total available SMBs not including the number of SMBs in reserve. When this number is less than 20, the XPM delays processing the origination until this number returns to 20 or greater.

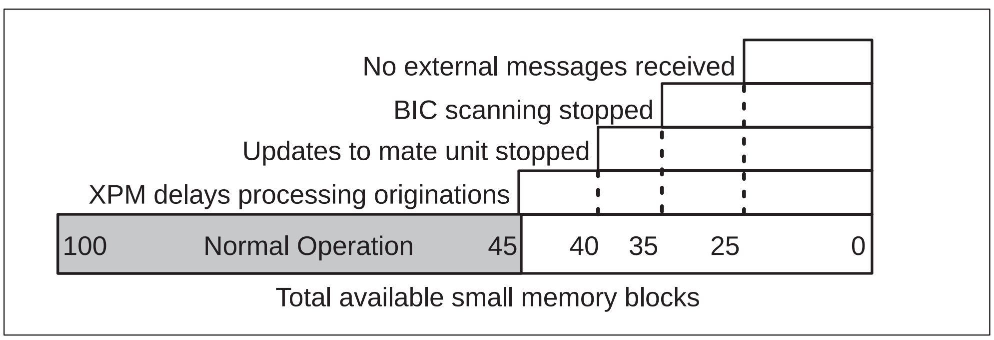
3 If the total number of SMBs available for external messages is less than 15, the following condition applies. The XLCM does not send call processing updates to the XLCM mate.

4 If the total number of SMBs available for external messages is less than 10, the following condition applies. The XLCM does not scan BIC for line scan changes.

To protect the XLCM during overload, an XLCM holds a reserve of small memory blocks. The system does not use these memory blocks to receive external messages. If the XLCM enters extremely heavy overload, internal processes have enough small memory blocks to finish tasks. The total number of SMBs available can be less than or equal to the SMB reserve size. In this condition, the system rejects external messages that require SMBs, except for maintenance or monitor messages. At this point, the XLCM sends an overload report to the computing module (CM).

The current overload protection system is static because the throttle levels are constant and do not react. The current overload protection system is also distributed. The system does not use one place to monitor overload or initiate and control protective measures.

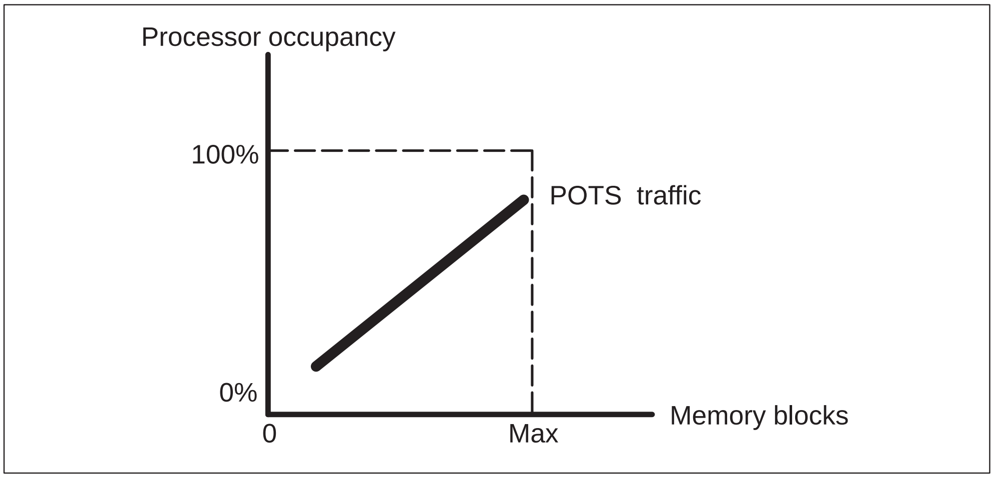
XLCM Overload Protection Systemxxx



Early POTS models of the small memory LCM (64k) show that LCM capacity has memory-block limits. The LCM runs out of small memory blocks before the LCM runs out of real-time use. The design of the LCM depends on this condition. Limits of memory block is an LCM characteristic carried over to the XLCMs.

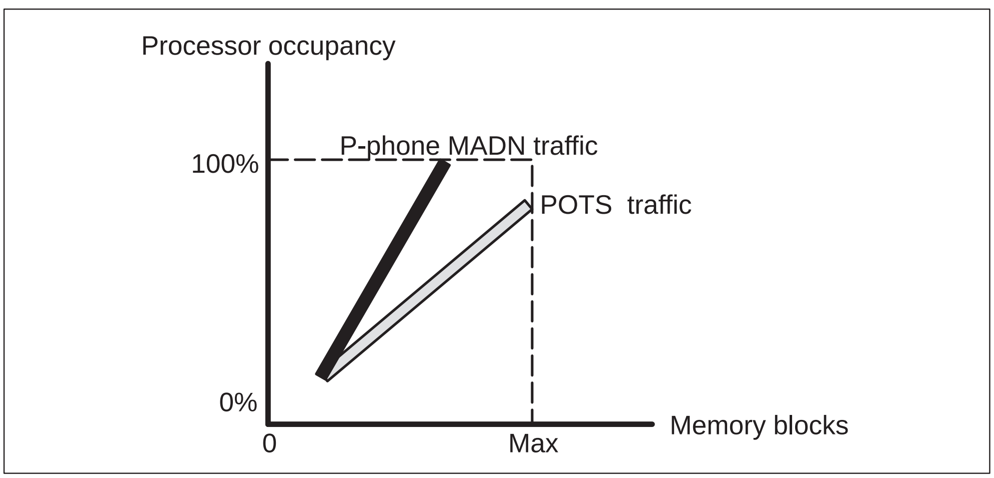
The XLCM overload system works with POTS traffic. The present selection of SMBs (100) and SMB reserve size (25) limits memory blocks of the processor with POTS traffic. The XLCM overload system uses all SMBs before the XLCM overload system uses all real-time use. The following rough graph compares processor occupancy or real-time use to memory-block use.

Processor occupancy (real-time usage) versus memory blocks

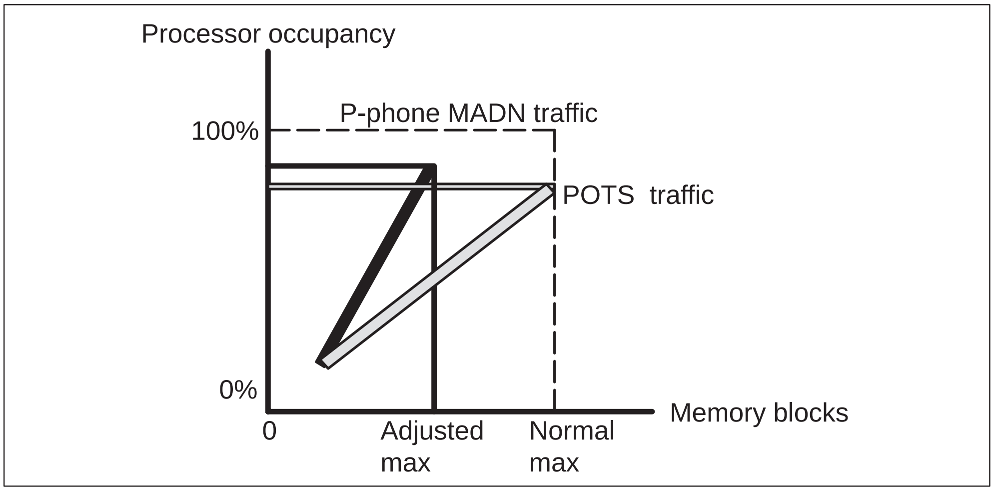


The XLCMs have more memory blocks than small-memory LCMs. Additional messaging requirements are present to accommodate some P-phones. These P-phones include P-phones provisioned with features like displays and Multiple Appearance Directory Number (MADN). The XLCM can use all the real-time before the XLCM uses all memory blocks. The following figure shows this real-time overload condition.

Processor occupancy—real-time overload



Processor occupancy—memory block reduction after real-time overload detection



The XLCM has memory block limits. Outages can occur because the XLCM cannot handle real-time overload. The following conditions can cause outages:

1 The system does not send an overload report because XLCMs do not detect real-time overload. As a result, the CM does not suspend functions that require a response from the XLCM. The CM suspends these functions when the system reports an overload. If the XLCM does not respond in time, the CM system busies the XLCM.

2 The system cannot handle being empty when lower priority tasks do not run. This condition can lead to traps or important software errors that cause the CM to system busy the XLCM.

Enhancements to the overload protection system

In addition to current functions, the enhanced XLCM overload protection system performs the following actions:

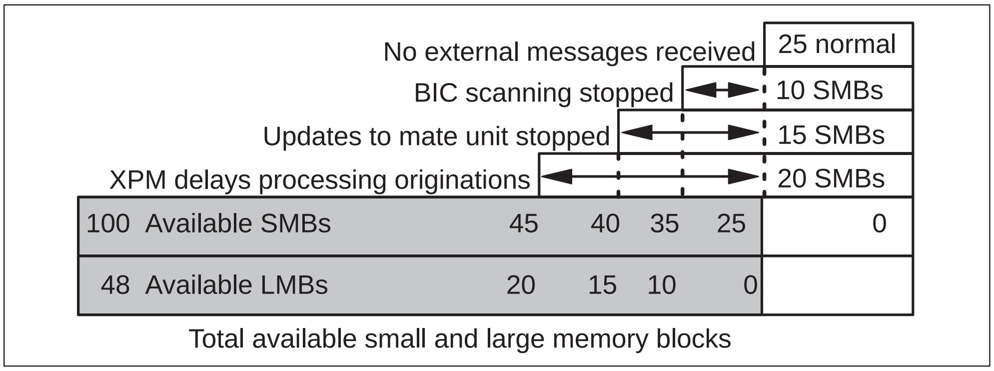
- detects when the XLCM is in real-time overload
- reports overload to the CM

Take protective measures to keep XLCM sanity. To retain XLCM call processing capacity, these protective measures are active for the minimum amount of time required.

This enhancement adds three new components to the current overload protection system.

- The processor occupancy data collection component is distributed over key areas of the XLCM code. This component collects raw data that can help detect real-time overload. This component leaves raw data in a depository for the data analysis component. The priority of this component matches the priority of the segment of the system where the component resides.
- The real-time data analysis component analyzes the data in the depository. This component produces an processor occupancy status that is easy to read. This status is a distress rating and not a percentage. The system does not use percentages. Percentages are to use when real-time is a small amount. Percentages do not supply all information that the control component needs. The control component uses the distress rating. The system reports the distress rating to the CM when the XLCM reports overload. The data analysis component indicates if the data analysis component runs normally. The data analysis component runs at a high priority.
- The real-time overload control component uses the distress rating output of the data analysis component. If the output indicates real-time overload, the control component adjusts parameters in the overload protection system. This action recovers some real-time and keeps the limits of memory block ahead of XLCM real-time limits. The following tables shows this action.   If the data does not indicate trouble, the following action occurs. The control component begins to restore the overload protection system parameters to allow maximum call processing. This component runs at a very high priority.

Overload protection system variable thresholds



Changes to the real-time subsystem

The real-time subsystem changes memory-block system parameters to keep limits of memory block ahead of real-time limits.

Improvements to the real-time subsystem include the following:

- The system discards work to preserve real–time. Until the recovery of real-time use, the real-time subsystem reduces the number of memory blocks available for external messages. The subsystem also reduces the number of associated throttles.
- Define real-time overload as a processor occupancy rate of 75 % or higher for a minimum amount of time. In the XLCM, calculation of percentages is very real-time intensive and is not a flexible method. Percentage calculation can result in early reaction if the XLCM is not in severe real-time trouble.
- Monitor the amount of time required to process key maintenance request at high levels (but not 100 percent) occupancy. This action makes sure that the XLCM responds to these requests before the CM times out or enters overload. The subsystem benchmarks the average time to process these key requests. If this action takes longer than this benchmarked average, the XLCM assumes real-time overload.
- Monitor idle task activity and enter real-time overload if an idle task does not run for a known period of time.
- Characterize the timer task slip counter at a high occupancy that is not 100%. If the timer task slips at more than the normal high occupancy rate, the XLCM enters real-time overload.
- Monitor the size of the set message queue. If this size gets too high, 40 or above, the XLCM is very near real-time overload.
- Include large memory blocks (LMB) in the work discard component for recovery of real-time.

XLCM log report appendages

The XLCM appends a new field to current overload messages sent to the CM. This new field reflects the level of the real-time overload. If the CM is at CCM04 or later, this new information appears in the following logs:

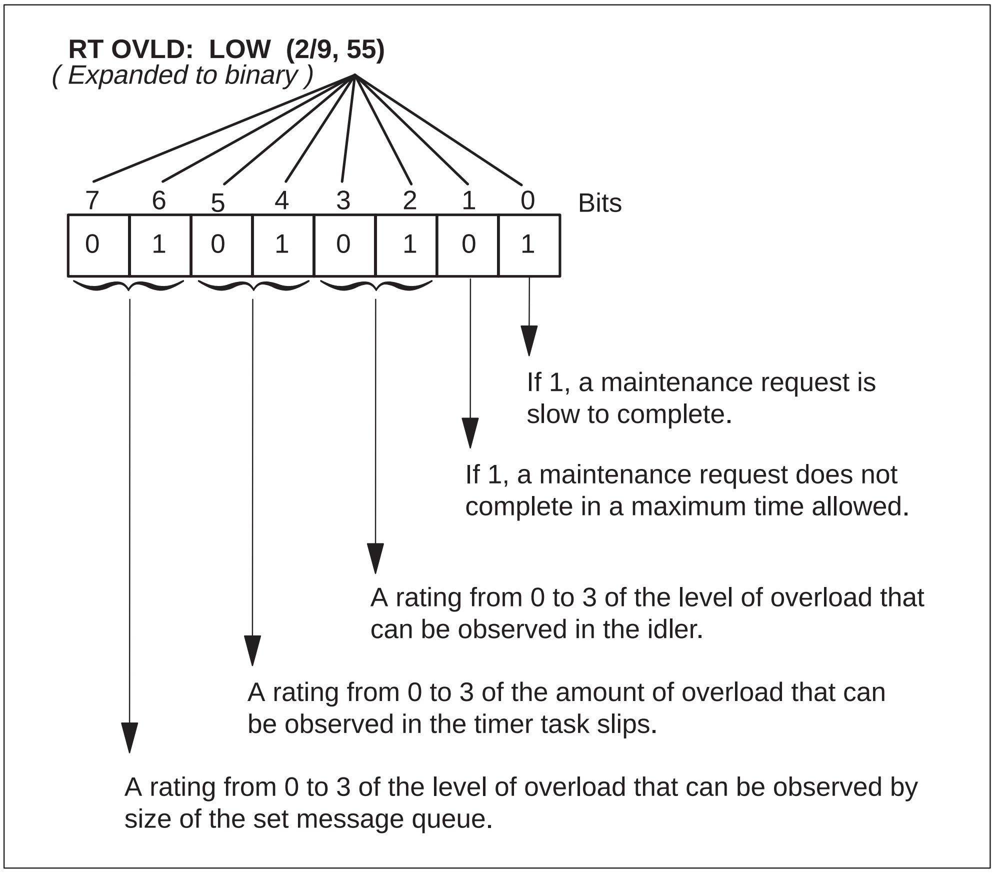
- modified PM180 LCM enters overload log
- modified PM180 LCM overloaded log

The new field contains a ratio of values 0 to 9 to values 5 to 9, where the values indicate the following:

- (0 to 9): the maximum real-time distress reached before the system must generate the overload report
- (5 to 9): the maximum level of real-time distress

The following table shows the real-time overload symptoms summary byte in hexadecimal output.

Summary of real-time overload symptoms



The XLCM maintains data about overload that provides a summary of the overload period. The summary is appended to the current overload exit message to the CM. If the CM is at CCM04 or later, a modified PM180 LCM out of overload log reflects this information.

This feature is active in XLCMs and International XLCMs with extended memory and XPM04 or later loads. The new logs automatically apply when operating company personnel install CCM04 in the CM.

This feature detects real-time overload and allows the system to report overload status to the CM. This feature preserves enough real-time to make sure that the XLCM can function according to the XLCM operating model. This model is memory block limited.

The real-time overload detection and protection subsystem integrate into the current memory-block overload system. When in real-time trouble, the system changes memory-block overload system parameters to reduce available memory blocks for new work. This action sheds work. This aspect of the design makes the new overload system dynamic. The system adjusts to allow very high processor occupancy under any traffic configuration.

Takeover capability

The LCM can operate in a load-sharing mode, because power connections between the two shelves of the LCM are present.

If one power converter fails, the mate converter supplies power to both shelves. This action is takeover. In the takeover state, the INSV unit assumes control of the lines. The INSV unit assumes control of the unit lines and the associated lines for the OOS mate unit.

The INSV unit has access to the DS30A C-side ports that the OOS mate used earlier. The DCC of the INSV unit accesses all 20 line subgroups (LSG).

The mate converter distributes ringing and ANI and coin control voltages to all 20 LSGs of both LCAs. The two ringing generators located in the HIE supply these voltages.

Takeover also occurs when one LCA control complex LCMP and DCC fails. The control complex that remains can support all DS-1 links and the LSGs of both LCAs.

The system terminates all calls in process at the time of takeover. These calls must be dialed again. The system maintains calls that are in progress and connected.

LCC takeover

The LCC provides an interface between the LCA and the DS-1 interface cards in the HIE shelf. Each LCA associates with an LCC in the HIE shelf. If an LCA shelf fails, the shelf is inactive and takes down the associated LCC.

If an LCC fails, the LCC takes down the associated LCA shelf.

If an LCC or an LCA shelf fails, the active LCC and LCA perform a takeover. The active LCC and LCA support the DS-1 links of the inactive LCC and LCA. Duplicate paths between the LCA shelves enable this takeover A takeback occurs when the inactive LCC and LCA become active again.

Takeback

When the failed unit returns to service, the system distributes again the subscriber lines that were in takeover back to their normal processor. The system does not lose any calls in talking or ringing states during a return to the normal mode of operation.

LCM talk battery audit

Before, the system did not report loss of talk battery to an LCM shelf unless the talk battery fuse had blown. The system did not report this loss because maintenance personnel did not receive an alert. The alert normally occurs when LCM subscriber lines cannot draw dial tone.

The Talk Battery Alarm feature addresses this problem. This feature adds new CM and LCM maintenance software that audits each LCM shelf for the presence of talk battery. If the audit fails to detect talk battery, the audit alerts maintenance personnel with a critical alarm log report (PM179).

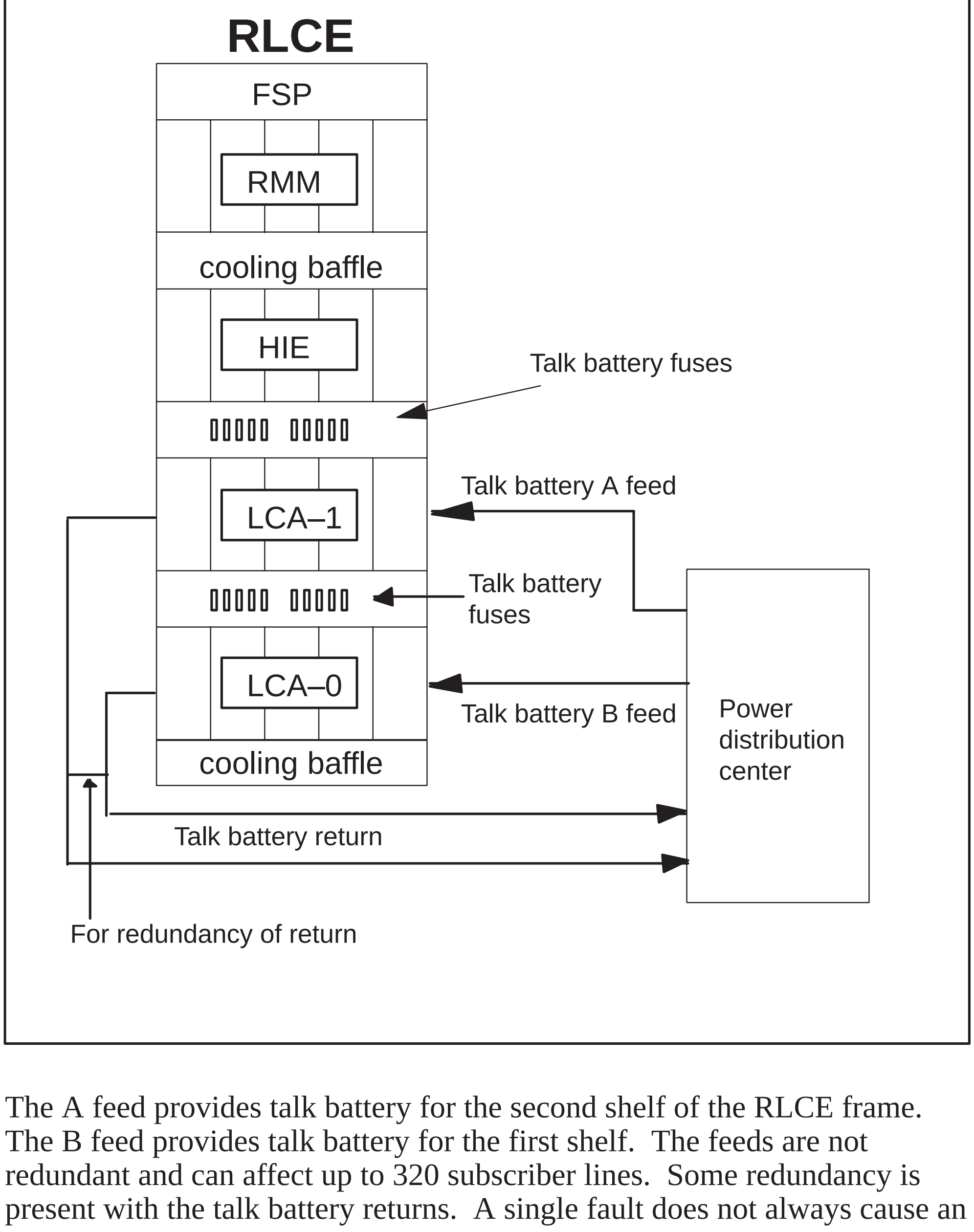
To support this feature, each LCM shelf must have a minimum of one world line card (WLC) (NT6X18BA). The subscriber can use the WLC for call processing. The system uses WLC for the talk battery audit. The system generates a minor alarm log report (PM179) in the following condition. There are no available WLCs to perform the audit when the feature is on.

Note: This feature supports all WLC types. There are no limits on where the WLC can reside in the LCM shelf.

Loss of talk battery

The following figure illustrates shows the talk battery distribution in a remote line concentrating equipment (RLCE) frame with two LCE shelves. The power distribution is the same for the OPAC.

Talk battery distribution on LCE frame



The A feed provides talk battery for the second shelf of the RLCE frame. The B feed provides talk battery for the first shelf. The feeds are not redundant and can affect up to 320 subscriber lines. Some redundancy is present with the talk battery returns. A single fault does not always cause an outage.

Before, during a loss of talk battery, the system did not indicate a problem unless the talk battery fuse had blown. If the fuse had blown, the LCM indicates `InSv` (in service) on the MAP display. The LCM performs a line card audit. This audit cannot check for loss of talk battery. The loss of talk battery affects one or two LCM shelves, depending on where the fault occurs.

Without talk battery, the LCM line cards cannot signal an off-hook condition. In this condition, the LCM detects off-hook lines as on-hook. The system automatically forces any LCM calls to the on-hook state when the system loses talk battery feed. The LCM lines cannot originate and terminate calls when talk battery is not available.

Feature activation

To activate the Talk Battery Alarm feature, change the value of office parameter TALK_BATTERY_ALARM in table OFCENG. The system disables the Talk Battery Alarm feature by default. This feature requires that each LCM shelf in the office have a WLC. A minor alarm occurs for each LCM shelf that does not contain a WLC.

While the Talk Battery Alarm feature is enabled, the system performs talk battery testing through diagnostics and background audits.

If the system disables the Talk Battery Alarm feature, the system clears talk battery alarms and ISTb reasons that this feature introduces.

Background audit

Each LCM can audit LCM shelves for loss of talk battery. When the system disables the Talk Battery Alarm feature, audits do not check for the loss of talk battery on office LCMs.

When the Talk Battery Alarm feature is enabled, the system searches for an available WLC on each LCM shelf. To be available, a WLC must be in one of the following states:

- hardware assigned, software unassigned (HASU)
- INSV and assigned to a subscriber

If the system does not find an available WLC, the system generates a minor alarm log report (PM179). This log report indicates that the system cannot test the talk battery, and the LCM becomes ISTb. If the system finds an available WLC, the system runs a special audit. This audit checks for loss of talk battery feed a minimum of one time each minute. The system tests all LCM shelves at the same time. The system checks each LCM shelf a minimum of each minute. Audits do not run talk battery tests on an OOS (Out Of Service) LCM.

If the available WLC used for audit testing becomes not available, the audit searches for another available WLC. If the audit finds another available WLC, audit testing continues with the new WLC. If the audit does not find an available WLC, the system generates a minor alarm log report (PM179). This log report indicates that the system cannot test the talk battery, and that the LCM shelf is set to ISTb.

To test for loss of talk battery feed, the system performs the following action. The system instructs WLC to verify that talk battery feed to the WLC is present. The test passes if talk battery feed is present and fails if talk battery feed is not present.

If off-hook, call processing busy (CPB), or both, occupy INSV WLC, the audit does not perform the talk battery test. The system assumes that the talk battery test passes. Examples of occupied states include talking, ringing and maintenance lockout. For ringing, the WLC is on-hook and in a CPB state.

When the audit finds a failure of the talk battery test, the system generates a critical alarm log report (PM179). The system places the LCM shelf in an ISTb state. The audit does not again report the failure until diagnostics clear the alarm and ISTb state.

Diagnostics

The INSV and OOS diagnostics for an LCM unit incorporate the talk battery test. The affected diagnostics include the following commands:

- Tst Unit unit_no
- Tst PM
- Tst Rex NOW
- Rts Unit unit_no
- Rts PM

Diagnostics report all talk battery failures. This action also occurs if the system tests the same LCM repeatedly. If the talk battery test passes, the diagnostics clear the alarm and ISTb reason. The manual and automatic versions of these commands are impacted. The diagnostics only run talk battery tests when the talk battery alarm feature is enabled.

To support the talk battery alarm feature, each LCM shelf must have a WLC. There are no provisioning rules that specify where the WLC can reside in the shelf. The maintenance line card in LSG 0 Card 0 for the LCM shelf can be assigned as a WLC. In this event, the feature does not always use this card, because this line card tests the ringing generators.

The MAP commands that can Bsy the last available WLC on an LCM shelf issue a warning message. There are three commands that can cause this condition:

- the Bsy command at the LTP MAP level when a WLC is posted
- the Diag command at the LTP MAP level when a WLC is posted. Diagnostics ManB the WLC for a limited time.
- the Bsy Drwr command at the PM MAP level when an LCM is posted

If one of these commands busies the last available WLC on the LCM shelf, the system displays a warning message. An example of a warning message follows:

Example of a MAP response:

```
Busying the last available WLC on LCM shelf.  This
prevents testing for talk battery failure on the LCM
shelf.  Minor alarm will be raised within one minute
unless WLC becomes available.
```

The Querypm Flt command displays the new ISTb reasons by shelf and LEN for both alarm conditions. An example follows.

Example of a MAP response:

```
Node inservice trouble exist:
One or both units Inservice Trouble:
LCM UNIT 0 Inservice Trouble Exist:
Talk Battery failure detected on shelf <shelf #> by <LEN>
LCM UNIT 1 No Faults Exist
or
Node inservice trouble exist:
One or both units Inservice Trouble:
LCM UNIT 0 Inservice Trouble Exist:
Cannot test Talk Battery on shelf <shelf #> by <LEN>
LCM UNIT 1 No Faults Exist
```

The MAP commands that can RTS the first available WLC on an LCM shelf issue the following notification messages. This notification message informs maintenance personnel that the system cleared the minor alarm and ISTb reason for the LCM shelf. This clearance occurs because a WLC is available to test for talk battery failures. There are two commands that can cause this condition. The first is the RTS command at the LTP MAP level when a WLC is posted and returned to service. The system response to the RTS command appears below:

Example of a MAP response:

```
RTSing the first available WLC on the LCM shelf.  Loss of
talk battery can now be detected on LCM shelf.  The minor
alarm and ISTb reason will be cleared for the LCM shelf
within ten minutes (unless the last WLC becomes
unavailable again).
```

The second is the RTS Drwr command at the PM level when an LCM is posted. The system response to the RTS Drwr command appears below:

Example of a MAP response:

```
RTSing DRWR of the first available WLC on the LCM shelf.
Loss of talk battery can now be detected on LCM shelf.
The minor alarm and ISTb reason will be cleared for the
LCM shelf within ten minutes (unless the last WLC becomes
unavailable again).
```

THe ESA operation is not impacted on RCC, in remote-off-remote configuration or RLCM/OPM. The system ignores talk battery alarm conditions during ESA operation. After exit from ESA mode, the CM tests the LCM for talk battery failures.

Limits and controls

The following limits apply to the Talk Battery Alarm feature:

The system supports the Talk Battery Alarm feature on the following LCM types:

- extended LCM (XLCM) (256-Kbyte capacity)
- enhanced LCM with ISDN (LCME)
- cabinetized XLCM (ELCM), also referred to as Meridian cabinetized LCM
- remote line concentrating module (RLCM)
- outside plant module (OPM), cabinetized RLCM with 256-kbyte capacity
- outside plant access cabinet (OPAC), reconfigured RLCM in a Series 800E cabinet with 256-kbyte capacity

The same WLC used for talk battery testing can be used as a subscriber line. There can be an additional delay of up to 90 ms before the subscriber receives dial tone in the following event:

- the talk battery test is in progress on a WLC
- the WLC goes on-hook to request a call origination
- the subscriber goes off-hook

There can be an additional delay of up to 90 ms before ringing begins in the following event:

- the talk battery test is in progress on a WLC
- the WLC receives a call termination request to ring the line

For both originations and terminations, there is no impact on call processing with the exception of this short delay.

- The Talk Battery Alarm feature can detect the loss of talk battery *feed* to an LCM shelf. The WLC limits this feature. This feature cannot detect the loss of talk battery *return*. Talk battery returns are duplicated and return failures are less possible to occur. As a result, this limit does not pose a serious concern. Refer to the previous figure Talk battery distribution on LCE frame.
- The CM does not perform talk battery tests while the LCM, or one of its C-side nodes, is in the overload condition.
- The Talk Battery Alarm feature isolates shelf-level failures of talk battery feed. This feature only guarantees reports of talk battery feed failures that affect talk battery for all lines on the LCM shelf. This feature may or may not detect drawer-level failures. Detection depends on the drawer in which the WLC resides and the drawer in which the failure occurs.
- Faults local to the WLC or the WLC drawer can prevent the WLC from detecting talk battery failures. These faults include faults that cause the WLC to fail line card diagnostics. In this condition, the WLC can report talk battery failure in error and cause the critical alarm. The WLC performs this action even though talk battery can be present for other lines on the shelf. These occurrences are not possible. The critical alarm log report (PM179) gives the location of the WLC to help troubleshoot these instances.
- The Talk Battery Alarm feature does not affect emergency stand-alone ESA operation on RCC, RLCM, or OPM. The system ignores talk battery alarm conditions or reports during ESA operation. As a result, the system does not report talk battery failures when an LCM is in ESA mode. After exit from ESA mode, the CM tests the LCM for talk battery failures.
- Operating company personnel activate the Talk Battery Alarm feature for an office. On activation of this feature, 10 min can elapse before each LCM in the office begins talk battery failure audits. This delay time depends on how long the LCM audit takes to cycle through each LCM in the office. An office with heavy traffic and a large number of LCMs can take longer than 10 min.

- Use of the SERVORD OUT command to delete the directory number (DN) assigned to the last WLC on an LCM shelf triggers an alarm. In this event, a minor `Cannot test Talk Battery` alarm occurs. The alarm message indicates the WLC for which the system deleted the last assigned DN. In this occurence, the WLC is HASU but in an unusual maintenance state. In this state, the LCM cannot use the WLC to detect talk battery failures. There are three methods to correct this condition:
  - BSY/RTS the LCM. The WLC is in the correct HASU maintenance state. The LCM can use the WLC for talk battery testing. This action is not recommended because of the service outage.
  - Assign a DN to the WLC. The LCM can use the WLC for talk battery testing.
  - Assign a second WLC on the same LCM shelf. This WLC can remain as HASU without an assigned DN.

The second option provides the easiest work-around. The third option requires an additional WLC, but provides redundancy for the Talk Battery Alarm feature.

ESA capability

The system can lose communication with the host because of DS-1 link or card failures. In this occurence an OPAC with feature package NTX154AA operates separate. With this feature, the OPAC automatically enters the (ESA).

The ESA operation continues until communications restore over a minimum of one of the DS-1 links. During entry and exit from ESA, the system drops all calls.

Refer to the ESA maintenance overview section of this guide for a complete overview of ESA operation for the OPAC.

RMM maintenance

The RMM performs the following maintenance functions:

- bootstrap-level (direct monitor) functions
- RMM table control and MAP terminal maintenance
- scan monitoring processes
- connecting to line test equipment
- self-testing

Drawer testing

The OPAC conducts a BIC loop-around test to detect line drawer faults. This test makes sure that the system can send message and speech data to and from the BIC card. If the BIC test fails, the CM implements a full in-service test on both BICs. This test makes sure that the fault is not transient or from the DCC or processor card.

If BIC or DCC tests fail, the system does not force the LCM into takeover mode.

If a drawer state changes to ISTb or SysB, the state of the OPAC changes to ISTb or SysB.

The system can detect some drawer ISTb conditions when the drawer or the PM is OOS. These conditions include BIC scan, BIC inhibit, BIC CM, and BIC activity.

The following list describes these conditions. Drawers with these conditions can be returned to service with an ISTb condition. In this event, the ISTb state clears when the system performs INSV unit or drawer tests.

- the BIC loop-around sets the drawer to the SysB state. The system cannot send messages to the drawer. All lines to the drawer are made LMB because the call processing is disabled.
- the BIC scan sends a scan message to the BIC to make sure that the scan chip can detect supervision changes on all datafilled lines. Because this involves a message, the path through the DCC is like the BIC looparound.
- the DCC loop-around tests a loop in the DCC. The looparound does not test all the DCC hardware for the DCC/BIC communication. If a fault with this hardware is present, the DCC looparound passes. Additional BIC looparound tests fail if drawer faults are not present.
- the DCC/BIC loop-around sets the drawer to the ISTb state. A failure on the speech path hardware to the drawer occurs. All channels are not affected if a channel fails the test. As a result, all processing can be possible. For this reason, the drawer state is updated to ISTb at the MAP display. The drawer can handle call processing. The DCC/BIC loop-around sends test patterns to the BIC to test the PCM path. The patterns that the transmit time switch receives are expected to be the same in a timeout period.

The list of full INSV tests follows:

- ACTIVITY_READ
- MSG_LOOPAROUND

- ANI_COIN_FAIL
- PARITY_TRAP_FAIL
- BIC_ACT_TEST
- POWER_CONVERTER_FAIL
- BIC_CM_TEST
- RINGING_FAIL
- BIC_INHIBIT_TEST
- RTM_CM_TEST
- BIC_LA_TEST
- RTTS_CM_TEST
- BIC_LOOPAROUND
- SANITY_TIMEOUT_FAIL
- BIC_SCAN_TEST
- SET_MSG_LOOPAROUND
- DCC_LA_TEST
- SUBCYCLE_LENGTH_FAIL
- DS1_LOOPAROUND
- SUBCYCLE_ORDER_FAIL
- IUC_LA_TEST
- TIMING_TEST
- LC_COM_TEST
- WRITE_PROTECT_FAIL
- LCC_FAIL
- ZERO_CROSSING_INT_FAST_FAIL
- LCC_LOOPAROUND
- ZERO_CROSSING_INT_SLOW_FAIL
- MEMORY_TEST

Faults that occur on a BIC drawer affect call processing regardless of the in-service unit that controls that drawer. The full in-service tests use the DCC. Where takeover is justified, you must first determine that the fault is not in the DCC.

If takeover occurs because of a reported drawer fault, the DCC is at fault. The DCC is at fault even though the LCM fails the BIC tests.

In the takeover mode, the DCC of the inactive unit cannot access drawers for call processing. The DCC of the inactive unit can access drawers for testing. The active LCM unit has access to all drawers through its DCC.

Valid drawer faults do not take an LCM unit out of service. The system continues to give the unit ISTb state. The ISTb reason is self-test or diagnostic fail. The ISTb reason depends on which test fails and causes the ISTb condition.

Additional diagnostic information is available for LCM shelves equipped with the NT6X51AB (XLCM processor) expanded memory board. After the CM detects an LCM unit with ISTb, the unit can be made SysB. Excessive unsolicited messages can make the unit SysB.

BIC relay test

The BRT tests the tip and ring reversal relay on each BIC of a specified LCM. The BRT allows for the manual testing of a single drawer of a specified LCM. The BRT allows for scheduled testing of LCMs in an office.

The command string QUERYPM FLT indicates the drawers that fails the manual or system BIC relay test. This test generates PM181 and PM132 log reports to indicate test results.

The following paragraphs discuss the levels of BRT testing.

- The office level test loops over each LCM that the schedule includes. A single BRT runs on each drawer of the specified LCM. The system displays the test results in a LOGUTIL report that combines the results of each drawer test.
- The LCM level test runs the scheduled BRT. The scheduled test selects an LCM that did not have drawers tested during the BRT window that office parameters define. A BRT runs on each drawer of this LCM.
- The drawer level test runs from the scheduled LCM-level test or manually from the LCM MAP level. This is a single LCM drawer test.

The office level test loops over the LCMs in an office and performs the LCM-level test. The LCM-level test loops over each drawer of a specified LCM and performs the drawer-level test that constitutes a BRT.

Office parameters for test scheduling

Scheduling for the BRT uses the information from two new office parameters in table OFCVAR: BICRELAY_XLCM_TEST_SCHEDULE and BICRELAY_NUM_SIMUL_TESTS.

These parameters allow the user the flexibility perform the following:

- schedule the BRT from one to seven days a week

- define the window size
- define how many LCM-level tests, described here, run at the same time

The following are descriptions of these parameters:

- BICRELAY_XLCM_TEST_SCHEDULE
  - This parameter defines the start time (BRTST_START_TIME) and stop time (BRTST_STOP_TIME) for the office-level test. These times cannot be the same. The test window must be a minimum of 10 min long. The last field of this parameter (BRTST_DAYS_OF_TST) specifies the day or days of the week when the office-level test runs (MON, TUE, WED, THU, FRI, SAT, SUN). You can datafill a maximum of seven days in any combination. You cannot datafill the same day more than one time.
  - If the start and stop times are the same, the system displays an error message. The system also diplays an error message if the test window is less than 10 min.
  - If you try to make a change during the defined test window during the test, the system displays a message. This message indicates that you can use the command string BICRELAY OFF to stop the BRT. You can make changes and use the command string BICRELAY ON to restart the BRT.
- BICRELAY_NUM_SIMUL_TESTS
  - This parameter indicates the number of LCM-level tests to run at the same time.
  - The parameter plus the start and stop times of BICRELAY_XLCM_TEST_SCHEDULE configure the number of LCMs being tested.
  - If you try to make a change during the defined test window during the test, the system displays a message. This message indicates that you must wait until the test stops. If the change is required immediately, you can use the command string BICRELAY OFF at the command interpreter (CI) level to stop the BRT. You can make the necessary changes and use the command string BICRELAY ON to restart the BRT.

Out-of-service unit tests

The BIC tests run during OOS LCM unit tests. Drawer tests only test drawers with the ISTb or SysB state. For this reason, OOS unit tests treat previously defective drawers as follows:

- With both units OOS, the system changes drawers with the SysB state to the ISTb state. This change allows the OOS test to test this drawer. If the fault persists, the system resets the drawer to SysB. If the drawer is not ISTb, the system changes the state to INSV.
- With only one unit out of service, the system tests only drawers with ISTb and INSV states. The system tests only these drawers because the mate unit is INSV and in control of all drawers. The system does not change or test drawers with a SysB state.

Impact on table LCMINV

Field BICTST is in table LCMINV. Field BICTST is a boolean that indicates if the test schedule includes a specified LCM.

Table control for LCMINV allows the user to change the MEMSIZE of a specified tuple when the LCM is INSV. The user can change the MEMSIZE from 64 kbyte to 256 kbyte.

If the user makes this change and does not change the load in the LCM to an XLCM load, the BRT does not test the LCM. To include the LCM in the test schedule, the user must perform the following actions:

- busy the LCM
- reload the LCM with an XLCM load
- RTS the LCM

If the user attempts an office-level test or manual LCM-level test on an LCM whose load does not change, the test does not run. The system generates a log that indicates that the LCM does not contain an XLCM load.

If the user changes the MEMSIZE field from 256 kbyte to 64 kbyte, the BICTST field must be set to N (no). If the BICTST field is set to Y, the system displays a message. This message indicates that the BICTST field is set to Y, and that Y is valid only for XLCMs. The system rejects the change.

If the MEMSIZE field is set to 256 kbyte, which indicates XLCM, the user can set the BICTST field to Y or N. An LCM entry in table LCMINV with the MEMSIZE field set to Y, is automatically included in the test schedule.

BICRELAY command

The BICRELAY command allows the user to perform the following actions when a specified LCM undergoes the system Bic relay test (BRT):

- enable the PM181 drawer state change logs
- disable the PM181 drawer state change logs
- reset the PM181 drawer state change logs
- disallow the PM181 drawer state change logs

Operating company personnel can perform the following actions:

- query the state of the BRT (ON or OFF)
- determine if PM181 drawer state change logs are allowed or suppressed
- query the number of BRTs in progress
- query the next LCM that the system BRT tests

Note: The system suppresses only the associated PM181 logs for the LCM that undergoes the BRT. Other PM181 that associate with other LCMs or XPMs is allowed.

The following table describes BICRELAY command parameters.

BICRELAY command parameters

Parameter	Description
ON	Allows the test to begin at the scheduled window. The MAP terminal displays a message that indicates that the test is turned ON. If the current data and time falls in the scheduled window, the office-level test starts immediately. If tests are in progress when you issue this command, the system displays a message. This message tells you to wait until tests are complete before you restart the BRT. This option does not impact the operation of the manual TST command at the LCM MAP level.
OFF	Disallows the resumption of the office-level test. The MAP terminal displays a message that indicates that the test is turned OFF. System BRTs in progress can complete. The OFF is the default. When you disable the test, the test does not begin again until you enable the test with the ON option. When enabled, the office-level test resumes at the point where the test is turned OFF. This option does not impact the operation of the manual TST command at the LCM MAP level.
SUPPRESS	When an LCM undergoes a system-initiated BRT, the system busies, tests and returns each drawer to service. When these state changes take place, the system generates a PM181 log that indicates the change. This parameter allows the user to suppress PM181 logs for an LCM that undergoes a system BRT. The system does not suppress PM181 logs for an LCM that does not undergo a system BRT. The parameter SUPPRESS does not effect a manual BRT run on a single drawer. The user can issue this parameter at any time. The system displays a message that indicates that the system suppresses the logs.
ALLOW	Allows the PM181 drawer change logs that the system BRT causes.

—continued—

BICRELAY command parameters (continued)

Parameter	Description
RESET	Allows you to restart an office-level test as if LCMs are not tested. Turn the test off before you can use this parameter. If you attempt to reset the BRT when BRT is ON, the system displays a message. This message indicates that you must turn the BRT OFF before the system can perform RESET. The message also indicates that all tests in progress must complete. You can use this option at any time. This option does not impact the operation of a manual TST command at the LCM MAP level.
QUERY	Displays the current status of the office-level test (ON or OFF). Displays the number of LCM-level tests in progress. Displays the next LCM to test in the scheduled BRT in the format of HOST 00 0 0. Displays the status of the SUPPRESS and ALLOW commands.
	—end—

Test operation

The system performs BRT LCM by LCM.

If you initiate the BRT manually, the system performs BRT drawer by drawer. On an LCM by LCM basis, the system automatically performs BRT on all drawers of the LCM.

Use the command string TST DRWR *drwr_no* RELAY at the LCM MAP level to manually initiate the single drawer test.

The system test performs the following steps:

1. loops over each LCM in the test schedule
2. loops over each drawer for each LCM
3. runs one tip and ring reversal relay test for each drawer
4. generates one log report with the results of all 20 drawers
5. sets the drawer and node ISTb status accordingly

Office-level test The system BRT displays the results of each LCM-level test in a PM132 log report.

Log PM132 displays a combined report of each drawer-level test in a given LCM. Log PM132 indicates the following:

- test passes
- reversal test fails
- test not run because
  - — line card is not available
  - — problems encountered with the MTE
  - — test aborts
  - — drawer is earlier OOS
  - — call processing is in progress
  - — bad hardware
  - — message link problems
  - — resources not available
  - — invalid load in the LCM
  - — error condition not expected
  - — conflicts in maintenance software
- test was run. Drawer fails to RTS after test

If an LCM-level test does not run because equipment is not available before the separate drawer tests, the system does not test the LCM. The system generates a PM181 log and the LCM node state does not change.

If a drawer test fails to run, the drawer remains in the current state. The system tests the drawer again in a later window.

The system lists all drawers that fail the BRT and set as ISTb when you enter QUERYPM FLT at the LCM MAP. The system sets node ISTb reason to `DRAWER FAULT` as before.

LCM-level test The system runs the office-level automated test when operating company personnel enter schedules in the office parameter. When the system tests an LCM, the system does not test the LCM again until the system successfully tests each LCM.

When the system tests all LCMs included in the schedule in the window, the BRT stops. The system resumes LCM tests when the next window arrives.

If the system does not test an LCM, the system skips the LCM in the current window. The system generates a PM181 information log that indicates why the system cannot perform the test.

If an LCM test runs when the stop time arrives, the system completes the current LCM level test.

The BRT records which LCM the system tests first in the given window. The system compares each subsequent LCM to the first LCM. If the LCMs are the same and the current date and time fall in the window, the BRT stops.

If the system does not test all LCMs in the window, the BRT begins where the BRT left off during the last scheduled window.

You can schedule the BRT to run at the same time as the automatic line test (ALT) or the LCM REX test.

You must not run the BRT and the ALT at the same time. Both or all tests use test equipment. Use of test equipment reduces the number of LCMs that the system can test in the window. As a result, the completion of the ALT slows.

These tests do not run at the same time on the same LCM. Define a window that does not coincide with the scheduled ALT or REX test.

Note: The LCM audit, the manual REX, and the system REX cannot run on the same LCM that runs the system BRT. You cannot ManB the LCM PM/UNIT during the system BRT.

The system runs simultaneous LCM tests if test equipment is available at the maximum number in the BICRELAY_NUM_SIMUL_TESTS parameter. The MTUs must be provisioned to allow the number of LCM-level simultaneous tests to run.

Because of real-time considerations, the BICRELAY_NUM_SIMUL_TEST parameter has a range of one through three. A higher number in this field allows the system to test additional LCMs in a given window.

Drawer-level test The BRT drawer-level test requires metallic test equipment and a single NT6X17 line card in each drawer tested. The world line card tests the BIC relay and must be in progress. The card must not indicate a diagnostics failure at the MAP terminal. The system must not indicate the card as missing (M).

The system places each drawer in a ManB state before the drawer-level test. Each drawer is OOS for approximately 10 s. During this time, the system suspends call processing.

When the tip and ring reversal relay test on all drawers is complete, the system displays results. The system displays results in a PM132 log report that includes results of each individual drawer test of a given LCM.

The system skips and tests the drawer on later passes of the BRT if

- a drawer was earlier OOS
- call processing is in progress

Single-drawer test The single-drawer test is for retest purposes if a failure occurs during the system test. This test runs from the LCM MAP level and is part of the TST DRWR command string. The RELAY option allows the BRT to run without running the main DRWR test. The BRT does not run unless you specify the RELAY option.

You ManB the drawer before the system runs the test. The system prompts you if the drawer is InSv, ISTb, or SysB. The manual BRT cannot run on a drawer where the LCM node is ManB, SysB, C-side busy (CBsy), or OffL. The system displays a message that indicates that the request is invalid and gives the current state of the node.

The single-drawer test displays a PM181 log with the results of the test. The system also displays a response at the MAP terminal and, if necessary, a card list that indicates the failed drawer.

If the system cannot run a single drawer test, the system does not set the drawer ISTb. You can return the drawer to service to the previous state.

Restarts The following information applies to manual and system-level restarts:

- warm or cold restarts
  - — The system aborts all drawer-level tests.
  - — The system saves ISTb reasons.
  - — The system aborts all LCM-level tests. These tests are system level if the tests are in the window. The test resumes after the restart. The system does not retest LCMs that the system tested.
- reload
  - — The system resets the BRT as if you issue the RESET option of the BICRELAY command.
  - — The system retains the ON/OFF settings of the BICRELAY command.
  - — The system retains the state of the SUPPRESS and ALLOW commands.
  - — The system clears ISTb reasons.

Interactions The BRT uses the test access bus, the MTE, and a single NT6X17 card in each drawer to complete tests. If you run ALT at the same time as a BRT, you can delay both tests. This delay can occur because both tests compete for the same test equipment.

If routine exercise (REX) runs on a given LCM, the system does not run the BRT on that LCM. The LCM remains in the current state. The system generates a PM181 log report that indicates that the BRT did not run because of the REX in progress.

Limits and controls

The following limits apply to the BRT:

- The system test manually busies the logical drawer before the system runs the RELAY test. If lines are in a call-processing-busy state, the system skips the drawer for this test cycle.
- The drawer must be ManB before you run a manual BRT on a single drawer.
- If you do not enter a minimum of one NT6X17 line card in each logical drawer, the system does not test the drawer.
- If the line card selected for tests is removed during the test, the drawer fails.
- If a drawer fails to RTS when the system BRT is complete, the system places the drawer SysB. The system audit can attempt to return the drawer to service.
- The system does not run this test on an LCM at the same time as an LCM audit and a REX test.
- You cannot enter the BRTST_START_TIME and BRTST_STOP_TIME fields of the BICRELAY_XLCM_TEST_SCHEDULE office parameter with the same value. There must be at least a 10 min time span between these fields.

Subscriber lines automatic maintenance

The system performs automatic subscriber lines tests on line circuits and loops. These tests normally run on a scheduled basis without switch operator involvement other than for initial scheduling. In a DMS-100 switch office, the system performs these tests under the lines maintenance (LNS) subsystem.

LCM REX test

The LCM REX test runs OOS diagnostics for each LCM unit. This test also runs in-service diagnostics for each unit in normal and takeover modes.

Office parameter NODEREXCONTROL in Table OFCVAR controls this test.

The system performs the REX test during the specified interval for one LCM at a time. The REX test tests LCMs in the same order that you entered the LCMs in the inventory table. You cannot test each LCM in the office during the REX interval.

In this case, when the next interval starts, REX starts where REX left off during the previous interval. A REX test on an LCM takes a maximum of 15 min.

LCM REX test flow

A REX test for an LCM includes the following steps:

1. If both units of the LCM are in-service, the system makes unit 0 SysB. The system generates aPM128 state change log with the following reason: `REX in progress`. The system makes LCM node status ISTb and generates a minor alarm.
2. The system runs InSv diagnostics on unit 1 in takeover. If any diagnostics fail, the system places the unit ISTb and generates a PM181 log.
3. The system returns unit 0 to service. The system runs OOS and InSv diagnostics. If OOS diagnostics fail, the system leaves the unit SysB. The system raises a major alarm and generates PM106. If the system successfully returns the unit to service and the InSv diagnostic fails, the system places the unit ISTb. The system generates a PM181 log.
4. If the system successfully returns unit 0 to service, the system repeats these steps for unit 1.

If a REX test fails, the system generates a PM600 log. The PM600 log initiates a major alarm for the XPM that failed the REX test. The major alarm appears at the MAP terminal under the PM banner at the top of the display. The system generates a PM181 log after a successful REX test.

If an InSv or OOS diagnostic test fails, the REX test failure reason includes the following:

- the mnemonic of the diagnostic that failed. A mnemonic is an easy to remember abbreviation.
- the unit that failed (0 or 1)

The PM600 log details the start time of each step the REX test performed. The PM600 log details the unit that the REX test step affected and the failure reason. The REX test steps in the log after the failed step are recovery actions the REX test initiates as a result of the failure. The log includes the unit number if the REX test action is unit-specific (BSY unit, RTS unit, TST unit, synchronization). The log does not include the unit number if the REX test action does not affect the node (SWACT, BSY both units). The log additional data consists of a card list and a mnemonic of the failed diagnostic.

The QUERYPM, QUERYPM FLT, TST REX QUERY, and TST REXCOV QUERY commands contain information about the last REX test. Manually and system-initiated REX tests store and display a new date, time, and status (passed or failed) in the REX test maintenance record. *Passed* means the REX test completed without errors. *Failed* means the REX test did not complete because of an error. This information is available through the QUERY PM and TST REX QUERY commands. If the REX test fails, you perform one of the following tests to return the XPM to service from ISTb:

- manual RTX
- manual REX
- automated REX

The system stores a REX test maintenance record for each XPM that contains the following information:

- REX test scheduler, if the XPM is in the system
- date, time, and result (passed or failed) of the last REX test
- failure reason, diagnostics failures, and a list of defective cards (if applicable), if the last REX test failed
- date and time of prior failed REX test
- date and time of first passed REX test following earlier failure

The following limits apply to REX tests:

- The system REX test controller runs a REX test on one XPM at a time if the office uses the NT-40 processor. The SuperNode supports concurrent REX tests for a maximum of ten XPMs with the same REX test class.
- A maximum of four LCM_REX_TESTs can run at the same time. These tests can be run if the HOST XPM to which the tests relate is not in the middle of a REX test.
- The SREX scheduler schedules LCM_REXCOV tests for converter and ringing voltages in LCM separately.
- For a REX test to run, the node must be InSv or ISTb because of a REX test failure.
- If a restart occurs when a REX test is in progress, the system does not generate a PM600 log. The restart deallocates the temporary data store that the system uses to build the PM600 log.

System REX controller: XPM maintenance

Feature AF3771, System REX Controller: XPM Maintenance, provides the SuperNode switch with an S/DMS system REX test (SREX) controller. The SREX controller coordinates all system REX tests under a common REX test scheduler. Feature AF3771 allows you to schedule LCM REX tests while other REX tests are in progress. The SREX test controller makes it easier to perform a REX test on the whole switch. This action includes all peripherals like the OPAC, in less time. The REX tests provide early indication of faults that can impact service. These tests allow operating company personnel to take corrective measures.

Feature AF3771 allows operating company personnel to find and resolve REX test failures earlier. This feature reduces power failures in the field. The SREX test controller allows operating company personnel to perform the following actions:

- change the order in which the system tests peripherals
- coordinate between manual-initiated and system-initiated REX tests
- use Table REXSCHED to receive alarms for the OPAC that are not in the middle of a REX test in a time limit set

The SREX test scheduler allows you to enter the CI level REXTEST command and the following parameters:

- SUSPEND suspends REX tests for one maintenance window. A maintenance window is the time period between the REXSTART and REXSTOP time entered in Table OFCVAR under the NODEREXCONTROL parameter.
- RESUME resumes REX tests after interruption of REX tests.

- QUERY returns the status of the REX test (active or suspended).
- HELP returns a brief description of the REX test.

The REX test order for feature AF3771 is as follows:

- first, critical nodes like the communications module (CM) and message switch (MS)
- second, the number of days since the last system or manual REX test
- third, the order of internal PM number

Enter Table REXSCHED to establish the REX test schedule for the OPAC. This table contains the information that the REX test coordinator requires to schedule the tests according to operating company specifications. You can enter Table REXSCHED to disable the test. For additional information about Table REXSCHED, refer to the data schema section of the *Translations Guide*.

The system generates the IOAU112 log report for LCMs if:

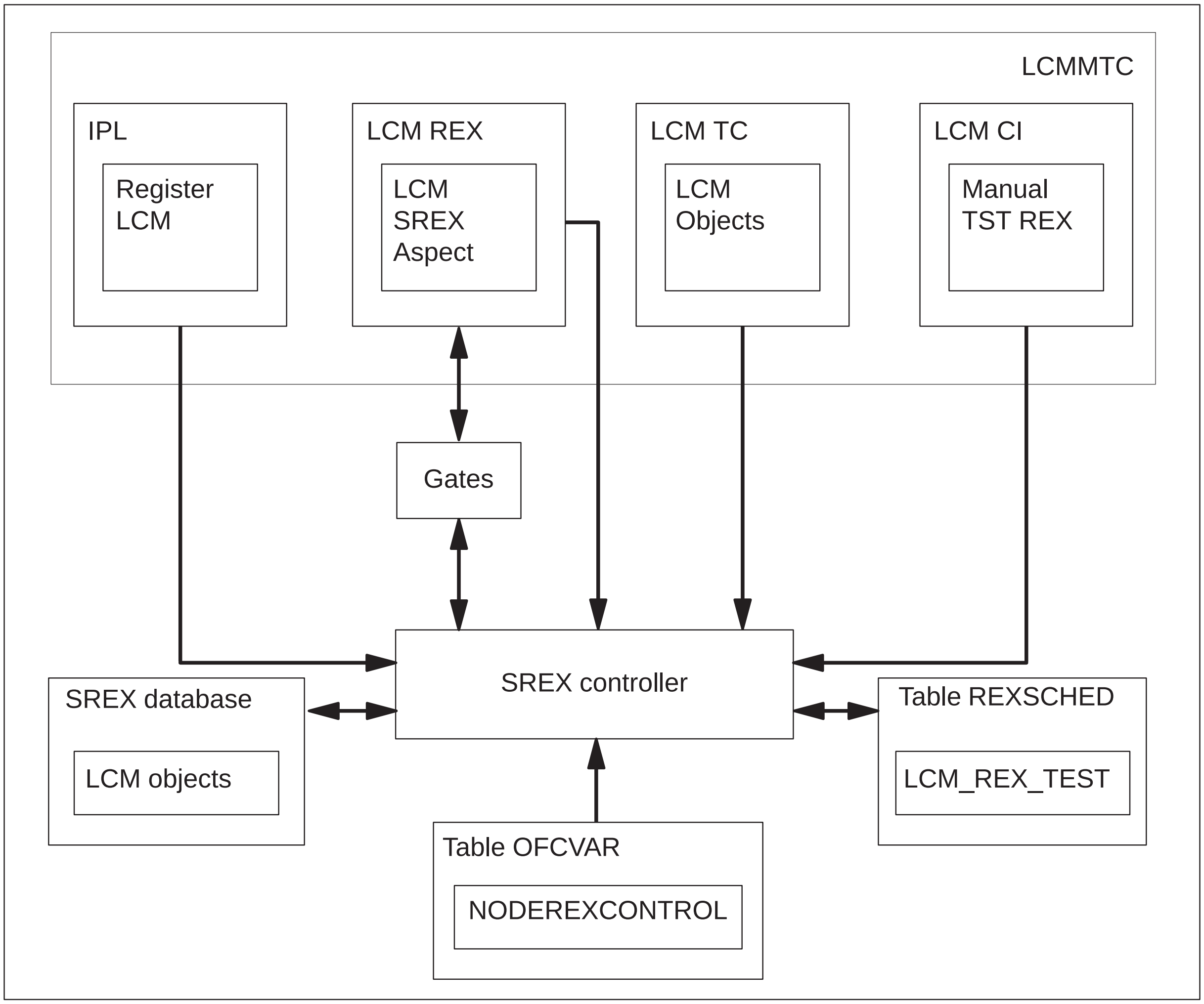
- the LCM is not REX tested for a minimum of seven days
- REX test takes more time than specified
- REX test cannot start after a defined number of attempts

Extended line concentrating module (LCM) REX test results

Table REXSCHED controls schedules of system REX (SREX) tests for LCMs. The LCM_REX_TEST task SREX can be performed concurrently in multiples of four and at the same time as REX tests of XPMs. The LGC, LTC, and the RCC XPMs can be hosts to LCMs. Conflicts arise when an XPM scheduled for REX tests is the host of an LCM scheduled for REX tests.

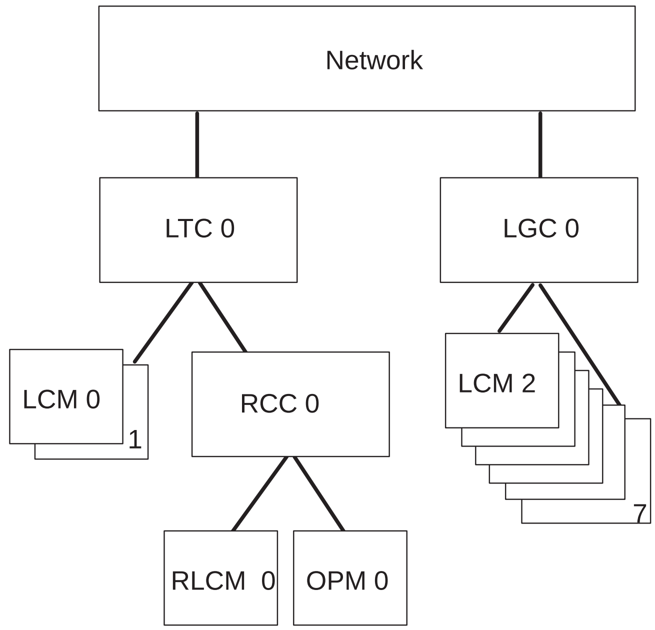
To avoid conflicts, the SREX controller schedules all concurrent REX tests of XPMs and LCMs. The LCM SREX subsystem registers the LCM_REX_TEST class and identifies dependencies with other REX_TEST types during initial program load (IPL). As LCM nodes are added to the SREX database, the controller automatically datafills entries with defaults in Table REXSCHED.

.SREX system dependencies



The converter voltage and ring test portions of LCM_REX_TEST require wait states and different test resources. These states and resources cause delays in SREX main task performance that are not acceptable. LCMCOV_REX_TEST, running at a lower priority, starts these tests separate from the LCM_REX_TEST. LCMCOV_REX_TEST requires logical test unit (LTU) connections in the maintenance line card. An LCM unit can access the single LTU when the other unit is OOS. This resource limit precludes concurrent LCMCOV_REX_TEST performance. The entry of the PARALLEL performance field for LCMCOV_REX_TEST, in Table REXSCHED, allows a maximum of one.

SREX schedules



Note 1: REX tests can run on LCM 0 and LCM 1 concurrent with REX tests that run on RCC 0 and LGC 0.
Note 2: REX tests cannot run on LCM 2 through LCM 7 if a REX test runs on LGC 0.

Separation of the LCM_REX_TEST and the LCMCOV_REX_TEST allows faster completion of site REX_TEST coverage. The LCM_REX_TESTs, without limits of the converter voltage and ring tests, can run at the same time. The user can schedule these tests separately for optimum performance periods.

> ***Note:*** The system performs LCMCOV_REX_TEST on LCMs, XLCMs, OPMs, OPACs, and RLCMs.

Feature AF3234 provides the following REX test enhancements for LCM peripherals and its variants, like LCME:

- the ESA REX test
- the LCM and ESA-independent REX test
- the MAP command for manual REX test
- the fault indicators
- the REX test maintenance record

- the MAP commands to access REX test failures

Emergency stand-alone REX test

The ESA REX tests the ability of RLCM units to enter and exit ESA. The ESA REX also tests the ability of RLCM units to message the ESA processor when in ESA. The ESA REX test begins after the LCM REX test is complete.

MAP commands for manual REX tests

The XLCM diagnostics provide the capability to start a manual LCM REX test. To initiate a manual REX test, add a REX or REXCOV parameter to the TST command at the PM level of the MAP display. Examples of this command are as follows:

>MAPCI;MTC;PM;POST LCM <site><frame><unit>
Note: Post the LCM

>QUERYPM
Note: Displays information about the LCM node. Feature AF5898 adds information about the LCMCOV REX test.

To set manual control of scheduled LCM or LCMCOV REX tests when the system posts the LCM, type

>TST REX [ON] [OFF]
Note: The system enables or disables the REX test of the posted LCM.

or

>TST COVREX [ON] [OFF]
Note: The system enables or disables the COVREX test of the posted LCM.

To set LCM REX tests for immediate performance, type

>TST REX NOW
Note: Performs LCM_REX_TEST on the posted LCM.

or

>TST COVREX NOW
Note: Performs LCMCOV_REX_TEST on the posted LCM.

The system displays the following message when you enter the TST COVREX NOW command.

Example MAP response:

```
LCM REM1 00 0 will be put into takeover mode during the
COV REX
Do you want to continue with the COV REX test
Please confirm (“YES”, “Y”, “NO”, or “N”)
```

Line concentrating module and ESA-independent REX test

The scheduler initiates REX tests on an LCM, and on completion, the scheduler initiates the ESA REX test. A manually started LCM REX test does not start an ESA REX test. A REX failure sets the LCM ISTb if InSv diagnostics fail or SysB if OOS diagnostics fail.

Fault indicators

A REX test failure sets the LCM unit ISTb or SysB with a reason of REX failed. The system performs audits on LCMs every 10 min and runs InSv tests. The ISTb flag remains with a REX failed reason. If the audit fails and the system detects additional failure conditions, the audit contributes to the ISTb list. The system returns the unit to ISTb rather than InSv with the REX failed reason if

- the LCM is SysB
- the system completes a successful RTS

To remove the ISTb state, the LCM must complete a successful manual RTS or a successful manual or scheduled REX test.

The system generates the node assessment graph log (NAG400) every hour or in response to the NAG command. This log lists all nodes that are not in-service (InSv). The REX_INFO field of log NAG400 displays the results of the latest REX test. For LCMs, the log lists the LCM_REX_TEST result first. A colon separates this result from the LCMCOV_REX_TEST result. For additional information about NAG400 logs, refer to the *OPAC Related Logs section of this document.*

The CI level NAG command allows you to display all OOS nodes. The MAP response to the NAG command is like the response that the NAG400 log report presents. The command and log report are part of the node assessment graph (NAG) feature. The NAG feature provides a snapshot of nodes in the system that are OOS or have a REX issue. To include the offline nodes in the output, enter the command string NAG ALL. To turn off the log report function that runs every hour, enter the command string NAG ON or NAG OFF.

The output or log report includes nodes in one of the following states:

- SysB
- CBsy
- ISTb
- ManB

These reports include nodes that failed, aborted or did not complete the last REX test. If a node does not have a REX problem, the string ATP appears in the REX column to indicate that all tests passed.

Example MAP response:

The following output depicts a shortened 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 RCC      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      .
   RCC2     1        ISTB   ATP             ISTB    ISTB
    :       :         :       :               :       :
    :       :         :       :               :       :
   LCM KRCM 03  0     .     PASS:   ----      .       .
Offline Node count:  3
```

REX maintenance records

The system generates a maintenance record from a REX test to indicate results of recent REX tests for each LCM you enter. This information is available at the PM level of the MAP display for a posted LCM.

> ***Note:*** Following a reload restart, the system erases the maintenance record for each LCM.

Escalation to manual maintenance

When automatic maintenance fails to correct a fault in the DMS-100 switch, the DMS-100 switch provides trouble indicators. These trouble indicators indicate a fault condition.

Alarms are examples of trouble indicators. Several OMs and log reports indicate a fault condition and a failure of automatic maintenance. Manual intervention becomes necessary as maintenance personnel attempt to clear the fault at the MAP terminal.

Alarm conditions

The maintenance system status header on the MAP display indicates alarm conditions for DMS-100 subsystems. The alarm conditions and meanings appear in the alarm description table.

Alarm description

Alarm	MAP display	Description
Minor	(blank)	normally does not affect service
Major	(M)	normally indicates a condition that threatens and degrades service
Critical	(*C*)	normally indicates a service power failure or potential service power failure

The type of alarm present appears under the header with the alarm importance.

If several alarms are present, the most important alarm appears. When maintenance personnel clear this alarm, the next most important alarm appears.

When an alarm condition is not present and the PM system is in-service, a dot (.) appears under the header PM.

The following table shows the alarms related to the OPAC that appear under the PM subsystem header of the MAP display.

Alarm class codes, displays, and conditions

PM header display	Condition
`PM`	All PMs are in service. Alarm conditions are not in effect. The alarm display area is blank.

`PM`
`nn SysB`
`*C*`
	More than ten percent of the PMs are SysB and have a critical alarm.

`PM`
`nn LCM`
`*c*`
	Both units of one or more LCMs are not InSv and have a critical alarm.

`PM`
`LCMRG`
`M`
	Both ringing generators (RG) of an OPAC have ISTb and a critical or major alarm is not present.

`PM`
`nn SysB`
`M`
	10% or fewer of the PMs are SysB and have a major alarm.

`PM` `LCMRG`	One RG of an OPAC has ISTb, and a critical or major alarm is not present. The alarm-display area is blank.
`PM` `nn ISTb`	The indicated number of PMs are ISTb. The alarm-display area is blank.
`PM` `nn CBsy`	The indicated number of PMs are CBsy. The alarm-display area is blank.
`PM` `nn ManB`	The indicated number of PMs are ManB (minor alarm). The alarm-display area is blank.
Note: If nn is greater than 99, two asterisks (**) appear instead of numbers.	

With the above alarm conditions, ESA module faults can generate alarms at the MAP PM level. These alarms can compare with alarms that current PMs raise.

The following are alarms that the system can generate:

- An ESA module in a ManB state generates a minor PM alarm.
- An ESA module in a CBsy state generates a minor PM alarm.
- An ESA module in an ISTb state generates a minor PM alarm
- An ESA module in a SysB state generates a major PM alarm.
- The system generates a critical PM alarm when 10% or fewer of the peripheral modules are SysB.

Subscriber lines manual maintenance

The system identifies subscriber lines that fail to meet quality standards to the switch operator. The system posts the failures at the line test position (LTP) or the ALT log subsystem generates output reports.

Refer to the *Input/Output System Reference Manual*. You can manually test and correct identified automatic maintenance failures.

Drawer maintenance

Drawer states can be monitored and changed from the LCM level of the MAP display. Test a unit manually at the MAP display to run a drawer test.

The drawer of a defective card can be removed from service for tests, and card replacement. This action does not affect other call processing or LCM maintenance.

OPAC power and environment system (PES) maintenance

Functional description

The Series 800E Cabinet provides the Outside Plant Access Cabinet (OPAC) with an environmentally controlled enclosure. The OPAC consists of the following:

- electronics compartment, which contains the electronics equipment and batteries
- attached power pedestal, which controls the ac power and contains the electromagnetic interference filters and ground bars
- termination compartment, which contains the cable and wire termination, protection, and cross-connections

Physical design

The exterior structure of the OPAC consists of welded 11 gauge, cold-rolled steel. The exterior structure includes the shell, exterior walls, and the floor. Other parts, like the equipment frames, use thicker materials. Insulation protects the cabinet against cold weather and sunlight.

The dimensions of the OPAC equipped with an air induction roof are 2.09 m (82.25 in.) wide by 1.65 m (65 in.) high by 0.76 m (30 in.) deep.

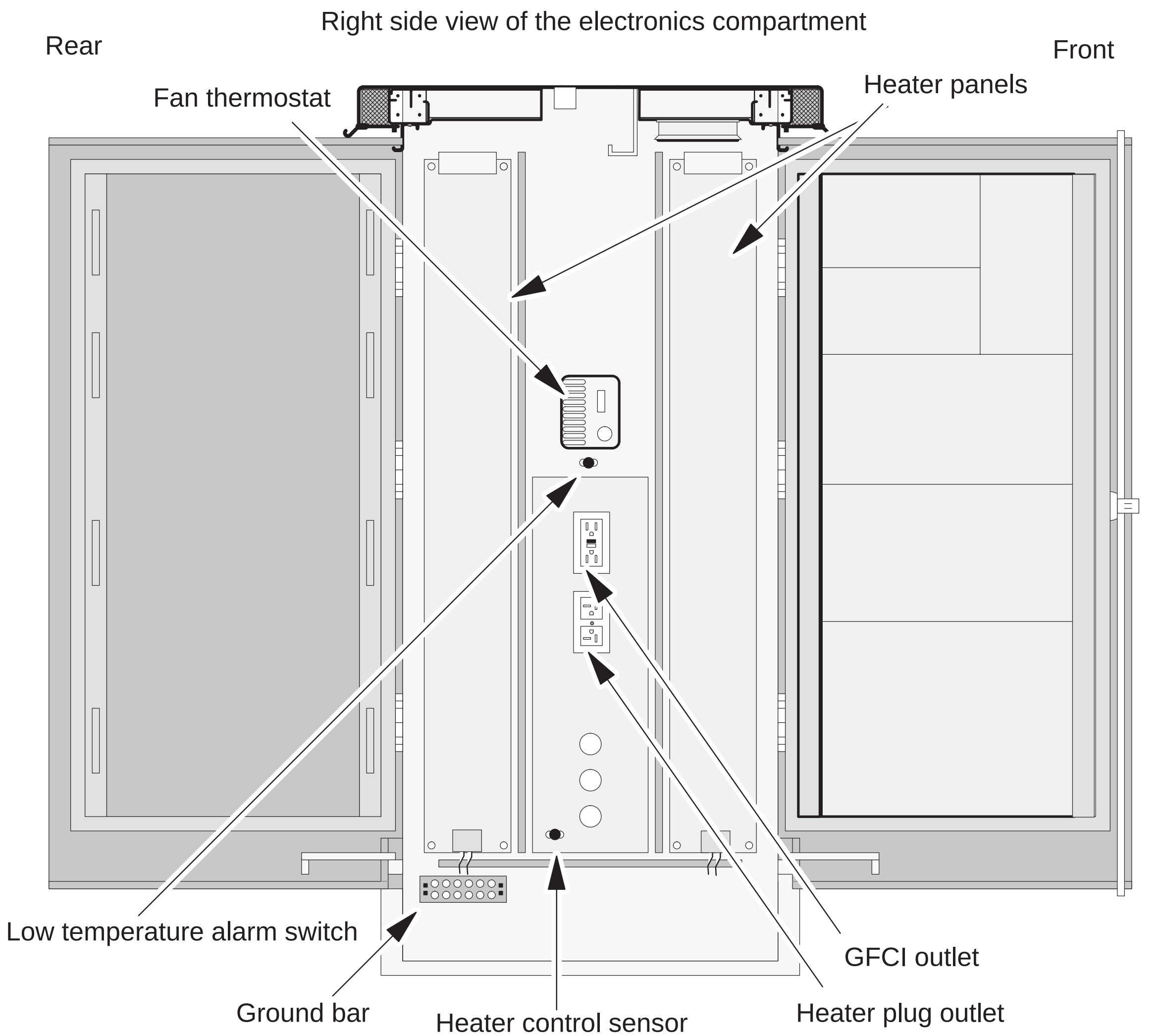
This section describes the roof design later in this section. Refer to the figure on page 2-13 for exterior views of the OPAC with air induction roof design.

An empty cabinet weighs 680 kg (1500 lb). A completely equipped cabinet, which includes electronics and batteries, weighs 1542 kg (3400 lb).

Electronics compartment

The electronics compartment contains the equipment frames and batteries. The electronics compartment is the only part of the cabinet that has environmental control.

Location of ac outlets and ground bar in electronics compartment of the OPAC



Enter the electronics compartment from the front and rear of the cabinet through the pairs of swinging doors.

A recessed hex-key lock hinges each cabinet door. Each door can be padlocked. Each door opens 120 deg. A door check locks the door in the open position.

Each set of doors has a door alarm. The alarm activates when the right hand door of the front or rear doors opens.

Three 25 in. swing frames hold the equipment shelves and additional battery strings. One 23 in. swing frame holds equipment supplied by the operating company.

Each frame pivots on hinges that swing out and away. The hinges allow for cabling, shelf interconnection and access to the backplane of the equipment shelves. The swings allow access to the batteries at the base of the cabinet. Locking latches hold the frames in position and are located at the lower part of the frame.

A shipping bracket secures the frames during cabinet transportation and remains in place for Earthquake Zone 4 environments.

The batteries are a valve-regulated lead acid type equipped with a plug-in connector for easy maintenance. Install a maximum of 38 batteries in the base of the compartment. Mount a maximum of ten batteries on two shelves in the right rear equipment frame (bay 3).

A 48 V string consists of eight 6-V/50-Ah (ampere-hour) batteries. The 6 V batteries are available in the following:

- four strings (two sets) for a total of 200 Ah backup
- six strings (three sets) for a total of 300 Ah backup

AC outlets and ground bars are located in the electronics compartment. See the figure on page 2-2. The ac duplex receptacles are provided for heaters and auxiliary 10-A service outlets.

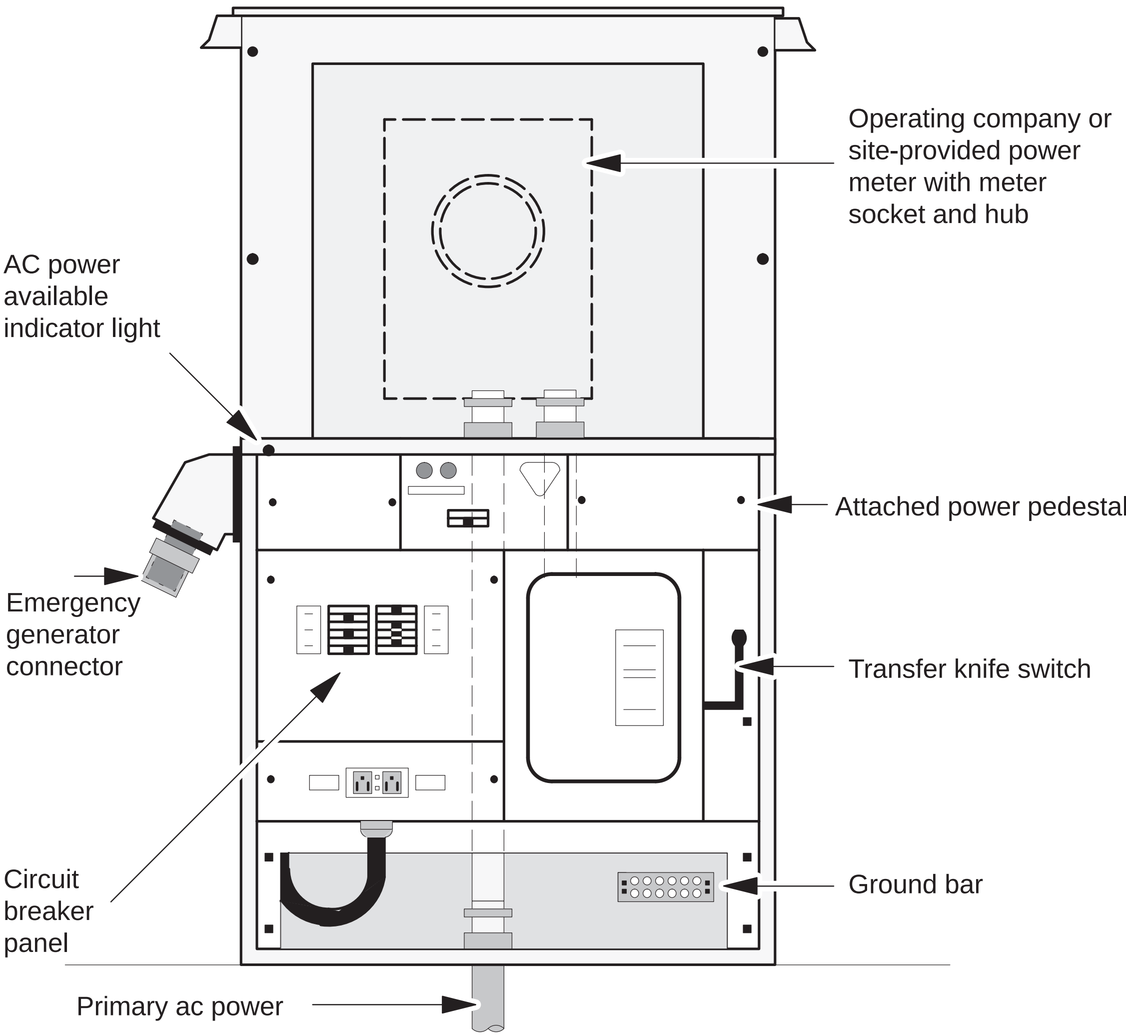
The auxiliary service outlets have a standard ground fault circuit interrupt (GFCI).

Attached power pedestal

The attached power pedestal houses all the components of an ac service equipment deadfront switch. The components include rectifier, ground fault circuit interrupt (GFCI) and heater circuit breakers. These components are for power distribution, surge protection, emergency generator connection and transfer capabilities.

The pedestal is equipped with a 2.5-in. hub to mount any business-size meter socket panel (24-in. maximum height). A red indicator light at the top left corner of the ac power pedestal illuminates when ac power is available. Refer to the following figure.

Electrical compartment and attached power pedestal



The pedestal has a 3.5-in. diameter primary power cable entrance hole for 2.5-in. trade size conduit. The pedestal has four 2-in. diameter knockouts for ground or different cable entrances.

A 7.5-in. by 25.38 in. open space is present along the lower rear bulkhead wall inside the pedestal. This space allows full access to the OPAC master ground bar and mounting hole locations.

The bottom of the ac attached pedestal contains two additional pedestal mounting holes. The cabinet has two mounting holes for final cabinet position.

Power requirements A single phase V 176–264 V, 47–63 hz, 3-wire ac commercial power supply, equipped with a 100 A attached power pedestal powers the OPAC.

In the event of a temporary power failure, a battery reserve of a maximum of 300 Ah powers the system equipment. The battery reserve has six battery strings. The battery reserve can power the system equipment for 6.6 h or more hours of continuous operation. This event occurs when the OPAC is configured to support the maximum of 20 A of additional operating company-provided equipment.

The power pedestal also contains an internally mounted knife switch to connect to a 60 A emergency generator connector (Hubbell Number 460B12W). A positive interlock feature prevents having the ac line and emergency power on at the same time.

Outside plant termination compartment

The outside plant termination compartment is the interface between the electronics equipment and the outside plant cable. When you view the cabinet from the front, the termination compartment is on the left end of the OPAC.

The primary modules inside the compartment are the service protection centers (SPC) and the service area interface (SAI). The SPC provides termination as protection against lightning and ac surges for all incoming copper.

The SAI provides cross-connection (rearrangement) facilities between equipment feeder lines and subscriber distribution lines.

The SPC and SAI and the termination compartment shell provide the following:

- entrance for buried incoming subscriber pairs
- entrance for buried pairs of incoming DS-1 lines
- entrance for buried pairs of incoming special service lines
- one gas or solid state protector for each subscriber pair
- 12 gas tube or solid state protectors for DS-1 lines
- 76 gas tube or solid state protectors for special service lines

- build indoor cross-connect (BIX) or screw down terminals for connecting subscriber pairs, DS-1 lines and special service lines

You can place optical fibers directly into the electronics compartment for termination at a rack-mounted fiber distribution panel. The fibers travel through a small opening at the top center of the bulkhead. This arrangement allows fiber cables or fiber bare-ended twisted wires to enter the electronics compartment.

Service protection centers (SPC)

All VF and DS-1 signal connections to the electronics compartment are made through the SPC.

The SPCs are visible when the termination compartment door and the SAI swing frame are open. Refer to the figure on page 2-7. The SPCs are mounted on the wall that separate the electronics and termination compartments.

Each SPC can contain up to 100 protector modules for incoming lines. The SPC module assemblies are 8-in. by 6-in. metal boxes mounted on the termination compartment wall.

A hinged door on the front of each module assembly provides access to a maximum of 100 protector modules inside. The following table describes the three types of module assemblies available.

Module assembly options

Module assembly	Description
VF	96-pair
VF/DS-1	76-pair VF, 12-pair transmit/12-pair receive DS-1s
RSVD	36-pair transmit/36-pair receive DS-1s

All of the VF module assemblies combined provide termination and protection for 256 or for 640 VF pairs. The termination and protection depend on the line capacity option selected.

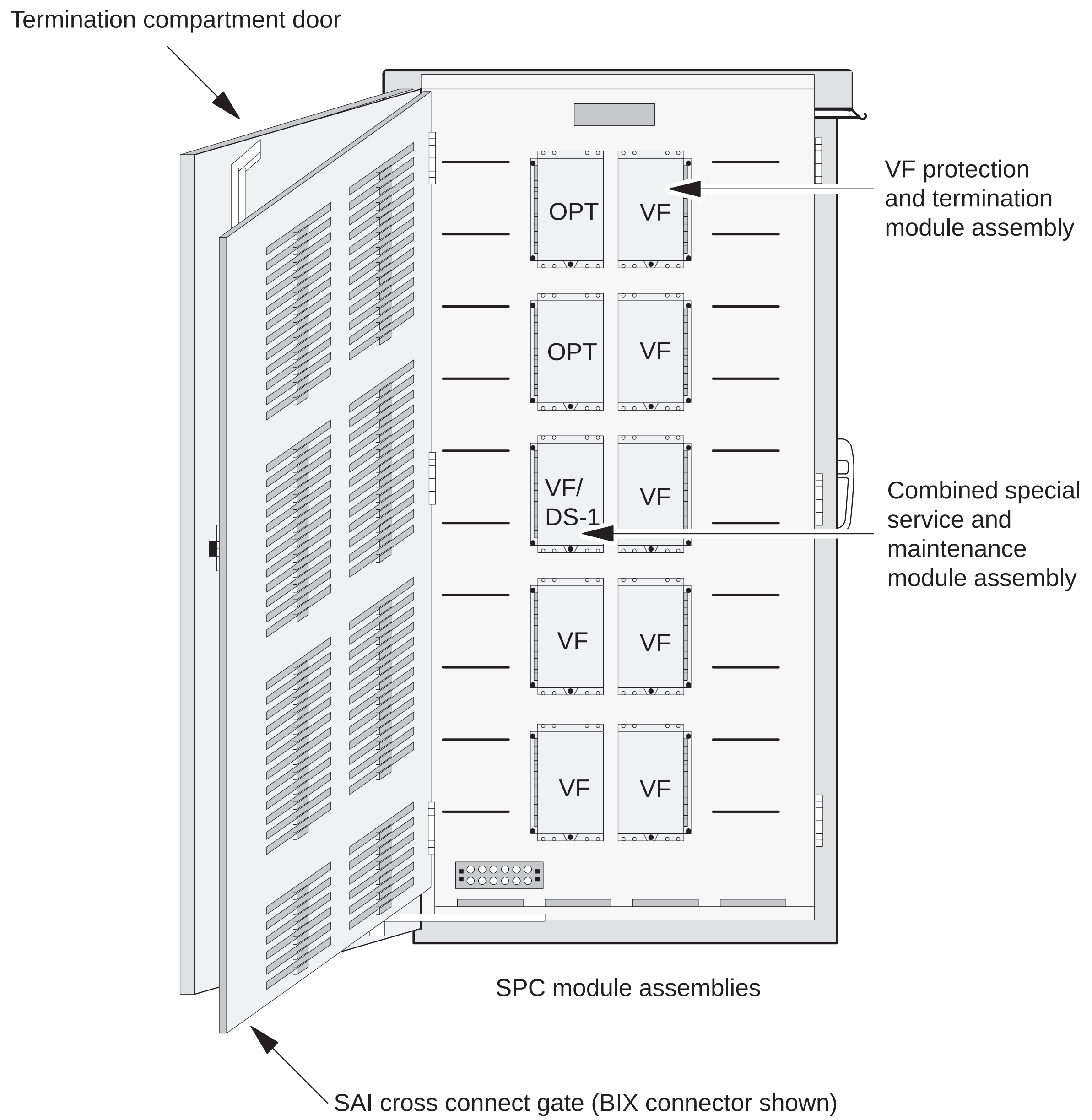
The optional module, (NTRX65AH VF 96-pair module) assemblies, protects up to 96 VF lines.

The optional combination module (NTRX65BF VF/DS-1) assembly accommodates up to 12 (two pairs each) DS-1 lines and 76 VF pairs. These pairs perform special service and maintenance.

The two previous module assemblies are available for use in optional positions 9 and 10 of the SPC.

Note: To maintain UL listing, the SPC must employ UL-listed, five-pin protector modules.

Service protection center



The protector modules in each SPC module assembly protects the cabinet electronics from lightning and ac surges. The protector modules can be five-pin gas tube or solid state. The solid state is 7X or better.

The SPC modules include integral cables with BIX or 3M screw-down connectors on the end. These connectors are secured to the SAI swing frame. These connections are cross connected to the operating company wires that enter from outside the cabinet.

Cables extend from the equipment side of the protector field of the module and pass through a connectorized bulkhead panel. These cables connect to the electronic equipment. The electronics compartment contains the bulkhead panel. The compartment is designed for electromagnetic interference (EMI) filtration and protection.

Serving area interface (SAI)

The SAI can, in specified conditions, be a feeder distribution interface. The SAL is a part of a swing frame that runs the length of the termination compartment. The SAI swing frame is visible when the termination compartment door opens. The SAI swing frame contains many connectors.

The SAI provides distribution of system-derived feeder pairs with a number of subscriber (distribution) pairs in a serving area. The feeder pairs are the 640 or 256 lines served by the OPAC. The subscriber pairs are operating company lines that cross connect at the OPAC.

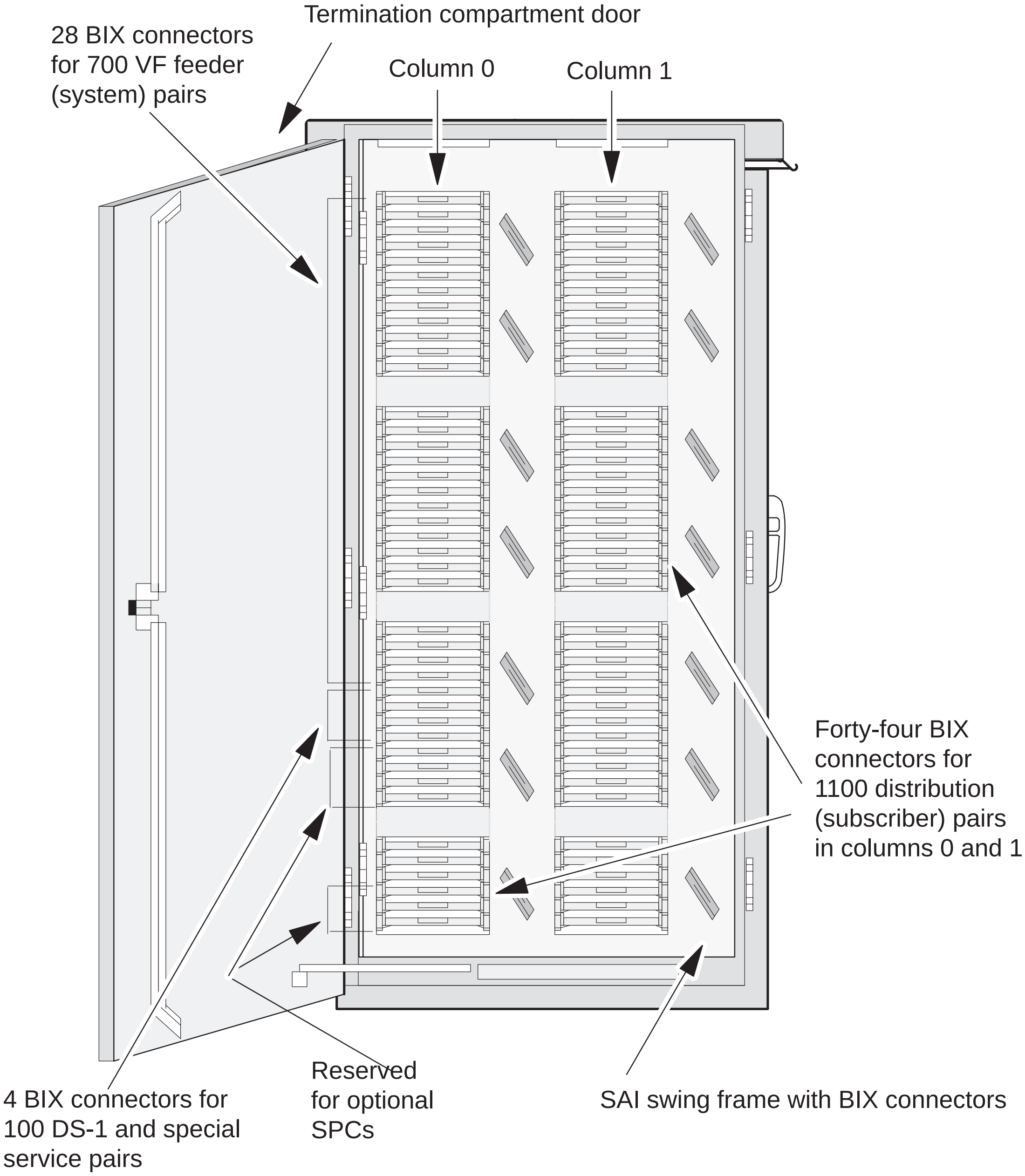
Two SAI options are available. Each option requires a different swing frame to hold connectors. The figure on page 2-9 demonstrates an option that uses NT BIX connectors. The other option uses the 3M binding post/screw connectors. This option appears in the figure on page 2-10.

The SAI is on a hinged frame. Latches on the top and bottom right edge of the frame can open the frame.

Two SAI options are available that depend on connector type. An NT outside plant BIX system based or 3M screw-held binding posts. The BIX system uses a high-density insulation displacement connector, each of which accepts 25 pairs.

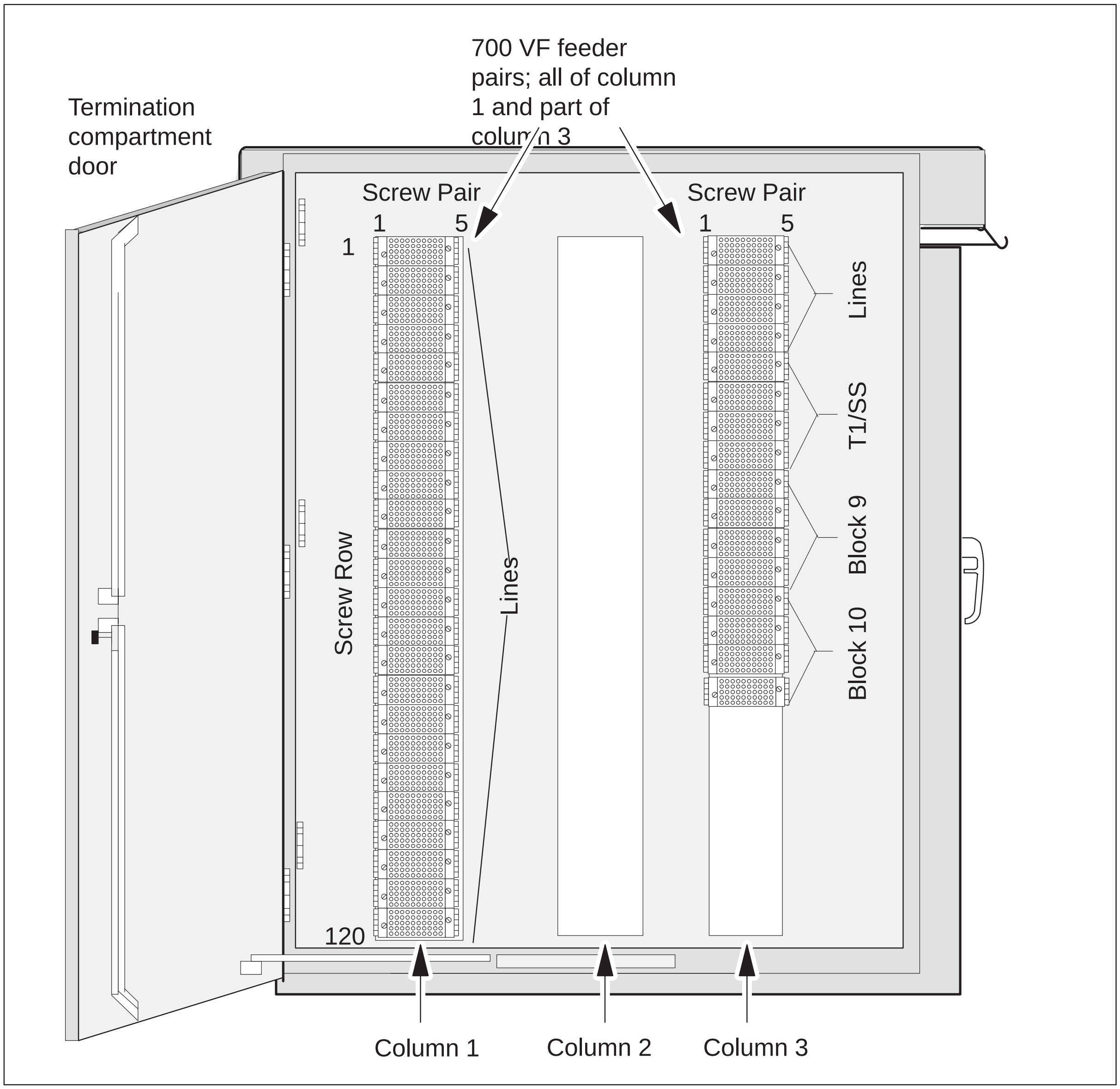
The 700 VF feeder or system pairs connect to the first 28 BIX connectors. The connections begin at the top of column 0 as the following figure shows. The eight connectors that remain are for special service circuits (SPC).

SAI swing frame with BIX connector option



The 44 connectors that remain in columns 0 and 1 serve 1100 distribution pairs. These distribution pairs are subscriber pairs.

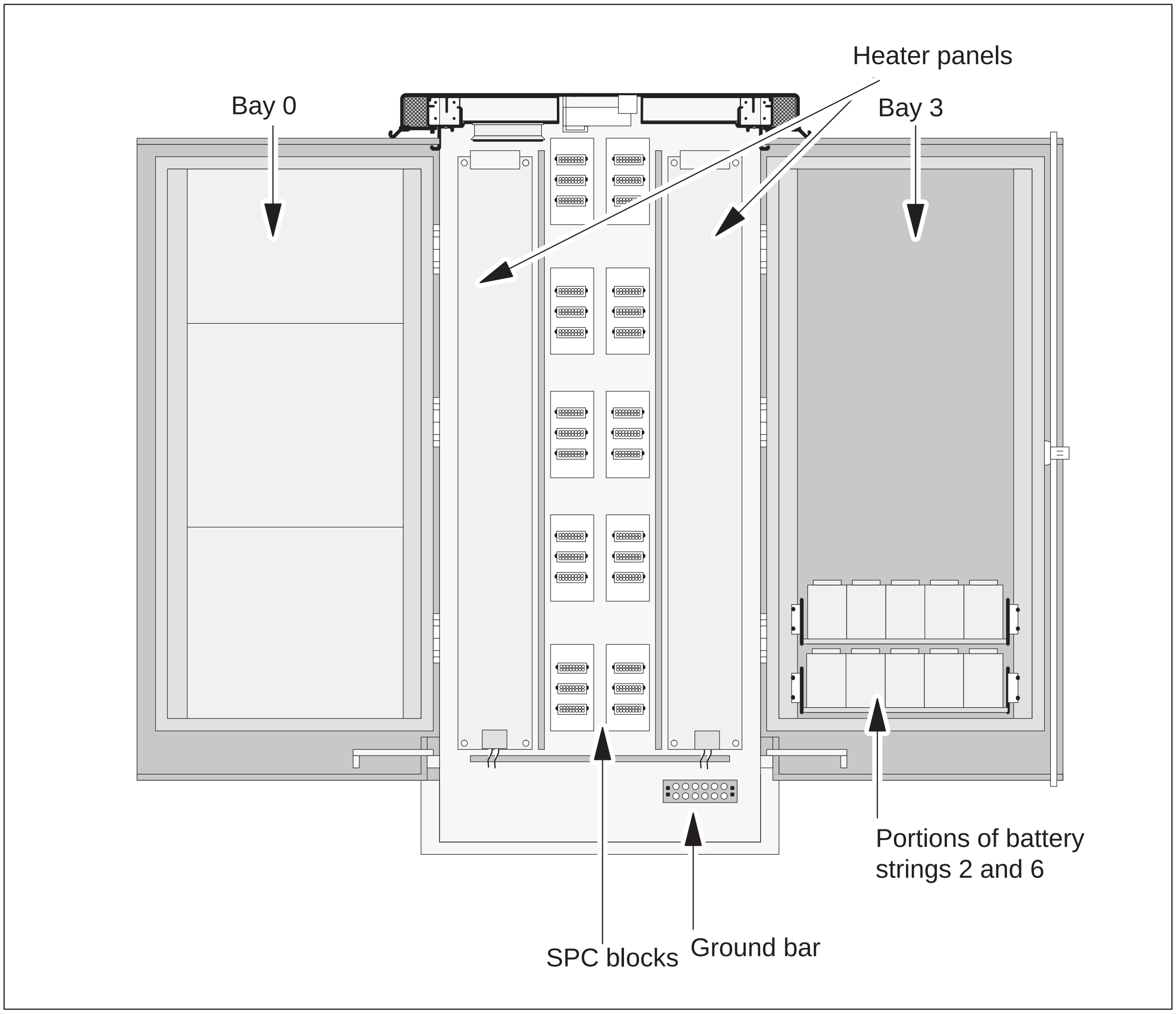
SAI swing frame with binding post connector option for a total of 1800 pair



The 700 VF feeder pairs for the 3M bound post option begin in column 1 and continue into column 3. A section of 100 maintenance and special service pairs are installed in column 3. Two hundred pairs reserved for optional SPC blocks follow this section. Column 2 and the positions that remain of column 3 contain 3M screw terminals, A0345316, which cross connects OSP. Blocks 9 and 10, which appear in the previous figure, are available for optional equipment.

Cables that extend from the equipment side of the protector field pass through a connectorized bulkhead panel. These cables connect to the electronics equipment. The electronics compartment contains the bulkhead panel. This panel filters and shields the EMI. Refer to the following figure.

Bulkhead of termination compartment, view from electronics compartment



Environmental control equipment

One in. thick foil-faced, closed-cell boards with a minimum insulation value of R8 insulate the cabinet. A positive temperature differential between interior cabinet air and outside air controls humidity.

Electric strip heaters are on the right and left walls of the main equipment compartment. Refer to the figures on pages 2-10 and 2-11. The heaters are flat elements that provide standard surface heating.

When the internal temperature drops below 41°F (5°C), four 150-W wall heaters turn ON.

When the temperature rises above 59°F (15°C), the heaters turn OFF. Low temperature alarms are activated when cabinet temperatures drop to 32° F (0°C).

Battery gases that generate in the electronics compartment vent through the roof of the electronics compartment.

Air induction roof

Noncorrosive materials compose the air induction roof. The roof design contains barriers that do not allow dust, sand, water and pests into the cabinet. Refer to the following figure.

Two air filters are located behind hinged filter covers. One air filter is on the front of the roof. One air filter is on the rear of the roof. The filters are made of open-cell, polyurethane foam.

Fans, heaters and insulation control the interior temperature. Six 6-in., 240, 48 V dc fans that a thermostat controls maintain air circulation and provide cooling. The six fans are for exhaust purposes. These fans circulate air out of the cabinet through the equipment side.

The thermostat controls the fans in the roof. The bank of fans turns on when the temperature inside the electronics compartment measures 65°F (18°C).

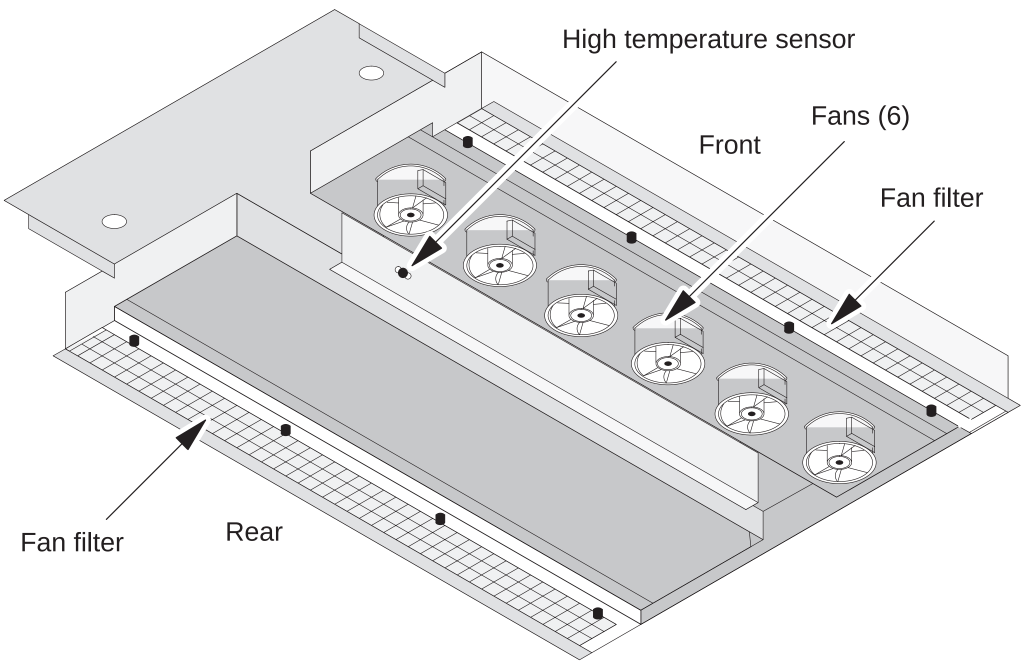
High temperature alarms activate when the cabinet temperature reaches 140° F (60° C) at the monitoring point. The fan arrangement and high temperature sensor location appear in the following figure.

Two cooling units are located under the HIE and RMM shelves. Each cooling unit contains two fans that run continuously.

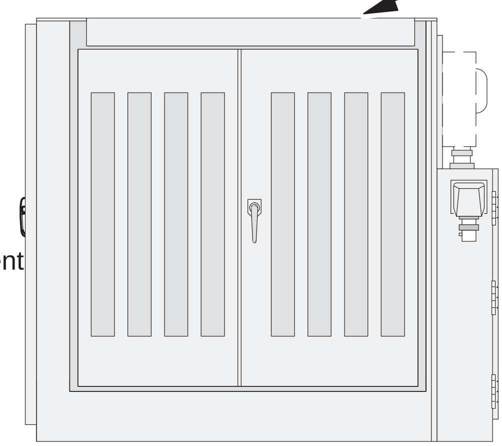
Foil-faced, closed cell boards with a minimum insulation value of R8 insulate the air induction roof. A positive temperature differential between interior cabinet air and outside air controls humidity.

Air induction roof ceiling fans and sensor locations

Inside cabinet view looking up



Front view of OPAC



Electrical system

The electrical system consists of several components. These components include the ac interface and distribution, ac generator transfer switch, the modular supervisory panel (MSP), the rectifiers and battery control unit (BCU). Additional components include the batteries and associated cabling and ground bars.

The following sections describe the powering system and electrical equipment in greater detail.

Power requirements

The OPAC supports a maximum of three 25 A rectifier modules. These modules power several different equipment and system configurations. A list of the business supply features appears in the following table.

Commercial power features

Power features	Requirements
Source	Single phase, 3-wire commercial power, 176–264 V, 47–63 Hz ac small amount at 100 A
Surge Arrestor	Metal oxide, varistor solid state, Joslyn Number 1250–33
Outlets	One dedicated outlet for ac heaters and two 120 V ac support outlets with a standard GFC Interrupt.
Rectifiers	A maximum of three NT MPR25 (NT5C06) 25 A rectifier modules.
Battery backup	A maximum of 300 Ah provide 6.6 h minimum reserves under maximum power drain.
Emergency connector	A 60 A Hubbel emergency generator connector.
Emergency transfer	An attached power pedestal with a double-pole, double-throw (DPDT) knife switch. Perform an emergency transfer with the transfer switch and generator connector, Hubbell Part Number 460B12W.

An OPAC with 640 lines requires two 25 A, 52.5 V rectifier modules and 200 Ah battery reserve to maintain stand-by power.

A third 25 A rectifier module is required to support additional optional equipment beyond a fully-loaded OPAC. When one module fails, the modules that remain increase output and continue to share the load.

Battery control unit

Locate the BCU at the top left hand corner of bay 1. The BCU contains two battery charging controllers (BCC 0 and BCC 1).

The BCU charges, monitors and protects the batteries. The BCU disconnects the batteries from the system when voltage drops below a preset or operating company determined level. The operating company sets the level in accordance with the battery manufacturer specifications.

When commercial or standby ac power is not restored before the BCU disconnects, the system shuts down.

Rectifier shelf

The NT5C06CA MPR25A rectifier modules provide power to the installed equipment, electronics, fans and batteries. Voltage adjustment is available from –44 to –56 V dc. Adjust to deliver the output specified for the system: –52.5 V dc.

The powering circuit allows replacement of a rectifier that has faults without the disruption of service. When necessary, you can remove or replace a rectifier module while the system is in operation. The rectifier shelf and installed rectifiers appear in the following figure.

Two rectifiers are required. A third rectifier can support optional equipment beyond a fully-loaded OPAC.

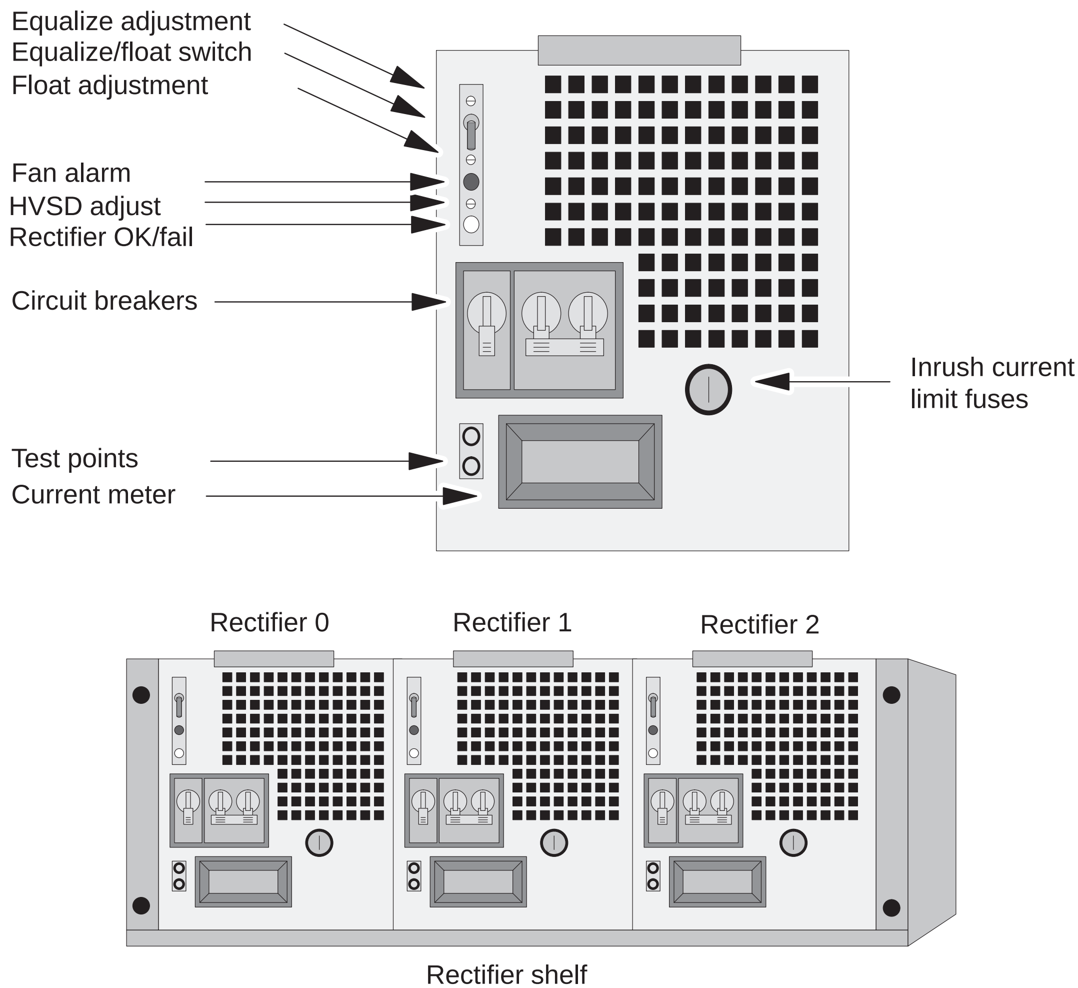
Batteries

A maximum of six strings of Eagle-Picher batteries comprise the OPAC batteries. Each battery string consists of eight batteries. These battery strings connect to the OPAC load or charge bus through the two BCCs in the BCU. BCC 0 and BCC 1 control of the battery strings appears in the following table.

BCC and battery strings

BCC	Battery string
0	0 1 2
1	4 5 6

Rectifier shelf with three MPR25A rectifiers



The BCU controls the BCC cards and the associated battery strings. The battery strings are moved in pairs from bus to bus. Battery string and battery string pairs appear in the following table.

Battery strings and string pairs

Battery string	Battery string pair
0 and 4	0
1 and 5	1
2 and 6	2

Battery string pairs can connect to the load bus, charge bus, discharge bus or none of these (open circuit). Moves from the load to charge bus or charge to load bus must occur through the open-circuit state.

The OPMPES software makes sure of this move. Battery string pairs normally connect to the load bus.

CAUTION
Loss of service
Make sure that one or more battery string pair remains on the load bus at all times.

Modular supervisory panel (NTRX40AA)

The MSP (NTRX40AA) is in bay 1 in the OPAC cabinet. The MSP provides alarm control, power circuit protection and talk battery filtering for the OPAC.

The MSP allows different accessories to be mounted on the rear. Slots 16 through 19 are available for optional fuse or breaker modules and MSP accessories to be mounted on the rear. Use these modules to power NT transmission equipment or customer-provided equipment.

Talk battery module (NTRX44AA)

The NTRX44AA talk battery module provides a filtered power feed of a maximum of 20A. Each card provides inrush current protection (soft-start) to protect against breaker trips. Each talk battery module occupies two card positions in the MSP.

This connectorized module provides power input and output through power ports and alarm output (fail and loss-of-power) through two 2-pin connectors.

The assembly includes a faceplate mounted light-emitting diode (LED), printed circuit board (PCB) mounted filter capacitors and an inductor. A captive screw attached to the faceplate provides positive memory and conductive coupling to the shelf.

The NTRX44AA provides the following functions:

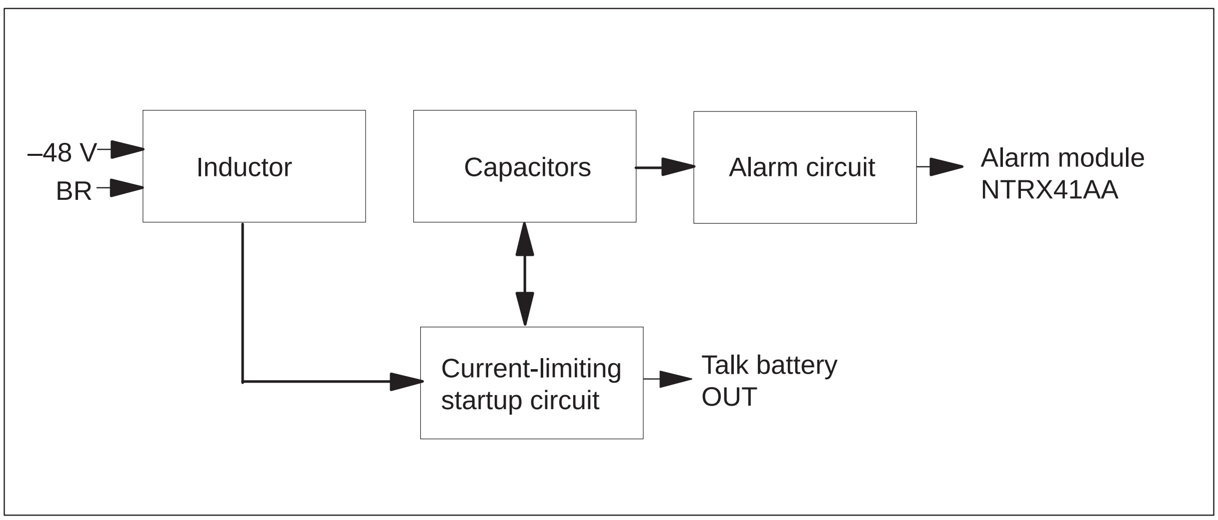
- termination point for power feeds
- filtered battery feed through connector interfaces
- soft-start provided by a current-limiting startup circuit to protect against breaker trip
- two fail alarms

The NTRX44AA has the following operating blocks:

- inductor
- capacitors
- current-limiting beginning circuit
- alarm circuit

The relationship between the functional blocks appears in the following figure.

NTRX44AA functional blocks



The NTRX44AA uses a 20A QHP77C bracket-mounted power inductor and six 80-V capacitors that provides 6800µF of capacitance.

Current-limiting startup circuit This circuit limits the inrush current on startup to eliminate the risk of tripping the feed breaker. A thermistor is the first to charge the capacitors.

The fully charged capacitors power on a relay. The contacts of the relay connect the capacitors to the output. This soft-start occurs 5 s from the time of application of input power.

Alarm circuit This block reports filter failure in the NTRX44AA to the alarm module (NTRX41AA) card through connector P3. When this eveny occurs, the alarm module generates a FRAMEFAIL alarm. Report any total power loss to the maintenance trunk monitor (MTM) through connector P4.

Output The output specifications for the NTRX44AA appear in the following table.

NTRX44AA output specifications

Parameter	Value
Voltage	–48 V
High voltage shutdown	–75 V
Low voltage shutdown	–42 V
Maximum current	20 A
Attenuation	40 dB @1 kHz
Output impedance	50Ω @300 to 3500 Hz

Alarm module (NTRX41AA)

The NTRX41AA alarm module occupies two card positions in the MSP. The module interfaces with the alarm backplane through a 4x30 NORCON connector. The connector has a key setting of C (top) and 3 (bottom) that polarizes. The module has a card latch to help card insertion and removal.

A captive screw, attached to the faceplate, provides positive hold and conductive coupling to the shelf.

The NTRX41AA alarm card monitors and detects the following types of faults:

- converter faults
- breaker failures
- fan failure from the fan alarm module (FAM)
- failures in the talk battery modules
- inverter failure in the cabinet

When any of the first five conditions occurs, the NTRX41AA raises alarms. The NTRX41AA sends signals to the MAP terminal through an NT0X10AA scan card.

The NTRX41AA has the following operating blocks:

- alarm circuit
- maintenance block

Alarm circuit The following four alarm inputs activate the alarm circuit that consists of transistor logic :

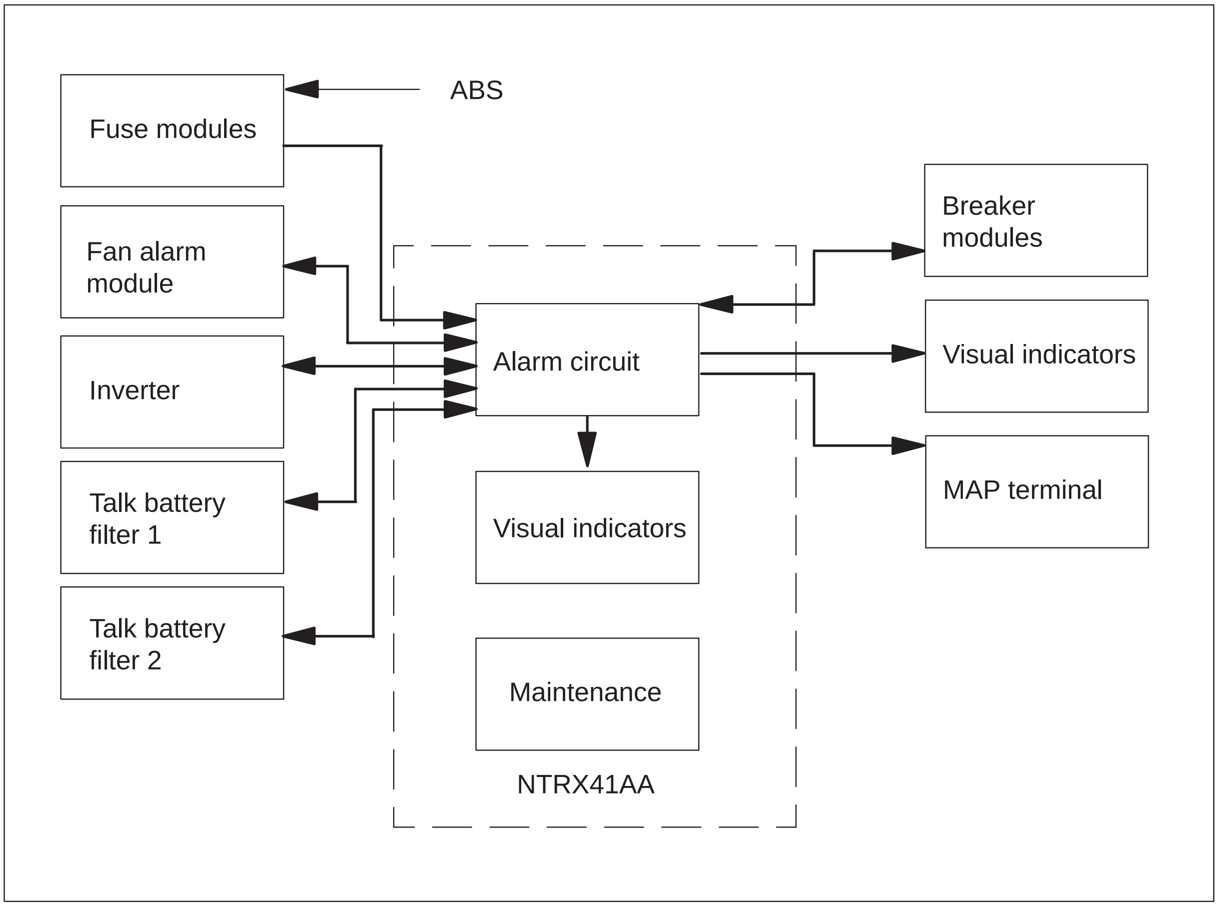
- battery-input voltage, which triggers a FRAMEFAIL signal for an inverter alarm, talk battery module alarm, or fuse module alarm
- battery-return voltage, which triggers a FRAMEFAIL signal for a converter fail alarm and line concentrating equipment (LCE) alarm
- 90 Vrms, which triggers a FRAMEFAIL signal for an RG on an LCE cabinet
- battery-input voltage generates a FANFAIL signal and triggers an alarm for the cooling units

The alarm circuit provides two LEDs as visual indicators of the FRAMEFAIL and FANFAIL signals.

Maintenance block The NTRX41AA provides maintenance features like jacks for telephone, data and ABS. These features provide for interoffice communication and data transmission. These features require dedicated FX facilities.

The relationship between the functional blocks appears in the following figure.

NTRX41AA functional blocks



Fuse module (NTRX43AA)

The NTRX43AA fuse module provides a maximum of eight current-limited feed outputs and one alarm output. Each of these cards occupies one card position. The MPS provisions three card positions.

This module does not contain the eight QFF fuses. The cabinet level supplies the fuses. The connectorized module provides separate power input ports for two groups of four fuses each. This module also provides an 18-pin output power output connector.

A separate two-pin connector provides alarm output.

The assembly includes eight fuse holders mounted on the faceplate. The fuse holder connector leads connect to the PCB. A captive screw attached to the faceplate provides positive hold and conductive coupling to the shelf.

The NTRX43AA provides the following functions:

- supplies eight current-limited outputs for different circuits
- reports fuse failures to the NTRX41AA alarm module

Connector P1 provides the power feed for fuses F01 through F04. Connector P2 provides the power feed for fuses F05 through F08.

These fuses mount on the faceplate of the NTRX43AA. Connector J1 provides the fused outputs with currents ranging from 0.18 A to 5.0 A. Connector P3 provides alarm outputs that report fuse failure to the NTRX41AA alarm module.

Breaker module (NTRX42AA, BA, CA, DA, EA, FA)

Each NTRX42 breaker module provisioned with the MSP provides two breakers.

- The NTRX42AA provides two 10-A breakers
- the NTRX42BA provides two 15–A breakers
- the NTRX42CA provides two 20–A breakers
- the NTRX42DA provides one 10–A and one 15–A breaker
- the NTRX42EA provides one 10–A and one 20–A breaker
- the NTRX42FA provides one 15–A and one 20–A breaker

Note: For modules with two different breakers, install the card with the smaller current breaker on top of the module.

Each breaker module provides two power feeds and allows the two front-mounted breakers to limit the input current. Each breaker module has the standard DMS converter interface. This interface allows the module to monitor converters, automatic recovery from low battery (ARLB) and an alarm output. Each breaker module occupies one card position in the MSP.

The breakers have designation labels at frame level. The connectorized module provides separate power input ports for each breaker and a common 24-pin power/signal/alarm output connector.

The primary functions of the NTRX42 are as follows:

- to monitor and detect converter failures
- to trip breakers when overcurrent conditions exist
- to trip breakers on converter failure
- to provide battery feed samples for the alarm module
- to respond to ARLB conditions

The NTRX42 contains the following operating blocks:

- ARLB
- trip circuitry and enable
- breakers

Trip and enable circuitry A transistor circuit trips the associated circuit breaker in response to alarm relay release in the associated power converter or RG. This circuitry provides the DRIVE or ENABLE signal for the converters that require these signals.

Breakers Two magnetic breakers stack one on top of the other in this breaker module. The breakers operate over the whole –48 V to –60 V range.

Fan alarm module (NTRX66AA)

The fan alarm module monitors the fans in the roof and the auxiliary cooling units. The fan alarm module determines when any fans do not operate.

The module monitors round, 6-inch, tube-axial fans. The fans are arranged in two banks. The intake fans are arranged in cooling units below the components in the electronics compartment. The exhaust fans are in the roof.

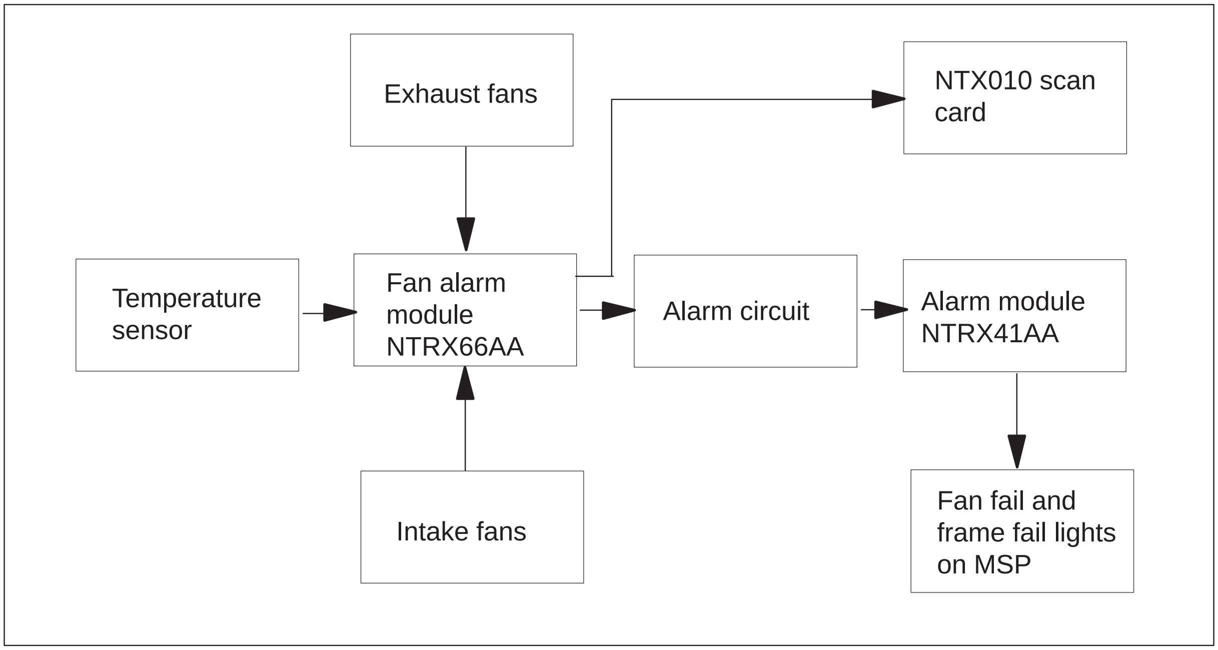
When the temperature inside the cabinet rises above 65F (18°C), the bank of exhaust fans activate. The bay operates continuously.

The fan alarm module monitors the operation of the fans. The alarm can notify the NTRX41AA alarm module when the temperature inside the cabinet rises. The alarm notifies the NTRX41AA when the temperature level must start the exhaust fans and the fans do not operate. When at any time the fans do not operate, the fan alarm module signals the NTRX41AA alarm module.

When a fan fails, the fan alarm module signals to the alarm module turns on the fan fail and frame fail lights. The fan fail lights and frame fail lights are on the MSP cover. The fan alarm module notifies the system of environmental control failure through the NT0X10 scan card in the RMM.

The fan alarm module occupies one card position in the MSP. The module occupies slot 20, because this module does not require visual access with the MSP front cover closed. A captive screw attached to the faceplate provides positive hold and conductive coupling to the shelf.

NTRX66AA functional blocks



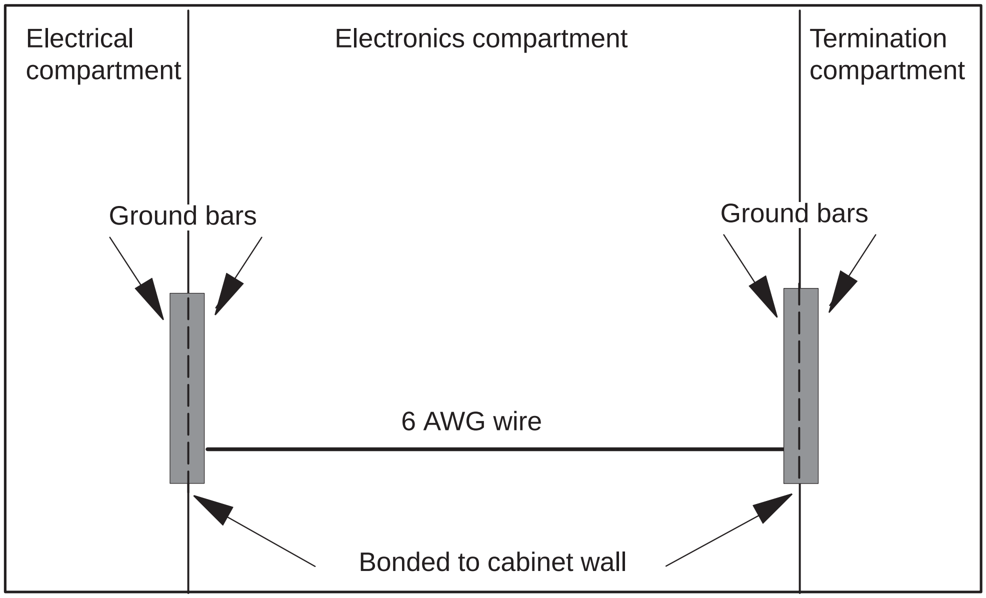
Grounding

All metal parts of the cabinet are grounded for safety and operating performance requirements.

Each wall of the electronics compartment has a ground bar. The ground bars connect by a No. 6 AWG cable. The ground bars collect the ground wires from the doors and swing frames, the SPCs and the ac power supply. The ground bars also collect the ground wires from the outside plant cables. The bars are between the cabinet walls to provide better cabinet bonding. The location of the bars provides secure metal-to-metal contact as the following figure shows.

The bars have additional lugs that allow special operating company applications and connections to an operating company-supplied ground. The cabinet operate with a maximum ground-to-earth resistance of 25 ohms (Ω).

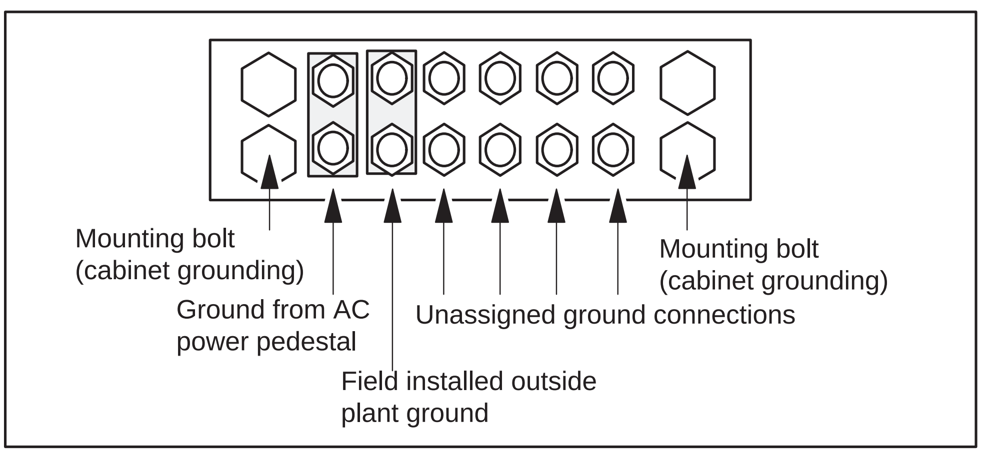
Grounding



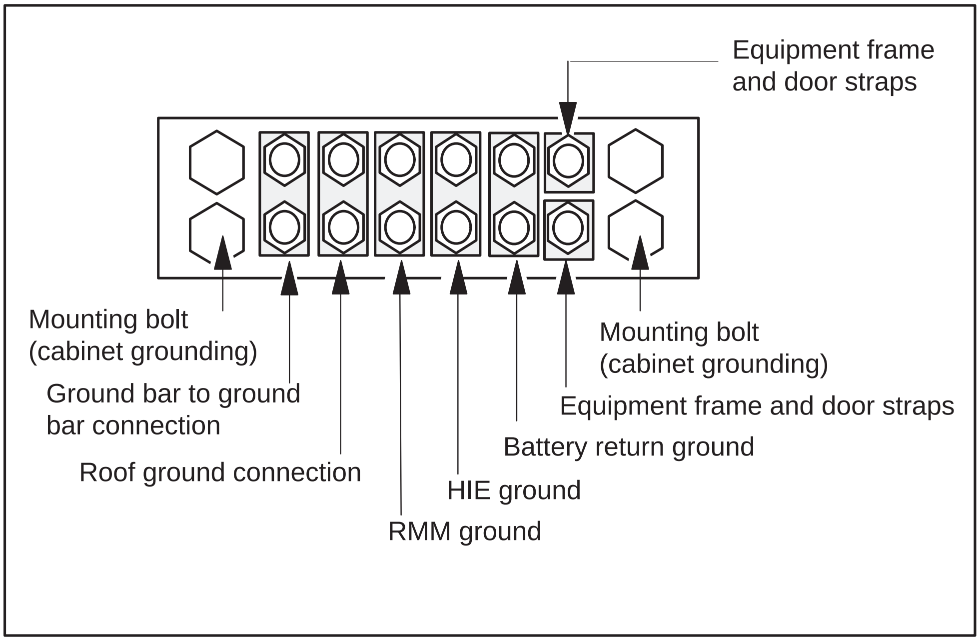
OPAC grounding network

The cabinet ground bar located in the electrical compartment connects to the OPAC main ground. The following figures illustrate the ground bar terminations. The operating company provides the ground in agreement with local utility codes and operating company requirements. The maximum recommended ground-to-earth resistance is 25 Ω.

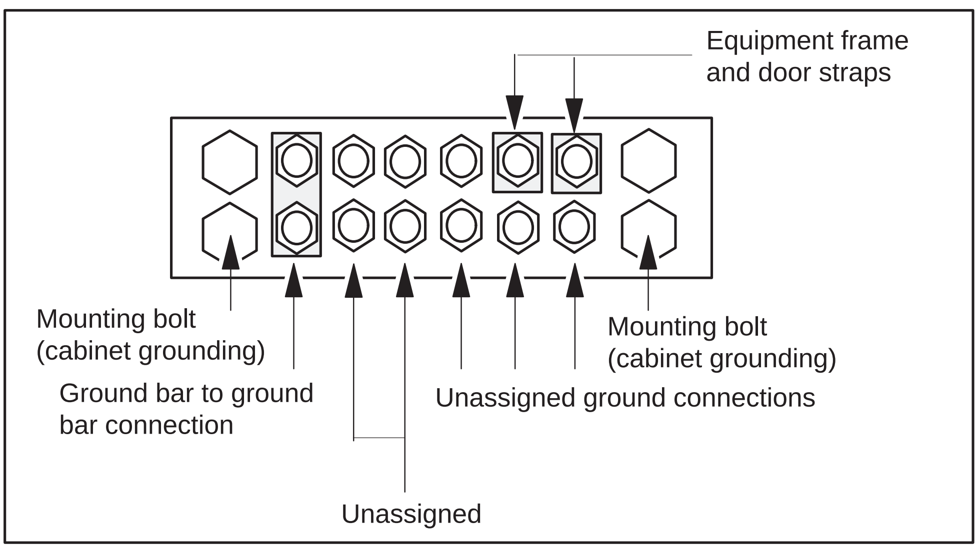
Ground bar assembly, on AC bulkhead viewed from AC compartment



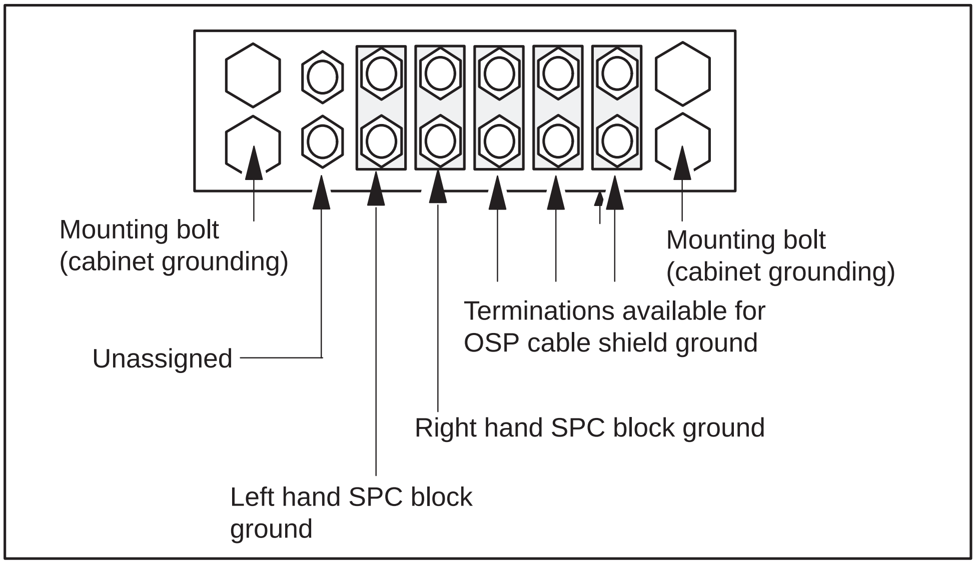
Ground bar assembly, on AC bulkhead viewed from inside cabinet



Ground bar assembly on SAI bulkhead viewed from inside cabinet



Ground bar assembly on SAI bulkhead viewed from SAI compartment



OPAC power and environmental system maintenance

Maintenance and user interface commands for the OPAC are the same as for the Remote Line Concentrating Module (RLCM). These commands also apply to the Outside Plant Module (OPM) with the power and environmental system (PES).

The OPAC maintenance that includes PES maintenance is known as OPMPES. The OMPES involves the following:

- table control for the OPMPES data in table OPMINV
- MAP terminal support for the OPMPES, that consists of
  - remote control of battery-string switching to
    - cause an open circuit (O/C) by removing a battery string pair from either the load bus or the charge bus
    - put a battery string pair on the load bus
    - put a battery string pair on the charge bus
  - commands for the circuits that control battery string switching and detect the alarm or the state conditions of an OPMPES
  - displays to identify the shelves and bay and to give the circuit location information that the command QUERYPM provides

- alarm detection and automatic battery switching when OMPES detects these conditions:
  - — ac power failure
  - — BCC fuse 0 or 1 failure
  - — rectifier 0 or 1 failure
  - — high temperature (EHT)
- log reports that record the changing events or failures that the OMPES system encounters
- one audit each hour in the OPMPES to confirm the condition of the OPMPES as viewed by the software

  Note: The batteries are set to a software state. The software state of the PES alarms is set to the hardware state of the OPMPES. When the detection of a mismatch between software and hardware occurs, the audit restores the hardware to the current condition of the software. The audit generates a log message that indicates the action of the audit.
- the state of the remote maintenance module (RMM) in the state of the OPMPES circuits

OPAC battery backup system

The OPAC provides up to six strings (three pairs) of batteries for backup power when an ac failure occurs. The amount of backup time the OPAC provides depends on the following causes:

- number of battery strings installed (none, four, or six)
- condition of the battery strings
- number of line drawers and line cards installed
- number of subscriber lines off-hook
- length of the subscriber loops

The OPAC contains Eagle-Picher 6 V batteries. The following are the estimated battery backup times for the OPAC:

- The estimated backup time for OPAC configured for 640 lines is 6.6 h when equipped with the following:
  - — ten line drawers and 640 line cards
  - — six strings (three string pairs) of Eagle-Picher batteries
  - — a call rate of 3.0 CCS, when 8.3% of lines are off-hook
  - — maximum of operating company provided equipment is 20 A.

- The estimated backup time for OPAC configured for 256 lines is 7.5 h when equipped with the following:
  - — ten line drawers and 256 line cards
  - — six string (three string pairs) of Eagle-Picher batteries
  - — a call rate of 3.0 CCS, where 8.3% of lines are off-hook
  - — maximum current load of operating company provided equipment is 20 A

OPAC power matrix and example current demand

The following power matrix of the OPAC provides for computing backup time estimates for different configurations.

For the OPAC without line drawers, the electric current demand is –52 V dc at 12 A.

The OPAC frame includes the following:

- frame support hardware
  - — modular supervisory panel
    - – two NTRX44AA talk battery filter cards
    - – one NTRX41AA alarm card
    - – three NTRX43AA fuse cards
    - – three NTRX42EA circuit breaker cards
    - – two NTRX42AA circuit breaker cards
    - – one NTRX66AA fan alarm card
  - — two NT8X02AB BCC
- HIE shelf
  - — two NT6X60CA ringing generators
  - — two NT2X70AE power converters
  - — two NT6X73AA link control cards (LCC)
  - — two or three NT6X50AA or AB DS-1 interface cards
  - — one NT6X75AA ESA tone and clock card
  - — one NT6X45AF ESA processor card
  - — one NT6X47AB 2 Meg ESA memory card or one NT6X47AC 4 Meg ESA memory card

- RMM shelf
  - one NT2X59 tone pad (group CODEC) card
  - one NT6X74AB RMM control card
  - one NT2X09AA more than one output power converter
  - one NT2X06AB power converter common features card
  - one NT2X10AC/2X11AC line test unit (LTU) analog/digital (pair)
  - one NT2X10BA/2X11BA multiline test unit (MTU) (pair)
  - one NT3X09BA 8x8 metallic test access (MTA) card
  - one NT3X09AA remote MTA card
  - two NT0X10AA different scan cards
  - three NT2X48AB Digitone receiver (DTR) cards
  - two NT2X90AD incoming/outgoing test trunk cards
- LCM with two units. Each unit includes the following:
  - one 6X53AA power converter
  - one 6X51AA processor
  - one 6X52AA digroup control card (DCC)

The total frame current for the base OPAC without line drawers is 12 A.

Line drawer current demand includes all lines on-hook

The base current demand for the OPAC appears in the following table. This table includes line drawers, line cards and all lines on hook.

Frame current with line drawers supplied

Drawers	Line cards	Frame current demand (A)
0	0	12
1	64	12.38
2	128	12.76
3	192	13.14
4	256	13.88
5	320	14.26

—continued—

Frame current with line drawers supplied (continued)

Drawers	Line cards	Frame current demand (A)
6	384	14.64
7	448	15.02
8	512	15.4
9	576	15.78
10	640	16.16

—end—

Current demands with the line off-hook

The amount of current that an off-hook line draws depends on the length of the loop.

For these calculations, model an NT6X17AA line card has the following parameters:

- line card battery feed resistance is 440 Ω
- phone resistance is 200 Ω
- assumed short loop resistance is 50 Ω
- assumed average loop resistance is 800 Ω

Use these values to estimate the off-hook line power requirements. The off-hook current for short loop is 77 mA and off-hook current for average loop is 77 mA.

Determine the estimated percentage of installed lines that are off-hook. Assume a call rate of 3.0 CCS or about 8.3% of the installed lines off-hook. For the OPAC, 8.3% of the lines is 54.

To calculate the total OPAC power demand, use the following equation:

(Number of lines off-hook) x (current per line) + base PWR demand + additional equipment current draw = Total frame power demand.

An OPAC with 640 lines, with 54 lines off-hook and 50 Ω loops has the following power demand:

- base frame current with 10 line drawers is 16.16 A
- total off-hook line current = (54 lines) x (77 mA/line) is 4.16 A

- optional equipment current draw (maximum) is 15 A
- total frame current is 35.32 A

OPAC power requirements

The power requirements for the OPAC at a call rate of 3.0 CCS appear in the following table.

OPAC power requirements at 3.0 CCS

Drawers	Lines	Idle frame current demand (A)	Off–hook line demand (A) short: average loops	Total frame demand (A) short: average loops	Total frame demand (A) short: average loops + 15 A option load
0	0	12	N/A	N/A	N/A
1	64	12.38	0.46 : 0.24	12.84 : 12.62	27.84 : 27.62
2	128	12.67	0.85 : 0.44	13.61 : 13.20	28.61 : 28.20
3	192	13.14	1.23 : 0.64	14.37 : 13.78	29.37 : 25.78
4	256	13.88	1.69 : 0.88	15.57 : 14.76	30.57 : 29.76
5	320	14.26	2.08 : 1.08	16.34 : 15.34	31.34 : 30.34
6	384	14.64	2.46 : 1.28	17.10 : 15.92	32.10 : 30.92
7	448	15.02	2.92 : 1.52	17.94 : 16.54	32.94 : 31.54
8	512	15.40	3.31 : 1.72	18.71 : 17.12	33.71 : 32.12
9	576	15.78	3.70 : 1.92	19.48 : 17.70	34.48 : 32.70
10	640	16.16	4.16 : 2.16	20.32 : 18.32	35.32 : 33.32

Calculating battery backup time

Use these values to calculate approximate battery backup time for the different configurations. Use the following steps complete the calculation:

1 Calculate the total battery power reserve.

— An- Eagle Picher battery at an 8-hour discharge rate is 46.4 Ah capacity. A 46.4 Ah/string x 6 strings is 278.4 Ah total backup power. The end of life capacity of the batteries is 80%. Derate the reserve power to give a worst case description as follows:

– 278.4 Ah x 0.80 is 222.72 Ah backup power

2 Divide the total backup power by the frame power demand to obtain the estimated backup time as in the following example:

– six strings of Eagle-Picher batteries at 80% are 222.72 Ah

– OPAC configured with 640 lines at 3.0 CCS is 20.32 A

Estimated backup time is (222.72 Ah) / (20.32 A) is 8.2 h.

The estimated backup times for OPACs with 222 Ah of reserve power available appear in the following table. The OPACs in this example have a call rate of 3.0 CCS.

Reserve power estimates for 3.0 CCS call rate

Drawers	Lines	Total frame demand (A) short average loops	Estimated backup time (hours) short loops: average loops without additional load	Estimated backup time (hours) short loops: average loops with additional 15 A load
0	0	: 12.00	: 18.6	: 8.2
1	64	12.84 : 12.62	17.3 : 17.6	8.0 : 8.1

Note 1: The above values (±15 percent) provide a good estimate of backup power and times.

Note 2: The above calculations do not include the following factors:

— line card types other than NT6X17AA (most other line cards draw less power)

— increase in battery current drawn by system packs as the battery voltage drops from –52 V dc down through –42 V dc

— decrease in loop current drawn by lines as the battery voltage drops from –52 V dc down through –42 V dc

Reserve power estimates for 3.0 CCS call rate (continued)

Drawers	Lines	Total frame demand (A) short average loops	Estimated backup time (hours) short loops: average loops without additional load	Estimated backup time (hours) short loops: average loops with additional 15 A load
2	128	13.61 : 13.20	16.4 : 16.9	7.9 : 7.9
3	192	14.37 : 13.78	15.5 : 16.2	7.6 : 7.7
4	256	15.57 : 14.76	14.3 : 15.1	7.3 : 7.5
5	320	16.34 : 15.34	13.6 : 14.5	7.1 : 7.3
6	384	17.10 : 15.92	13.0 : 13.6	6.9 : 7.2
7	448	17.94 : 16.54	12.4 : 13.5	6.8 : 7.0
8	512	18.71 : 17.12	11.9 : 13.0	6.6 : 6.9
9	576	19.48 : 17.70	11.4 : 12.6	6.5 : 6.8
10	640	20.32 : 18.32	10.9 : 12.2	6.3 : 6.7

Note 1: The above values (±15 percent) provide a good estimate of backup power and times.

Note 2: The above calculations do not include the following factors:

- — line card types other than NT6X17AA (most other line cards draw less power)
- — increase in battery current drawn by system packs as the battery voltage drops from –52 V dc down through –42 V dc
- — decrease in loop current drawn by lines as the battery voltage drops from –52 V dc down through –42 V dc

—end—

Normal charge time

When all rectifiers fail or ac power is not available for more than six hours, the batteries can discharge. When ac power resumes after after a deep battery discharge, the OPAC load bus recharges the batteries. The OPAC load bus recharges the batteries to 90% of the available capacity in 24 h. The system recharges the batteries to 100% of available capacity in 48 h.

Fault conditions

The PES and the RMM use a system of alarms and audits to monitor fault conditions for the OPAC.

PES description

The PES controls the power and environmental conditions of the OPAC. The PES has two functions:

- the alarm system, that monitors fault conditions
- the battery control and testing system, which is an automatic maintenance feature

Alarm system

The NT0X10AA scan cards in slot 07 and 08 of the RMM monitor alarms. The designation for NT0X10AA is PESALRM. Designation occurs at the PES MAP level. The following table lists alarms that indicate possible fault conditions.

PESALRM indicators

Alarm	Functions monitored
AC	Rectifier 0 and 1 failure (note 1)
BCCF0, BCCF1	(NT8X02) battery control charging fuse alarms
CL0	Rectifier 0 current limit (note 2)
CL1	Rectifier 1 current limit (note 2)
ECU	Fan failure
EHT	Extremely high temperature
ELT	Extremely low temperature
FL0	Rectifier 0 failure to sense output
FL1	Rectifier 1 failure to sense output
FSP	Fuse or converter failure
FRNT	Front or rear door open

Note 1: The ac alarm is not a physical alarm that the NT0X10AA scan card monitors. The ac alarm is a logical alarm set when both the FL0 and FL1 alarms are set.
Note 2: The CL0 and CL1 alarms do not appear at the MAP terminal because MPR25A rectifiers do not supply a limit alarm.

—continued—

PESALRM indicators (continued)

Alarm	Functions monitored
HBT	High battery temperature, not supported on the OPAC, always a dot (.)
SIDE	Side door open, not supported on the OPAC, always a dot (.)

Note 1: The ac alarm is not a physical alarm that the NT0X10AA scan card monitors. The ac alarm is a logical alarm set when both the FL0 and FL1 alarms are set.
Note 2: The CL0 and CL1 alarms do not appear at the MAP terminal because MPR25A rectifiers do not supply a limit alarm.

—end—

The NT0X10AA scan card located in slot 07 monitors an installed third rectifier and any customer installed equipment. This process requires datafill as an external (EXT) alarm for display at the MAP terminal.

Note: The banner of the MAP display, not the PES level display, shows the EXT alarm status.

The group of alarm states and circuit card states reflects the condition of the PES. Every detected alarm change, and change of circuit states, causes the PES condition to change.

The system stops every alarm in the RMM. The cabinet alarm system consists of the following four alarms:

- low or high temperature
- door open
- fan operation
- rectifier

The low voltage alarm, used during ac failure, activates when the dc battery load bus voltage reaches –47 V dc (± 1 V).

PES cards

The PES cards are:

- BCC battery charging controller card (NT8X02)
- BCCDVR battery charging controller driver card (BCCDVR) (NT3X09AA)
- PESALRM PES alarm detector card (NT0X10AA)

The following list describes the OPM alarm conditions and the priority and causes for each card

- Red—The system detects one or more serious problems. This condition causes a major alarm at the PM level if PM alarms are not present. The following are the detected alarms:
  - AC failure
  - FL0 detected
  - FL1 detected
  - EHT detected
  - ELT detected
  - MSP detected
  - FRNT or rear door open
  - Side door open, not supported on the OPAC, always a dot (.)
- Amber—The system detects one or more problems that can be severe. An equipped battery string is not always present on the load bus and other PM alarms are not always present. If these events occur a minor alarm occurs at the PM level. The detected alarms are:
  - BCCF0 detected
  - BCCF1 detected
  - ECU (fan failure) detected

The amber condition occurs if the BCCDVR and OESALRM cards are in one of the following states:

- peripheral busy (P)
- system busy (S)
- manual busy (M)

The amber condition occurs if the BCCDVR and OESALRM cards have a disabled battery rotation audit or a battery string marked F. The F indicates if the string fails weekly tests.

- Green—The system does not detect an alarm. Every card and facility are in service (InSv) or normal.
- OffL—The BCCDVR and PESALRM cards are offline. This state does not affect the PM command OffL. Ignore the alarms that the system can detect because they are for information only.

Load bus low voltage alarm

During a power failure, the system forces battery strings on the load bus. The system locks the strings to load the bus for the duration of the failure.

The OPAC power backup provides battery power for at least 6.6 h when the OPAC has equipment that the operating company provides. The equipment must draw 20 A above the basic OPAC equipment load requirements.

When a power failure occurs

- A major alarm results.
- If the measurement of the load bus voltage reveals a level that is too low, one of the following events occur:
  - — The system generates a log that indicates the low voltage in the load bus.
  - — A major alarm appears at the PM level of the MAP display
  - — The command QUERYPES displays the failure status after the post of the affected OPM.

A load bus which, during a power outage, measures 47 V or less, triggers the low voltage alarm. The load bus is normally 52 V. An MTU tests equipment.

The discharge rate of the battery strings varies with the OPM load. The OPAC has a minimum of 6.6 h of backup for the following reserve power and load conditions:

- six strings of Eagle-Picher batteries at 80 % or greater capacity
- an OPAC call rate of 3.0 CCS or less

The sequence of easily seen events is as follows:

- power failure occurs, load bus and batteries are at –52 V
- in the first 90 s, voltage drops to approximately –49 V
- in the next hour, voltage rises to approximately –50 V because of the battery characteristics
- the voltage drops; at –47 V the load bus voltage alarm occurs
- when the batteries are at –47 V, at least 1.5 h of backup power remains available

During the power outage, the OPAC hardware audit runs every 15 min and tests the load bus voltage. If the load bus test fails because the voltage is less than –47 V, the following events occur:

- The system generates a log.
- A major alarm status appears at the PM level of the MAP display.
- The system records the trouble for the QUERYPES command.

Automatic maintenance

The OPAC provides a maximum of six strings (three pairs) of battery strings for backup power in the event of an ac failure.

Feature package NTX147AB provides automatic maintenance for the PES batteries and power system. Feature package NTX147AB consists of the following:

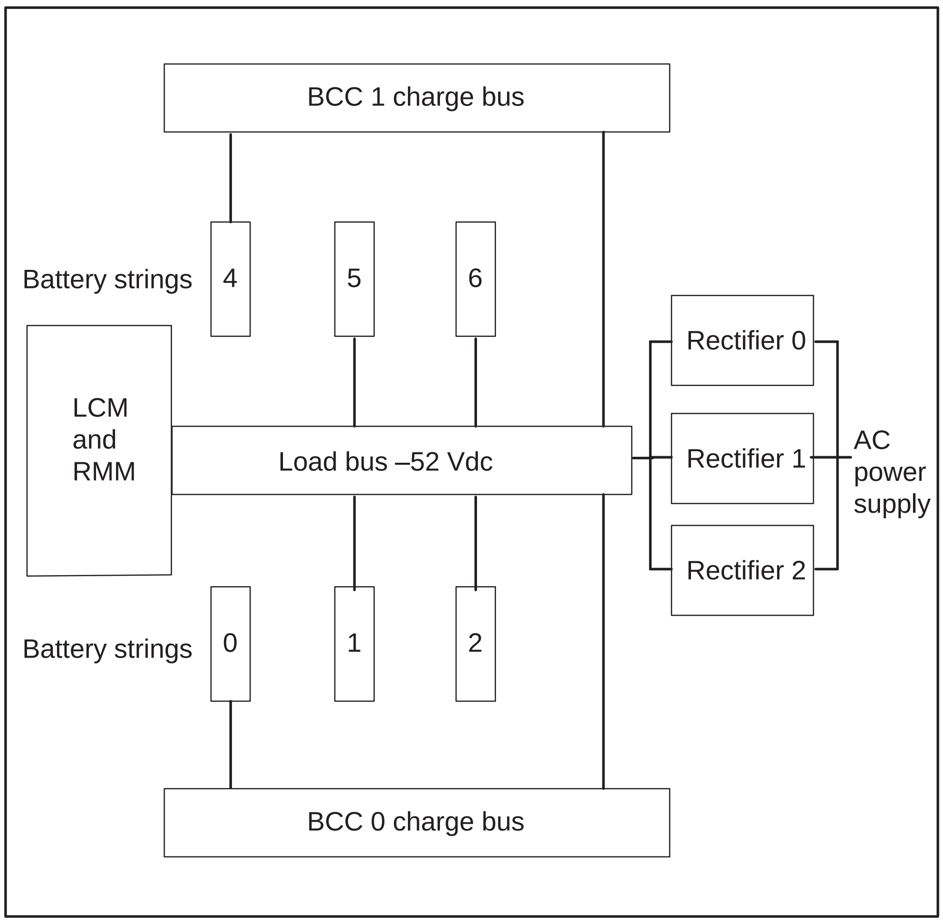
- automatic battery testing
- charge bus diagnostics
- automatic battery rotation to keep the batteries charged with an acceptable level of energy

Battery control and testing system

The battery control and testing system consists of three sections:

- BCC—The BCC consists of two NT8X02AA or AB cards. The NT8X02 contains the OPAC charge bus. The charge bus is a dc-to-dc converter. The output of the converter can be up to 5 V higher than the rectifier voltage of the load bus. For example, if the load bus voltage level is at –52.0 V dc, the maximum charge bus voltage is –57.0 V dc. The following figure contains an example of an OPAC with strings 0 and 4 on the charge bus. The other strings are on the load bus.

OPAC with string 0 and 4 on the charge bus



Note: The NT8X02AB is the UL-approved version of the NT8X02AA and is backward compatible with the NT8X02AA.

The charge bus is a current taper charger in which output current drops as the voltage of the bus increases.

For example, assume the level of the load bus rectifiers is 52.0 V dc. A battery string can move from the load bus to the charge bus. When a battery string moves, the charge bus voltage adjusts to above the load bus current. The charge bus voltage supplies approximately 3 A to the battery string.

As the voltage of the battery string increases, charge bus output current drops. When the battery string reaches the maximum charge bus voltage of 57.0 V, the output current of the charge bus is approximately 0 A.

The NT8X02 contains a discharge resistor (the discharge test bus) and the circuitry that moves the battery strings between the following:

- load bus
- charge bus
- discharge test bus
- open circuit state

The OPAC has BCC 0 and BCC 1. The BCC 0 controls battery strings 0, 1, and 2, and BCC 1 controls battery strings 4, 5, and 6.

- BCCDVR card—The BCCDVR card is the NT3X09AA in RMM slot 6. This card relays battery control commands from system software to the NT8X02 BCC card. The card relays the commands to move the battery strings between the open circuit state, load bus, charge bus, and discharge bus. The card is designated BCCDVR at the PES MAP terminal.
- test access card—The test access card is the NT3X09BA MTA card in RMM slot 05. This card provides the MTU access to the LCM line circuits. This card also provides test access to each battery string and charge buses.

Hardware audit

The system performs a hardware audit on the PES each hour. This audit checks four systems:

- NT0X10AA PESALRM card
- NT3X09BA BCCDVR card
- NT8X02AA/AB BCC charge bus voltage
- OPAC load bus voltage

NT0X10AA PESALRM card

Each hour the hardware audit polls the PESALRM card and compares the reported data with alarm data that the software stores. If the reported data does not match stored data, the system generates a PES102 log report. The report contains the message `HW battery or alarm state not = sw state`. An updated PES MAP display reflects the setting or clearing of the new alarm.

Note: The PESALRM card must report the setting or clearing of alarms immediately. This audit polls the PESALRM card to make sure the system software has not lost alarms in the last hour.

NT3X09AA BCCDVR card

Each hour the hardware audit polls the BCCDVR card and compares the reported data with relay data that the software stores.

If the data that the hardware audit reports does not match the stored data, the system generates a PES102 log report. The log indicates that the hardware battery or alarm state does not equal the software state. In response, the software attempts to set the BCCDVR card relay to the correct state.

NT8X02AB BCC charge bus voltages

The hardware audit measures the charge bus voltage on BCC 0 and BCC 1 each hour. If the voltage on BCC is lower or higher than expected, the system initiates the following actions:

- The system reports a minor alarm in the PM subsystem at the status display header on the MAP display.
- If the OPAC state is green, the system changes the OPAC to amber.
- The system generates a PES105 log report to report the BCC that failed.
- The system generates a PES116 log to report the measured voltages.

Note: The system does not run this test during ac failure mode.

OPAC load bus voltage

The system does not run this allocation of the hardware audit during normal OPAC operation.

When an ac failure occurs, the hardware audit runs every 15 min and not each hour. The system checks OPM load bus voltage and polls the PESALRM and BCCDVR cards. Every 15 min, the MTU in the RMM measures the load bus voltage.

The voltage can drop to –47 V or less than –47 V. If this event occurs the system generates a PES104 log report with the message `load bus low voltage`. The load conditions determine the amount of reserve power that the batteries have. The batteries can have 1.5 to 2 hours of reserve power.

When the batteries reach –42.5 V dc, the BCC disconnects the batteries from the load bus.

Battery rotation and testing audit

The OPAC battery rotation and testing audit, which runs every hour, controls and monitors the OPAC automatic battery rotation. During an ac failure, the audit increases every 15 min. The audit increase does not effect battery rotation because no rotation occurs in the ac failure mode.

Intermittent charging scheme

The OPAC uses an intermittent charging scheme that the battery rotation and testing audit implements. Do not confuse the OPAC intermittent charging scheme with the float or cyclic charging schemes. These schemes are referred to in other battery application manuals. A description of each scheme follows.

- A float charging scheme applies a constant voltage to the batteries to keep the batteries charged. The scheme also recharges the batteries after discharge, and prevents accumulation of sulfate deposits on internal battery plates.
- A cyclic charging scheme means that the batteries are discharged between each charging cycle. The OPM batteries experience a deep discharge in the OPM during extended ac outage.
- An intermittent charging scheme maintains the batteries on the system load bus at a voltage just above the battery open circuit voltage. This voltage is –50 V dc for the Eagle-Picher battery.

  This voltage can maintain batteries in a complete charged state. This voltage is also enough to recharge the batteries to between 90 % and 100 % after a discharge. This voltage is not enough to prevent accumulation of sulfate deposits on battery plates. The batteries are moved from the load bus to the charge bus for a short period of time. Charge bus voltage is enough to make sure the batteries are charged to full capacity. This voltage forces sulfates that accumulate on the battery plates back to the battery liquid.

The OPAC intermittent charging scheme offers the following advantages:

— Extended battery life—Intermittent charging instead of float charging can extend battery life by 50 % to 100 %. Lead-acid batteries are very sensitive to temperature. Every 7°C to 10°C (45°F to 50°F) the temperature rises above 25°C (77°F) causes a life reduction of 50 %. The OPAC internal temperature is an average of 12°C to 15°C (54°F to 59°F) above outside ambient temperature.

— Intermittent charging reduces the load bus voltage, which increases battery life.

This voltage reduction lowers the following:

- battery-charging current
- the battery internal temperature rise
- the rate of battery-positive grid corrosion

A battery like the Eagle-Picher has an expected life of 4 to 5 years at 25°C. Float charging gives this same battery an expected life of 1.5 to 2 years in the OPAC environment. Intermittent charging allows the life of the Eagle-Picher batteries to extend to over three years. Battery life is shorter in hot environments and longer in cool environments.

— Lower OPAC power consumption—A lower OPAC load bus voltage, decreases power use through resistive loads like subscriber loops.

— Advanced battery testing capabilities – Intermittent charging allows performance of battery open circuit, discharge, and post boost charge tests. These tests determine the state of the battery strings.

The battery rotation and testing audit is a feature of the system software that controls OPM battery charging and testing. The battery rotation and testing audit has five modes of operation. The operation modes are:

1. normal battery rotation mode
2. rotation disabled mode
3. ac failure mode
4. post-ac failure mode (short)
5. post-ac failure mode (extended)

Normal battery rotation mode

During normal battery rotation mode, battery string pairs are rotated from the load bus to the charge bus. This action occurs for a given time each week. Battery testing occurs each Sunday. Office parameters in table OFCSTD control battery rotation and testing.

The following table lists and describes the office parameters of table OFCSTD that are entered for battery rotation and testing. Refer to the *Translations Guide* for additional information on office parameters.

Battery rotation and testing parameters entered in table OFCSTD

Parameter	Range	Default value	Description
OPM_CHARGE_START_TIME	0 through 23	23	This parameter controls the time of day the system moves a battery string pair from the load bus to the charge bus. The default value of 23 corresponds to 11:00 P.M.
OPM_CHARGE_DURATION	0 through 20	7	This parameter controls the amount of time a battery string remains on the charge bus.
OPM_DISCHARGE_TIME	0 through 4	–4	This parameter controls the amount of time a battery string remains connected to the discharge bus during the weekly discharge test. The default value is four, which corresponds to 1 h.
OPM_MIN_CHG_VOLT	–400 through –500	–420	This parameter controls the minimum voltage a battery string must be at before rotation to the charge bus. The default value is –420, which corresponds to –42.0 V.
OPM_VOLT_TST_OCC	0 through –600	–504	This parameter is the value of the voltage of a battery string compared to the open circuit test. The default for Yuasa and Eagle–Picher batteries is –504. This value corresponds to –50.4 V. If this parameter is set to 0, the open circuit test does not occur.

—continued—

Battery rotation and testing parameters entered in table OFCSTD (continued)

Parameter	Range	Default value	Description
OPM_VOLT_TST_DIS	0 through –600	–495	This parameter is the value to which the voltage of the battery string compares during the discharge test. The default value for Yuasa and Eagle Picher batteries is –495, or –49.5 V. If this parameter is at 0, the discharge test does not occur.
OPM_VOLT_TST_CHG	0 through –600	–509	This parameter is the value to which the voltage of a battery string compares to during the post-charge test. The default value for Yuasa and Eagle Picher batteries is –509 or –50.9 V. If this parameter is 0, the post charge test does not occur.
OPM_VOLT_TST_LTU_ ADJUSTMENT	0 through 50	10	The comparison voltages for the open circuit, discharge, and post-charge tests are specified for the MTU. The MTU has 0.5 % accuracy and 0.1-V resolution. This parameter adjusts the comparison values when battery testing uses an LTU (two percent accuracy and 1-V resolution) instead of an MTU.

—end—

Table OPMINV

Field ENABATST in OPMINV can be set to Y (yes) or N (no) for each OPAC. When set to Y, the system performs weekly battery tests. When set to N, the system bypasses weekly battery tests.

Battery rotation and test cycle

The battery rotation and test cycle lasts four weeks and begins again. The following table describes the rotation and test cycle. The header `Week` at the PES MAP level displays the present audit week. The legend for the table that follows is:

- O/C is open circuit
- DISCHG is discharge through NT8X02 card
- CHG is charge bus
- STn is battery string pair

- MEAS is measure voltage

OPAC battery rotation and test cycle

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1		MEAS ST0					
	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST0	ST0	ST1	ST2	ST3	ST0
	O/C ST0						
	for 24 hr	MEAS ST0	MEAS ST1	MEAS ST2	MEAS ST3	MEAS ST0	
		CHG ST0	CHG ST1	CHG ST2	CHG ST3	CHG ST0	
		O/C ST0	O/C ST1	O/C ST2	O/C ST3	O/C ST0	
		MEAS ST0					
2		MEAS ST1					
	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST1	ST1	ST2	ST3	ST0	ST1
	O/C ST1						
	for 24 hr	MEAS ST1	MEAS ST2	MEAS ST3	MEAS ST0	MEAS ST1	
		CHG ST1	CHG ST2	CHG ST3	CHG ST0	CHG ST1	
		O/C ST1	O/C ST2	O/C ST3	O/C ST0	O/C ST1	
		MEAS ST1					
		MEAS ST2					

—continued—

OPAC battery rotation and test cycle (continued)

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
3	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST2	ST2	ST3	ST0	ST1	ST2
	O/C ST2						
	for 24 hr	MEAS ST2	MEAS ST3	MEAS ST0	MEAS ST1	MEAS ST2	
		CHG ST2	CHG ST3	CHG ST0	CHG ST1	CHG ST2	
		O/C ST2	O/C ST3	O/C ST0	O/C ST1	O/C ST2	
		MEAS ST2					
4		MEAS ST3					
	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST3	ST3	ST0	ST2	ST2	ST3
	O/C ST3						
	for 24 hr	MEAS ST3	MEAS ST0	MEAS ST1	MEAS ST2	MEAS ST3	
		CHG ST3	CHG ST0	CHG ST1	CHG ST2	CHG ST3	
		O/C ST3	O/C ST0	O/C ST1	O/C ST2	O/C ST3	
		MEAS ST3					

—end—

Each battery string pair has a charge cycle one time a week and a test-and-charge cycle every 4 weeks. Every week the test-and-charge cycle activities occur for a different battery string pair.

Less than four batteries can be entered for an OPAC. If this event occurs no battery rotation activity takes place during periods reserved for not entered strings. A minimum of four battery strings can be provisioned in the OPAC. This condition is true unless the operating company chooses to not have battery backup.

Test-and-charge cycle description

The test-and-charge cycle detects battery strings that fail to hold enough charge and need replacement.

The test-and-charge cycle starts on a Sunday. The following steps summarize the procedure for all strings in the table on page 2-47.

1 On Sunday at the time set by office parameter OPM_CHARGE_START_TIME, the system measures the voltage of the load bus. The system measures the voltages of the two BCCs, and every datafilled, open-circuited, battery string. The system sends the results to a PES116 log.

2 The string to test remains open-circuited for 24 h.

3 The cycle measures the voltage of the string pair and tests the voltage against the OPM_VOLT_TST_OCC value. The pair can fail this test and fail the previous test-and-charge cycle. If this event occurs the system marks the string as failed.

4 If the system does not mark the string as failed, the system discharges the string for OPM_DISCHARGE_TIME if OPM_DISCHARGE_TIME > 0 and OPM_VOLT_TST_DIS > 0.

5 The system measures battery string voltages again. The strings remain connected to the test load resistor, and are compared against the OPM_VOLT_TST_DIS value. The pair can fail this test and fail the previous test-and-charge cycle. If this event occurs the system marks the string as failed.

6 If the system does not mark the string pair as failed, the string pair is open-circuited. If a discharge does not occur, the system measures the open-circuit voltage. The system tests the discharge or open-circuit measured voltage against the OPM_MIN_CHG_VOLT value before the battery string connects to the charge bus. If this test fails, the system does not sound an alarm. The following events occur:

   — test-and-charge cycle aborts

   — the battery is moved to the load bus

   — a PES115 log reports the bypass of the charge cycle

The system moves the pair to the charge bus for OPM_CHARGE_DURATION.

7 When the charge period is complete, the pair is open-circuited.

8 At OPM_CHARGE_START_TIME on Tuesday, the system measures and tests the voltage against OPM_VOLT_TST_CHG. If the voltage fails the test, the system marks the string as failed. The system returns the pair to the load bus and the charge cycle for the next string begins.

Note 1: When a system software marks a battery string pair as failed, follow the test procedures listed in "Manual test procedures for system-failed battery strings"in this document.

Note 2: After a battery string pair that failed system testing is replaced or passes manual tests, return the battery string pair to service. Use the BSY and RTS commands to return the pair to service.

The following table describes the rotation cycle for week 2. The table uses the default start time of 11 p.m. (23:00) and the default discharge time of 60 minutes. The legend for the table is:

- O/C is open circuit
- STn is battery string pair
- CHG is charge bus
- DISCHG is discharge through NT8X02 card
- MEAS is measure voltage
- LDB is load bus
- TST is test

Cycle rotation for week 2

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			6:00	6:00	6:00	6:00	6:00
			O/C ST1	O/C ST2	O/C ST3	O/C ST0	O/C ST1
	22:00	22:00					
	MEAS ALL	TST OCC 1					
2	O/C ST1	DCHG ST1					
		23:00	23:00	23:00	23:00	23:00	23:00

—continued—

Cycle rotation for week 2 (continued)

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		TST DIS 1	TST CHG 1				
		CHG ST1	LDB ST1	LDB ST2	LDB ST3	LDB ST0	LDB ST1
			O/C ST2	O/C ST3	O/C ST0	O/C ST1	
			TST MIN 2	TST MIN 3	TST MIN 0	TST MIN1	
			CHG ST2	CHG ST3	CHG ST0	CHG ST1	
—end—							

Charge cycle

If the string voltage meets the bus minimum requirements you can put a string on the charge bus. The charge cycle begins with a measurement of battery string voltages. The charge cycle consists of the following steps:

1 At OPM_CHARGE_START_TIME, the battery pair to be charged is open-circuited. The system measures and tests pair voltages against the OPM_MIN_CHG_VOLT value. If one string voltage does not meet the minimum voltage required, the system leaves the pair on the load bus. The charge cycle for that day is bypassed, and the system generates a PES115 log.

2 If the pair passes the minimum voltage test, the system moves the pair to the charge bus for OPM_CHARGE_DURATION.

3 When the charge period is over, the pair is open-circuited.

4 At OPM_CHARGE_START_TIME the next day, the system moves the pair to the load bus. The charge cycle for the next battery string pair begins.

Rotation disabled mode

Use the command string AUDIT DISABLE to disable the OPAC battery rotation and test software from the PES MAP level.

This command string halts battery rotation, charges, and test activities. This command string does not halt the hardware audit that runs every hour.

Disable the battery rotation and testing software when you perform manual maintenance on the batteries. Manually manipulate battery strings from the PES MAP level after you disable the battery rotation and testing audit.

When manual battery maintenance is complete, use the AUDIT ENABLE command string to enable the battery rotation and testing audit.

ac failure mode

When rectifiers 0 and 1 fail, FL0 and FL1 alarms result. When this condition occurs, the OPAC enters ac failure mode. During ac failure mode, the system places the battery strings on the load bus and manual battery activities are not allowed. The hardware audit runs every 15 min. The hardware audit does not run every 1 hour.

When the hardware audit runs, the system checks the PESALRM card, BCCDVR card, and load bus voltage.

Rectifier 2, which can be provisioned, continues to provide power to the OPAC during a failure of rectifiers 0 and 1. The PES MAP display continues to display alarms FL0 and FL1.

If rectifier 2 fails, an EXT alarm appears at the MAP terminal in the system status display banner.

Post-ac failure mode (short)

If the outage does not exceed 15 min, corrective action depends on the restoration of power in time to prevent negative results. These negative results occur during the next test-and-charge cycle.

Restoration of power can occur in the 12 h before the start of the test-and-charge cycle. Restoration of power can occur during the scheduled test-and-charge cycle. If one of these events occur tests do not resume. The system leaves the strings on the load bus until the next charge cycle.

The next charge cycle can be the charge part of the test-and-charge cycle. If this event occurs charging occurs but tests do not take place.

If restoration of power occurs at an other time, after a 15-min delay, the scheduled charging activity resumes.

If a string must be on the charge bus or open-circuited, the system returns the string to that state. The charge cycle events that follow occur at normal intervals. While the process can produce a short charge period, normal charge cycle events do little to affect battery life.

When the OPAC is in post-ac failure mode (short), `Week` at the PES MAP display shows `P/S`.

Post-ac failure mode (extended)

If an ac outage exceeds the short ac failure interval, the outage is an extended ac outage. When this event occurs, complete the following steps:

1. The strings remain on the load bus for 24 h.
2. Starting with battery pair 0, the system charges each equipped battery string pair, that did not fail, for 5 h. The system open-circuits the pairs for 1 h, and moves the pairs to the load bus. The system can encounter a pair that fails or is not equipped. A pair can fail the minimum charge voltage test. When one of these conditions occurs, the system skips the pair and charges the next equipped pair that passes. A skipped, equipped battery pair remains on the load bus.
3. After the battery pair 3 is moved to the bus load or skipped, the strings remain on the load bus for 24 h.
4. Audit activity resumes with the next charge period or at the beginning of the next test-and-charge cycle. This selection depends on the rotation schedule that appears on page 2-50.

The OPAC can be in extended post-ac failure mode. If this event occurs the header `Week` at the PES MAP display shows the message `P/E`.

If the remote maintenance module (RMM) at the OPAC is OOS, the system cannot report alarms or perform battery rotation or testing. Alarm reports, battery rotation, and battery tests resume when the RMM is returned to service.

Escalation to manual maintenance

The DMS-100 Group of peripheral modules (PM) are reliable under many fault conditions. The PM is reliable, but automatic maintenance can fail to correct a fault. Manual action can troubleshoot or clear a fault condition.

The following sections describe manual commands from the MAP terminal and diagnostic maintenance at the OPAC site.

Manual testing OPAC systems

The PES test (TST) command allows manual testing of the following:

- PESALRM (NT0X10AA) card
- BCCDVR (NT3X09AA) card
- ChargeBus (NT8X02AB)

If the user enters the TST command and does not enter parameters, the system tests the three systems. If the user enters the parameter PESALRM, BCCDVR, or CHARGEBUS, the system only tests that system.

The PESALRM and the BCCDVR card must be in the ManB state before a manual card test can occur.

The TST command cannot be executed for the ChargeBus while the OPAC is in ac-failure mode.

Failure in one of the three tests initiates the following actions:

- The system generates a log.
- The system reports a minor alarm in the PM top level of the MAP display.
- If the OPAC state is green, the state changes to amber.

For each test that passes, but has an alarm from a previous test:

- The alarm condition clears.
- The system generates a log.
- If other OPAC alarms are not present, the OPAC state changes from amber to green.

Manual battery actions and system voltage measurements

Operating company personnel can perform the following operations on the OPAC batteries from the PES MAP level:

1 O/C battery string pair

2 place battery string pair on the charge bus

3 place battery string pair on the load bus

The operating company personnel can measure the following voltages from the PES MAP level:

- all battery string voltages
- system load bus voltage (rectifier voltage)
- BCC 0 and BCC 1 charge bus voltages

Before one of the previous operations can occur, use the AUDIT DISABLE command to disable the OPAC battery rotation and testing audit.

When the user disables the audit, the OPAC state changes from green to amber. The system generates a PES113 log with the message `Battery Audit Dis from Ok`.

OPENCKT_ (0–3)

Use the OPENCKT command to move a battery string pair from the load bus or charge bus to the open circuit state. The OPENCKT command operates on the battery string pairs as follows:

- OPENCKT_0—moves battery strings 0 and 4 to an O/C state
- OPENCKT_1—moves battery strings 1 and 5 to an O/C state
- OPENCKT_2—moves battery strings 2 and 6 to an O/C state

CHARGE_ (0–3)

Use the CHARGE command to move a battery string pair from the open circuit state to the charge bus. The CHARGE command operates on battery string pairs in the same manner as the OPENCKT command.

Note 1: You cannot move a battery string pair directly from the load bus to the charge bus. Use the OPENCKT command to open-circuit the battery string pair. Use the CHARGE command to move to the charge bus.

Note 2: Place one battery string pair on the charge bus at a time.

LOADB_ (0–3)

Use the LOADB command to move a battery string pair from the O/C state to the load bus. The LOADB command operates on battery string pairs in the same method as the OPENCKT command.

Note 1: You cannot move a battery string pair directly from the charge bus to the load bus. Use the OPENCKT to open circuit the battery string pair and use the LOADB command to move to the load bus.

Note 2: During an ac failure, the system moves all battery strings to the load bus. System software does not allow removal of any battery strings from the load bus until the ac failure clears.

MEASURE

The MEASURE command measures the following:

- voltage of a battery string pair
- the load bus that uses the MTU in slots 03 and 04
- the RMM
- the charge buses (BCC 0 and BCC 1)

Measured voltages appear on the PES MAP display.

- MEASURE LOADB—measures load bus voltage
- MEASURE BCC—measures the charge bus voltages or BCC 0 and BCC 1

- MEASURE PAIR—measures the voltages of battery strings as follows:
  - 0 measures the voltages of strings 0 and 4
  - 1 measures the voltages of strings 1 and 5
  - 2 measures the voltages of strings 2 and 6
- MEASURE ALL—measures the voltages of the load bus, BCC 0, BCC 1, and all battery string pairs.

Querying PES alarms

Use the QUERYPES command at the PES MAP level to query PES alarms .

The user can enter the QUERYPES command and not enter parameters. The state of OPAC alarms systems appears in table form on the MAP display.

If the FLT parameter (QUERYPES FLT) follows the QUERYPES command, the system only displays OPAC alarm systems that generate alarms.

A QUERYPES display that does not have faults in the PES and battery string pair 3 on the charge bus follows:

```
     QueryPES
     PES 0 ,  CONDITION GREEN,  KOPM 0 0 ,  RMM  3 ,
     BCCDVR CCTNO: 6 ,  PESALRM CCTNO: 10  ON RMM  3 ,
     EHT .,ELT .,BCCF0 .,BCCF1 .,FL0 .,FL1 .,HBT .,FRNT
O,SIDE .,
     BCC0: .   .   .  CHG , FSP ., AC ., CL0 ., CL1 .,
     BCC1: .   .   .  CHG , BCCDVR ., PESALRM ., ECU .
     AUDIT DIS  AUDIT WEEK:  4
```

The following example describes a QUERYPES display with the rectifier 1 alarm and the ECU alarm, that indicates a fan failure, set:

```
     QueryPES
     PES 0 ,  CONDITION RED   ,  KOPM 0 0 ,  RMM  3 ,
     BCCDVR CCTNO: 6 ,  PESALRM CCTNO: 10  ON RMM  3 ,
     EHT .,ELT .,BCCF0 .,BCCF1 .,FL0 .,FL1 F,HBT .,FRNT
.,SIDE .,
     BCC0: .   .   .   .  , FSP ., AC ., CL0 ., CL1 .,
     BCC1: .   .   .   .  , BCCDVR ., PESALRM ., ECU F
     AUDIT  .   AUDIT WEEK:  2
```

The following example describes a QUERYPES FLT display, with the ECU alarm set, the audit disabled, and battery string pair 1 failed.

```
QueryPES flt
ECU F,
BCC0: .   F   .   .  ,
BCC1: .   F   .   .  ,
AUDIT DIS
```

In the QUERYPES display, faults are not present, but extended post-ac processing is in progress:

```
     QueryPES
     PES 0 ,  CONDITION GREEN ,  KOPM 0 0 ,  RMM  3 ,
     BCCDVR CCTNO: 6 ,  PESALRM CCTNO: 10  ON RMM  3 ,
     EHT .,ELT .,BCCF0 .,BCCF1 .,FL0 .,FL1 .,HBT .,FRNT
.,SIDE .,
     BCC0: .  CHG  .    .  , FSP ., AC ., CL0 ., CL1 .,
     BCC1: .  CHG  .    .  , BCCDVR ., PESALRM ., ECU .
     AUDIT .    AUDIT WEEK:  P/E
```

In the QUERYPES FLT display, faults are not present, but extended post-ac processing is in progress:

```
QueryPES  flt
NO FAULTS--BUT IN POST AC FAILURE MODE. CHECK LOGS
```

The following figure describes a typical posted PES in the green state.

Posted PES 2 with OPAC in GREEN state

```
 CM    MS      IOD    NET    PM    CCS    LNS    Trks   Ext    Appl
  .     .       .      .     .      .      .       .     .      .

PES                    SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM          0      0       0       0       0      30
 2 Post_
 3                       RED      AMBER     GREEN     OFFL
 4           PES         0          0         3        0
 5
 6 Tst_      PES       2 Cond:  GREEN  REM1     01   0   RMM   3
 7 Bsy_                                              Audit  Week  HBT
 8 Rts_       Common     Rectifiers                    .      2    .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .      .   .   .   .       .        .      .   .
11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
12 Next      0= W    .    .    .    -  EHT ELT  FRNT SIDE    0   1
13 Audit_    1= W    .    .    .    -   .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

Posted PES 2 with ac failure occurrence

```
  CM    MS      IOD    NET    PM    CCS    LNS    Trks   Ext   Appl
  .      .       .      .    1PES    .      .      .      .     .
                               M

 PES                     SysB   ManB    OffL    CBSY    ISTB    InSV
  0 Quit      PM           0      3       4       0       4      30
  2 Post_
  3                       RED      AMBER     GREEN     OFFL
  4           PES          1          0         2        0
  5
  6 Tst_      PES       2 Cond:  RED    REM1     01   0   RMM   3
  7 Bsy_                                           Audit  Week  HBT
  8 Rts_       Common     Rectifiers                 .      2    .
  9 OffL_       AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
 10              F       F   F   .   .   .   .       .       .   .
 11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
 12 Next      0= .    .    .    .    -  EHT ELT  FRNT SIDE    0   1
 13 Audit_    1= .    .    .    .    -   .   .    .    .      .   .
 14 QueryPES
 15 OpenCkt_
 16 Charge_
 17 LoadB_
 18 Measure_  >
```

During the ac-failure period, the system runs the load bus low voltage test every 15 min.

Test failure triggers the major audible alarm again. Operating company personnel can use the QUERYPES command to obtain an explanation of the trouble. The following figure describes a trouble explanation.

Trouble explanation

```
 CM     MS     IOD    NET    PM    CCS    LNS    Trks   Ext   Appl
 .      .       .    1LINK  1PES    .      .      .      .     .
                              M
PES                  SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM         0      3       4       0       4      30
 2 Post_
 3                    RED      AMBER     GREEN     OFFL
 4           PES        1          0         2        0
 5
 6 Tst_      PES       2 Cond:  RED    REM1     01   0   RMM   3
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers                .      2    .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              F      F   F   .   .       .       .      .   .
11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
12 Next      0= .    .    .    .    -  EHT ELT  FRNT SIDE    0   1
13 Audit_    1= .    .    .    .    -   .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_  >queryPES
```

The system response to a QUERYPES follows:

```
>QueryPES
 PES 2, CONDITION RED, REM1 01 0, RMM 3,
 BCCDVR CKTNO 6, PESALRM CKTNO 10   ON RMM 3,
 EHT ., ELT ., BCCF0 ., BCCF1 ., FL0 F, FL1 F, FRNT .,
SIDE .,
 BCC0: . . . ., FSP ., AC F, CL0 ., CL1 .,
 BCC1: . . . ., BCCDVR ., PESALRM ., ECU .
 LOAD BUS low voltage alarm
```

On-site outdoor physical maintenance

Maintenance work that occurs during bad weather requires use of a tent or like cover. Use a 3.05 m by 3.66 m by 1.83 m high (10 ft by 12 ft by 6 ft) ground tent with a built-in ventilator/heater port.

Work that occurs in bad weather requires that the tent be a minimum ambient temperature of 0° (32° F). This condition applies to work that is done when the bay doors are open. For work that requires open front or rear doors only, the outside ambient temperature of the cabinet can be as low as -15° C (+5° F). The temperature can remain low if the work does not exceed a time limit of 5 to 10 min.

The termination compartment door can remain open for a maximum period of 10 to 20 min at a low minimum ambient temperature of -15° C (+5° F).

For work that requires open doors for longer periods, erect a tent over the OPAC cabinet. Heat the tent interior to a minimum ambient temperature of 0° C (32° F).

Battery physical inspection

Inspect the batteries every 6 months. Inspect battery pack terminals, connectors, and shelves for indications of moisture or corrosion.

If signs of moisture or corrosion are present, take the following steps:

1 Remove battery packs from the affected area, floor or shelf.

2 Clean the affected areas with an application of baking soda and water. Continue until the cleaning application does not foam when it is applied.

3 Completely dry cleaned areas and replace the battery packs on the shelves.

Battery electrical inspection

The DMS-100 host office computing module (CM) contains the OPAC battery-charging and maintenance routines.

The MTU contains an internal voltage standard and performs voltage measurements with ± 0.5 % accuracy and 0.1 V resolution. System software performs the required battery capacity every month.

If the system marks a battery string as failed, follow the procedures listed in Manual test procedures for system-failed battery strings. This procedure is on page 2-64. Use this procedure to confirm the test failure. If necessary, replace the batteries.

Every three months test the rectifier voltage to make sure the voltage is set correctly. From the OPM MAP level, use the MEASURE LOADBUS command to measure the rectifier output voltage.

If the voltage does not equal –52.5 V dc, adjust the rectifier voltage at the OPAC site. Refer to the procedure that follows for instructions.

Rectifier voltage adjustments

Perform the rectifier voltage procedure every three months. Refer to the following procedure for instructions on the rectifier voltage adjustments.

1 Proceed to the OPAC site.

2 Use a voltmeter with a minimum of 2 % accuracy to measure the rectifier output voltage.

If the voltage is	Do
equal –52.5 Vdc, ± 0.5 V	step 4
not equal –52.5 Vdc, ± 0.5 V	step 3

3 Adjust the rectifier voltage screws until the voltage is within specification and the current from each rectifier is balanced.

4 If the rectifier voltage is low, wait 24 h before you start battery capacity tests.

5 From the PES MAP level, perform the MEASURE LOADB command. Make sure the voltage measurement is –52 or –53 V. Repeat this step two more times to ensure consistency.

If the voltage is	Do
out of range	step 5 or 6
within range	step 7

6 Replace the MTU and perform step 4.

7 Perform battery capacity tests every 3 months.

8 Perform battery capacity tests every 6 months.

Battery capacity tests

If the MTU measurements are within specifications, perform these tests every six months. If the MTU measurements are not within specifications, perform the tests every three months. To prevent conflicts with the automatic battery testing, do not perform this procedure on Monday or Tuesday. Refer to the procedure that follows for instructions on battery capacity tests.

1 Make sure extended power failures do not occur at the OPAC site in the last 72 hours. (The OPAC is not in a post-ac failure recovery mode.)

2 Post the correct alarm state and post the OPAC to be tested.

3 From the PES MAP level, enter the command string AUDIT DISABLE to disable the automatic battery rotation and testing.

4 From the PES MAP level, open circuit 0 for strings 0 and 4 and open circuit 1 for strings 1 and 5.

5 Wait 6 h.

6 Proceed to the OPAC site.

7 Use a voltmeter with 0.2 % or greater accuracy, to measure the voltage of each battery string pairs 0 (strings 0 and 4), and 1 (strings 1 and 5).

8 If the voltage of a string is less than 50.4 V (80 % capacity), replace string within 1 month.

   If the voltage of a string is less than 49 V (about 50 % capacity), immediately disconnect that string from the system. This action prevents the risk of cracked batteries before you can order and install new batteries.

9 From the PES MAP level, place battery circuit 0 for string pairs 0 and 4 back on the load bus. From the PES MAP level place battery circuit 1 for string pairs 1 and 5 back on the load bus.

10 Repeat steps 3 through 8 to test string pair 2 (strings 2 and 6) and not string pairs 0 and 1.

11 From the PES MAP level, enter the AUDIT ENABLE command to enable the battery rotation and testing routines again.

   Note: If an ac failure greater than 5 min occurs during this procedure, return to step 1.

The system can mark a battery string as failed. If this event occurs follow the manual procedures listed under Manual test procedures, for system-failed battery strings. Use these procedures to confirm the test failure. If necessary, replace the batteries.

Manual test procedures for system-failed battery strings

The system can mark a battery string pair as failed. When this event occurs the PES117 log records the voltages of the strings and the test that fails. The office parameters set the values used for testing.

The voltage identifiers in the PES117 log correspond to the office parameters as follows:

- OPEN-CIRCUIT indicates the value failed the test against OPM_VOLT_TST_OCC (–504 or –50.4 V dc)
- DISCHARGE TEST indicates the value failed the test against OPM_VOLT_TST_DIS (–495 or –49.5 V dc)
- POST CHARGE indicates the value failed the test against OPM_VOLT_TST_CHG (–509 or –50.9 V dc)

The manual test procedures that determine if the batteries need replacement depend on the test that fails. The procedures consist of activities that occur at the MAP terminal and at the OPAC site.

Procedure that follows failure of open circuit test at the MAP terminal

The procedures that follow contain instructions on the actions to take for specified failed tests.

1. Disable the AUDIT from the PES MAP level.
2. Use the PES117 log to determine the voltage of the battery string tested below OPM_VOLT_TST_OCC. If the system marked strings 1 and 5 failed, determine if string 1, 5, or both strings caused the alarm.

   For OPACs, the default for OPM_VOLT_TST_OCC is –504 or –50.4 V dc.
3. Place the failed battery string pair on the charge bus for 6 h.
4. Open circuit the failed battery string pair for at least 6 h.
5. Use the PES MAP level MEASURE command to measure the voltage of the failed battery string pair.
6. If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair on open circuit and proceed with OPM site tests.

   For OPACs with an MTU, the default for OPM_VOLT_TST_CHG = –509 or –50.9 V dc.

   For OPACs with an LTU, OPM_VOLT_TST_LTU_ ADJUSTMENT (default is 10) offsets and truncates the default for OPM_VOL_TST_CHG. –509 + 10 = –499 Trunc (–499)=–490 or –49 V dc.

7 If the voltage equals or is less than OPM_VOLT_TST_CHG, the string can still accept a charge. BSY and RTS the BCCDVR to return the battery string pair to service.

If O/C test marks the same string failed within the next two months, proceed directly to the OPAC site tests.

Procedure that follows failure of discharge test at the MAP terminal

1 Disable the AUDIT from the PES MAP level.

2 Determine which battery string voltage tests below OPM_VOLT_TST_DIS using the PES117 log report. If the system marks strings 1 and 5 failed, determine if string 1, 5, or both caused the alarm. For OPACs, the default for OPM_VOLT_TST_DIS = –495 or –49.5 V dc.

3 O/C the failed battery string pair and proceed with the OPAC site tests.

Procedure that follows failure of a post–charge test at the MAP terminal

1 Disable the AUDIT from the PES MAP level.

2 Determine which battery string voltage tests below OPM_VOLT_TST_CHG using the PES117 log report. If the system marks strings 1 and 5 failed, determine if string 1, 5, or both caused the alarm.

For OPACs, the default for OPM_VOLT_TST_CHG = –509 or –50.9 V dc for Eagle-Picher batteries.

3 From the PES MAP level place the failed battery string pair on the charge bus for 6 h.

4 O/C the failed battery string pair for a minimum of 6 h.

5 Use the PES MAP level MEASURE command to measure the voltage of the failed battery string pair.

6 If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair open circuit and proceed with OPAC site tests.

7 If the voltage is equal to or more negative than OPM_VOLT_TST_CHG, the string can accept a charge. Busy and RTS the BCCDVR to return the battery string pair to service.

If the post-charge test marks the same string failed within the next two months, proceed directly to OPAC site tests.

OPAC site tests

1 Make sure the AUDIT is disabled and the failed battery string pair is open-circuited from the PES MAP level.

2 Proceed to the OPAC site to perform the following steps.

3 Use a voltmeter with a minimum 0.2 % error, to measure the voltage of both rectifiers using the test points on the face of the rectifiers.

4 The voltage must be –52.5 V dc, ± 0.5 V. Low rectifier voltage can cause a battery string to fail any of the other tests.

   If rectifier voltage is within specification, measure the voltage of each battery in the failed battery string. If the voltage of any battery is more than 1 V less then the voltage of the other batteries in the string replace the whole string.

   If the rectifier voltage is not within specification, adjust the rectifier float screw. Continue to adjust until the voltage is within specification and the current from each rectifier is balanced.

5 Measure the voltage of the entire battery string. If the open-circuit or post-charge test fails, and the battery string voltage is less than OPM_VOLT_TST_OCC (–50.4V dc), replace the entire string.

   If the discharge test fails, and the battery voltage is less than OPM_VOLT_TST_DIS (–49.5 V dc) replace the entire string).

6 If any string continues to fail the audit test while other strings pass, replace the entire string because the string is probably weak.

   If all strings appear good, return the battery strings to service with the BSY BCCDVR and RTS BCCDVR commands. Enter the commands from the PES level of the MAP display to return the battery strings to service.

ESA maintenance overview

Functional description

The Outside Plant Access Cabinet (OPAC) with the Emergency Stand-Alone (ESA) feature package NTX154AA is a different configuration than the standard OPAC.

Special hardware components are necessary in addition to the ESA software. This chapter treats the ESA configuration separately.

The OPAC is a remote configuration. Because of this condition, communication links between the OPAC and the host site can be damaged or severed. Service can be interrupted also.

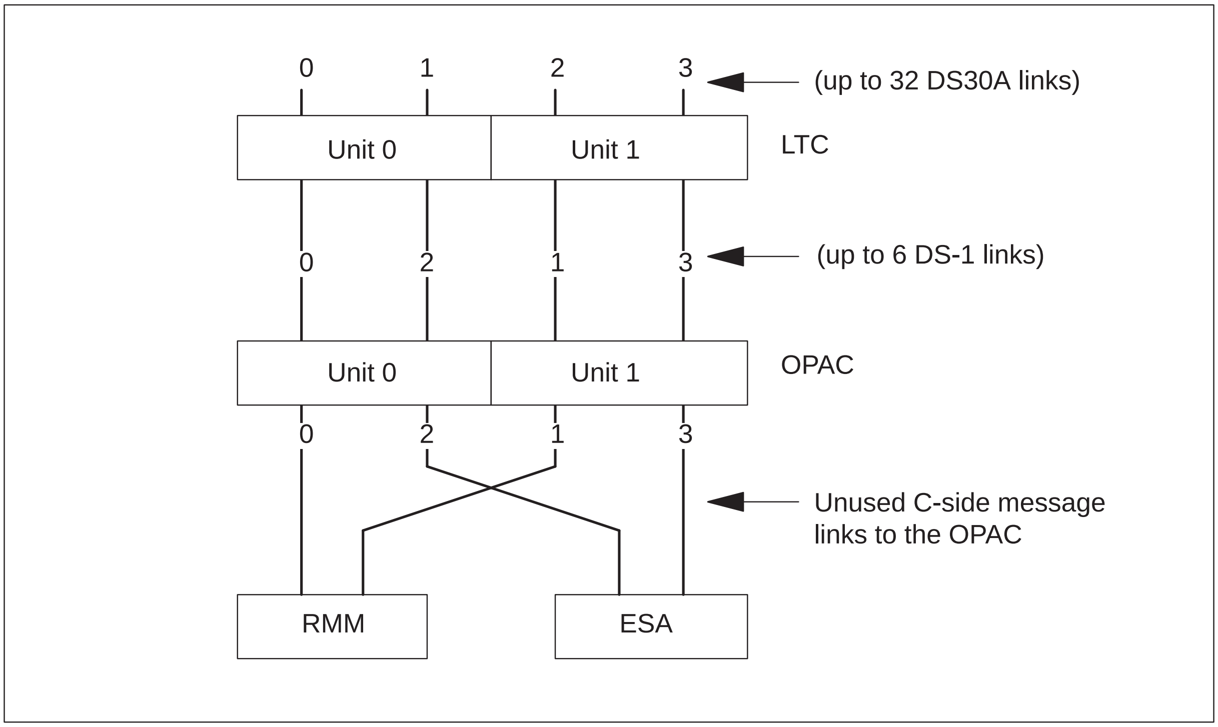
The ESA feature package design allows the OPAC to provide stand-alone call-processing ability. The OPAC needs this ability if a loss of communication with the host occurs.

The ESA feature package allows the OPAC to emulate call processing functions of the line trunk controller (LTC) and the computing module (CM).

ESA hardware representation

The following figure represents the ESA hardware configuration when the OPAC is functioning normally. This figure is a model of the hardware from the view of the MAP terminal. This diagram shows the OPAC as a control side (C-side) node to the ESA processor and the remote maintenance module (RMM).

OPAC ESA hardware representation

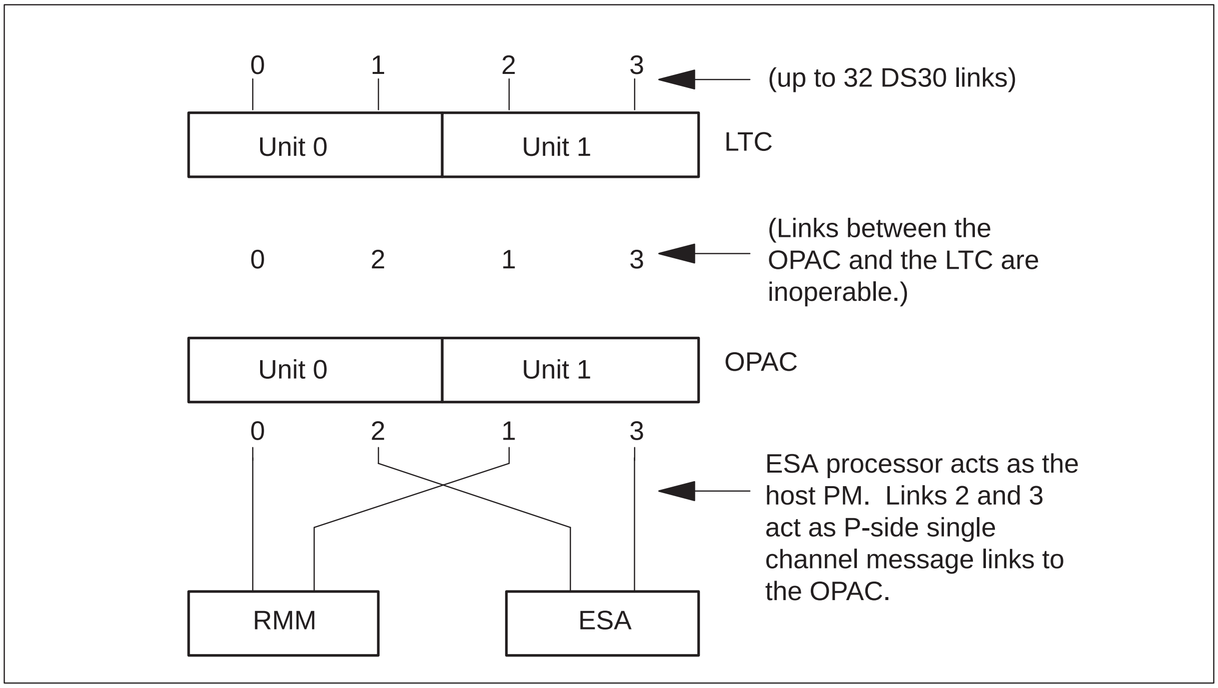


When the OPAC goes into ESA mode, the previous diagram is not accurate. In ESA mode, the ESA processor acts as the host peripheral module (PM). In this example, the host PM is the LTC. Refer to the following figure.

Because OPAC functions separately from the host, this hardware configuration is not visible from the view of the MAP terminal.

In the following figure, links 0 and 1 to the RMM are DS30A links that support 30 channels. Links 2 and 3 to the ESA processor are single-channel message links.

OPAC hardware representation in ESA operation



ESA operation

The OPAC enters ESA mode when the OPAC loses the ability to communicate with the host site. Two conditions cause ESA mode at the OPAC:

- communication links that the system cannot use
- loop-around message audit failure

When the OPAC enters ESA mode, the system takes down all active calls, which causes a cold enter condition.

The line concentrating module (LCM) detects loss of communication with the host.

When the LCM determines the ESA mode is necessary, the LCM switches the C-side links from the host to the ESA processor. The ESA processor uses the tone and clock card to detect the link switch.

When the ESA processor detects the link switch, the system initiates ESA enter. The type of failure determines the time span between loss of communication and ESA mode.

The ESA processor is the only processor at the OPAC that can communicate with the CM during ESA exit. The DMS-100 switch instructs the ESA processor to exit ESA.

During ESA mode, call processing occurs through the ESA processor. The ESA processor has a module of software, called the ESA CC.

The ESA CC emulates the DMS-100 switch CM and handles line-to-line call processing. The ESA CC contains a subset of the translations data found in the CM.

This subset is a snapshot of the CM data needed for ESA call processing. The translation data in the snapshot data are static data. The system does not enter the OPAC ESA mode until the ESA processor is loaded with static data.

The download of the static data to the ESA CC0 from the CM truncates some translations data. This condition means the static data are not subsets of the CM and the system only supports basic calls.

During OPAC ESA mode, the system supports plain old telephone service (POTS) and Meridian Digital Centrex (MDC) subscriber lines.

The ESA processor has a nailed-up direct communication link with the DMS CC when the OPAC is not in ESA operation. The link is not available during ESA operation. The ESA processor establishes the nailed-up connection with the DMS CC after the links are restored. The DMS CC must instruct the ESA processor to exit ESA. The ESA processor is the only processor at the OPAC that can communicate with the DMS CC during ESA exit.

ESA hardware

Feature package NTX154AA for the RLCM equipment frame has two possible configurations.

1. The NT6X45AF based ESA package consists of three pieces of equipment:

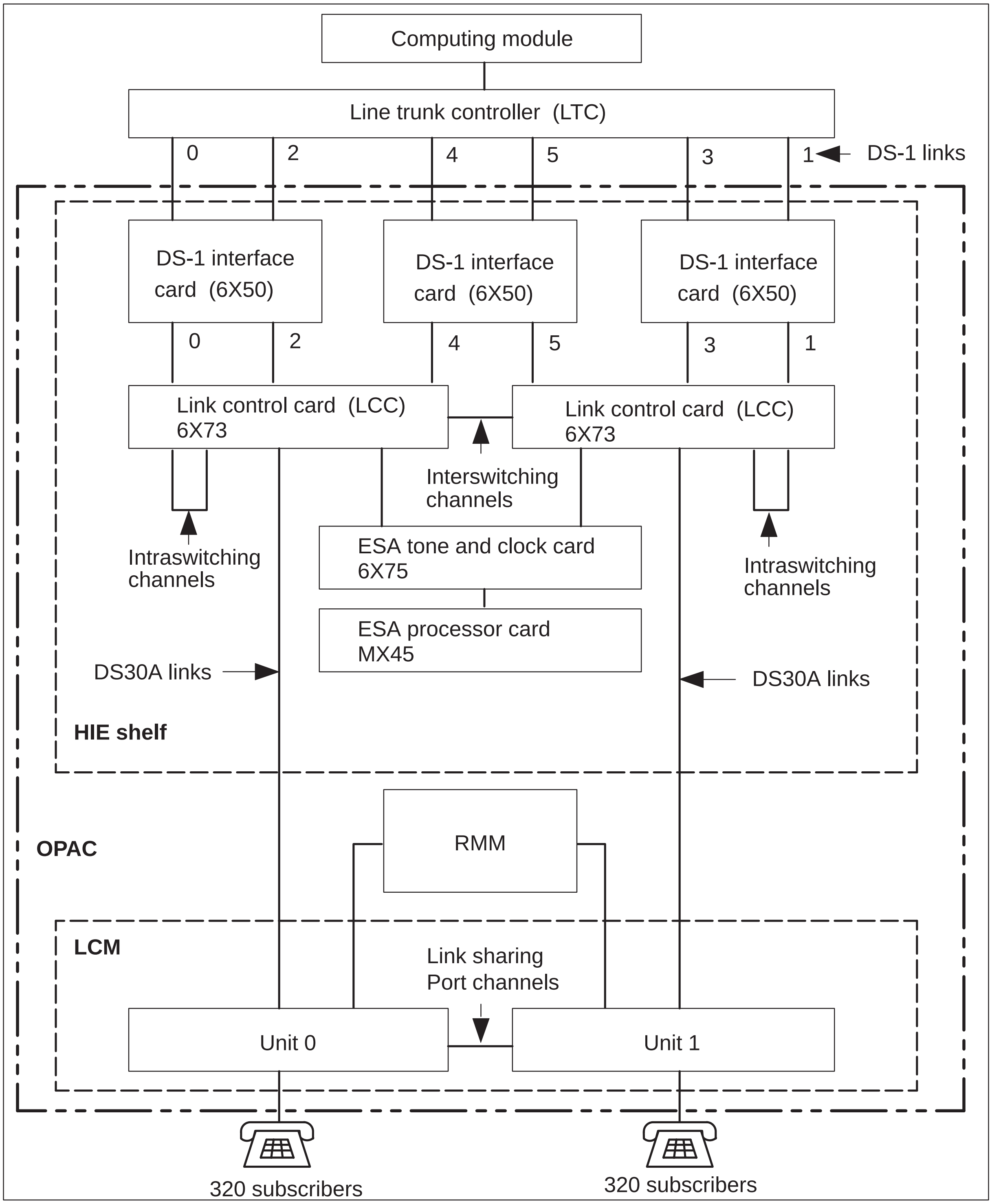
- one ESA memory card (NT6X47AC), slot 14
- one ESA processor card (NT6X45AF), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

2. The NTMX45AA based ESA package consists of two pieces of equipment. This package includes an ESA processor that enables duplicate Nxx in ESA mode and provides firmware downloads. This card has 8 Mbyte of on-card memory. With this package, the ESA memory card is not needed and slot 14 has a filler plate.

- one ESA processor card (NTMX45AA), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

Refer to the figure “OPAC with ESA hardware block diagram” for a block diagram of an OPAC with the ESA hardware.

OPAC with ESA hardware block diagram



NT6X45AF – ESA processor card

This card is the same processor card used in the LTC. The LTC processor card, when used in the RLCM equipment frame, is called the ESA processor.

NT6X47AC – 4 Mbyte memory card

This card is the same memory card used in the LTC. This card contains 4 Mbyte of memory. The system uses 3 Mbyte of memory for call processing when the RLCM enters ESA. The 6X47AC is required for ESA loads for BCS33 and higher.

NT6X75AA – ESA tone and clock card

This card provides the following:

- a frame pulse for clock generation during ESA mode. The frame pulse replaces the lost DS-1 frame pulse from the host
- tones to an LCM during ESA
- an interface for the ESA processor used to send and receive messages to and from the host during normal operations. During ESA mode, this card communicates with both units of the LCM and the RMM.

NTMX45AA – ESA processor card

This card is an improvement over the NT6X45AF ESA processor. Eight megabytes of on-card memory enable duplicate Nxx numbers in ESA mode. This card also supports in-service firmware downloads. With this ESA processor, the NT6X47AC ESA memory card is not needed and slot 14 of the HIE shelf has a filler plate.

NT2X48AB – digital 4-channel receiver card

The RMM for ESA operation requires the Digitone receiver (DTR) card. The ESA processor brings DTRs into service when in ESA. The ESA processor turns the DTRs off when the processor leaves ESA.

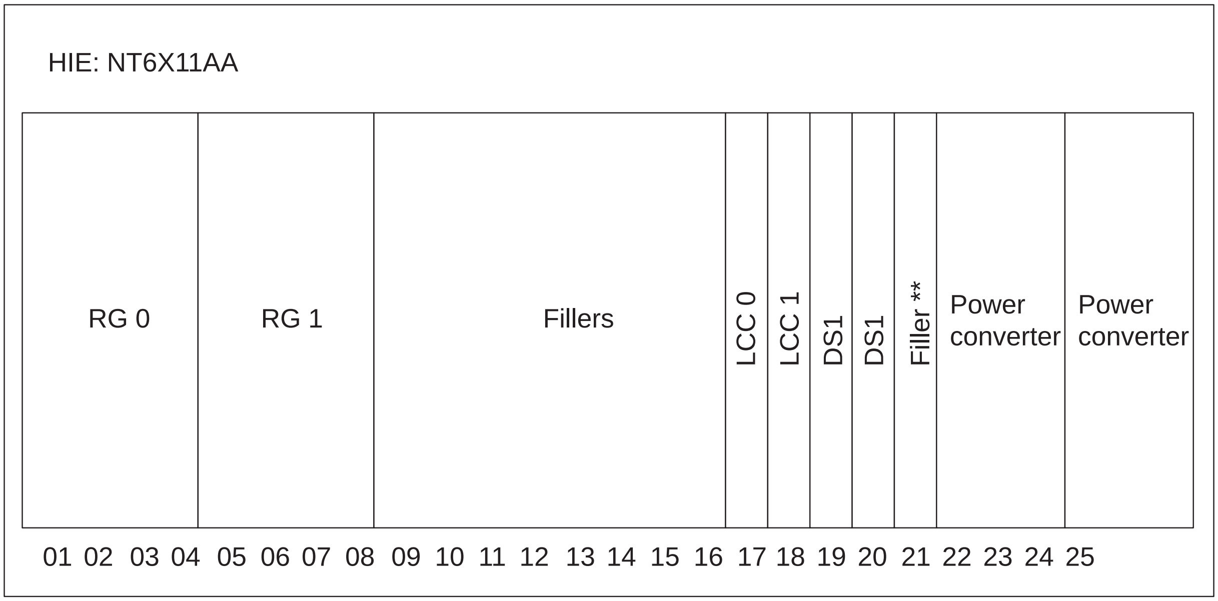
The RMM for ESA Digitone calls uses a single-card 4-channel DTR (NT2X48BB). In addition to Digitone reception, the RMM provides diagnostics for the ESA processor. Refer to the table on page 3-9 and the figure on page 3-9 for the location of the DTR cards.

Additional LTC hardware

The additional hardware in feature package NTX154AA for the host LTC is the messaging card (NT6X69). This card allows communications with the ESA processor.

The following figure shows the layout of the cards in the host interface equipment shelf.

Host interface equipment shelf



The following table describes the cards in the host interface equipment shelf.

Host interface equipment cards

Slot	Abbreviation	NT PEC	Remarks
01–04	RG 0	NT6X60	OPAC ringing generator
05–08	RG 1	NT6X60	OPAC ringing generator
09–13		NT0X50	Filler panel
14–16	ESA	(Note 1)	ESA control complex (Note 1)
17,18	LCC	NT6X73	Link control card (LCC-0, LCC-1)
19,20	DS-1	NT6X50	DS-1 interface (2 DS-1 links for each card)
21		NT0X50	Filler panel (Note 2)

Note 1: When ESA is not provisioned, these card slots have filler panels (NT0X50AA). When selected, the ESA package has two possible configurations. Refer to sections “ESA hardware” and “ESA control complex” in this document.

Note 2: For a total of six DS-1 links, slot 21 is provisioned with a DS-1 interface card.

—continued—

Host interface equipment cards

Slot	Abbreviation	NT PEC	Remarks
22–24		NT2X70	Power converter
25		NT2X70	Power converter

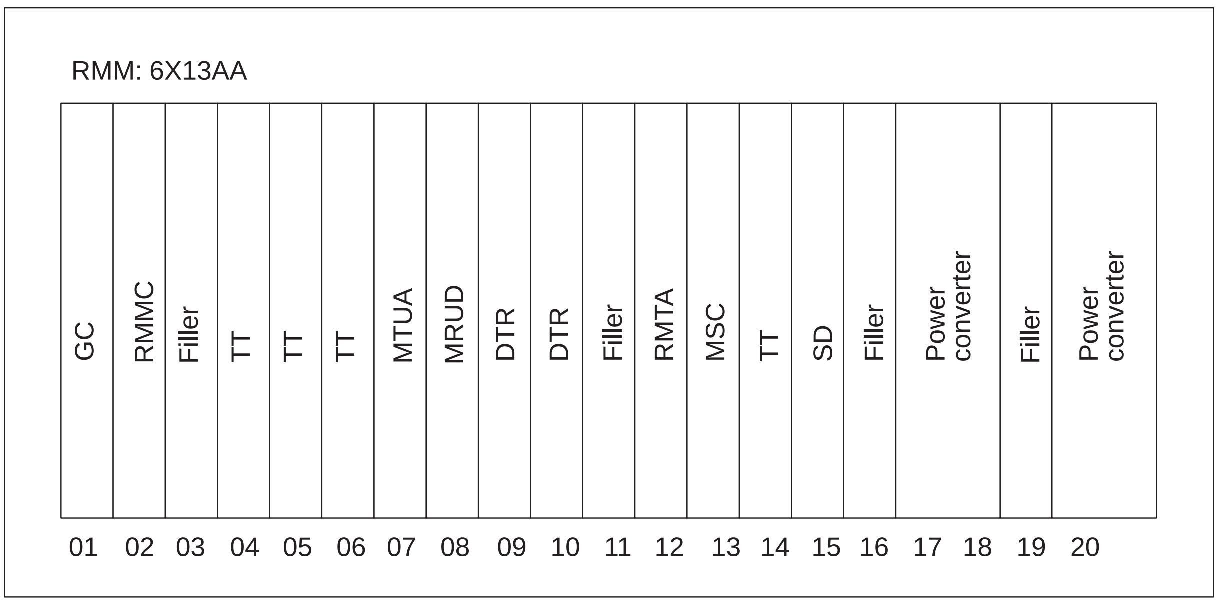
Note 1: When ESA is not provisioned, these card slots have filler panels (NT0X50AA). When selected, the ESA package has two possible configurations. Refer to sections “ESA hardware” and “ESA control complex” in this document.

Note 2: For a total of six DS-1 links, slot 21 is provisioned with a DS-1 interface card.

—end—

A setup of RMM test and service circuit cards appears in the following figure. For more information about how to provision, refer to the *Provisioning Manual, PLN-8991–104*

Remote maintenance module shelf



Remote maintenance module cards

Slot	Abbreviation	NT PEC	Remarks
01	GC	NT2X59	Group codec
02	RMMC	NT6X74	RMM control card

Remote maintenance module cards (continued)

Slot	Abbreviation	NT PEC	Remarks
03		NT0X50	Filler panel
04–06	TT	NT2X90	Test trunk circuit
07	MTUA	NT2X10	Multi-line test unit, analog
08	MTUD	NT2X11	Multi-line test unit, digital
09,10	DTR	NT2X48	DTR (Refer to note.)
11,16		NT0X50	Filler panel
12	RMTA	NT3X09	Remote metallic test access
13	MSC	NT0X10	Miscellaneous scan card
14	TT	NT2X90	Test trunk circuit
15	SD	NT2X57	Signal distribution card 1
17,18		NT2X09	Power converter
19		NT0X50	Filler panel
20		NT2X06	Power converter

Note: The common location language identifier (CLLI) name for the Digitone receiver cards is ESA digit tone receiver (ESADGTR). Table CLLI uses the ESA digit tone receiver (ESDGTR).

In-service firmware downloading

In-service firmware downloading permits ESA processor 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 the NTMX45AA ESA processor.

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).

LOADFW command syntax determines the firmware load application from the firmware upgrade application. The command syntax for the LOADFW command is:

```
LOADFW: Load Firmware onto ESA.
        ALL parameter will execute LOADFW on
        all ESAs in the post set.
        LOADFW UPGRADE must be used to activate
        the new firmware.
Parms: [<FILE> STRING]
        [UPGRADE {UPGRADE}]
        [NOWAIT {NOWAIT}]
        [ALL {ALL}]
```

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

>LOADFW

or

>LOADFW <file_name>

Note 1: If the firmware file name is not specified with the LOADFW command, the command applies the firmware file name provisioned in table XESAINV, field E2LOAD.

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

Loadfile verification

The system performs integrity checks on the firmware for loadfile accuracy. A loadfile record length check makes sure the file is a firmware file before the XPM uses the file. 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) with a 16-bit checksum. The CM sends a validation message to the XPM to check the accuracy of the firmware load. The XPM extracts the CRC and checksum that is in the firmware load. The XPM calculates 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 is ready for the firmware upgrade. To upgrade the firmware use one of the following command string sets:

>LOADFW UPGRADE

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

The next table lists parameters used with the LOADFW command.

LOADFW parameters

Parameter	Value	Definition
filename	n/a	Name of firmware file. If the firmware file is not specified, the firmware load found in table XESAINV, field E2LOAD 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.

Software operation

Refer to the *Extended Peripheral Module Translations Reference Manual*, 297-8321-815 for an overview of the software operation of the ESA feature package. This overview includes a complete list of the features.

Intracalling during ESA mode

The ESA mode uses the intracalling feature which also functions in non-ESA mode. Intracalling allows the user to switch calls at a remote location without transmission back to the host.

The number of designated intracalling channels on the OPAC determines the number of intraswitched and interswitched calls supported during ESA. The number of channels depends on the following:

- number of equipped DS-1 ports available
- the number of DS-1 links for host communication

The ESA processor handles all intracalling during ESA mode. The ESA processor contains a subset of the translation data found in the CM.

ESA call processing

When the OPAC is in ESA mode, the ESA CC handles line-to-line call processing. The basic call processing structure of the ESA CC appears in the figure “ESA CC basic call processing structure.”

The ESA CC has only one queue. All messages from the server are sent to this first-in first-out (FIFO) queue for call processing. Before call processing begins, the system needs terminal data. The system gathers terminal data from the static data downloaded from the CM and the dynamic data in the terminal status table (TST).

Terminal status table

The TST has an entry for each possible line appearance the ESA processor can handle. Each entry has 2 bytes and each byte contains a data structure. This chapter describes the two data structures.

The unprotected line data (ULD) helps the ESA CC determine what action to take when an event message arrives from a terminal. An event message establishes or changes a line state. The ULD also keeps track of errors a line generates during call processing.

The ESA call process blocks (CPB) store the number of reorigination attempts for a line. After completion of an origination, the TST stores the index of the call in a CPB.

Every line can have several call processing line states. The call processing line states determine what the system does with a specified message. The ESA CC first screens the line states of all messages.

The call process controller (CPC) handles all lines in the following states:

- idle
- originate
- abandon
- lockout
- call processing-busy (CPB)

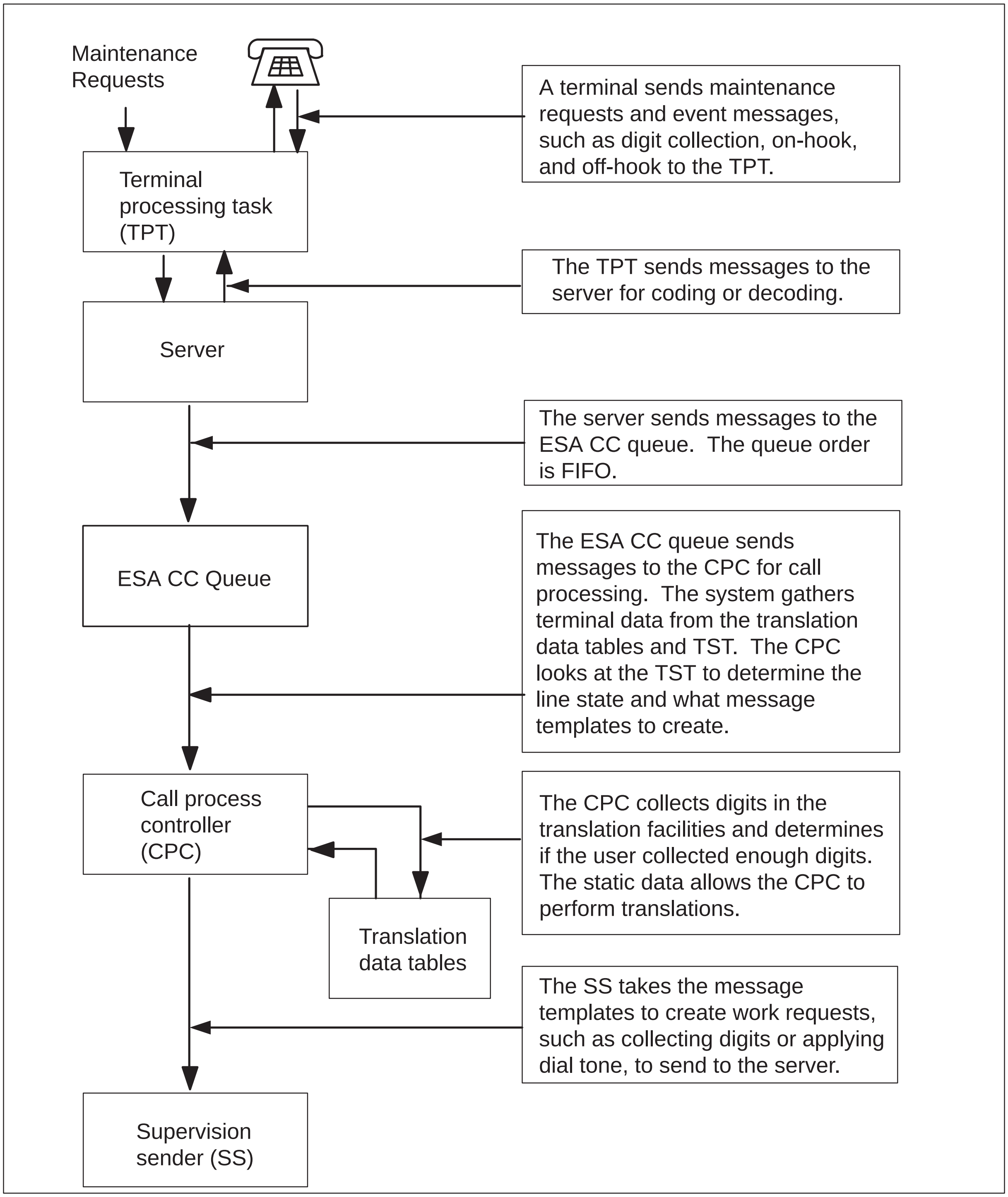
The system processes these lines based on the call processing state stored in their CPB index. The CPC ignores all lines in the system busy (SysB) or manual busy (ManB) states.

Refer to figure Terminal status table, on page 3-14, for a diagram of the TST.

Terminal status table

<table>
<tr><th rowspan="2">Line</th><th colspan="8">Byte 1</th><th colspan="8">Byte 1</th></tr>
<tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0
•
•
•
•</td><td colspan="4">Error count/cause
•
•
•
•</td><td colspan="4">Line state
•
•
•
•</td><td colspan="8">CPB index/origination count
•
•
•
•</td></tr>
<tr><td>640</td><td colspan="4">Error count/cause</td><td colspan="4">Line state</td><td colspan="8">CPB index/origination count</td></tr>
</table>

ESA CC basic call processing structure



The first byte (unprotected line data) in the TST is divided as follows:

- error count/cause: The first four bits contain the count of the errors the software of a line detects. Each error increases the count. If the error count reaches a preset threshold, the system removes the line from service. The system records the last cause of the error in place of the error count.
- line state: The last four bits contain the state of the line. The line states are as follows:
  - ManB: The line is manually busy. The system suspends service to the line and ignores any messages from the line. Calls cannot terminate to this line.
  - idle: The line is equipped. The line is call-processing idle now. The line looks for an off-hook condition. The system treats origination messages from the line as a call origination. Calls can terminate to this line.
  - originated: The line originated a call, but resources are not available to service the line. If still off-hook, the line reoriginates the call after a 1 s delay. The system can receive an on-hook message before the 1 s timer expires. If this message occurs, the system puts the line in the abandon state. The line can reoriginate only three times before the system puts the line into the lockout state. Calls cannot terminate to this line.
  - abandon: The line waits for another origination attempt. Any off-hook or on-hook message puts the line into the idle state. When in the idle state, idle scan for an off-hook condition starts. Calls cannot terminate to this line.
  - CPB: The line is call processing-busy. In this state, a CPB is associated with the line. The associated CPB index is in the second byte of the TST. The system directs messages the line generates to the associated CPB index. Calls cannot terminate to this line.
  - lockout: The line is not involved with an active call. There is no CPB associated with the line, but the system monitors the line for an on-hook condition. An on-hook message causes the line to return to an idle state. When in the idle state, the idle scan for an off-hook condition starts. Calls cannot terminate to this line.
  - SysB: The system detected too many errors on the line. The system puts the line out of service. The system stores the last cause of the error in the error count/cause byte of the TST. The system ignores all messages from the line.

The ESA line-audit process returns the line to service.

The second byte in the TST contains the CPB index/origination count. A CPB is the data base associated with an active call process. There are only enough CPBs to handle the maximum number of intraswitched and interswitched calls.

The number of supported ESA calls is lower than the number of supported lines. There are not enough CPBs for all available channels.

The CPB consists of the following signaling states and call processing data:

- CPB states:
  - call processing idle (CP_Idle): The start-up state prior to any call processing. The system requests line resources, DTR and connection, at this time.
  - dialing: The Server receives the digits. Digit translation occurs when the server receives a digit report.
  - routing: This state is a transitional state from dialing or CP_Idle to another state.
  - revertive wait for on-hook: This call is a revertive call. The system is waiting for the call originator to go on-hook before ringing applies.
  - ringing: Ringing applies to the call terminator. Audible ringing is supplied to the call originator. A ring splash can apply to the opposite side of the terminator. Ring splash occurs is the call is revertive and the office has coded ringing.
  - talking: This is a voice connection between the call originator and terminator. The tip and ring reversal relay are restored for semipost-paid coin line.
  - originator disconnected: The originator has gone on-hook first. The system idles the originating line. Supervision continues on the terminating line.
  - terminator disconnected: The terminator has gone on-hook first. The terminating line is idle. Supervision continues on the line of origination. Lines with cutoff on disconnect feature have an operational cutoff relay.
  - release originator: A transitional state where the system releases the originator from call processing.
  - busy: The system applies a busy tone to the originating line. Supervision and timing are done on the terminal.
  - reorder: The system applies a reorder tone to the terminal. The system performs supervision and timing on the terminal.

  - — coin disconnect supervise: The originating coin line has gone on-hook first. The system uses the coin release function. Call processing waits for the result of the coin function. Supervision continues on the terminating line.
  - — coin disconnect: The terminating coin line has gone on-hook first. The system uses the coin release function. Call processing waits for the result of the coin function.
- call processing data:
  - — digit count/digit registers: The system stores digits collected during digit collection in the registers. Digit count indicates the number of digits collected.
  - — routing information: This byte contains the results of digit translation. The possible results include the types of termination that follow:
    - regular
    - automatic line
    - revertive
    - hunt group
    - reorder termination
    - busy
  - — terminator line character: The byte results from the digit translation.
  - — terminator ring character: The byte contains the ringing characteristics as a result of digit translation.
  - — originator revertive ring character: The byte contains the ringing characteristics of digit translation.
  - — originator, terminator, DTR: This is the channel numbers of the three types of terminals that use channels in an active call.
  - — translation and audit-specific data: This is the data translations use as flags for audits on a CPB during the digit collection phase.

Call channel management

All calls at an OPAC in ESA mode are intraswitched or interswitched. Completion of a call requires an intraswitched or interswitched channel.

If an intraswitched or interswitched channel is not available, the TPT sends a channel-blocking message to the ESA CC. The call originator receives a reorder tone.

Digitone receiver management

The ESA processor needs to know the location of the DTRs in the RMM. The DTR data is downloaded with the static data.

Because Digitone (digital 4-channel) receivers are allocated in a circular fashion, all receivers get equal distribution.

The steps that follow explain how a receiver is used:

1. A line can originates a call when the line goes off-hook. This action requests a receiver.
2. If the system finds a receiver that is not assigned, the system marks the receiver not free. The system assigns the receiver to the call.

   Note: If all receivers are assigned, the system waits 3 s to find a free receiver. If after 3 s the system does not find a free receiver, the system puts the line into the abandon state.

3. When the user finishes dialing, the receiver is free and ready for use by another call.

A received dial pulse (DP) digit also frees the receiver. Use of a DP telephone on a line entered as Digitone causes the receiving of a dial pulse. A free receiver maximizes DTR use.

ESA CC supervision sender

The ESA CC uses a streamlined set of execs to handle call processing. The system loads the definition of all the execs in the ESA exec lineup. The system performs this load at the exec download time of the return-to-service (RTS) sequence.

The supervision sender uses the execs to create work requests for the Server.

ESA translation data

When the OPAC is in ESA mode, the ESA CC uses a subset of translation data from the CM to perform translations. The CM downloads this subset of the CM data to the ESA CC. The ESA call processing needs this part of the CM data.

This type of translation data are called static data. The system generates ESA logs when the downloaded data exceeds the OPAC ESA maximum.

Refer to *Extended Peripheral Module Translations Reference Manual* for more information about ESA translations.

The ESA CC requires two types of static data: general XPM-type and ESA translations.

The user manually downloads general static data when the ESA CC is ManB. The system loads the static data when the ESA CC is RTS. The user only loads ESA static translations data when the ESA CC is in-service (InSv).

Downloading the ESA processor

The following methods are used to download translation data to the ESA processor:

- manually: The LOADPM command downloads data manually to the ESA processor.
- during RTS: The RTS command downloads data automatically to the ESA processor if the processor cannot perform call processing with available data.
- automatically: The system loads data during daily updates of the ESA processor as the RLCM_ESADUPD_HOUR office parameter specifies.

Supported subscriber line types

During OPAC ESA mode, the supported subscriber line types are POTS and MDC.

POTS line types

The supported POTS line types include the following:

- 1FR – single party flat rate.
- 1MR – individual message rate. The system treats lines like single party flat rate lines.
- 2FR – two parties flat rate.
- 4FR – four parties flat rate fully selected without ANI.
- 8FR – eight parties flat rate semi-selective without ANI.
- 10FR – multiparty flat rate without ANI.
- CCF – coin coin first service. The coin is returned.
- CDF – coin dial tone first service. The coin is returned. The CDF telephones cannot make 911 or 0 calls without the first coin deposit while in ESA mode.
- CSP – coin semi-postpay service. The coin is not returned. A coin is not needed to allow a speech path.
- PBX lines – PBX message rate lines are treated as PBX flat rate lines.

MDC lines

The supported MDC line types include the following:

- Loop and ground start lines.
- 500 and 2500 set.
- Meridian business set (MBS). The MBS is treated as a 2500 set. The primary directory number (PDN), HOLD, and RELEASE keys are supported.
- Digital data unit (DDU). The PDN, HOLD, and RELEASE keys are supported. There is no modem pooling.
- Lines with cutoff on disconnect option. (Cutoff relay operates for 300 ms.)

Supported subscriber services

During OPAC ESA mode, the supported subscriber services are POTS and MDC.

POTS subscriber services

The POTS services provided includes the following:

- one home numbering plan area (HNPA) code for each OPAC
- services for single-party, multiparty, coin, and PBX lines
- three to seven digits local dialing plan
- up to 16 prefix or special numbers for each OPAC with a maximum of 15 digits each for special termination (for example, 0-, 0+, 411, 911)
- the system routes empty terminations or terminations that are not valid to reorder or announcement termination

MDC customer group services

The MDC services provided include the following:

- maximum 640 members in a customer group
- maximum 32 customer groups for each OPAC
- up to eight prefix or special numbers for each OPAC with a maximum of 15 digits each for each customer group. For example, 0+, 411, 9+ with or without second dial tone, prefix fence and ambiguous numbers.
- station-to-station dialing for one- through six digit extension numbers
- denied incoming call for a station
- direct outward dialing with or without second dial tone for termination to another customer group or POTS lines within the same OPAC

- inter-customer group calling by the same dialing plan, except lines with the denied incoming option
- the system treats primary numbers of the multiple appearance directory (MADN) groups as regular MDC lines
- multiple centrex customer dialing plans

Channel configuration

On ESA entry, the system reconfigures the C-side channel map of the OPAC to provide more interswitch channels for ESA call processing.

Interswitch and intraswitch channels make call connections through the OPAC without involving a host connection. The interswitch and intraswitch capabilities allow call processing to continue in ESA operation.

On OPAC ESA entry, the system configures the RLCM channels. The system configures the RLCM channels as is all DS-1 ports are not equipped except for primary ports 0 and 1. Ports 0 and 1 must be equipped in OPAC ESA.

More interswitch channels are made available for unit-to -unit calls, by reconfiguring the C-side channels on ESA entry. Refer to the following table for a list of the channel breakdown in OPAC ESA.

The OPAC does not gain channels through the reconfiguration of C-side channels on OPAC ESA entry. The OPAC gains in the number of interswitch channels offset by a decrease in the number of intraswitch channels.

Channel availability after ESA entry

Port number	Number of intrachannels	Intrachannels	Number of interchannels	Interchannels
0	6	2, 7, 12, 18, 23, 28	0	none
1	6	2, 7, 12, 18, 23, 28	0	none
2	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30

—continued—

Channel availability after ESA entry (continued)

Port number	Number of intrachannels	Intrachannels	Number of interchannels	Interchannels
3	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
4	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
5	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
—end—				

Exiting OPAC ESA mode

After communications are restored, the CM recovers the OPAC from the ESA mode. When the OPAC exits ESA mode, the system takes down all active calls. This action is a cold exit.

When the system restores C-side communication between the OPAC and the CM, the CM initiates the ESA exit sequence. Before the ESA exit sequence begins, the CM communicates with the ESA processor over the nailed-up connection. This communication determines if the OPAC is in ESA mode and if the system can recover OPAC immediately.

A system exit or a manual exit are two methods for the recovery of the OPAC.

ESA system exit

A system exit is an automatic exit from ESA mode the CM starts without operator interference.

The CM starts a system exit if one of the following conditions occur:

- at least one LCM unit of the OPAC is SysB or C-side busy (CBsy)
- the RLCM_XPMESAEXIT office parameter time-out value is not zero

The system exit sequence are as follows.

1 The system restores C-side communications between the CM and the OPAC.
2 The CM discovers the OPAC is in ESA mode.
3 The CM enters ESA time-out mode.
4 When the CM times out, the CM sends an ESA-exit request to the ESA processor.
5 The OPAC and the ESA processor perform exit operations.
6 The ESA processor tells the line concentrating module (LCM) to return the link control card (LCC) to normal operations.
7 The ESA processor sends operational measurements, peg counts, and the reason for introduction of ESA mode back to the DMS CM. The PM171 displays the PM171 log. The system generates a PM181 log if the ESA exit has problems.
8 The CM returns the OPAC to service.
9 Return the ESA processor and RMM nodes to service.

ESA manual exit

A manual exit is an exit from ESA mode the operating company personnel start at the LCM MAP level with the RTS command.

A manual exit is necessary if either of the following conditions occurs:

- both LCM units of the OPAC are in a ManB state
- the RLCM_XPMESAEXIT office parameter time-out value is zero

Override of a time-out value other than zero occurs when the user manually busies the LCMs of the OPAC. The user performs this action at the LCM MAP level and causes a manual exit. Use the FORCE option and the BSY command.

The following steps describe the manual exit sequence:

1 The system restores C-side communications between the CM and the OPAC.

2 The CM discovers the OPAC is in ESA mode.

3 The CM queries the OPAC for the number of active calls.

4 The CM displays the number of active calls on the MAP display. The CM queries the operating company personnel if the personnel want ESA-exit.

5 If operating company personnel confirms the ESA-exit, the CM sends the ESA-exit request to the ESA processor. If operating company personnel do not want the ESA-exit, the system leaves the OPAC ManB. The OPAC stays in ESA mode.

6 The OPAC and the ESA processor perform exit operations.

7 The ESA processor tells the LCM to return the LCC card to normal operations.

8 The ESA processor sends the following to the CM:

   — operational measurements

   — peg counts

   — the reason that the OPAC entered ESA mode

   The system displays this information in the PM171 and PM181 logs.

9 The CM returns the OPAC to service.

10 Return the ESA processor and RMM nodes to service.

11 Receiver off-hook.

Tones during ESA mode

The ESA tone and clock card (NT6X75AA) provides five continuous tones when an OPAC is in ESA mode. The LCM interrupts these tones to give the tones the system specifies.

The tones appear on channel 16 on the incoming C-side ports of the OPAC. The OPAC ESA tones, their channel appearance, and cadence appear in the following table.

OPAC ESA tones

Tone type	Tone ID (HEX)	Channel appearance		Cadence (in seconds)	
		Port	Channel	On	Off
Busy	81	1	16	0.5	0.5
Reorder	82	1	16	0.25	0.25
ROH*	83	2	16	0.1	0.1
Audible	80	4	16	2.0	4.0
Warble	8D	5	16	2.0	4.0
Dial	06	7	16	N/A	N/A

Note: Idle tone uses a start-cadence message, but the OPAC connects the receive path to a port that provides idle tone.

Providing tones

The following steps provide tone to a subscriber.

1 The ESA processor sends a start-cadence message to the ESA tone and clock card. This message specifies the tone required, the terminal identification, and the cadence times.

2 The ESA tone and clock card performs the following when the card receives the start cadence message:

   a. If necessary, the terminal current receive path connection breaks.

   b. The receive path of the terminal connects to the appropriate port.

   c. The specified cadence for that tone is set up.

The steps that follow clear the tone.

1 The ESA processor sends a stop-cadence message to the ESA tone and clock card. This message specifies the terminal identification.

2 The ESA tone and clock card sends stop-cadence messages to the LCM when the card receives the stop cadence message. The messages tell the LCM to disconnect the terminal connection to the correct port and channel 16.

Ringing during ESA mode

The OPAC needs duplicated ringing generators. The OPAC ESA mode supports the following ringing types:

- coded
- frequency
- superimposed
- immediate

Treatments during ESA mode

The OPAC ESA mode supports the following treatments, or tones:

- busy
- reorder
- receiver off-hook (ROH)

ESA limits and restrictions

The following limits and restrictions apply to the OPAC in ESA mode.

Limits during the ESA mode

Limits during the ESA mode for POTS lines and features are the following:

- the ESA mode only supports the three-to-seven digit POTS dialing plan.
- the ESA mode only supports one HNPA code for each OPAC.

The following limits apply during the ESA mode for MDC lines and features:

- The ESA mode for MDC lines only supports the MDCXLA translation selector for station-to-station calling. The MDCXLA translation selector is the number of digits in the extension number. If the system does not datafill the selector, the system uses the POTS translation.
- The MDC lines do not support network class of service (NCOS). The system restricts customer groups or lines to a dialing plan common to all customer groups.
- The system can support the primary number of a MADN during the ESA mode. The group must be an MDC business set PDN key or a 500/2500 set directory number.

Note: The system does not support all MDC and POTS features or lines.

Restrictions during ESA mode

As a global restriction, ESA mode does not support the following:

- line diagnostics.
- MADN group operation.
- recorded announcements.

As a restriction that applies during ESA mode for POTS lines and features, ESA mode does not support the following:

- Local call detail recording (LCDR).
- Local automatic message accounting (LAMA).
- Centralized automatic message accounting (CAMA).
- Remote register signal distributor point lines.
- Dial tone speed operational measurements (OM).
- Teletypewriter exchange service (TWX).
- Foreign exchange calls.
- Equal access features.

As a restriction that applies during ESA mode for MDC lines and features, the following are not supported:

- Station message detail recording (SMDR)
- Attendant consoles
- Custom calling features, that include the following:
  - flashing
  - conference calls
  - DDU feature keys. There is no action results when the user presses feature keys.
- Remote meter pulsing lines
- MDC electronic business set feature keys. An action does not result when the user presses feature keys.
- Party line circle digits
- Automatic number identification (ANI)

Fault conditions

The fault condition of communication links that the system cannot use triggers the ESA mode of operation. There are several possible reasons for this fault condition.

Unusable communication links

The following conditions do not allow the use of communication links from the OPAC to the CM:

- There is a break in the links between the OPAC and the host.
- The peripheral side (P-side) message link (DS-1 cards) of the LTC are pulled out.
- The C-side message link (DS-1 cards) of the OPAC are pulled out.

The RLCM_ESAENTRY_BADLINK office parameter determines the desired delay time between failure of the C-side message link and enter of the ESA mode.

Loop-around message audit failure

The OPAC enters ESA mode when the loop-around message audit detects failure of messaging between the OPAC and the CM. The following conditions cause this failure:

- An extended loss of communication with the CM for longer than the time-out period the RLCM_ESAENTRY_BADCSIDE office parameter specifies.
- Both LTC units (C-side peripherals) are ManB.
- Network planes of the LTC or LGC are ManB.

The RLCM_ESAENTRY_BADCSIDE office parameter determines the desired delay time between failure of OPAC communication with the C-side peripheral and entering ESA mode.

The delay time prevents the OPAC from entering the ESA mode while the system performs a restart. A restart causes the loop-around message to fail. The OPAC enters ESA mode if all loop-around messages within the time-out period fail.

The following fault conditions can occur during ESA operation:

- line errors
  - too many originations
  - confusion message received
  - line translation error
  - dial pulse error (bad digits)
  - Digitone error (bad digits)
  - ringing error
  - coin error
- defective Digitone receivers
- static data failure

Audits correct these fault conditions.

Automatic ESA maintenance

When fault conditions occur, the DMS-100 switch and the OPAC initiate audits and other system processes to clear the fault. For ESA maintenance, these automatic features are the following:

- line audits
- DTR audits
- downloading static data
- routine exercise (REx) tests
  - read only memory (ROM) diagnostics
  - random access memory (RAM) diagnostics

ESA line audits

The ESA line audit process returns SysB lines to service after a specified period of time. In ESA mode, the system declares a line SysB when too many errors occur.

An error on a line increases the error count associated with the line. If the error count reaches a preset threshold, the system makes the line SysB. The system stores the last cause of error in the TST.

A line in a SysB state cannot originate or terminate a call. This line does not tie up ESA resources. The line audit process returns SysB lines to service. This process makes sure a line with a transient fault continues to receive service.

Digitone receiver audit

The DTR audit monitors the status of the Digitone receivers. If a call process possesses a DTR for longer than two audits, the audit terminates the process. A cleanup process starts for the CPB. The audit also makes the DTR ready for use when the audit marks the DTR free.

Error tracking detects damaged Digitone receivers. Before a receiver is not assigned, the system makes an error count check. When the number of errors reaches a preset error threshold, the system takes the receiver out of service. An audit returns the receiver to service and sets the error count to zero.

Automatic static data downloading and system maintenance

The system automatically loads the ESA CC with static translations data. The system can download this data after ESA RTS. Operating company personnel can download the data when the ESA CC is InSv.

The office parameter RLCM_ESADUPD_HOUR determines the time at which the system updates the static translations data in the ESA CC. The system performs the equivalent to the LOADPM CC ESADATA command string in sequence on each OPAC with the ESA option. Table LCMINV sets this ESA option.

Note: Damage occurs to the static data if the OPAC and a host Remote Switching Center (RSC) are on the same static update hour.

When the OPAC runs another maintenance function at the automatic update time, the automatic update process waits 30 s. The automatic update process waits for the function that runs now to finish.

If the running function continues to run after 30 s, the system marks the OPAC with the in-service trouble (ISTb) status. The following reason is associated with the ISTb: `ESA STATIC DATA`.

If the automatic update process fails during the static data load, the system marks the OPAC with the SysB status.

If a failure occurs while the user downloads a table, the system generates an ESA log (ESA101 through ESA107).

Each log identifies and describes the table that failed to download. The remainder of the tables do not download. The system marks the OPAC with the SysB status and the following reason: `ESA DATA`.

Note 1: The OPAC cannot enter ESA while static data loads.

Note 2: If the OPAC is out of service during the daily update, the system updates the data as part of the normal RTS sequence.

Routine exercise test

Routine exercise (REx) tests are a series of tests performed on ESA hardware. This hardware is not used while the ESA processor provides normal service.

The system performs these tests as a routine. To perform the REx test, the user can enter the test (TST) command with the REx option. These tests require that both LCM units of the OPAC, RMM, and ESA processor are InSv.

The REx test indicates the ability of the LCM units to enter and exit ESA mode. The test also indicates the ability of the LCM units to send messages to the ESA processor while in ESA mode.

The system only tests one LCM unit at a time. A test of both units at the same time causes calls connected at the time of the test to lose service. While the system tests one unit, the other unit continues call processing in the takeover mode.

The system runs a lockout task on the tested LCM unit to prevent accidental attempts at maintenance on the unit. The lockout task is the same task an ESA exit uses. Lockout does not perform maintenance.

Takeover and takeback on an LCM unit affects calls that are connecting, but not calls already connected. The system returns the LCM unit to service before the system tests the other unit.

The actions that follow occur during a REx test:

1. The system tests the messaging ability of each of the peripherals (ESA module, LCM units, and RMM). If any of these preliminary tests fail, the system does not run REx tests.
2. When preliminary tests pass, the system places one LCM unit in ESA mode and the other unit in the takeover mode. The unit in the ESA mode has messaging links switched from the host to the ESA module.
3. The ESA processor tests the ability of the LCM units to message to the ESA module under ESA conditions.
4. The system performs other diagnostics on the ESA module. Other diagnostics include the tones test, and a comparison of LCC control and 6X75 status bytes.
5. After all tests are complete, the system takes the unit out of the ESA mode. The system returns the unit to service.

6 If the REx tests passed, the system uses the other LCM unit to test the ESA module.

ESA ROM diagnostics

The ESA processor has a ROM diagnostic test. Operating company personnel uses the LOADPM command to implement this test.

This test consists of the standard XPM ROM tests, which test the processor and memory complex, and also basic messaging functions. The messaging functions are the CM to ESA processor messaging capabilities.

ESA RAM diagnostics

The ESA processor has a RAM diagnostic test. Operating company personnel enter the TST command to use this test. The system can use the test during an RTS. The ESA RAM diagnostic test consists of the following tests:

- a message test
- an NT6X75 card test that tests the functions that follow:
  - — an NT6X75 status to ESA processor
  - — ESA processor to NT6X75 control
  - — A-bus interface to ESA processor and memory
  - — frame interrupt generator
  - — clock synchronization hardware
  - — tone generator
  - — ESA messaging hardware
- the NT6X75 card test includes the following:
  - — status and control test
  - — RAM test
  - — frame pulse interrupt test
  - — voltage controlled crystal oscillator (VCXO) clock test

Escalation to manual maintenance

Specified testing conditions described in the following sections can require manual maintenance.

Loading ESA static translations data

This section describes how to load the ESA processor manually with static translations data. Static translations data are the subset of CM translation data downloaded into the ESA processor.

The steps that follow manually download static data:

- Display the ESA MAP level for the desired OPAC.
- Make sure the ESA processor is InSv or ISTb.
- To load the ESA static data, type

  >LOADPM CC ESADATA
  and press the Enter key.

If this process fails, the system makes the ESA processor SysB.

ESA manual exit

Use the RTS command to perform a manual exit from the ESA mode at the LCM MAP level. The conditions that follow require a manual exit:

- Both LCM units of the OPAC are in a ManB state.
- The timeout value for the RLCM_XPMESAEXIT office parameter is zero.

Note: The user can override a timeout value other than zero. To perform this override, manually busy the LCM units of the OPAC at the LCM MAP level. This process starts a manual exit. Use the FORCE parameter with the BSY command.

LTC maintenance to prevent ESA mode

When both LTC C-side peripheral units are ManB, communication between the OPAC and the CM is broken.

The OPAC enters ESA mode after the following conditions occur:

- an interruption of communication between the OPAC and the CM
- the timeout period in the RLCM_ESAENTRY_BADCSIDE office parameter expires.

The following warning message appears when the user attempts to manually busy an LTC: `This action will take this PM and its subtending nodes out of service.`

Note: The user must prevent putting the OPAC into ESA mode. The user must busy the OPAC or ESA CC before the user places the LTC in a ManB state.

OPAC signaling

Signaling for OPAC

This section describes the signaling that OPAC uses to communicate with the DMS-100 switch and provide subscriber services. The following subsections discuss OPAC signaling protocols and the types of subscriber services that the OPAC signaling protocols support.

OPAC signaling links

The DS-1 interface cards (NT6X50AA, AB) are in the host interface equipment shelf. The DS-1 interface cards are the signaling interface between the OPAC and the host XMS-based peripheral module (XPM). The XPM can be a line group controller (LGC), a line trunk controller (LTC), or the remote cluster controller (RCC) of a Remote Switching Center (RSC).

Each DS-1 interface card can accept a maximum of two DS-1 links from the host XPM. A minimum of two and a maximum of six DS-1 links can connect OPAC equipment to the DMS-100 switch. Six provisionable DS-1 links can connect operating company-configured systems to DMS-100.

The OPAC and the host XPM exchange information over the DS-1 links through dedicated message channels. The exchange of information, or signaling information, allows the OPAC and the host XPM to communicate the states of subscriber lines. The exchange of signaling information allows the host XPM to execute call processing, arrange test configurations and pass test results.

The OPAC is subordinate to the DMS-100 switch. The host office handles all intersystem signaling between the host and other systems, and operator host to subscriber signaling.

Message channels

The OPAC requires a minimum of two DS-1 links to the host. These links are the primary links. The LCM section of the OPAC requires two message channels to the host XPM.

The LCM message channels occupy channel 1 on each of the primary DS-1 links to the host. The remote maintenance module (RMM) requires two message channels to the host XPM. These channels occupy channel 2 on each of the primary links.

The emergency stand-alone (ESA) processor also requires two message channels to the host. These message channels occupy channel 3 on each of the primary links. If the ESA processor is not available, channel 3 is available for speech traffic.

Signaling protocol

The message channels on the primary DS-1 links permanently assigned (nailed-up) connections to the DMS central control (CC). The message channels on the primary DS-1 links use the DMS-X protocol to communicate with the host.

The DMS-X is a half-duplex, byte-oriented protocol started with a full duplex message channel, like the DS-1 links. The LCM processor handles the DMS-X message protocol on the message channels to the host.

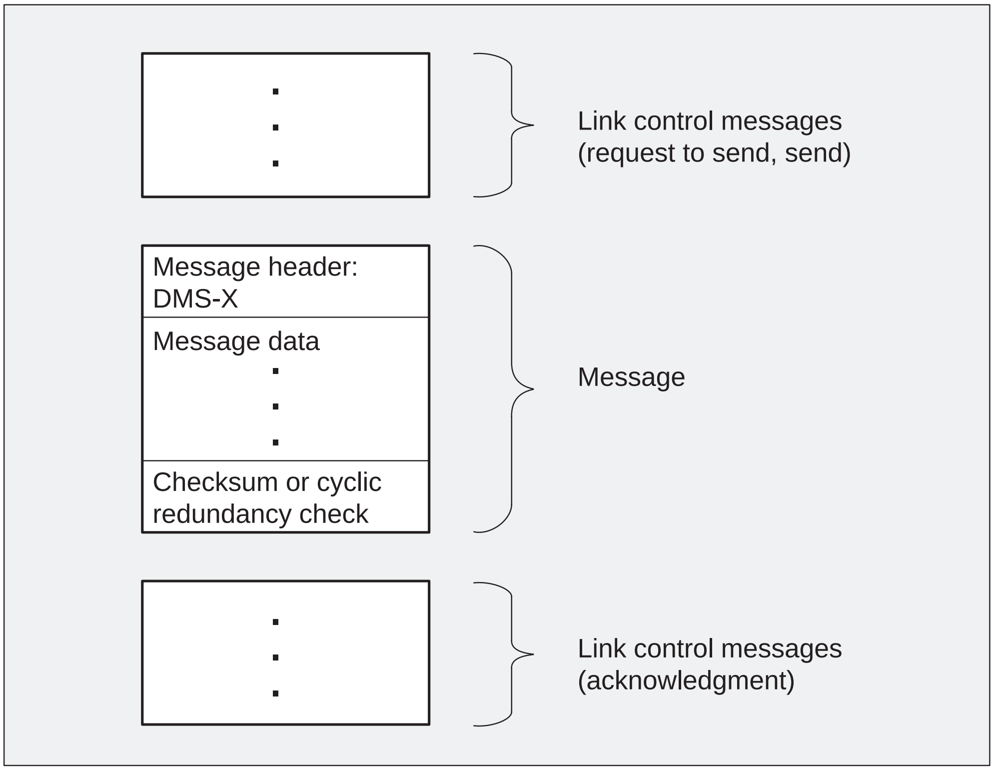
The RMM control card processes DMS-X messages, trunk messages, and pulse code modulation (PCM) data. The ESA processor is the interface that communicates with the host XPM through DMS-X protocol. The communication with the host XPM occurs when the OPAC is in ESA mode.

DMS-X protocol

The DMS-X protocol is a state-driven code that requires handshake messaging between the OPAC and host at each data transfer stage. The required handshake messaging allows the terminals that communicate to delay the message transfer if either terminal is not ready.

The DMS-X protocol consists of a general form of handshaking protocol. This protocol appears in the following figure.

DMS-X handshaking protocol

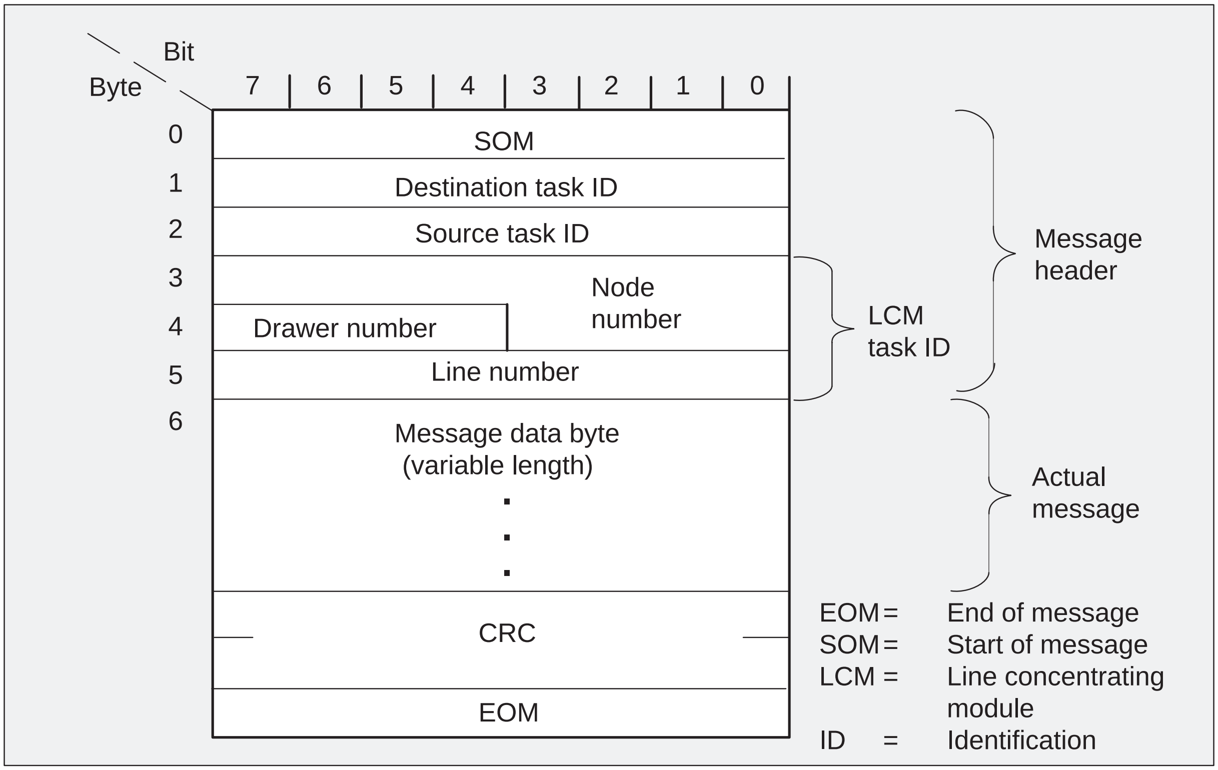


The DMS-X protocol includes a cyclic redundancy check (CRC) code for error detection. Message time-out and message checksum or CRC calculation performs message error detection.

When protocol, checksum, or CRC failure occurs on an outgoing message, the sending node attempts the send sequence again. On an incoming message failure, the sending node reroutes the message over an alternate central-side (C-side) link. Hardware redundancies provide for a minimum of one other path to and from a node.

The format of DMS-X messages appears in the following figure.

DMS-X message format



The DMS-X message header is in the first six bytes:

- The first byte specifies the start of message (SOM).
- The second byte specifies the destination task identification (ID) of the message. An outgoing message uses the destination task ID to identify the process that receives the message. The process is the task in the LCM.
- The third byte specifies the source task ID. An incoming message uses the source task ID to identify the LCM task that sent the message.
- The next three bytes specify the task ID number.

The number of bytes in the correct message or data can change. The CRC that occupies two bytes detects transmission errors. The end of message occupies 1 byte.

Signaling functions

To support call processing activities, signaling allows the functions of call origination, tone generation, digit collection, and ringing to occur.

Call origination

Signaling transmits on-hook and off-hook signals. The signals allow the host XPM to identify subscribers that request service.

When a subscriber lifts the handset from the cradle, a voltage source in the OPAC provides a steady flow of current. The current travels through the transmitter. The LCM processor detects the current and sends an off-hook message to the central office (CO).

The CO reads the off-hook signal as a request for service. The CO allocates a channel on a DS-1 link to serve the subscriber line. The CO applies dial tone to the line.

The type of telephone determines if the subscriber line transmits open pulses or dual-tone multifrequency signals through the OPAC to the CO. The CO analyzes the digits and determines if an interoffice call occurred. The system seizes the calling end of the trunk. A connect signal transmits to the called end of the trunk. A connect signal is a sustained off-hook signal. This signal indicates a request for service and continues as long as the connection holds.

Tone generation

The host XPM provides all correctly cadenced tones. The OPAC applies these tones to subscriber lines as required. The tones that the host supports and that the OPAC applies are as follows:

- dial tone
- audible ringing
- warble ringing
- busy tone
- reorder tone
- receiver off-hook (ROH) tone

Digit collection

The OPAC performs the digit collection function of subscriber dialing. The dial pulse, or dual tone multifrequency (DTMF) support the types of dialing.

Dial pulsing or multifrequency signaling can transmit the address of a called party. Dial pulsing and multifrequency signaling are for digit transmission. These signals, with other types of signaling, provide the DS-1 links with complete signaling capability.

Dial pulse signaling The LCM of the OPAC performs dial pulse digit collection. The number of on-hook intervals in a train of pulses represents the numeric value of each digit. This design occurs with dial pulsing.

Short off-hook intervals separate the on-hook intervals of each digit. At the same time, long off-hook intervals separate the digits. Percent break is the break time expressed as a percent of the pulse period (break + make duration).

The three important characteristics of dial pulsing are speed, percent break, and interdigital time. The host XPM analyzes these factors and assigns a channel or time slot in the digital line.

DTMF signaling Digitone telephones send dial pulses or dual-tone multifrequency signals to transmit address information over a line. During normal operation, the remote maintenance module (RMM) forwards this signal to the host. During ESA operation, this information travels to a Digitone receiver in an RMM.

The DTMF signals are specified groups of tones that represent single digits (0-9) and other special units. Special trunk interface circuits, the DT and MF receivers handle the accurate decoding of the tones to digits.

The RMM of the OPAC explains the output of these receivers to determine when a digit is received. The RMM relays the digits from the MF receiver to the host XPM. The host XPM analyzes the digits and applies a ringing signal to the called line.

End-to-end signaling

End-to-end signaling allows a subscriber to send DTMF signals to the far end. A subscriber sends the DTMF signals with the keypad of a Meridian Digital Centrex (MDC) Meridian Business Set (MBS). The subscriber presses the keys at the MBS to outpulse DTMF signals to the machine. These signals can start, stop, rewind, and play back the recordings on tape at the machine. After each 130 ms DTMF signal, the PCM signal reconnects.

Ringing

The CO determines the type of ringing to use. The CO sends a ringing signal to the OPAC. The CO sends the ringing signal to the OPAC over the DS-1 channel associated with the subscriber line called. This directs the OPAC to connect the ringing generator to the line called.

The ringing types that the CO provides and the OPAC applies are as follows:

- bridged ringing (single-party)
- superimposed ringing (multiparty)

- coded ringing (cadencing)
- frequency selective ringing (FSR)

ESA signaling

The ESA feature is an emergency service that provides a subset of call processing capabilities. This subset occurs when a loss of communication to the host occurs. The ESA feature includes call processing for basic station-to-station calls in the OPAC for plain old telephone service (POTS) and MDC lines.

The OPAC equipped with the ESA feature package provides the same tones as a functioning OPAC. The tones appear on channel 16 of the incoming C-side ports of the OPAC. The OPAC software provides the tone cadence. The OPAC software controls the time switching in the link control card (LCC) to interrupt the tone.

To provide a tone in ESA mode, the ESA processor sends a start cadence message to the OPAC. This message specifies the tone required, the terminal identification, and the cadence times.

When the OPAC receives a make cadence message, the OPAC performs the following steps:

- Breaks the terminal current receive path connection, if necessary.
- Connects the receive path of the terminal to the correct port.
- Arranges the specified cadence for the correct tone.

When handling the idle tone, the start cadence message uses the idle tone. The OPAC connects the receive path to a port that provides idle tone.

OPAC hardware

This chapter describes the Nortel Outside Plant Access Cabinet (OPAC) hardware components. The Nortel OPAC hardware components give operating company clients and subscribers the full resources of the digital switching system. The following sections describe the hardware components in the OPAC. These sections describe additional components.

OPAC hardware components

The OPAC is in an NT Series 800E Cabinet that contains the following standard components:

- line concentrating module (LCM)
- host interface equipment (HIE)
- remote maintenance module (RMM)
- modular supervisory panel (MSP)
- fuse panel
- battery control unit (BCU)
- rectifiers
- T1 repeaters
- environmental controls.

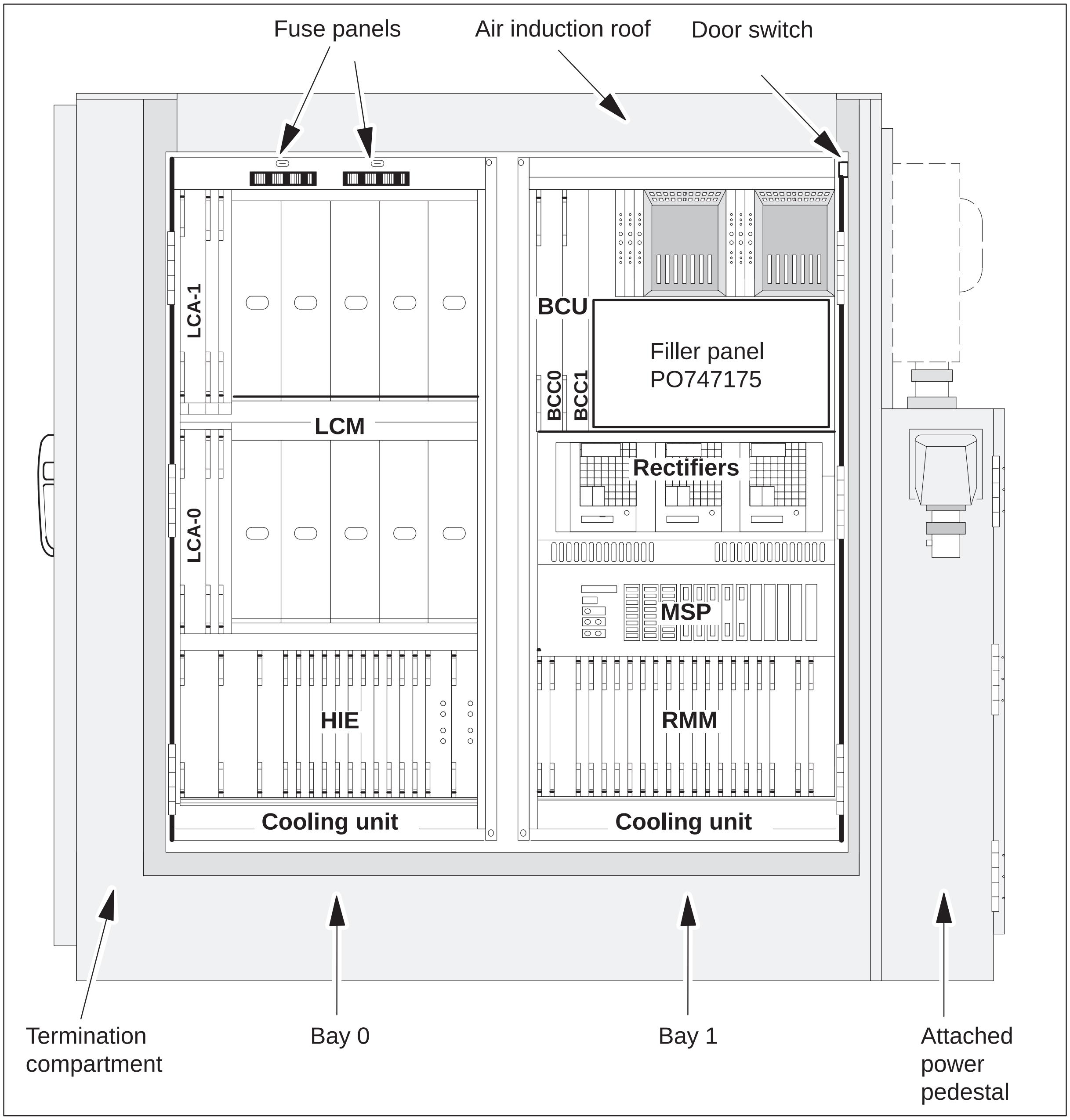
Hardware configuration

The layout of the OPAC equipment in the 800E Cabinet appears in the following figure. The multi-compartmented cabinet is a strong, insulated, weatherproofed structure. This structure provides protection and a controlled environment for electronic, termination, electrical, and power equipment.

The approximate external dimensions of the enclosure are 2.09 m by 1.65 m by 0.76 m (82.25 in. by 65 in. by 30 in.). An empty cabinet weighs approximately 680 kg (1500 lb). A completely equipped cabinet with electronics and batteries weighs approximately 1542 kg (3400 lb).

The housing is steel. Bay frames and bases use heavier materials.

Electronics compartment (cabinet front view)



The following sections describe the three OPAC compartments.

Electronics compartment

This compartment houses the frames that mount electronic shelves and batteries. Refer to the previous figure for a front view. This compartment is the only section that is environmentally controlled.

For more information on these OPAC temperature and humidity controls, refer to the Environmental controls section. The Environmental controls section is on pages 5-11 of this chapter.

The two line concentrating arrays (LCA) of the OPAC LCM are on two shelves, one above the other. Each LCA is provisioned with the following:

- a maximum of five line drawers NT6X05AA
- a di–group control card (DCC)
- an LCM processor (LCMP) card
- a power converter card.

A line drawer position that is not provisioned requires contents, NT6X05AX, to complete a drawer. The RMM and HIE are on two shelves. The MSP fills one shelf.

The space that remains, contains a rectifier system that has two or three rectifiers, a BCU, and T1 repeaters. Environmental controls, batteries, LCA fuse panel, ac outlets, and ground bars are in the electronics compartment. In this compartment, 26 vertical mounting spaces for operating company equipment are in the left rear gate of the compartment.

The electronics compartment is accessible through the front and rear cabinet doors. Four swing frames hold the equipment shelves and battery strings. The swing frames, are labeled bay 0, 1, 2 and 3. Refer to the figure on pages 5-4 for the rear view of the OPAC.

Each frame pivots on hinges. The frames swing out and away from each other to allow cabling and shelf interconnection. The frames allow access to the backplane of the equipment shelves or to the batteries at the base of the cabinet. The frames are held in position with a locking latch at the lower part of the frame. Ground bars are found on the compartment wall. The ground bars collect the ground wires that come from the equipment mounted in the frames.

Attached power pedestal

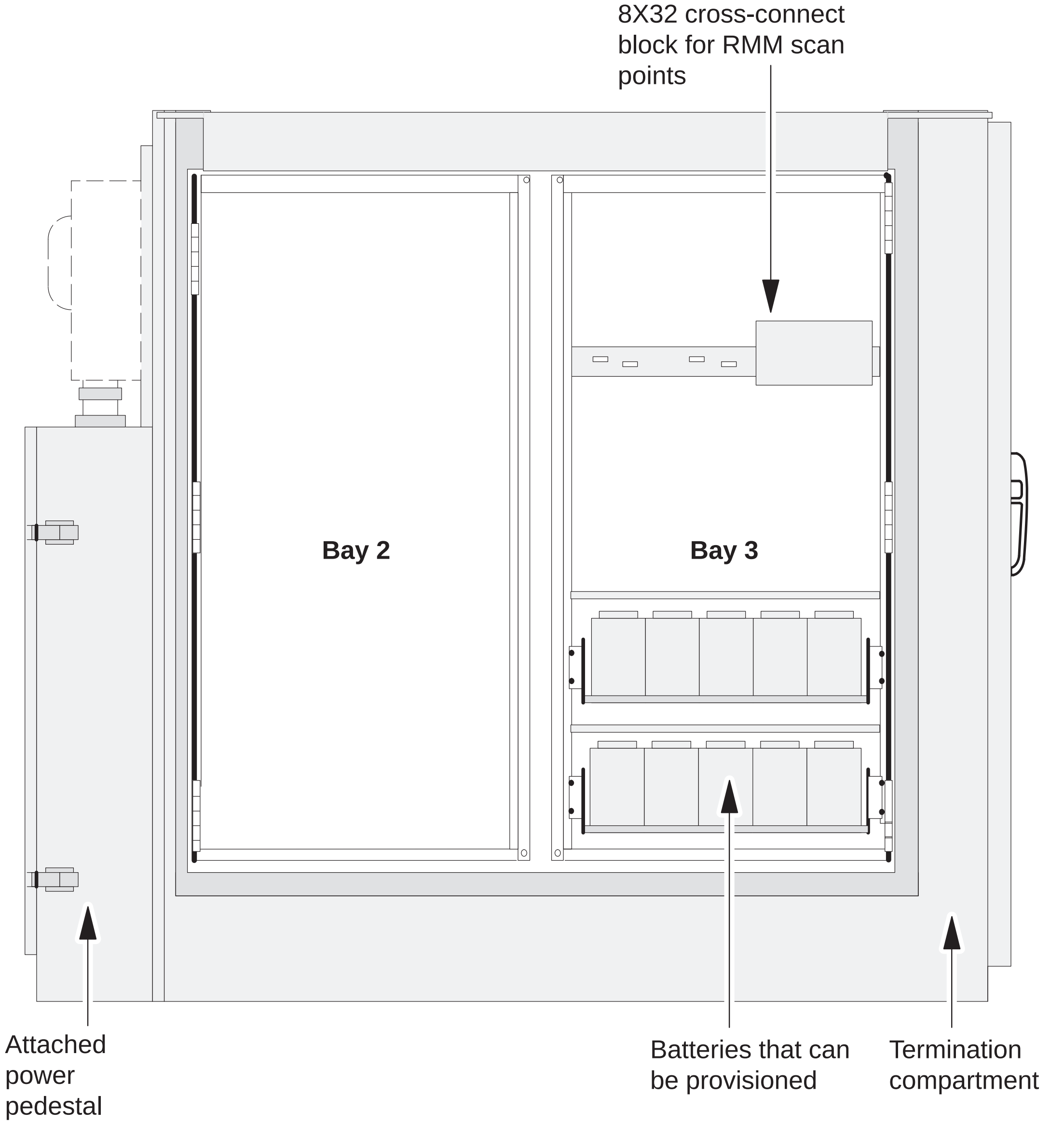
The attached power pedestal NT7A68 bolts on the right side of the cabinet. This compartment distributes ac power from the attached power pedestal. Refer to the figure Electronics compartment, that shows bay 2 and 3 Nortel-provided equipment from a rear cabinet view.

Included with the power pedestal are rectifier, ground fault interrupt (GFI), and heater circuit breakers. Heater circuit breakers are for power distribution, surge protection, and emergency generator connection and transfer capabilities.

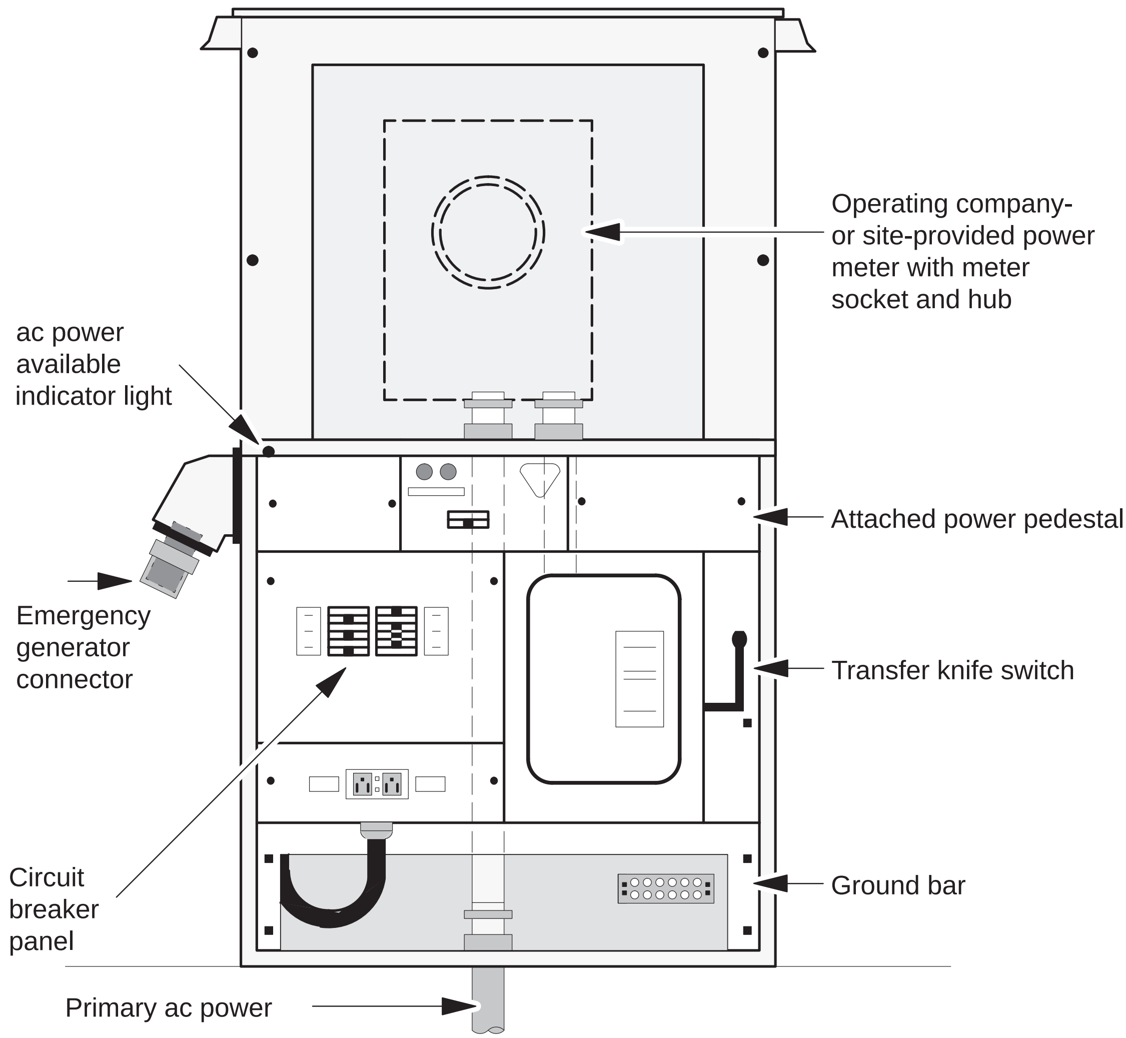
The pedestal is equipped with a primary power cable entrance hole for a 2.5 in. conduit. The pedestal is equipped with four knockouts for ground or different cable entrances.

A large 7.5 in. by 24 in. opening is along the lower rear bulkhead wall inside the pedestal. The opening allows full access to the Series 800E. Cabinet master ground bar and mounting hole locations.

Electronics compartment that shows bay 2 and 3 Nortel-provided equipment (rear cabinet view)



Electrical compartment with attached power pedestal (cabinet view from right)



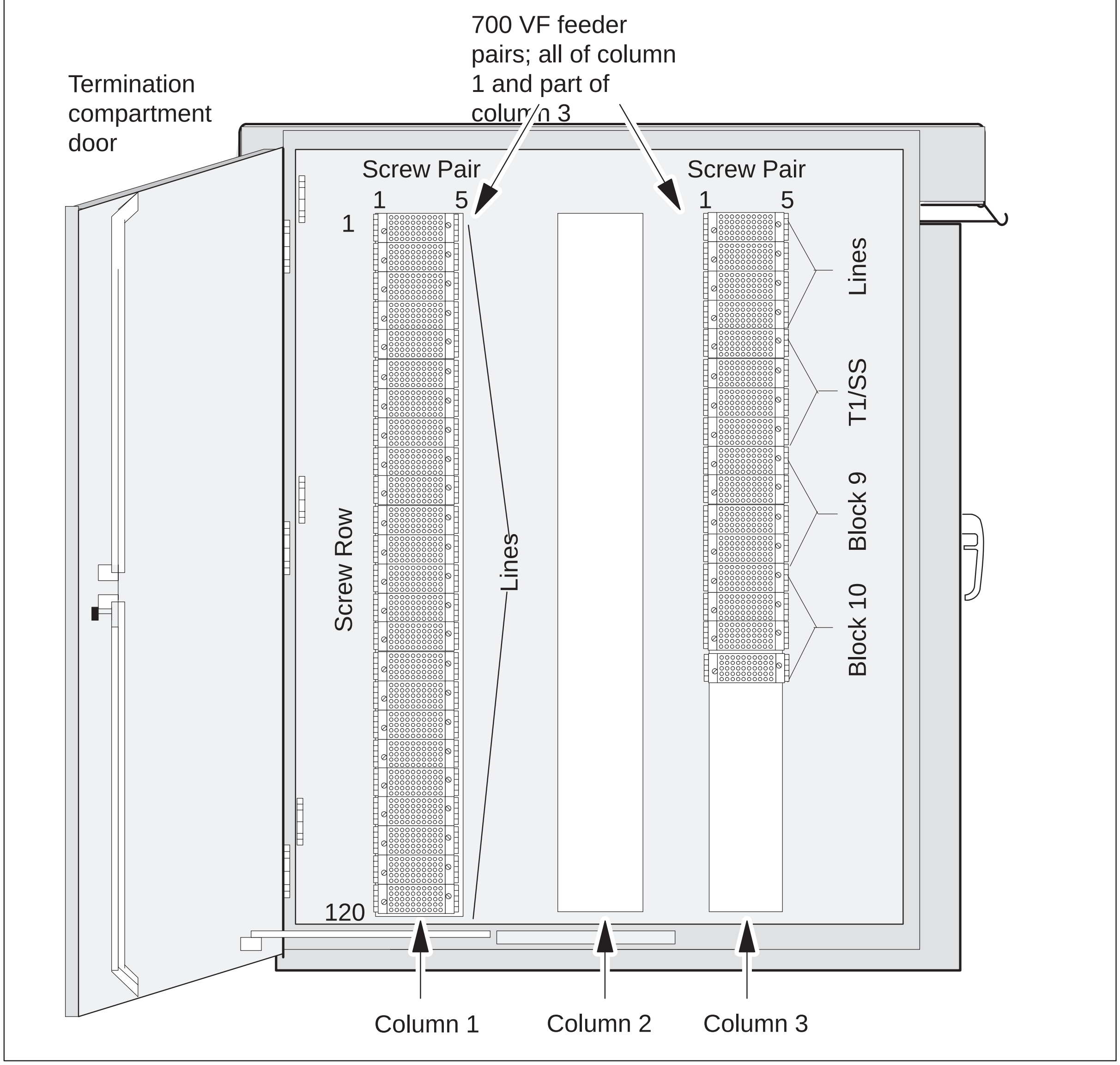
The OPAC uses a single phase, 176–264 V 47–63 Hz, 3-wire ac commercial power supply. When a temporary power failure occurs, an available battery reserve powers the system equipment. The battery reserve has a maximum of 300 Ampere–hours (Ah) and powers the system equipment for a maximum of eight hours.

Termination compartment

The termination compartment is on the end of the cabinet opposite the ac power pedestal. The following figure contains this compartment. This compartment is the interface between the electronics equipment and the outside plant cables. Access is through a full-height single door that is not alarmed.

Note: You cannot access the electronics compartment from this compartment.

Termination compartment SAI gate with a total of 1800 binding post connections



The voice frequency (VF) and T1 lines connect to the electronics compartment through NTRX65 Service Protection Center (SPC) modules. These modules provide surge and lightning protection and electromagnetic interface (EMI) filtering for the cable connections to the electronics shelves. Ten SPC modules, or 1000 pairs are possible.

The SPC modules include integral cables with BIX or screw-down connectors on the end. The connectors secure to a swinging gate. The swinging gate is part of the serving area interface (SAI). The connectors accept the wires that enter from outside the cabinet.

Four openings provide cable entry. One conduit is provided for a remote ground. The NT BIX provides for 1100 outside plant cable pairs.

Line concentrating module

The LCM NT8X04AB, is the basic design building block of the remote peripheral group. The OPAC connects to the host network over two to six DS-1 links through a connection controller peripheral. A line group controller (LGC), a line trunk controller (LTC), or a remote cluster controller (RCC) are connection controller peripherals.

When the LCM is connected to DS-1 links, the LCM can function at a distance. DS30A ports of the LCM are mapped to DS-1 interface cards that connect to the host office. These DS30A ports are on the digraph control cards (DCCs) of the LCM.

The LCM contains two shelves that are one above the other at the top of bay 0, that hold LCAs. Each LCA consists of a maximum of five line drawers NT6X05AA. A completely equipped LCM contains ten line drawers. An LCM supports up to 640 subscriber lines when completely equipped.

Each LCA has a control complex, processor and digroup control, and power converter. The control units operate in a load sharing mode.

If one of the processors fails, the mate processor takes control over the LCM. If one power converter fails, the power converter that remains can supply power to all line cards of the LCM.

The OPAC contains a dual-unit LCM NT8X04AB, mounted in an LCM shelf assembly NT8X0401. The NT8X04AB contains processor cards with 64 kb of memory, that require the LCM software load. The LCM software load has 256 kb of memory that requires the extended-memory LCM (XLCM) software load.

The circuits in the LCM appear in the following list:

- NT6X51AA, AB—LCM processor or XLCM processor
- NT6X52AA—DCC
- NT6X53AA—Power converter 5V/15V
- NT6X54AA—Bus interface card (BIC) one for each line drawer
- A maximum of 640 line cards.

Line cards

Each one of the ten line drawers of the LCM contains a pair of line subgroups (LSG) and a single BIC. Each LSG contains 32 line cards that support a minimum of 256 to a maximum of 640 subscriber lines.

The subscriber line card types that the OPAC supports appear in the following list:

- NT6X17AC—Type A line card
- NT6X17BA—World line card
- NT6X18AB—Line card type B with and without +48 V, coin, private branch exchange (PBX), and ground-start
- NT6X19AA—Message waiting (MWT) line card
- NT6X20AA—MWT converter
- NT6X21AC—MBS line card 15 KFT
- NT6X71AC—Data line card (DLC) digital multiplex system (DMS)-100/SL-100
- NT6X99AA—Datapath bit error rate tester line card with two slots.

Host interface equipment

The HIE provides voltages that ring to subscriber telephones. The HIE NT6X1108 formats DS30A signals from the LCM into DS-1 format. This format is acceptable for transmission to the host through DS-1 interface cards. The HIE cards appear in the following list:

- NT2X70AE—Power converter ± 5 V/± 12 V, two
- NT6X50AB—DS-1 interface cards, two or three
- NT6X60CA—North American ringing generator, two
- NT6X73AA—Link control card (LCC), two.

In order for the OPAC to function with Emergency Stand-Alone (ESA) capability, the HIE shelf must include the following additional cards:

- NT6X45AF—ESA processor
- NT6X47AC—ESA memory
- NT6X75AA—ESA tone and clock card.

Link control cards

The LCCs are in the HIE shelf NT6X1101. The LCCs convert data between DS-1 format, to and from the host office, and DS30A format, to and from the LCM.

The DS30A ports of the LCM map to the DS-1 interface cards in the HIE. Data is sent through the DS-1 links to the host.

One LCC is present in the HIE for each LCM unit LCA shelf. In normal operation, the two LCCs connect to even and odd LCAs. If an LCC fails in the HIE, the mate LCA can handle all the DS-1 links.

Each LCC functions as a clock. Each LCC locks frequency to the first DS-1 links. The same clock source, the host LTC/LGC drives both LCC clocks. The LCC clock functions serve both the DCCs and the RMM.

Remote maintenance module

Another top-level component of the OPAC is the RMM, or RMM NT8X0415. The RMM NT8X0415 is in the RMM shelf assembly NT6X1301. The RMM is a single-shelf module based on the maintenance trunk module (MTM).

The RMM provides maintenance and service capabilities for the OPAC. This module connects to LCCs in the HIE through DS30A links. The LCC passes maintenance requests from the host to the RMM. The LCC provides a link between the RMM and line circuits in the LCA.

The RMM consists of the following:

- two power converters
- an RMM control card
- a coder–decoder (CODEC) and tone card
- multi-output power cards
- space for a maximum of 14 provisionable service cards.

The RMM contains one set of common cards NT6X13AB.

The common cards in the RMM appear in the following list:

- NT2X06AB—Power converter common feature
- NT2X09AA—Multi-output power converter
- NT2X59AA—Group CODEC DMS-100/200
- NT6X74AB—RMM control card.

Temporary cards in the RMM are:

- NT0X10AA—Miscellaneous scan card
- NT2X10AB—Line test unit (LTU) analog card
- NT2X10BA—Multiline test unit (MTU) analog card
- NT2X11AA—LTU digital card
- NT2X11BA—MTU digital card
- NT2X48AB—Digitone receiver card
- NT2X57AA—Signal distribution card, type 1
- NT2X90AC—Incoming/outgoing test trunk
- NT3X09AA—Remote metallic test access (MTA)
- NT3X09BA—8 by 8 MTA

Modular supervisory panel

The system provides the OPAC with a MSP, NTRX40AA. The MSP distributes power and provides alarm monitor and control functions. Modules are provisioned to provide specified functions.

The MSP is above the RMM in bay 1 of the OPAC.

Fuse panel

The fuses in the fuse panel P0746078 are in line between the LCA power converters and each line drawer. The fuses are at the top of bay 0. The fuse panel mounts into a gate-like shelf.

Battery control unit

The BCU is at the top left hand corner of bay 1. The BCU NT8X0301 has two battery charge controller (BCC) cards: BCC0 and BCC1 NT8X02AB.

The BCC cards manage the switching of battery strings between the load bus, charge bus, and discharge bus. The BCC cards manage the batteries in string pairs.

Rectifiers

The rectifier shelf contains two or three NT5C06CA MRP25E ac-to-dc rectifiers. A minimum of two rectifiers are required. Three rectifiers allow for n+1 redundancy when optional or customer installed equipment requires dc power dissipation over 25 ampere (A) total.

The 25 A rectifiers accept ac power from the attached power pedestal. The 25 A rectifiers deliver dc power to operate the installed equipment, fans, and BCU. Output voltage is adjustable from –44 V dc to –56 V dc. The system adjusts output voltage to provide an output of –52.5 V dc ± 0.5 V dc.

The rectifiers are above the MSP in bay 1.

T1 repeater shelf

The T1 repeaters, used for metal connections back to the host are in an A0617243 shelf from Wescom.

The shelf comes factory wired for six slots. The slots are dedicated to the OPAC for a host communication link. There are 16 additional slots are available for links operating company-provided equipment located in the cabinet requires. This unit fills the shelf space in the top right-hand corner of bay 1.

The shelf features rear-access wire-wrap connectors. The connectors allow the T1 signal to bridge to a fiber unit that eliminates the requirement for T1 repeater cards.

Environmental controls

Temperature sensing

Four environmental thermostats and alarms sense temperature:

- high temperature alarm fixes at 60° C, at the top of bay 0
- heater thermostat fixes, ON at 5° C, OFF at 15° C, on the ac outlet box cover
- fan thermostat is adjustable, exhaust bank ON at 18° C, (65° F) above the heater thermostat
- low temperature alarm fixes at 0° C, below the fan thermostat.

For more information on environmental monitoring equipment, refer to the *Alarm Clearing Procedures*.

Cooling units

The OPAC has two cooling units under the HIE and RMM shelves. Each cooling unit contains two fans. These fans are provided in addition to the fans in the roof assembly. These fans run continuously to circulate air in the cabinet. The baffle can be removed for maintenance. The baffel must be installed again because the baffle directs air flow in the cabinet.

Air induction roof option

The air induction roof NTRX61BA-BC controls the OPAC interior temperature. Fans circulate outside air through the cabinet. The roof keeps the cabinet free from dust, sand, water, and pests. Two air filters are made from open-cell, polyurethane foam, and are behind hinged filter covers.

Six six-inch, 240 cfm, 48 V dc fans, controlled by a thermostat, circulate and cool the air. The fans turn ON at 18° C (65° F). The fans turn OFF when cabinet temperatures fall below 18° C (65° F), add or subtract 2° C.

Heaters

Electric strip heater pads, are on the walls of the electronics compartment. The units, are flat elements that provide standard surface heating.

When the internal temperature drops below 5° C (41° F), four 150W wall heaters turn ON. When the temperature is greater than 15° C (59° F), the heaters turn OFF.

Insulation

One inch thick foil-faced, closed-cell boards insulate the cabinet.

Use of air filters

The air filters are made from a woven mesh polypropylene or an open cell foam. The polypropylene or foam is immediately in front of the air intake and exhaust openings.

The filters, stop dust, sand, water, snow, and pest entry. The filters have a minimum dust arrestment of 80% and a minimum fire rating of UL Class 2.

Gas vent

Hydrogen battery gas vents in the OPAC through filters on the air induction roof. The maximum gas increase allowed is 1%.

Humidity control

The system mixes outside humid air with warmer cabinet air to control humidity.

Weatherproofing

Closed-cell gasketing mounts on the internal edge of each door. Closed-cell gasketing provides a weather seal on the four doors of the electronics compartment. This gasketing has an internal EMI gasket that contacts conductive tape to provide the EMI seal.

Additional OPAC components

The following sections discuss the optional components available for the OPAC.

Batteries/battery shelf

Two optional battery shelves, in the rear right frame, secure ten Eagle-Picher 6-V batteries, AO623729.

The size of batteries and the space available in the cabinet allow only six strings, pairs 0, 1, and 2, in the cabinet. The size of the batteries and the space allow eight batteries for each string, for 48 batteries aggregate. Thirty-eight batteries are on the OPAC cabinet floor. Ten batteries can be on the battery shelf in bay 3. Refer to the following figure for battery arrangement.

The batteries are pressure-vented, maintenance-free, lead acid type. A 48 V string consists of eight Eagle-Picher 6-V/50-Ah batteries. The operating company can provide the batteries.

Note: The battery configuration in the OPAC does not support a string pair 3, strings 3 and 7, as in the Outside Plant Module.

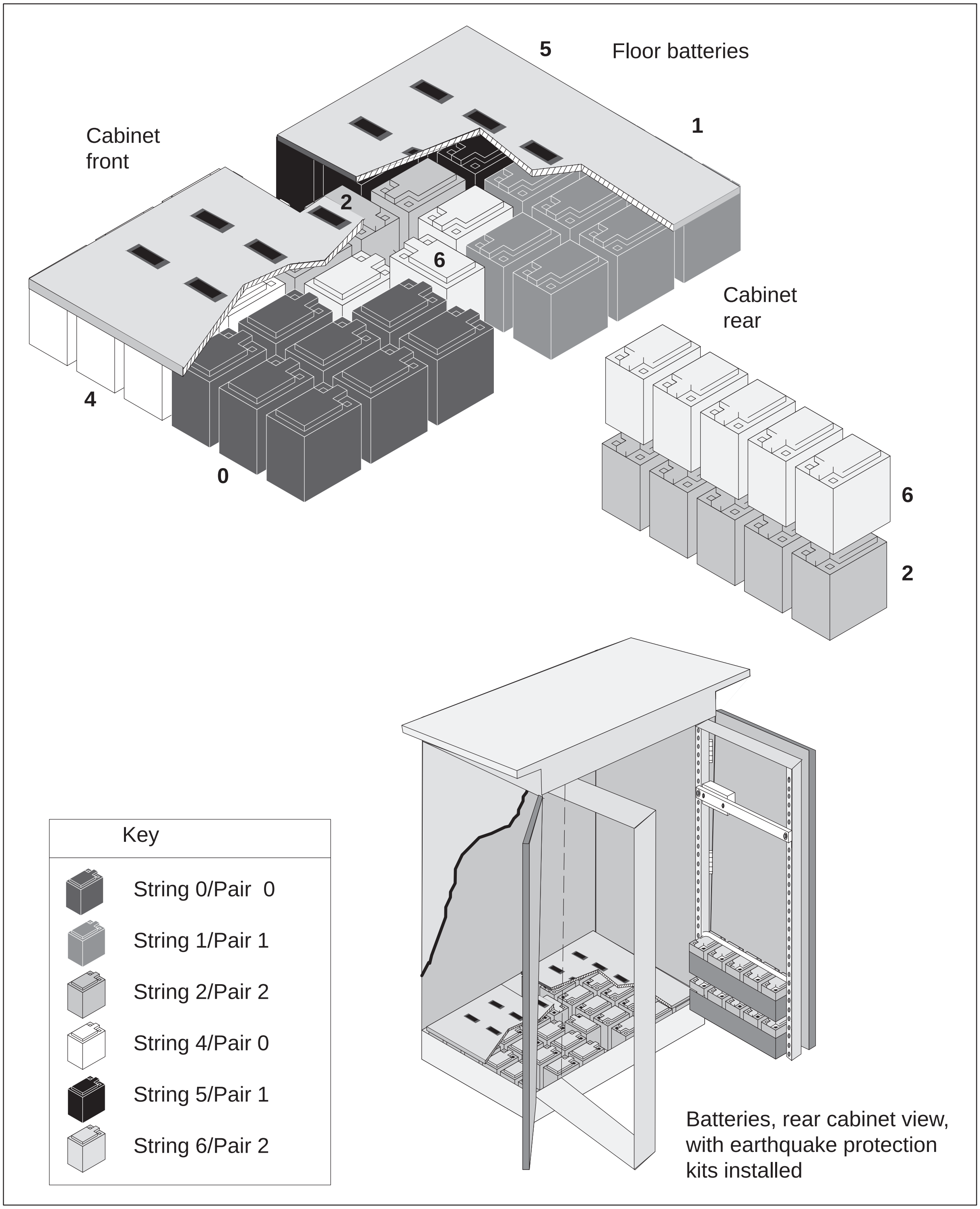
Operating company-provided equipment

The OPAC provides 26 vertical mounting spaces of 23 in. rack in the left rear frame, in bay 2, for operating company-provided equipment. The OPAC provides approximately 10 in. by 19 in. in the right front frame, in bay 1, for operating company-provided equipment.

If OPAC does not provide optional battery shelves in bay three, ten vertical spaces of rack are available to mount equipment. The additional capacity combined with increased power of 20 A allows flexibility to mount many transmission, special circuit and test equipment.

The OPAC provides an 8 by 32 single post wirewrap cross-connect block mounted in position 40 of bay 3. The block is factory wired to the RMM shelf slot 07 NT0X10 with 13 scan points. Five of 13 of scan points are reserved for NTI, 8 scan points, and customer use. The block wires through the SAI bulkhead block 08, and out to tip/ring pairs 777 through 788. VF filters the signals at the bulkhead. The connections are available to the operating company for different signals to go through the bulkhead. The operating company uses the remainder of the block connections. The operating company uses two additional block mounting on the mounting bracket. The following figure demonstrates the procedure:

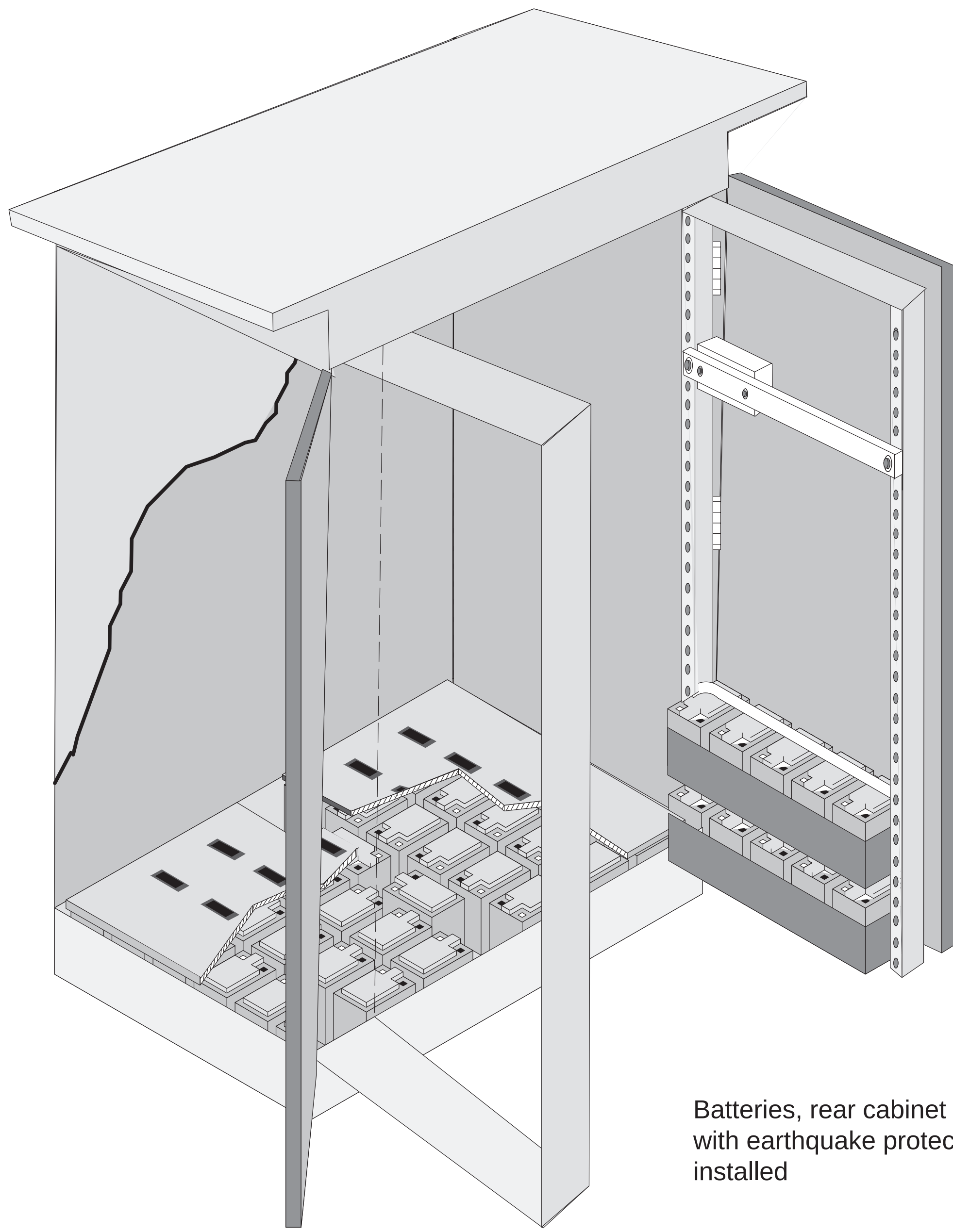
OPAC battery arrangement and back cabinet view without earthquake protection



Earthquake protection equipment

Earthquake protection battery covers, are available for the floor mounted batteries. The NTRX6310 kit is available for the 4-string option. The NTRX6311 kit is available for the 6-string option. The NTRX6311 kit contains brackets for the door mounted batteries. Brackets for the door mounted batteries are in the NTRX63AC battery string upgrade kit. Refer to the following figure for a 6-string option:

OPAC battery arrangement and back cabinet view with earthquake protection



Batteries, rear cabinet view, with earthquake protection kits installed

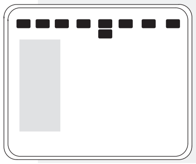
The OPAC recovery procedures

This chapter contains the recovery procedure for the Outside Plant Access Cabinet (OPAC) standard configuration.

Maintenance personnel use this procedure to return to service an OPAC from a completely out-of-service condition.

Recovering an out-of-service OPAC

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Application

Use this procedure to recover service in an OPAC when both units of the line concentrating module (LCM) are out of service. This condition always produces a central side busy (CBsy) alarm.

The OPAC alarm appears under the PM header in the MAP subsystem display. This alarm indicates an alarm condition in the OPAC. The *n* indicates the number of OPACs with alarms. The **C** that appears under the alarm indicates that the alarm class is critical.

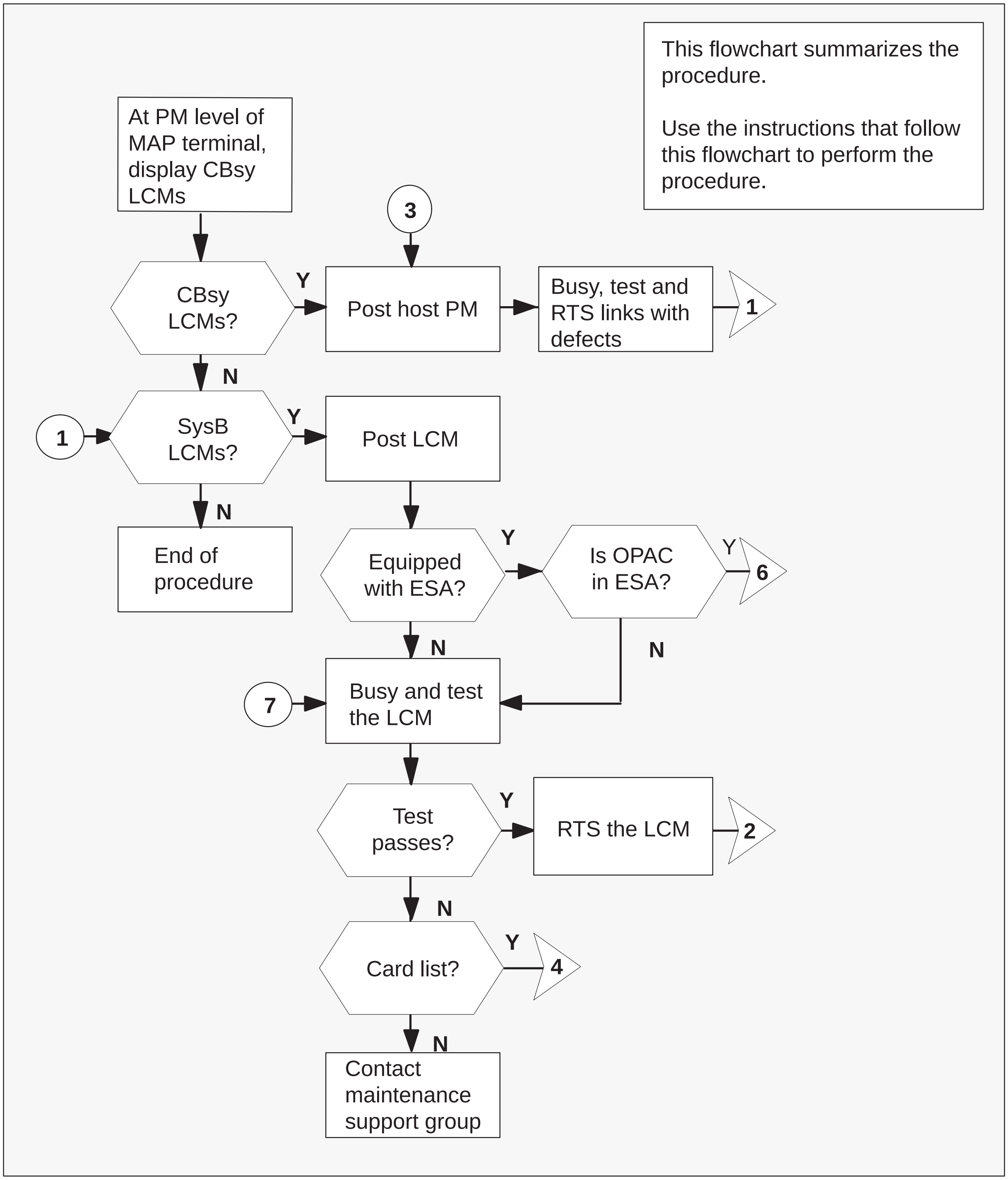
Action

The flowchart that follows provides a summary of the procedure. Use the instructions in the step-action procedure that follows the flowchart to perform the recovery task.

Note: The numbers the flowchart contains do not coincide with the step-action numbers. The numbers indicate procedure in the flowchart.

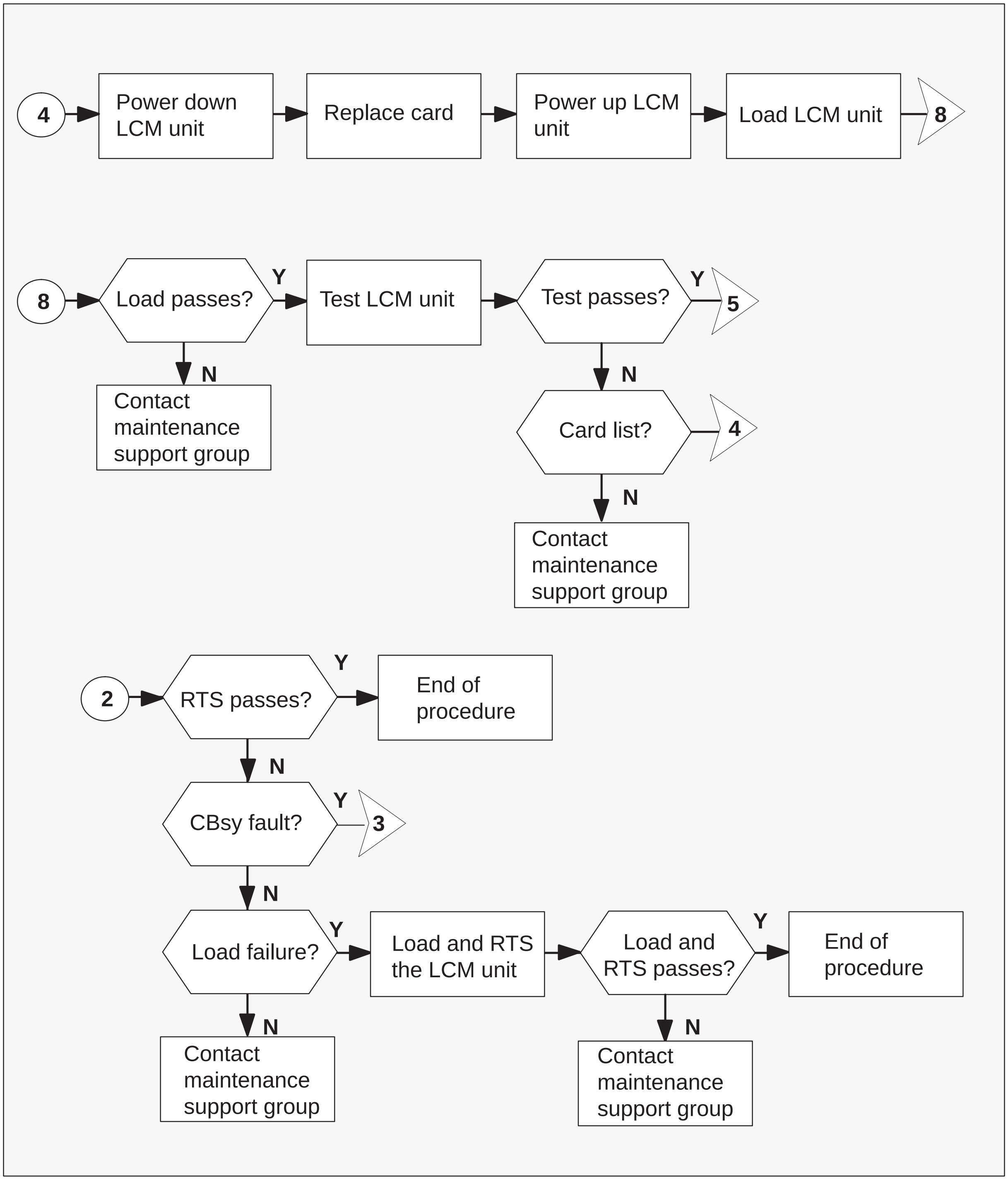
Recovering an out-of-service OPAC (continued)

Summary of Recovering an out-of-service OPAC



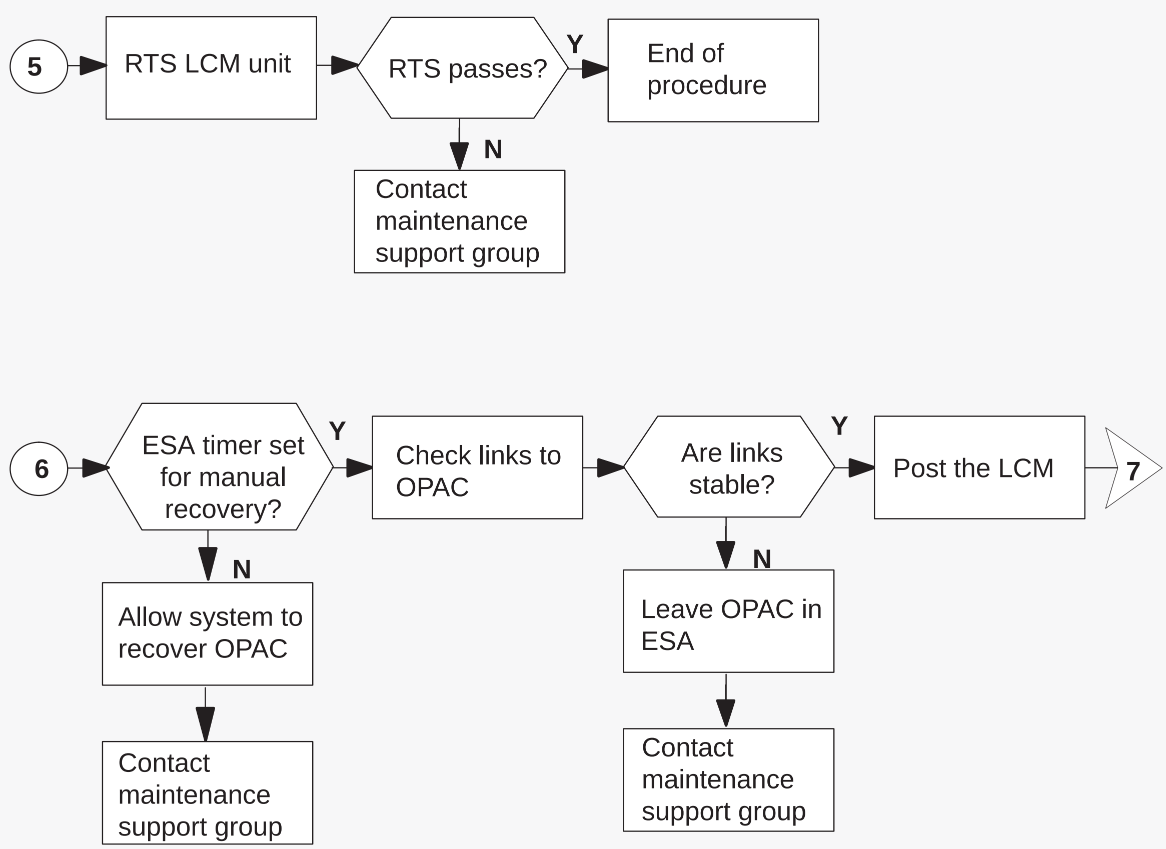
Recovering an out-of-service OPAC (continued)

Summary of Recovering an out-of-service OPAC (continued)



Recovering an out-of-service OPAC (continued)

Summary of Recovering an out-of-service OPAC (continued)



Recovering an out-of-service OPAC (continued)

Recovering an out-of-service OPAC

At the MAP terminal

1 Make sure that the OPAC receives power.

2 To silence an alarm that remains audible, type:

>MAPCI;MTC;SIL;PM
and press the Enter key.

3 To identify the OPAC with defects, type:

>DISP STATE CBSY LCM
and press the Enter key.

If response	Do
shows CBsy LCMs are not present	step 14
shows CBsy LCMs are present	step 4

4 To post the OPAC with the alarm condition, type:

>POST LCM CBsy
and press the Enter key.

Note the name and number of this OPAC.

5 To identify central side (C-side) links to the host PM, type:

>TRNSL C
and press the Enter key.

Example of a MAP response:

```
Link 0: LTC 0   2; Cap MS; Status: SysB  ;MsgCond: CLS
Link 1: LTC 0   6; Cap MS; Status: SysB  ;MsgCond: CLS
```

6 To post the host PM, type:

>POST PM pm_no
and press the Enter key.

where

pm	is a line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC)
pm_no	is the number of the PM

Recovering an out-of-service OPAC (continued)

7 To display the peripheral side (P-side) links, type:

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link 2: LCM REM1 00 0    2; Cap MS; Status: SysB ;MsgCond: CLS
Link 6: LCM REM1 00 0    1; Cap MS; Status: SysB ;MsgCond: CLS
```

Record information for the links with a status that is not OK.

8 To busy the damaged link, type:

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of a defective P-side link identified in step 7

9 To test the busy link, type:

>TST LINK link_no
and press the Enter key.

where

link_no is the number of a defective P-side link made busy in step 8

If test	Do
passes	step 10
fails	step 29

10 To return to service (RTS) the busy link, type:

>RTS LINK link_no
and press the Enter key.

where

link_no is the number of a defective P-side link tested in step 9

If RTS	Do
passes and other links that are not system busy (SysB)	step 11
passes but other links are SysB	step 8
fails	step 29

Recovering an out-of-service OPAC (continued)

11 To post the OPAC that you noted in step 4 with the alarm condition, type:

>POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0–511)
lcm	is the number of the LCM unit of the OPAC (0 or 1)

12 To busy both LCM units of the OPAC, type:

>BSY PM
and press the Enter key.

13 To return to service (RTS) the PM, type:

>RTS PM
and press the Enter key.

If RTS	Do
passes	step 36
fails	step 29

14 To identify the defective OPAC and display the LCM by site, type:

>DISP STATE SYSB LCM
and press the Enter key.

If response	Do
shows SysB LCMs are not present	step 36
shows SysB LCMs present	step 15

15 To post the OPAC with the alarm condition, type:

>POST LCM SYSB
and press the Enter key.

Recovering an out-of-service OPAC (continued)

16

> **CAUTION**
> **Failure to allow enough time can cause false alarm indication.**
> Allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

To determine if the OPAC has emergency stand-alone (ESA), type

>QUERYPM
and press the Enter key.

Example of a MAP response:

```
PM Type: LCM  Int. No.: 20  Status index: 9  Node_No: 165
Memory Size: 64K
ESA equipped: Yes, Intraswitching is On
Loadnames: LCMINV – LCM33c ,Unit0: LCM33c ,Unit1: LCM33c
Node Status: (OK, FALSE)
Unit 0 Status: (OK, FALSE)
Unit 1 Status: (OK, FALSE)
 Site Flr RPos Bay_id  Shf  Description   Slot   EqPEC
 TRLC  01  D04 RLCM 40  04  LCM  40  0           6X04AA
```

If OPAC	Do
has ESA	step 17
does not have ESA	step 24

17 Manually check for dial tone at the remote to determine if the OPAC is in ESA. A PM alarm that appears on the MAP screen indicates the OPAC is in ESA.

If the OPAC	Do
has dial tone	step 18
does not have dial tone	step 24

18 Determine if the OPAC has the ESA timer set for manual recovery from ESA. To access table OFCENG, type:

>TABLE OFCENG
and press the Enter key.

Recovering an out-of-service OPAC (continued)

19 To check the OPAC exit time, type:

>POS RLCM_XPMESAEXIT
and press the Enter key.

Example of a MAP response:

```
        PARMNAME            PARMVAL
---------------
RLCM_XPMESAEXIT               0
```

If PARMVAL is	Do
set to zero	step 20
greater than zero	Allow the system to recover the OPAC. Go to step 29.

20 Check if links to the OPAC are stable before you manually restore the OPAC from ESA. To find the link numbers for this OPAC, type:

>TRNSL C
and press the Enter key.

Example of a MAP response:

```
Link  0: LTC 1       0;Cap MS;Status:OK     ;MsgCon:OPN
Link  1: LTC 1       2;Cap MS;Status:OK     ;MsgCon:OPN
Link  2: LTC 1       3;Cap  S;Status:OK
Link  3: LTC 1       4;Cap  S;Status:OK
```

where

the number that appears next to the word Cap is the host XPM link number.

21 To access the CARRIER level of the MAP terminal, type:

>TRKS;CARRIER
and press the Enter key.

Recovering an out-of-service OPAC (continued)

22 To post the host XMS-based peripheral module (XPM) links and check link conditions for slips and framing errors, type:

>POST pm pm_no link_no
and press the Enter key.

where

pm	is a line trunk controller (LGC), line group controller (LTC) or remote cluster controller (RCC)
pm_no	is the number of the PM (0 to 255)
link_no	is the number of the link associated with the host XPM (Refer to step 20 display)

Note: Repeat the POST command for each link.

Example MAP response:

```
N CLASS  SITE LTC CK D ALRM SLIP FRME  BER  ES SES STATE
0 REMOTE HOST   1  0 C         0    0 <–7.   0   0 INSV
```

where

The number that appears under the CK header is the host XPM link number.

Note: This display shows carrier facilities from the host XPM to the OPAC. Use the detail REM option to check the carrier facilities from the remote site back to the host XPM.

If link conditions	Do
show a high number of SLIP and FRME	Leave the OPAC in ESA. Go to step 29.
show a very low number of SLIP and FRME	step 23

23 To post the OPAC with the alarm condition, type:

>PM; POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0–511)
lcm	is the number of the LCM unit of the OPAC (0 or 1)

Recovering an out-of-service OPAC (continued)

24 To busy both LCM units of the OPAC, type:

>BSY PM
and press the Enter key.

Go to step 27.

25 To test both LCM units of the OPAC, type:

>TST PM
and press the Enter key.

If test	Do
passes	step 27
fails, and the system generates a card list	step 26
fails, and the system does not generate a card list	step 29

26 The card list identifies the cards with a high possibility of defect. Replace the cards as this procedure directs.

If last card on list	Do
has not been replaced	step 30
has been replaced	step 29

27 To attempt to return the OPAC to service, type:

>RTS PM
and press the Enter key.

If MAP prompt	Do
shows RTS is successful	step 36
shows CBsy	step 5
shows load failure	step 28
shows any other message	step 29

Recovering an out-of-service OPAC (continued)

28 To attempt to reload the OPAC, type

>LOADPM PM CC
and press the Enter key.

If load is	Do
successful	step 27
not successful	step 29

29 Contact your maintenance support group for additional instructions in how to clear this fault.

30 Switch off the circuit breaker to power down the converter in the LCM unit of the OPAC.

Use the table below to find the modular supervisory panel (MSP) circuit breaker that serves the unit.

Circuit breaker	Unit
CB01	LCA 0
CB03	LCA 1

31 Go to the *Card Replacement Procedures.* Replace the first, or next, card on the card list. Notify outside plant personnel that the card must be changed. Go to step 32 when the card is replaced.

32 Switch on the converter circuit breaker to power up the converter in the LCM unit of the OPAC on which you work.

Use the table below to find the MSP circuit breaker that serves the unit.

Circuit breaker	Unit
CB01	LCA 0
CB03	LCA 1

Recovering an out-of-service OPAC (continued)

33 To attempt to load the LCM unit, type:

>LOADPM UNIT lcm_unit_no CC
and press the Enter key.

where

lcm_unit_no is the LCM unit of the OPAC to load (0 or 1)

If load	Do
is successful	step 34
is not successful	step 29

34 To test the LCM unit, type:

>TST UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit of the OPAC to test (0 or 1)

If test	Do
passes	step 35
fails, and the system generates a card list	step 26
fails, but the system does not generate a card list	step 29

35 To attempt to return the LCM unit to service, type:

>RTS UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit of the OPAC to return to service (0 or 1)

If RTS	Do
passes	step 36
fails	step 29

Recovering an out-of-service OPAC (end)

36 The procedure is complete.

If the MAP subsystem displays additional alarms, proceed to the correct alarm clearing procedure.

Alarm clearing procedures

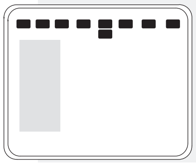
This chapter contains the alarm clearing procedures for the Outside Plant Access Cabinet (OPAC). The alarm indicates the procedure required to clear the trouble.

Maintenance personnel use these procedures to clear alarms as the alarms appear at the MAP display.

Procedures in this chapter correspond with the alarms. The system names the alarms as the alarms appear at the MAP display. These procedures appear in alphabetical order.

OPAC critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Application

Use this procedure to recover service in an OPAC when both units of the line concentrating module (LCM) are out of service. This condition always produces a central side busy (CBsy) alarm.

In the MAP display, the OPAC alarm appears under the PM header of the alarm banner. The message indicates a critical alarm condition in the OPAC. The *n* indicates the number of OPACs with alarms. The **C** that appears under the message indicates the alarm is critical.

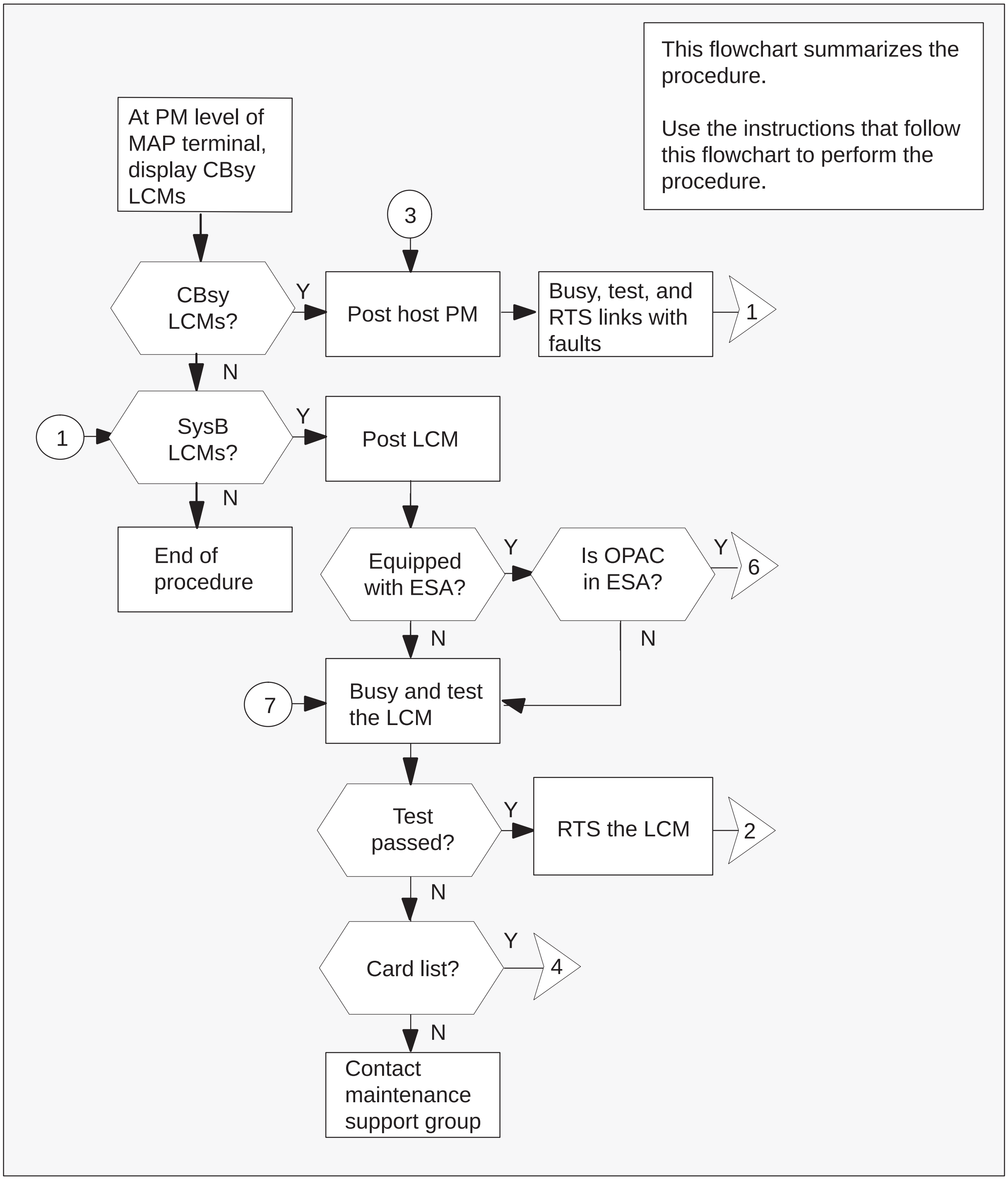
Action

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.

Note: The numbers displayed in the flowchart do not match the step-action numbers. The numbers indicate movement in the flowchart.

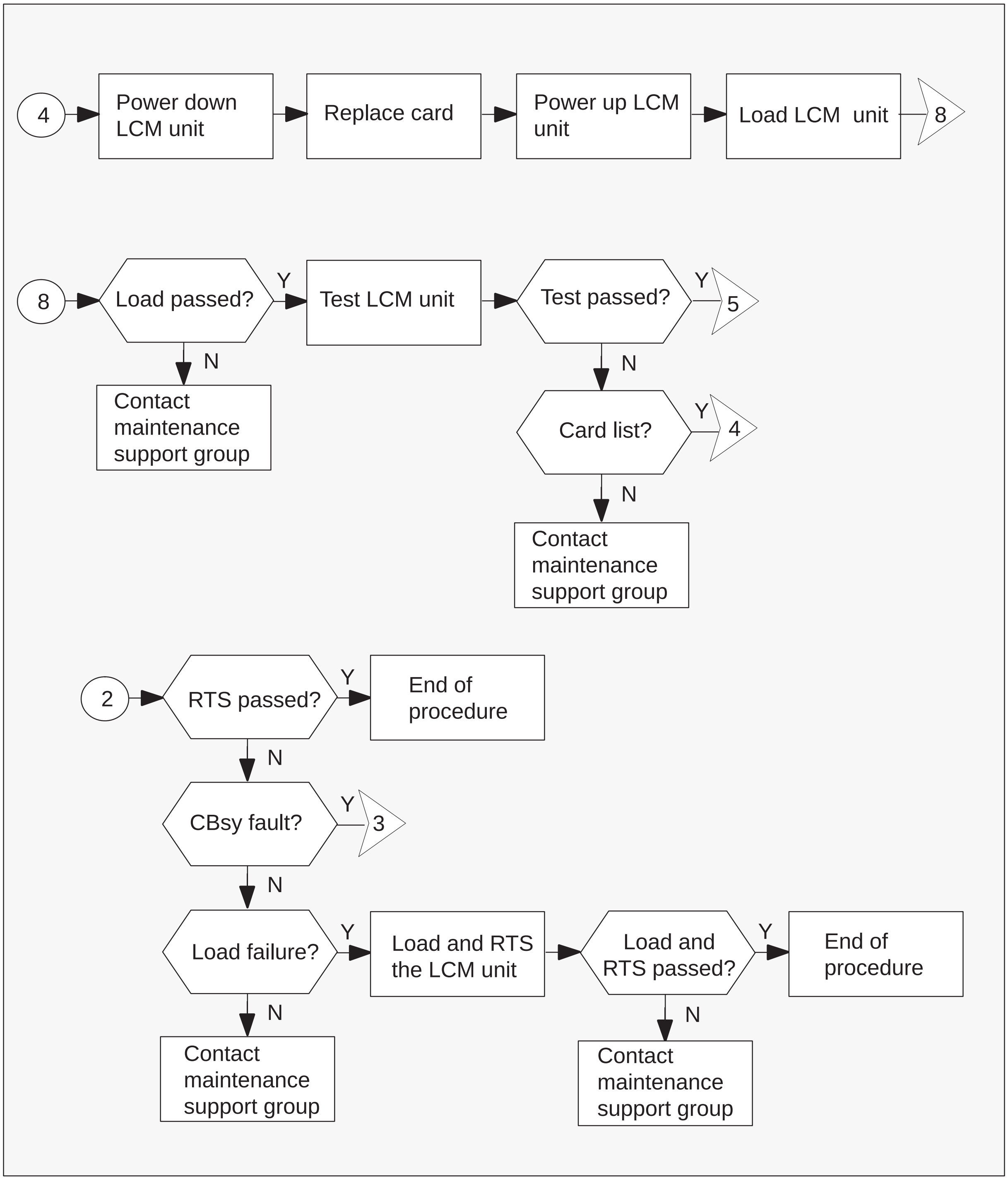
OPAC
critical (continued)

Summary of an OPAC critical alarm

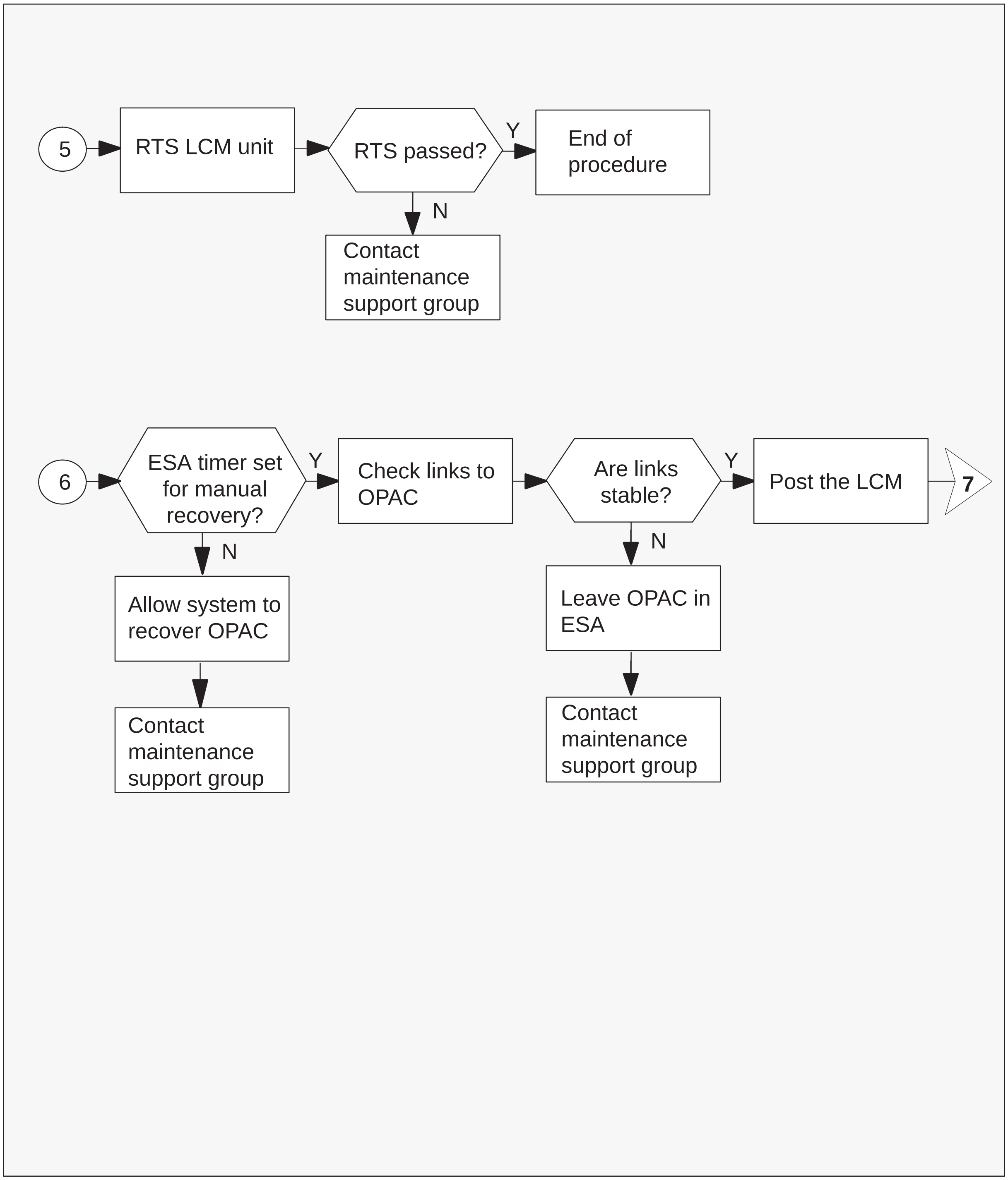


OPAC
critical (continued)

Summary of an OPAC critical alarm (continued)



Summary of an OPAC critical alarm (continued)



OPAC
critical (continued)

Clearing an OPAC critical alarm

At the MAP terminal

1 Make sure that the OPAC is receiving power.

2 To silence an audible alarm, type

>MAPCI;MTC;SIL;PM
and press the Enter key.

3 To identify the OPAC that has faults, type

>DISP STATE CBSY LCM
and press the Enter key.

If the response	Do
does not indicate CBsy LCMs	step 14
indicates CBsy LCMs	step 4

4 To post the OPAC with the alarm condition, type

>POST LCM CBsy
and press the Enter key.

Note the name and number of this OPAC.

5 To identify the central side (C-side) links to the host PM, type

>TRNSL C
and press the Enter key.

Example of a MAP response:

```
Link 0: LTC 0   2; Cap MS; Status: SysB  ;MsgCond: CLS
Link 1: LTC 0   6; Cap MS; Status: SysB  ;MsgCond: CLS
```

6 To post the host PM, type

>POST pm pm_no
and press the Enter key.

where

pm — is a line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC)

pm_no — is the number of the PM

OPAC
critical (continued)

7 To display the peripheral side (P-side) links, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link 2: LCM REM1 00 0    2; Cap MS; Status: SysB ;MsgCond: CLS
Link 6: LCM REM1 00 0    1; Cap MS; Status: SysB ;MsgCond: CLS
```

Record information for the links that have a state other than OK.

8 To busy the link that has faults, type

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of the P-side links with faults identified in step 7

9 To test the busied link, type

>TST LINK link_no
and press the Enter key.

where

link_no is the number of the P-side links busied in step 8

If test	Do
passes	step 10
fails	step 27

10 To return to service (RTS) the busied link, type

>RTS LINK link_no
and press the Enter key.

where

link_no is the number of the P-side links tested in step 9

If the RTS	Do
passes and other links are not system busy (SysB)	step 11
passes and other links are SysB	step 8
fails	step 27

OPAC
critical (continued)

11 To post the OPAC with the alarm condition identified in step 4, type

>POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0 to 511)
lcm	is the number of the LCM unit of the OPAC

12 To busy both LCM units of the OPAC, type

>BSY PM
and press the Enter key.

13 To RTS the PM, type

>RTS PM
and press the Enter key.

If the RTS	Do
passes	step 33
fails	step 27

14 To identify the OPAC that has faults, and to display the LCM by site, type

>DISP STATE SYSB LCM
and press the Enter key.

If response	Do
does not indicate SysB LCMs	step 33
indicates SysB LCMs	step 15

15 To post the OPAC with the alarm condition, type

>POST LCM SYSB
and press the Enter key.

OPAC
critical (continued)

16

> **CAUTION**
> **If you do not allow the time required for the system to clear the alarm, a false alarm indication occurs.**
> Allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

To determine if the OPAC is equipped with emergency stand-alone (ESA), type

>QUERYPM

Example of a MAP terminal response:

and press the Enter key.

```
PM Type: LCM  Int. No.: 20  Status index: 9  Node_No: 165
Memory Size: 64K
ESA equipped: Yes, Intraswitching is On
Loadnames:LCMINV– XLCM08BB,Unit0:XLCM08BB ,Unit1:XLCM08BB
Node Status: (OK, FALSE)
Unit 0 Status: (OK, FALSE)
Unit 1 Status: (OK, FALSE)
 Site Flr RPos Bay_id  Shf  Description   Slot   EqPEC
 TRLC  01  D04 RLCM 40  04  LCM  40  0           6X04AA
```

If OPAC	Do
has ESA	step 17
does not have ESA	step 24

17 To determine if the OPAC is in ESA, manually check for a dial tone at the remote. A PM alarm appears on the MAP display screen that indicates the OPAC is in ESA.

If the OPAC	Do
has dial tone	step 18
does not have dial tone	step 24

OPAC
critical (continued)

18 Determine if the OPAC has the ESA timer set for manual recovery from ESA. To access table OFCENG, type

>TABLE OFCENG
and press the Enter key.

19 To check the OPAC exit time, type

>POS RLCM_XPMESAEXIT
and press the Enter key.

Example of a MAP response:

```
        PARMNAME            PARMVAL
---------------
RLCM_XPMESAEXIT               0
```

If PARMVAL	Do
is set to zero	step 20
is greater than zero	Allow the system to recover the OPAC. Go to step 27.

20 Before manually restoring the OPAC from ESA, check to see if links to the OPAC are stable. To find the link numbers for this OPAC, type

>TRNSL C
and press the Enter key.

Example of a MAP response:

```
Link  0:    LTC 1       0;Cap MS;Status:OK     ;MsgCon:OPN
Link  1:    LTC 1       2;Cap MS;Status:OK     ;MsgCon:OPN
Link  2:    LTC 1       3;Cap  S;Status:OK
Link  3:    LTC 1       4;Cap  S;Status:OK
```

where

the number that appears next to the word “Cap” is the host XPM link number.

21 To access the CARRIER level of the MAP terminal, type

>TRKS;CARRIER
and press the Enter key.

OPAC
critical (continued)

22 Post the host XMS-based peripheral module (XPM) links and check link conditions for slips and frame errors. To perform these actions, type

>POST pm pm_no link_no
and press the Enter key.

where

pm	is an LGC, LTC, or RCC
pm_no	is the number of the PM (0 to 127)
link_no	is the number of the link associated with the host XPM (refer to step 20 display)

Note 1: Repeat the POST command for each link.

Example MAP response:

```
N CLASS  SITE LTC CK D ALRM SLIP FRME  BER  ES SES STATE
0 REMOTE HOST   1  0 C         0    0 <-7.   0   0 INSV
```

Note 2: The number that appears under the CK header is the host XPM link number.

Note 3: This display shows carrier facilities from the host XPM to the OPAC. Use the Detail REM option to check the carrier facilities from the remote site back to the host XPM.

If link conditions	Do
display a high number of SLIP and FRME	Leave the OPAC in ESA. Go to step 27.
display a very low number of SLIP and FRME	step 23

23 To post the OPAC with the alarm condition, type

>PM; POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0 to 511)
lcm	is the number of the LCM unit of the OPAC

OPAC
critical (continued)

24 To busy both LCM units of the OPAC, type

>BSY PM
and press the Enter key.

Go to step 25.

25 To test both LCM units of the OPAC, type

>TST PM
and press the Enter key.

If test	Do
passes	step 25
fails, and a the system generates a card list	step 26
fails, and the system does not generate a card list	step 27

26 The card list identifies the cards that have possible faults. Replace the cards one at a time in order as directed by this procedure.

If you	Do
replaced the last card on the list	step 28
did not replace the last card on the list	step 27

27 To return the OPAC to service, type

>RTS PM
and press the Enter key.

If MAP prompt	Do
indicates RTS is successful	step 33
indicates CBsy	step 5
indicates load failure	step 26
indicates all other results	step 27

OPAC
critical (continued)

28 To attempt to reload the OPAC, type

>LOADPM PM CC
and press the Enter key.

If load	Do
is successful	step 25
is not successful	step 27

29 For additional information on how to clear this fault, contact the maintenance support group.

30 Switch the circuit breaker to the OFF position to power down the converter in the LCM unit of the current OPAC.

Use the following table to determine which modular supervisory panel (MSP) circuit breaker serves the unit.

If the circuit breaker	The unit
is CB01	is LCA 0
is CB03	is LCA 1

31 Refer to the *Card Replacement Procedures* section. Replace the first card that appears on the card list. Notify outside plant personnel before you change the card. After you replace the card, go to step 30.

32 Switch the circuit breaker to the ON position to power up the converter in the LCM unit of the current OPAC.

Use the following table to determine which MSP circuit breaker serves the unit.

If the circuit breaker	The unit
is CB01	is LCA 0
is CB03	is LCA 1

OPAC
critical (continued)

33 To load the LCM unit, type

>LOADPM UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit of the OPAC to be loaded (0 or 1)

If the load	Do
is successful	step 34
is not successful	step 27

34 To test the LCM unit, type

>TST UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit of the OPAC to test (0 or 1)

If the test	Do
passes	step 32
fails, and the system generates a card list	step 26
fails, and the system does not generate a card list	step 27

35 To attempt to RTS the LCM unit, type

>RTS UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit of the OPAC that must return to service (0 or 1)

If the RTS	Do
passes	step 33
fails	step 27

OPAC
critical (end)

36 This procedure is complete

If additional alarms appear, proceed to the correct procedure to clear the alarm.

LCM (RG) critical

Alarm display

CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Indication

The following text under the PM header at the MTC level of the MAP display indicates an alarm that involves an outside plant module (OPM):

- the LCM refers to a line concentrating module
- an *n* next to the LCM indicates the number of LCMs affected
- a *C* indicates that the alarm class is critical

Meaning

Both of the ringing generator units are in the in-service trouble (ISTb) state.

Result

If both ringing generator units fail, the system does not automatically switch to an active ringing generator (SwRG). If SwRG does not occur, the system cannot generate ringing. This alarm affects subscriber service.

Common procedures

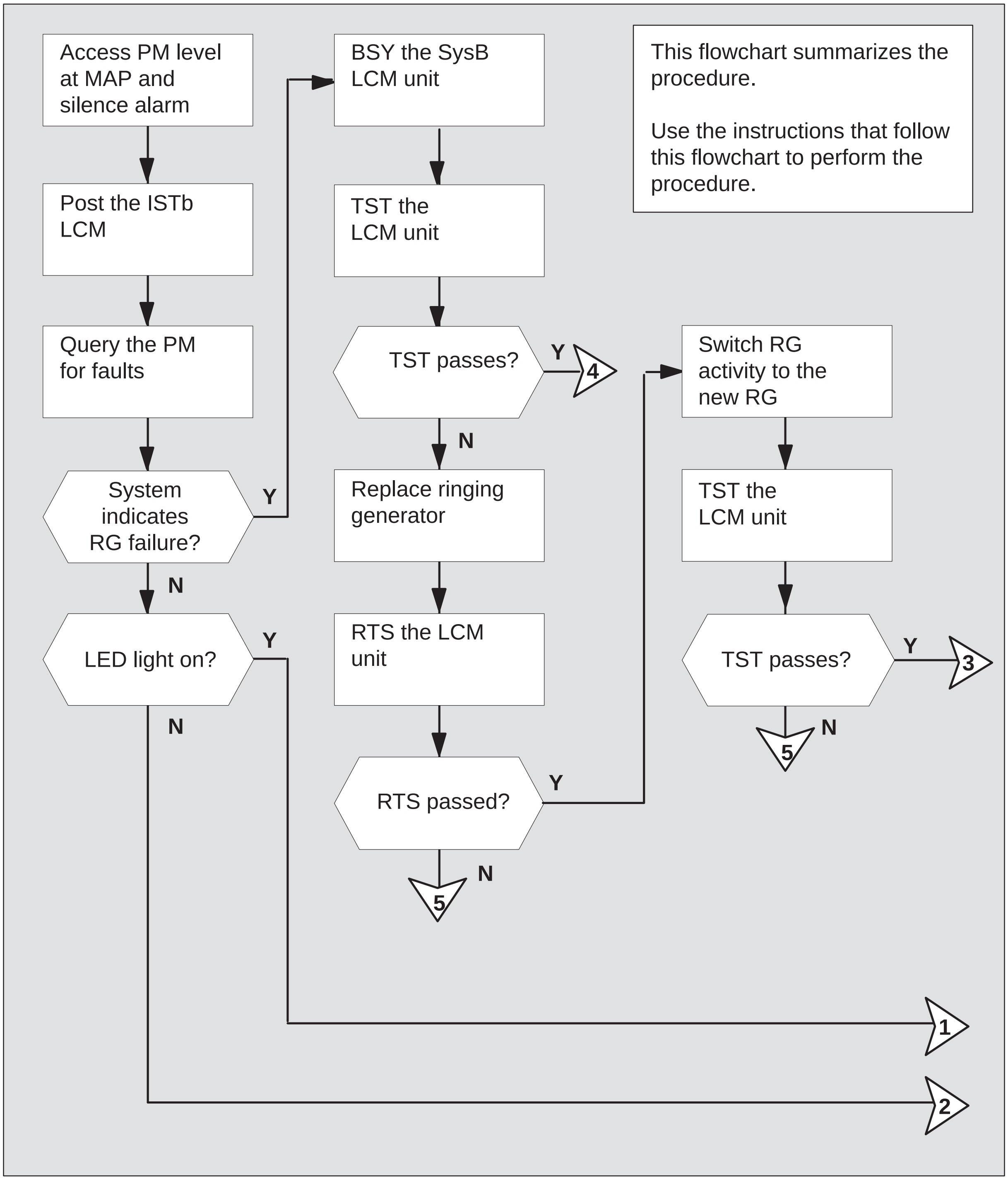
There are no common procedures.

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.

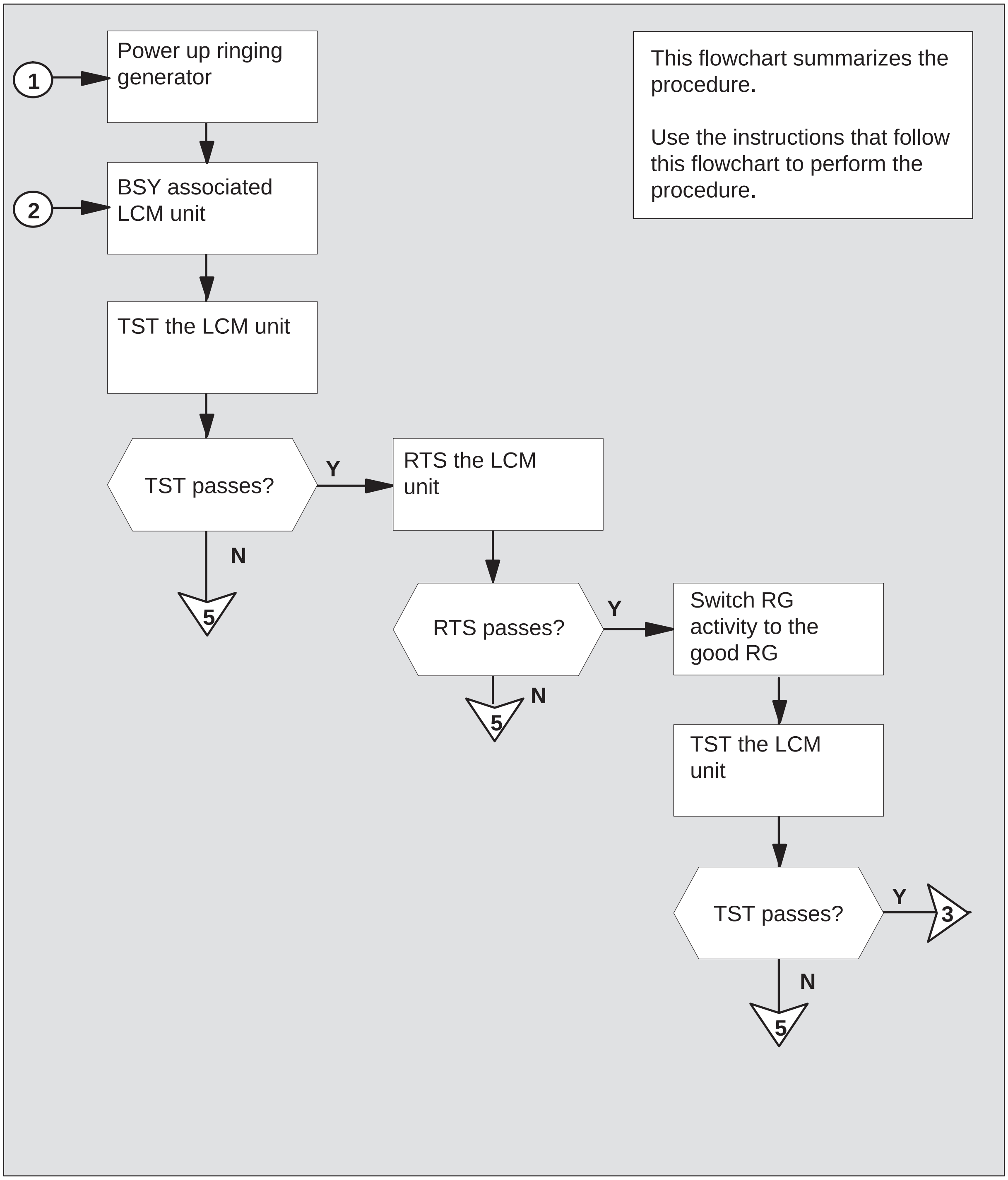
LCM (RG)
critical (continued)

Summary of LCM (RG) critical alarm



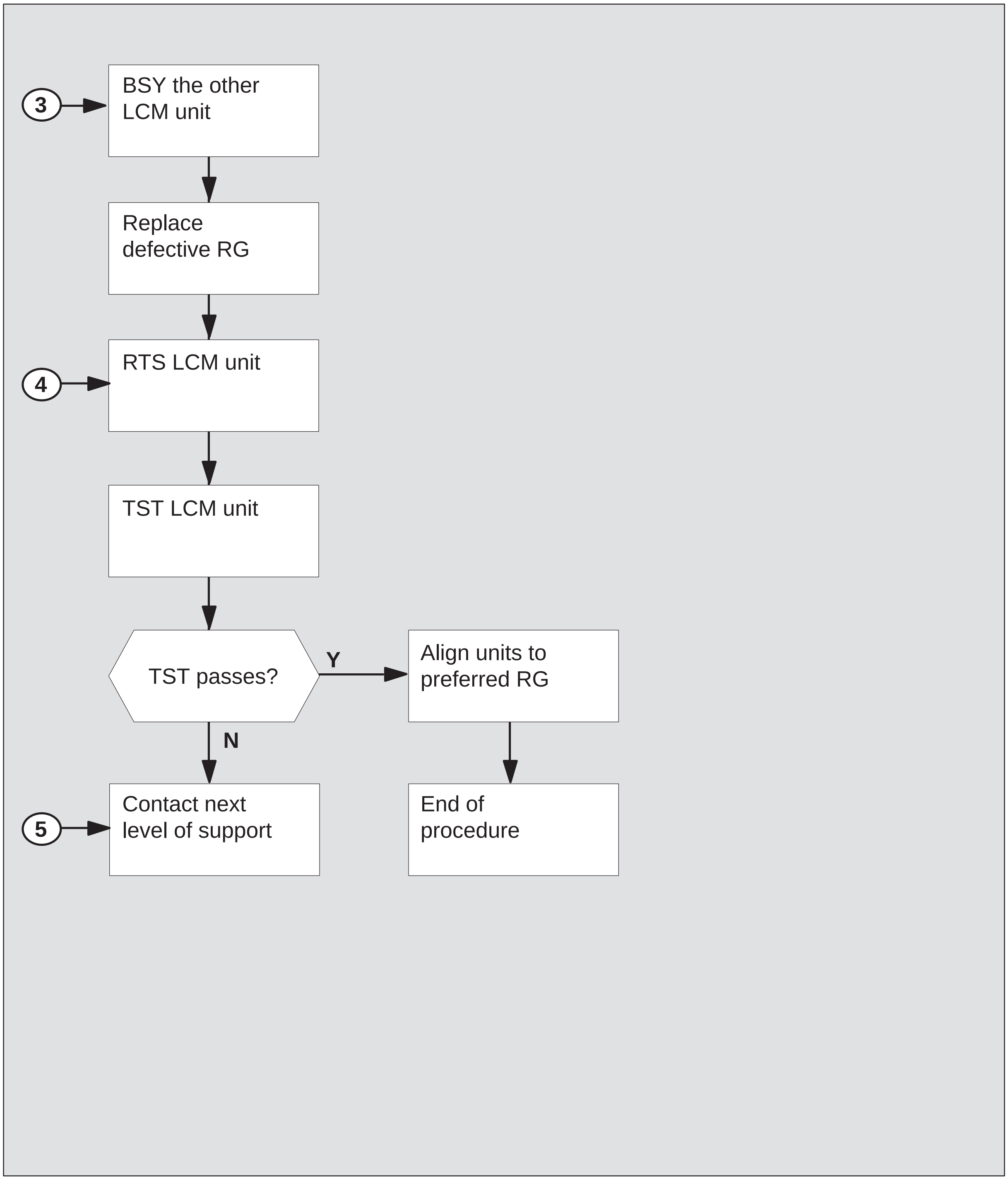
LCM (RG)
critical (continued)

Summary of LCM (RG) critical alarm (continued)



LCM (RG)
critical (continued)

Summary of LCM (RG) critical alarm (continued)



LCM (RG)
critical (continued)

Clearing an LCM (RG) critical alarm

> **ATTENTION**
> Enter this procedure from a PM system level alarm clearing procedure step that identified a PM alarm. The step must identify the PM alarm with an OPAC ringing generator fault.

At the MAP terminal

1 To silence the alarm, type

>MAPCI;MTC;PM;SIL
and press the ENTER key.

2 To identify the LCM that has faults in the OPAC, type

>DISP STATE LCM ISTb
and press the ENTER key.

Example of a MAP response:

```
ISTb: REM1 00 0
```

3 To post the ISTb LCM identified in step 2, type

>POST LCM ISTb
and press the ENTER key.

Example of a MAP display:

```
        SysB     ManB     OffL     CBsy     ISTb      InSv
PM       0        0        2        0        1         12
LCM     0        0        2        0        1          9

LCM   REM1  00 0 ISTb  Links_OOS:  CSide  0   PSide   0
Unit0:   SysB                /RG: 0
Unit1:   ISTb                /RG: 0
                          11  11  11  11  11  RG:Pref 0 ISTb
 Drwr:  01  23  45  67  89  01  23  45  67  89     Stby 1 ISTb
        ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
```

LCM (RG)
critical (continued)

4 To check for fault indicators, type

>QUERYPM FLT
and press the ENTER key.

Example of a MAP display:

```
 LCM   UNIT 0  Inservice troubles Exist:
Ringing Generator Failure:Ring Generator ANI/COIN Fault
 LCM   UNIT 1  Inservice Troubles Exist:
Ringing Generator Failure:Ring Generator in Excess load
```

If system	Do
indicates RG failre	step 6
does not indicate RG failure	step 5

At the OPAC cabinet

5 Check if the LED light on the ringing generator is on .

If the LED light	Do
is ON	step 6
is OFF	step 7

6 To power up the ringing generator, move the power switch to the ON position. This action turns the LED light off. These switches are identified as follows:

RG 0 corresponds to LCM unit 0 (CB6 – HIE slot 1)

RG 1 corresponds to LCM unit 1 (CB8 – HIE slot 5)

At the MAP terminal

7 To manual busy the SysB LCM unit identified in step 2, type

>BSY UNIT unit_no
and press the ENTER key.

where

unit_no is the number of the SysB LCM unit (0 or 1)

LCM (RG)
critical (continued)

8 To test the ManB LCM unit, type

>TST UNIT unit_no
and press the ENTER key.

where

unit_no is the number of the ManB LCM unit (0 or 1)

If the system	Do
generates a card list	step 9
does not generate a card list	step 18

9 Check the card list from step 8.

```
SITE     FLR RPOS     BAY_ID   SHF DESCRIPTION SLOT     EQPEC
REM1     01  A00      OPE 00   05  LCM:14 0    01       6X60
REM1     01  A00      OPE 00   33  LCM:14 0    04       6X51
REM1     01  A00      OPE 00   05  LCM:14 0    05       6X60
REM1     01  A00      OPE 00   47  LCM:14 0    04       6X51
```

10 Determine if the NT6X60 card was replaced.

If you	Do
replaced the NT6X60 card	step 18
did not replace the NT6X60 card	step 17

11 To return the LCM unit to service, type

>RTS UNIT unit_no
and press the ENTER key.

where

unit_no is the number of the LCM unit (0 or 1) to be RTSed

If RTS	Do
passes	step 12
fails	step 18

LCM (RG)
critical (continued)

12 To align RG activity to the new RG, type

>SWRG UNIT unit_no
and press the Enter key.

where

unit_no   is the LCM unit (0 or 1) associated with the new RG

Example of a MAP display:

```
LCM REM1 14 1 Unit 1 SWRG Passed
```

If the SWRG command	Do
passes, and RG activity must switch for the other unit	step 13
passes, and both units accept RG activity	step 13
fails	step 18

13 Repeat step 12 for the other LCM unit.

14 To test the new RG, type

>TST UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the LCM unit (0 or 1) associated with the new RG.

Example of a MAP response:

```
LCM REM1 00 0 Unit 1  InSvce Tests Initiated
LCM REM1 00 0 Unit 1  Tst Passed
```

If TST	Do
passes	step 15
fails	step 18

15 Repeat step 7 through step 14 for the other LCM unit.

LCM (RG) critical (end)

16 To align RG activity to the preferred RG, type

>SWRG UNIT unit_no
and press the Enter key.

where

unit_no is the LCM unit (0 or 1) associated with the new RG

Example of a MAP display:

```
LCM REM1 00 0 InSv Links  OOS: Cside 0 Pside 0
Unit 0: InSv      /RG:0
Unit 1: InSv      /RG:0
                           11  11  11  11  11  RG: Pref 0 InSv
Drwr:  01  23  45  67  89  01  23  45  67  89      Stby 1 InSv
       ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
```

Note: Repeat this step until both units of the LCM are on the preferred RG.

If the SWRG command	Do
passes	step 18
fails	step 19

17 Go to *Card Replacement Procedures*. Replace the first card on the list. When you complete the card replacement procedures, go to step 11 of this procedure.

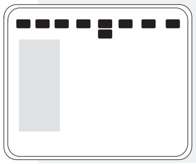
18 For additional help to clear this alarm, contact the next level of support.

19 This procedure is complete.

If other alarms appear, refer to the appropriate procedures to clear the indicated alarms.

OPAC talk battery alarm
Critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Indication

The following text beneath the PM header at the MTC level of the MAP display indicates an international line concentrating module (ILCM) alarm:

- an *n* next to the ILCM indicates the number of ILCM modules affected
- a *C* indicates that the alarm class is critical

Meaning

One or both LCM units do not have a talk battery.

Result

If the alarm affects the circuit breaker CB8, call processing ceases. There is no alarm.

If the alarm affects the circuit breaker CB9, call processing ceases. An alarm sounds to indicate this condition.

Common procedures

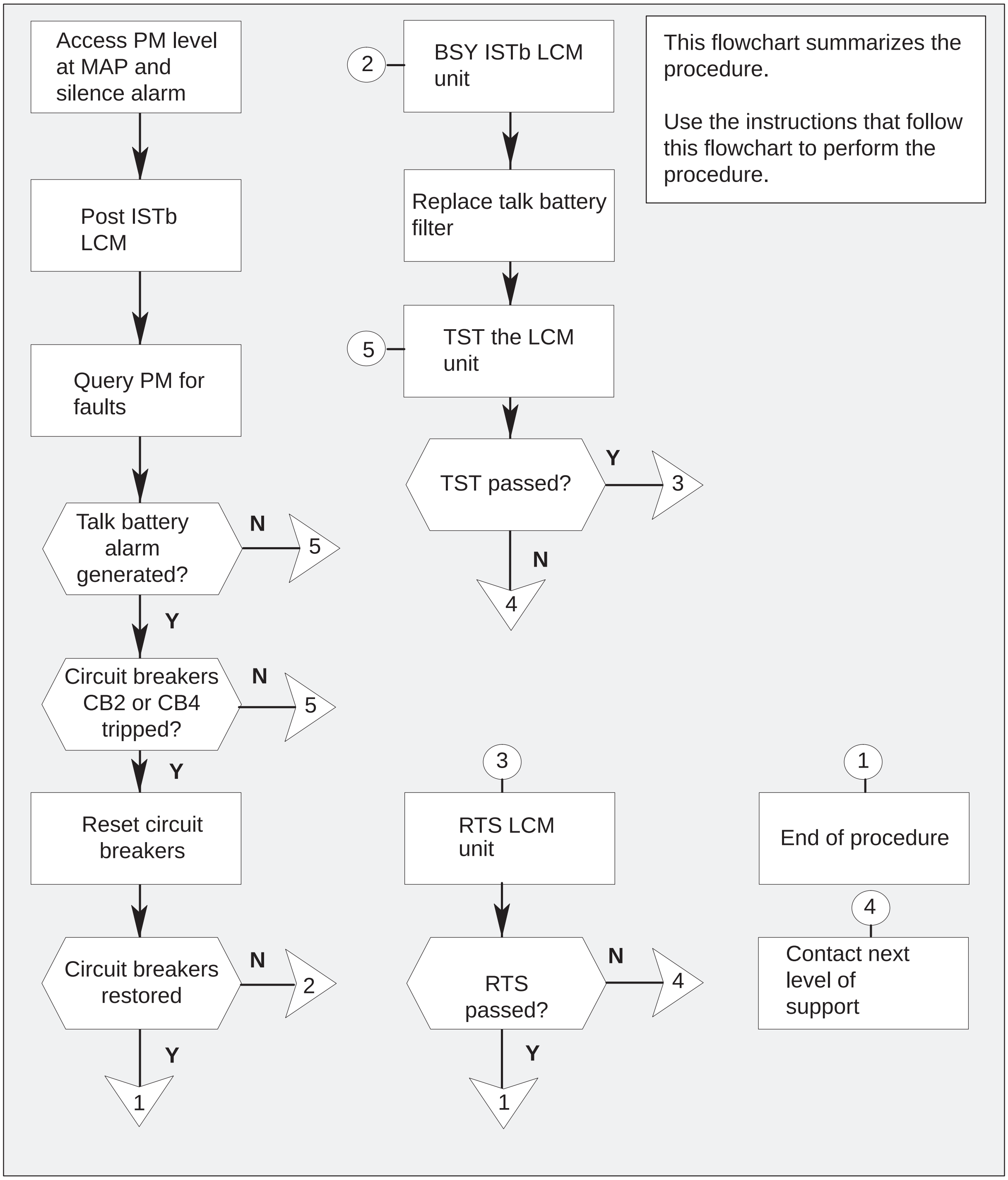
There are no common procedures.

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.

OPAC talk battery alarm
Critical (continued)

Summary of clearing a OPAC talk battery alarm Critical alarm



OPAC talk battery alarm
Critical (continued)

Clearing a OPAC talk battery alarm Critical alarm

At the MAP terminal

1 To silence the alarm, type

>MAPCI;MTC;SIL
and press the Enter key.

2 To access the PM level of the MAP display, type

>PM
and press the Enter key.

3 To identify the OPAC that has faults, type

>DISP STATE ISTB LCM
and press the Enter key.

OPAC talk battery alarm
Critical (continued)

4 To post the OPAC that lost talk battery, type

>POST LCM site frame lcm
and press the Enter key.

site	is the OPAC site name (alphanumeric)
frame	is the OPAC frame number (0 to 511)
lcm	is the LCM number (0 to 1)

Example of a MAP display:

```
 CM     MS      IOD      Net      PM      CCS      Lns      Trks      Ext   APPL
  .      .       .        .      1LCM      .        .        .         .      .
                                  *C*

LCM               SysB      ManB      OffL      CBsy      ISTb       InSv
 0 Quit     PM    0          0         2         0         2           42
 2 Post_    LCM   0          0         0         0         2            9
 3 ListSet
 4 SwRG     LCM   REM1 14 0   ISTB      Links_OOS:  CSide  0   PSide   0
 5 Trnsl_   Unit0:   InsV                  /RG: 1
 6 Tst_     Unit1:   InsV                  /RG: 1
 7 Bsy_                                11  11  11  11  11  RG:Pref 1 InsV
 8 RTS_     Drwr:  01  23  45  67  89  01  23  45  67  89     Stby 0 Insv
 9 OffL            ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the OPAC cabinet

5 Check the fuses in each LCA baffle.

If fuses are	Do
blown (indicator protrudes)	step 6
not blown	step 11

OPAC talk battery alarm
Critical (continued)

6 Determine which fuse is blown.

Note: Fuses 01 to 05 supply +5 V, fuses 06 to 10 supply +15 V and fuses 11 to 15 supply –48 V.

If the blown fuse	Do
is any one of 01 to 05	Remove the blown fuse and proceed to step 9
is any one of 06 to 15	step 7

7 Use the following table to determine which +15V fuse (06 through 10) is associated with which –48V fuse (11 through 15).

–48V fuse number	+15V fuse number
11	06
12	07
13	08
14	09
15	10

8 Remove the blown fuse and the associated fuse. For example, if the blown fuse is 11, remove fuse 06.

9 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

OPAC talk battery alarm
Critical (continued)

10

DANGER
Risk of fire
To prevent risk of fire, replace the blown fuse with a fuse of the same type, rating (color code), and manufacturer.

Insert the +15V fuse. Next, insert the –48V fuse.

If the fuse	Do
blows again	step 56
does not blow	step 11

11 Inspect the MSP. Check circuit breakers CB2 and CB4.

If circuit breakers	Do
tripped	step 21
did not trip	step 12

At the PDC frame

12 Locate the fuses that power the OPAC talk battery circuits.

13 Determine if the fuse is blown.

If the fuse	Do
is blown	step 14
is not blown	step 57

14 Remove the fuse holder that contains the blown fuse.

OPAC talk battery alarm
Critical (continued)

At the OPAC cabinet

15 Trip the circuit breaker CB2 or CB4 to remove the talk battery filter out of the circuit. This procedure prevents the cartridge fuse from blowing.

If affected unit is	Trip circuit breaker
Unit 0	CB2
Unit 1	CB4

At the PDC frame

16 Replace the cartridge fuse inside the fuse holder.

17

DANGER
Risk of fire
To prevent risk of fire, replace the blown fuse with a fuse of the same type, rating (color code), and manufacturer.

Replace the blown fuse.

18 Install the fuse holder on the PDC frame again.

At the OPAC cabinet

19 Reset circuit breaker CB2 or CB4. Move the switch to the ON/OFF position and back to the ON position in quick succession. The LED must turn OFF.

If circuit breaker	Do
trips again	step 20
remains ON, LED goes off	step 57

20 Determine if the fuse did blow again.

If the fuse	Do
did blow again	step 56
did not blow again	step 57

OPAC talk battery alarm
Critical (continued)

21 Verify if the MSP uses NTI repeaters.

MSP	Do
uses NTI repeaters	step 22
does not use NTI repeaters	step 32

22 Reset circuit breaker CB2 or CB4. Move the switch to the ON/OFF position and back to the ON position in quick succession. The LED must turn OFF.

If circuit breaker	Do
trips again	step 23
remains ON, LED goes off	step 57

At the MAP terminal

23 To busy the LCM unit, type

>BSY UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit to make busy

If circuit breaker tripped is	Busy
CB2	unit 0
CB4	unit 1

OPAC talk battery alarm
Critical (continued)

24 To identify the C-side peripheral, type

>TRNSL C
and press the Enter key.

Example of a MAP response:

```
                 Host XPM type and number
   Link  0: LTC 0    0;Cap  MS;Status:OK   ;MsgCon:CLS
   Link  1: LTC 0    1;Cap  MS;Status:OK   ;MsgCon:CLS
   Link  2: LTC 0    3;Cap   s;Status:OK
   Link  3: LTC 0    4;Cap   S;Status:OK
```

25 To post the host peripheral, type

>POST pm_type pm_no
and press the Enter key.

where

pm_type	is the host peripheral (LGC, LTC or RCC2)
pm_no	is the host XPM number

26 To display the P-side links, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link 0: LCM REM1 00 0  2;Cap MS;Status:OK;  MsgCond: CLS
Link 1: LCM REM1 00 0  1;Cap MS;Status:OK;  MsgCond: CLS
```

Record information for the links to be made busy.

27 To busy the links, type

>BSY LINK link_no
and press the Enter key.

where

link_no	is the number of a P-side link that interfaces the OPAC

Note: Perform this step for each link that interfaces the OPAC unit made busy in step 23.

OPAC talk battery alarm
Critical (continued)

28 To access the CARRIER level of the MAP display, type

>TRKS;CARRIER
and press the Enter key.

29 To post the host XPM P-side links, type

>POST pm_type pm_no link_no
and press the Enter key.

where

pm_type	is the host peripheral (LGC, LTC or RCC2)
pm_no	is the peripheral number
link_no	is the number of the link associated with the host XPM. Refer to step 24 display.

When the “`MORE ...`” prompt appears, use the NEXT command to view additional links.

Example of a MAP response:

```
N CLASS SITE LTC CK D ALRM SLIP FRME BER  ES SES STATE
0 REMOTE HOST 0   0 C       0    0   <–7. 0   0  ManB
                  ▲
                  └─Host XPM P-side link number
```

30 To offline the links to prevent alarms and to reset the counters after restoring the links, type

>OFFL item_no
and press the Enter key.

where

item_no is the item number under the *n* (0-4) column

Note: Perform this step for each link made busy in step 27.

At the OPAC cabinet

31 Remove the fuses and unseat the repeaters for the LCM unit that the alarm affects.

If affected LCM unit	Do
is unit 0	step 32
is unit 1	step 33

OPAC talk battery alarm
Critical (continued)

32 Remove the fuses and repeaters associated with CB2 and LCA 0 in the following order:

a. remove –48V line drawer fuses, 11 through 15

b. remove fuse F01 of the MSP, associated only with CB2

c. unseat NT repeater cards 1 through 4.

Go to step 34.

33 Remove the fuses and repeaters associated with CB4 and LCA 1 in the following order.

a. remove –48V line drawer fuses, 11 through 15.

b. unseat NT repeater cards, 5 through 7.

34 Obtain a capacitor forming tool.

Note: A capacitor forming tool consists of a 100 watt 120V light bulb tightened into a socket with pigtail leads.

35 Loosen the slotted nut on the front of the MSP.

36

DANGER
Risk of electrocution
Some terminals in the MSP have electrical potential of –48V dc to –60V dc. Do not touch any terminals in the MSP.

Open the MSP panel.

OPAC talk battery alarm
Critical (continued)

37

DANGER
Risk of electrocution
Some terminals in the MSP have electrical potential. Remove all jewelry before you perform this step.

Connect the leads of the capacitor forming tool across the top and bottom terminals with wires attached to them, top and second from the bottom terminals, of the tripped circuit breaker.

If, after 1 min, the bulb	Do
is lit and you did not replace the capacitor	step 38
is lit and you did replace the capacitor	step 56
is not lit	step 45

38 Locate the talk battery filter capacitor in the MSP.

If the circuit breaker	The capacitor to replace
is CB2	is C1
is CB4	is C2

39 Obtain a replacement capacitor.

40 Label the leads that go to the positive capacitor terminal as (+) and label the leads that go to the negative capacitor terminal as (–). This procedure prevents a reversal of the leads.

41 Disconnect the leads from the short-circuited capacitor.

42 Remove the capacitor.

43 Install a replacement capacitor.

44 Connect the leads labeled (+) to the positive capacitor terminal and the leads labeled (–) to the negative capacitor terminal. Go to step 37.

OPAC talk battery alarm
Critical (continued)

45 Set the circuit breaker to ON.

If the circuit breaker	Do
remains ON	step 46
trips again	step 56

46 Insert the five –48V line drawer fuses removed in step 32. Pause for 15 s before you insert each fuse.

47 Reseat the NTI repeaters that you unseated in step 32.

At the MAP terminal

48 To access the CARRIER level of the MAP display, type

>TRKS;CARRIER
and press the Enter key.

49 To post the host XPM P-side links, type

>POST pm_type pm_no link_no
and press the Enter key.

where

pm_type	is the host peripheral (LGC, LTC or RCC2)
pm_no	is the peripheral number
link_no	is the link number associated with the host XPM. Refer to step 24 display.

Note: When the

`MORE`
prompt appear, use the NEXT command to view additional links.

Example of a MAP response:

```
N CLASS SITE LTC CK D ALARM SLIP FRAME BER  ES SES STATE
0 REMOTE HOST 0   0 C       0    0   <–7. 0   0  OFFL
                    └─Host XPM P-side link number
```

OPAC talk battery alarm
Critical (continued)

50 To busy the links offlined in step 30, type

>BSY item_no
and press the Enter key.

where

item_no	is the item number under the *n* (0-4) column

Note: Perform this step for each link offlined earlier.

51 To access the PM level of the MAP and post the host peripheral, type

>PM;POST pm_type pm_no
and press the Enter key.

where

pm_type	is the host peripheral (LGC, LTC or RCC2)
pm_no	is the host XPM number

52 To return to service the links made busy in step 27, type

>RTS LINK link_no
and press the Enter key.

where

link_no	is the P-side link number that interfaces the OPAC

Note: Perform this step for each link made manually busy.

OPAC talk battery alarm
Critical (end)

53 To post the OPAC, type

>POST LCM site frame lcm
and press the Enter key.

site	is the OPAC site name (alphanumeric)
frame	is the OPAC cabinet frame number
lcm	is the LCM number (0 to 1)

54 To test the LCM unit, type

>TST UNIT lcm_unit
and press the ENTER key.

where

lcm_unit	is the LCM unit made busy in step 23

If TST	Do
passes	step 55
fails	step 56

55 To RTS the LCM unit, type

>RTS UNIT lcm_unit
and press the ENTER key.

where

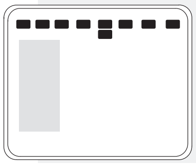
lcm_unit	is the LCM unit tested in step 54

56 For additional help, contact the next level support.

57 This procedure is complete. If the system displays other alarms, perform the appropriate alarm clearing procedures for the indicated alarms.

RLCM
major

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM** **M**	.	.	.	.	.

Indication

The alarm code RLCM under the peripheral module (PM) subsystem header indicates a line concentrating module (LCM) alarm. The *M* under the LCM indicates a major alarm. The number (*n*) before RLCM indicates the number of OPACs with a major alarm.

Meaning

The number (*n*) indicates the OPACs that are in the manual busy (ManB), system busy (SysB), or C-side busy (CBsy) state.

Result

The ManB and SysB units do not directly affect service. One unit of the OPAC continues to provide service.

There is no local backup. A failure of the other unit of the OPAC will interrupt service.

A CBsy condition can interrupt communication between the OPAC and the host. This interruption reduces the service that the OPAC provides to the local area.

Common procedures

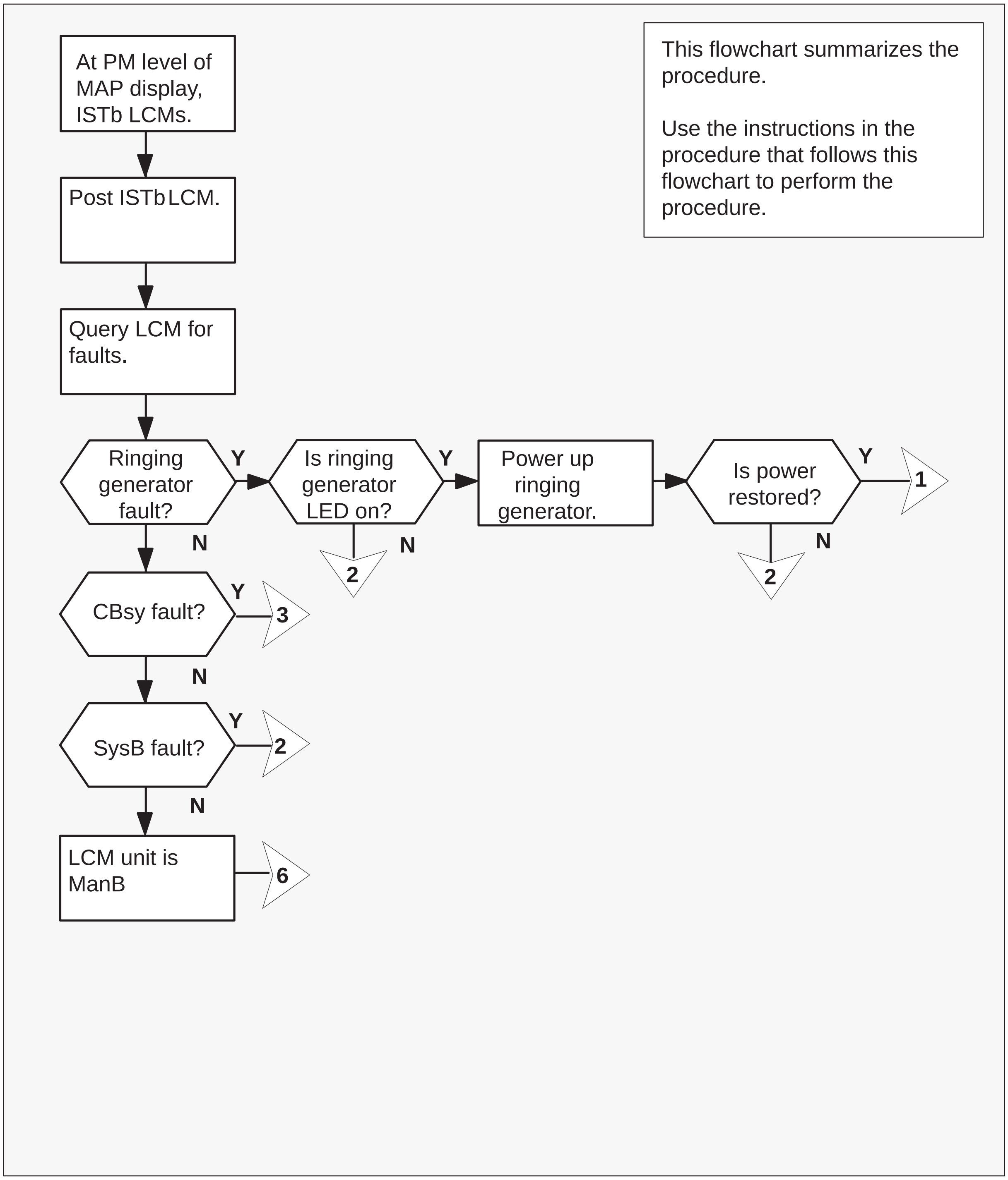
There are no common procedures.

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.

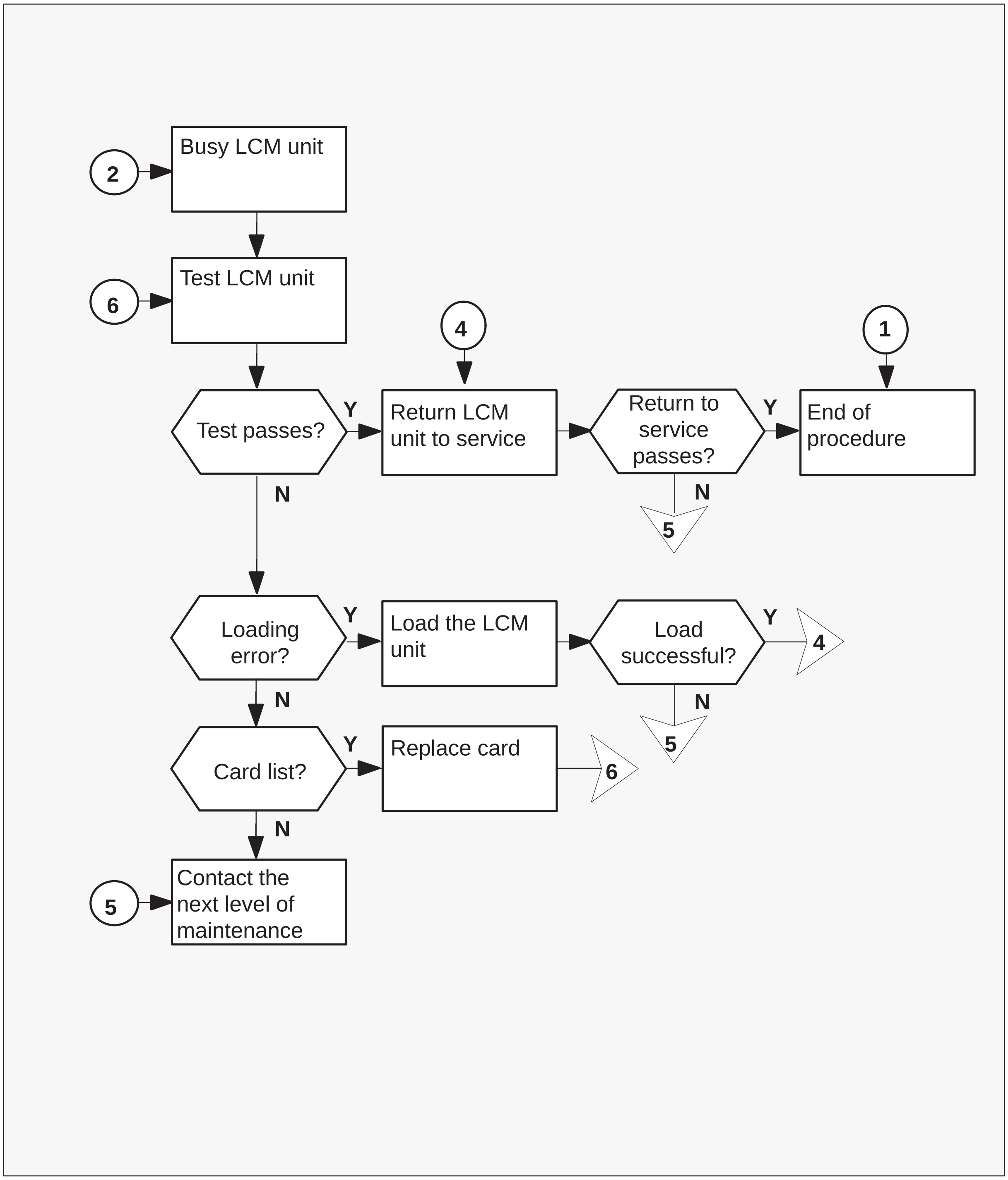
RLCM
major (continued)

Summary of RLCM major alarm



RLCM
major (continued)

Summary of RLCM major alarm (continued)



Clearing an RCLM major alarm

At the MAP terminal

1 If an alarm is audible, silence the alarm. To silence the alarm, type:

>MAPCI;MTC;SIL
and press the Enter key.

2 To access the PM level of the MAP display, type:

>PM
and press the Enter key.

3 To identify the LCM at the OPAC that has faults, type:

>DISP STATE ISTB LCM
and press the Enter key.

4 To post the LCM at the OPAC with the alarm condition, type:

>POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0 to 511)
lcm	is the number of the LCM

5 To determine the fault indicators, type:

>QUERYPM FLT
and press the Enter key.

If fault	Do
is ringing generator	step 6
is CBsy (C-side busy)	step 9
is SysB	step 16
is ManB	step 17

RLCM
major (continued)

At the LCM

6 Inspect the ringing generator to see if LED is ON.

If the LED	Do
is ON	step 7
is OFF	step 16

7 To power up the ringing generator, move the power switch to the ON position. (The LED turns off.) The switches are identified as:

RG 0 corresponds to LCM unit 0
RG 1 corresponds to LCM unit 1

8 Determine if power is restored to the ringing generator (RG).

If	Do
turning ON the RG restores power	step 23
turning ON the RG does not restore power	step 16

At the MAP terminal

9 To identify C-side links to the host PM, type:

> TRNSL C
and press the Enter key.

Example of a MAP response:

```
Link 0: LTC 0       2; Cap MS; Status: OK    ;MsgCond: OPN
Link 1: LTC 0       6; Cap MS; Status: SysB  ;MsgCond: OPN
```

10 To post the host peripheral (LGC, LTC, or RCC), type:

> POST pm pm_no
and press the Enter key.

where

pm is LGC, LTC, or RCC
pm_no is the number of the peripheral

11 To identify the P-side links that have faults, type:

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link 2: LCM REM1 00 0   2; Cap MS; Status: OK   ;MsgCond: OPN
Link 6: LCM REM1 00 0   1; Cap MS; Status: SysB ;MsgCond: CLS
```

12 To busy the link that has faults, type:

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link identified in step 11

13 To test the busied link, type:

TST LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link busied in step 12

If test	Do
passes	step 14
fails	step 21

14 To return the busied link to service, type:

>RTS LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link busied in step 12

If RTS	Do
passes and other links are not SysB	step 23
passes but other links are SysB	step 12
fails	step 21

RLCM
major (continued)

15 To post the LCM in the OPAC with the alarm condition, type:

>POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0 to 511)
lcm	is the number of the LCM

16

CAUTION
If you do not allow the time required for the system to clear the alarm, a false alarm indication can occur.
Make sure to allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

To busy the OPAC unit associated with the alarm, type:

>BSY UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit to be busied (0 or 1)

17 To test the busied unit, type:

>TST UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit to test (0 or 1)

If test	Do
passes	step 19
fails because of loading error	step 18
fails, and the system produces a card list	step 20
fails, and the system does not produce a card list	step 21

18 To attempt to load the LCM unit, type:

>LOADPM UNIT lcm_unit CC
and press the Enter key.

where

lcm_unit is the number of the LCM (0 or 1) you are loading

If load	Do
is successful	step 19
is not successful	step 21

19 To attempt to return the LCM unit to service, type:

>RTS UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit (0 or 1) to return to service

If RTS	Do
passes	step 23
fails	step 21

20 The card list identifies the cards that have possible faults. Replace the cards one at a time in the following order:

If you	Do
did not replace the last card on the list	step 22
replaced the last card on the list	step 21

21 For additional help, contact the next level of maintenance.

22 Go to the *Card Replacement Procedures*, to replace the first (or next) card on the card list. Notify outside operating company personnel that you are changing the card.

Go to step 17 when you replace the card.

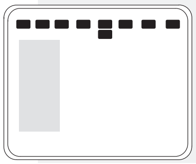
RLCM
major (end)

23 The procedure is complete.

If other alarms appear at the MAP display, proceed to the appropriate alarm clearing procedure.

OPAC (RG) major

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				M					

Indication

The alarm code LCM indicates a line concentrating module (LCM) ringing generator (RG) alarm. The alarm code LCM appears under the PM subsystem header at the MTC level of the MAP display.

The number (*n*) before LCM indicates the number of LCMs with this alarm. The *M* under the LCM indicates a major alarm.

Meaning

One of the ringing generator units is in the in-service trouble (ISTb) state.

Result

This alarm does not affect service. The system switches to a backup ringing generator (SwRG). If the backup ringing generator fails, the system does not produce ringing.

Common procedures

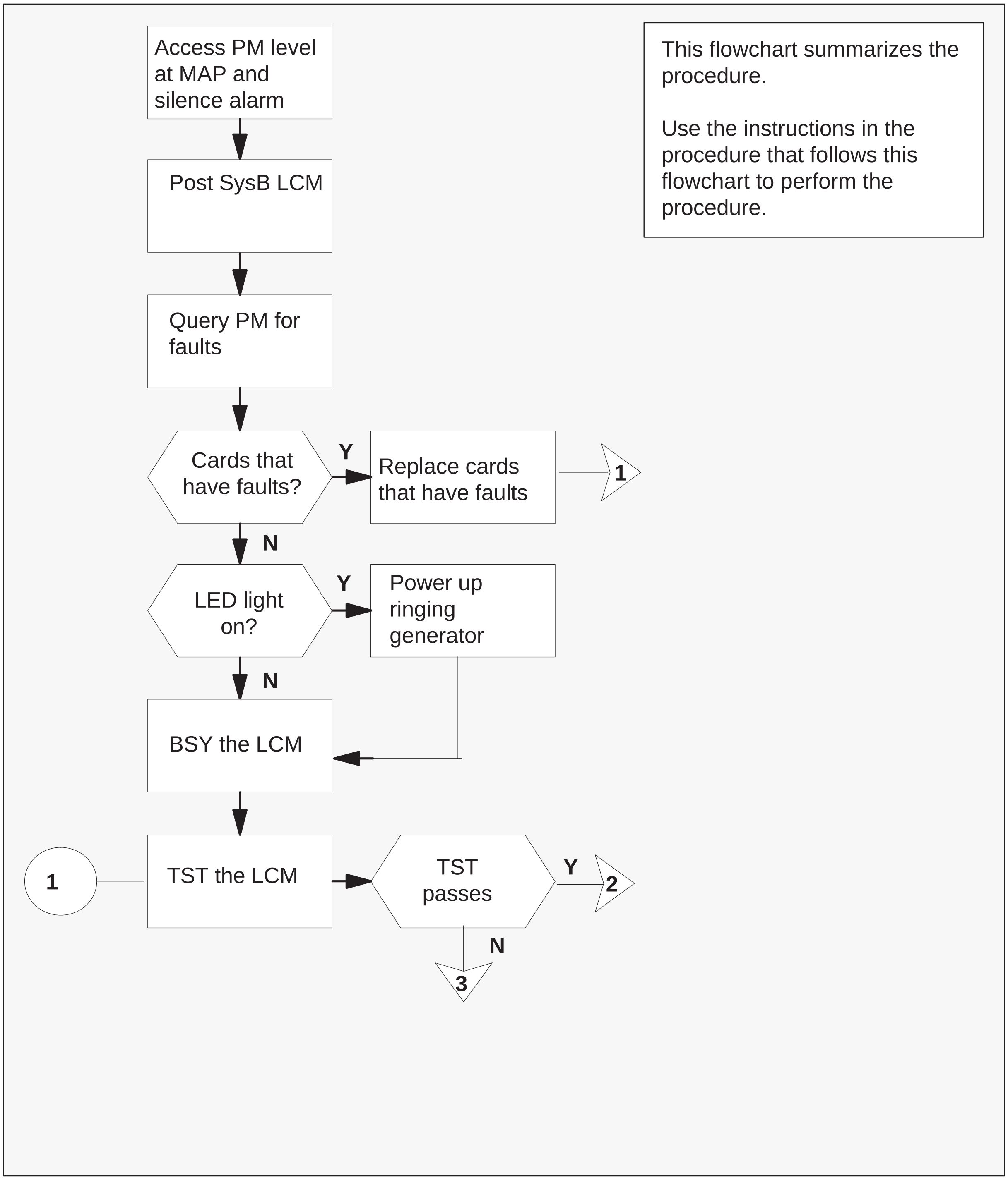
There are no common procedures.

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.

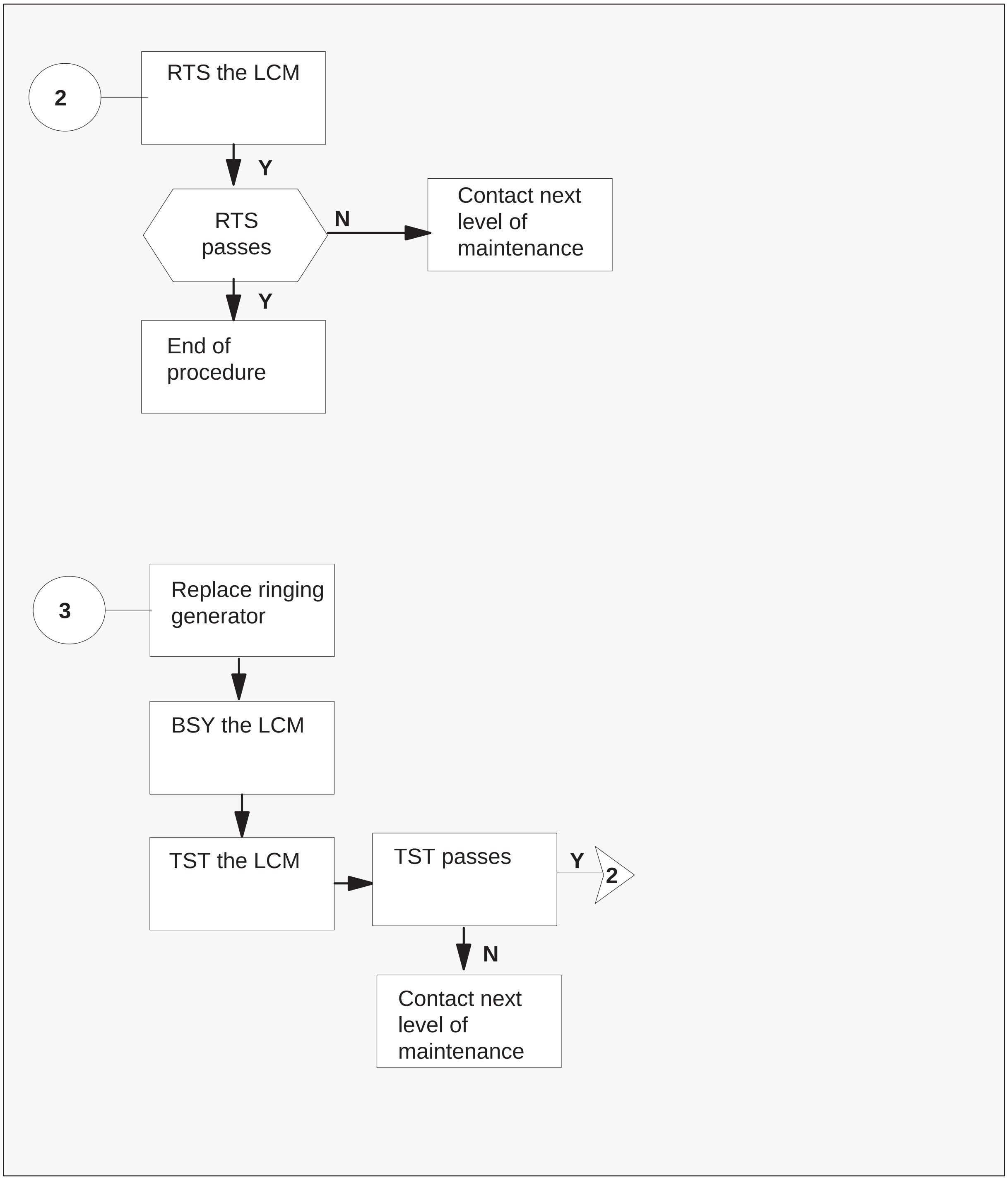
OPAC (RG)
major (continued)

Summary of Clearing an OPAC (RG) alarm



OPAC (RG)
major (continued)

Summary of clearing an OPAC (RG) alarm (continued)



OPAC (RG)
major (continued)

Clearing an OPAC (RG) alarm

At your current location

1 Enter this procedure from a peripheral module (PM) system level alarm clearing procedure step. The step must identify a PM alarm associated with an RLCM ringing generator fault.

2 To silence the alarm, type

>MAPCI;MTC;PM;SIL
and press the Enter key.

3 To identify the LCM in the OPAC that has faults, type

>DISP STATE LCM ISTB
and press the Enter key.

Example of a MAP display:

```
ISTb  LCM: 2
```

OPAC (RG)
major (continued)

4 To post the ISTb LCM from step 3, type:

>POST LCM ISTB
and press the Enter key.

Example of a MAP display:

```
 CM   MS   IOD   Net   PM   CCS   Lns   Trks   Ext   Appl
  .    .     .     .  1LCM   .     .     .      .    .
                        M

 LCM             SysB  ManB   OffL  CBsy   ISTb   InSv
 0 Quit       PM   1     0      2     0       2    12
 2 Post_      LCM  0     0      2     0       2     9
 3 ListSet
 4 SwRG   REM1   14 1 ISTb Links_OOS: CSide 0  PSide 0
 5 Trnsl_  Unit0:  InSv     /RG: 1
 6 Tst_    Unit1:  SysB     /RG: 1
 7 Bsy_                      11 11 11 11 11 RG:Pref 1 ISTb
 8 RTS_  Drwr: 01 23 45 67 89 01 23 45 67 89   Stby 0 InSv
 9 OffL         .. .. .. .. .. .. .. .. .. ..
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

OPAC (RG)
major (continued)

5 To check for fault indicators, type:

>QUERYPM FLT
and press the Enter key.

Example of a MAP display:

```
 CM   MS   IOD   Net   PM   CCS   Lns   Trks   Ext   Appl
  .    .     .     .   1LCM   .     .     .     .     .
                         M
 LCM            SysB  ManB   OffL  CBsy   ISTb   InSv
 0 Quit       PM   1     0     2     0       2    12
 2 Post_      LCM  0     0     2     0       2     9
 3 ListSet
 4 SwRG   REM1 14 1 ISTb Links_OOS: CSide 0 PSide 0
 5 Trnsl_ Unit0:  InsV          /RG: 1
 6 Tst_   Unit1:  SysB          /RG: 1
 7 Bsy_                      11 11 11 11 11 RG:Pref 1 ISTb
 8 RTS_  Drwr: 01 23 45 67 89 01 23 45 67 89   Stby 0 InsV
 9 OffL         .. .. .. .. .. .. .. .. .. ..
10 LoadPM_ QUERYPM FLT
11 Disp_   Node inservice troubles exist:
12 Next      One or both Units inservice trouble
13          RLCM UNIT 0 No faults exist
14 QueryPM   RLCM UNIT  1 Inservice Troubles Exist:
15          Ringing Generator in Excess load
16
17
18
```

If the system	Do
indicates a defective card	step 12
does not indicate a defective card	step 6

OPAC (RG)
major (continued)

At the OPAC

6 Inspect the Ringing Generator. Check if the LED is ON.

If the LED	Do
is ON	step 7
is OFF	step 8

7 To power up the ringing generator, move the power switch to the ON position. (The LED goes OFF.) The switches are identified as:

>RG 0 corresponds to LCM unit 0 (CB6 - HIE slot 1)
>RG 1 corresponds to LCM unit 1 (CB8 - HIE slot 5)

At the MAP terminal

8 To manually busy the ISTb LCM unit from step 3, type:

>BSY UNIT unit_no
and press the Enter key.

where

unit_no is the number of the ISTb LCM unit.

OPAC (RG)
major (continued)

9 To test the ManB LCM, type:

>TST UNIT unit_no
or

>TST PM
and press the Enter key.

where

unit_no is the number of the ManB LCM unit.

Example of a MAP response:

```
LCM REM1    14  1   Unit 1  InSvce Test Initiated
LCM REM1    RLCM    RSC0 14  1  Unit 1      InSvce Test
Initiated
LCM REM1    14  1    Unit 1 Tst Failed: (Reason for failure)
                      or
LCM     REM1    14  1   Unit 1  InSvce Test Initiated
LCM     REM1    14  1   Unit 1  Tst passed14    1   Unit 1
Tst Failed: (Reason for failure)
                      or
LCM     REM1    14  1   Unit 1  InSvce Test Initiated
LCM     REM1    14  1   Unit 1  Tst passed
```

If TST	Do
passes	step 11
fails	step 14 (replace the ringing generator)

10 After you replace the ringing generator (NT6X60), test the LCM in the OPAC again. To test the LCM, type:

>TST PM
and press the Enter key.

If TST	Do
passes	step 11
fails	step 16

11 To return the LCM to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no is the number of the ManB LCM unit.

If RTS	Do
passes	step 17
fails	step 16

12 Check the card listing that appears in the following MAP display.

Example of a MAP display:

```
SITE    FLR  RPOS   BAY_ID  SHF DESCRIPTION SLOT    EQPEC
REM1    01   A00    LCE(I) 00   32  RLCM:000    :01  6X60
REM1    01   A00    LCE(I) 00   32  RLCM:000    :04  6X51
```

If you	Do
replaced all the cards on the list	step 16
did not replace all the cards on the list	step 15

13 Determine if the NT6X60 ringing generator was replaced.

If you	Do
replaced the NT6X60 ringing generator	step 16
did not replace the NT6X60 ringing generator	step 14

14 Go to the correct procedure for the NT6X60 circuit card in the *Card Replacement Procedures*.

After you finish with the card replacement procedures, go to step 9.

OPAC (RG)
major (end)

15 Go to the correct procedure in the *Card Replacement Procedures* for the next card on the card list.

After you finish with the card replacement procedures, go to step 9.

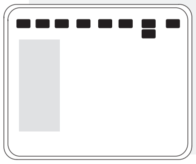
16 For additional help, contact the next level of maintenance.

17 The procedure is complete.

If other alarms appear at the MAP display, refer to the appropriate alarm clearing procedures.

Ext MSP
major

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.		.	.	.	**nFSP.**	.
								M	

Indication

The alarm code FSP appears under the Ext subsystem header of the alarm banner at the maintenance (MTC) level of the MAP display. This alarm code indicates an Ext modular supervisory panel (MSP) alarm.

The number (n) before FSP indicates the number of OPACs with this alarm. The letter M under the LCM indicates a major alarm.

Meaning

An MSP alarm occurs when the OPAC has a power fault or a cooling unit fault The number that precedes FSP indicates the number of cabinets in the system with an MSP alarm.

Result

The nature of the fault and the type of frame that contains the fault determines the impact on subscriber service.

Common procedures

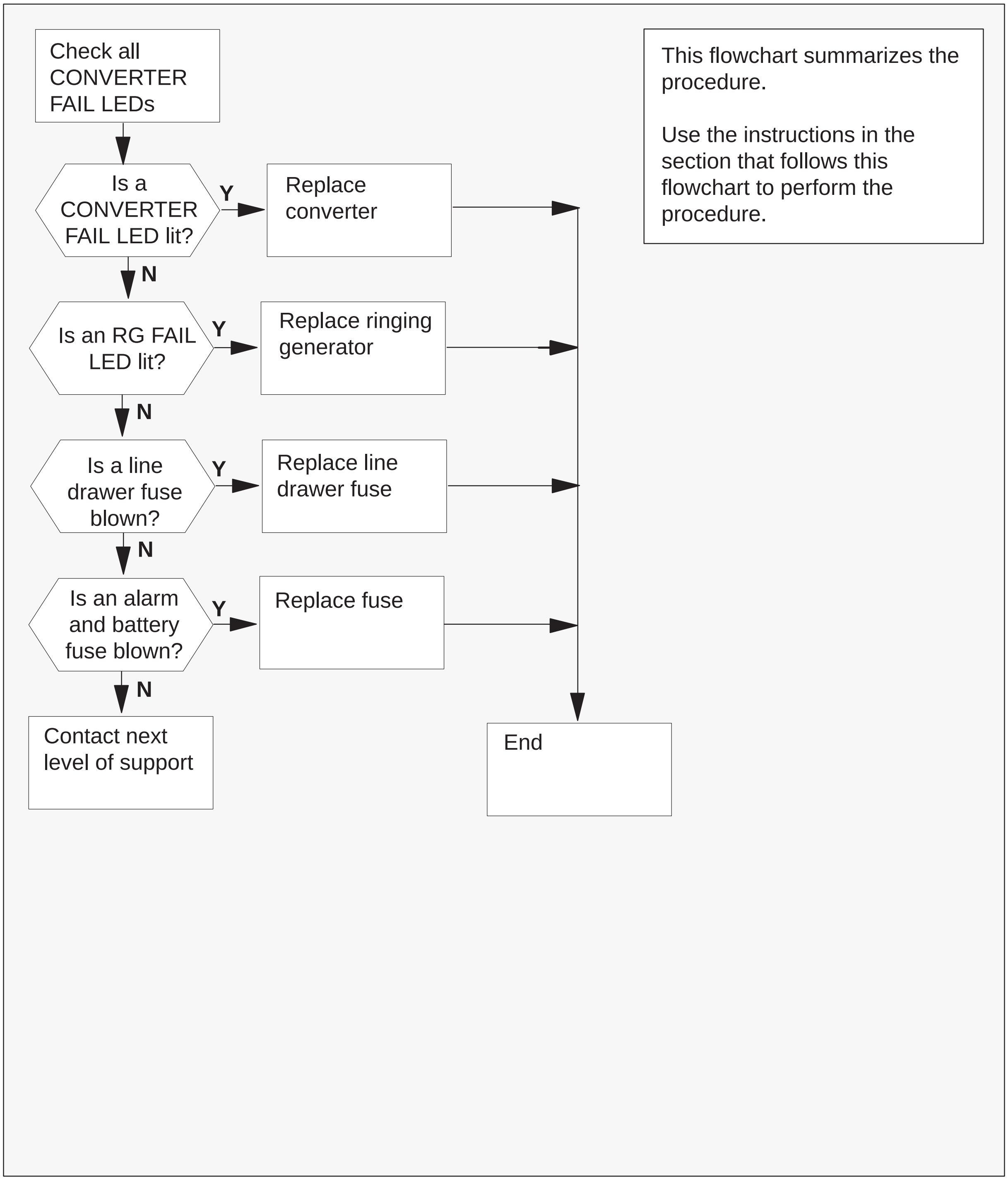
There are no common procedures.

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.

Ext MSP
major (continued)

Summary of clearing an Ext MSP major alarm



Clearing an Ext MSP major alarm

At the OPAC

1 Check the CONVERTER FAIL LED on each converter in the cabinet.

If	Do
a CONVERTER FAIL LED is lit	step 51
the CONVERTER FAIL LEDs are lnot it	step 2

2 Check the RG FAIL LED on both RGs. The RGs are located at the bottom of the cabinet. The FAIL LED is located on the front panel of the RG.

If	Do
an RG's FAIL LED is lit	step 39
the RGs FAIL LEDs are not lit	step 3

3 Check the line drawer fuses located on the fuse panel at the top of bay 0.

If	Do
a fuse is blown (protrudes)	step 8
the fuses are not blown	step 4

4 Check the alarm battery supply (ABS) fuses (01 to 04). These fuses are located on the MSP.

If	Do
a fuse is blown (protrudes)	step 5
the fuses are not blown	step 84

5 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

Ext MSP
major (continued)

6

> **DANGER**
> **Risk of fire**
> Replace the fuse with a fuse of the same type, rating (color code) and manufacturer. This action provides continued protection against risk of fire.

Remove the blown fuse.

7 Insert the replacement fuse.

If the fuse	Do
blows (protrudes) again	step 84
does not blow	step 81

8 Determine the fuse that is blown.

Note: Fuses 01 to 05 supply +5 V, fuses 06 to 10 supply +15 V, and fuses 11 to 15 supply –48 V.

If the blown fuse is	Do
is 01 to 05	step 13
is 06 to 15	step 9
is RA or RB	step 13

9 Use the following table to determine which +15 V fuse (06 through 10) is associated with which –48 V fuse (11 through 15).

–48 V fuse number	+15 V fuse number
11	06
12	07
13	08
14	09
15	10

Ext MSP
major (continued)

10 Remove the blown fuse and the associated fuse. For example, if the blown fuse is 06, then remove fuse 11.

11 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

12 Insert the –48 V fuse first. Insert the +15 V fuse second.

If the fuse	Do
blows (protrudes) again	step 16
does not blow	step 81

13 Obtain a replacement fuse with the same voltage as the blown fuse.

14

DANGER
Risk of fire
Replace the fuse with a fuse of the same type, rating (color code), and manufacturer. This action provides continued protection against risk of fire.

Remove the blown fuse.

15 Insert the replacement fuse.

If the fuse	Do
blows (protrudes) again	step 18
does not blow	step 81

16 Remove the blown fuse and the associated fuse. For example, if the blown fuse is 06, remove fuse 11.

17 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

Ext MSP
major (continued)

18 Use the following table to identify the drawer associated with the blown fuse. The drawers are located in the shelf below the fuse panel. The RA and RB fuses supply ringing voltage to all five drawers in the shelf.

Fuse number	Drawer number
01, 06, 11	1 (leftmost)
02, 07, 12	2
03, 08, 13	3
04, 09, 14	4
05, 10, 15	5

19

DANGER
Personal injury
Do not touch the line feed resistors on the line cards. The line feed resistors generate enough heat to burn you.

CAUTION
Loss of service
Carry out this procedure during periods of low traffic.

Pull out the line drawer you identified. Begin with the left drawer when you handle a blown RA or RB fuse.

20 Unseat all the line cards in the drawer. Do not remove the linecards from the drawer.

If you	Do
handle any one of fuses 01 to 05	step 22
handle any one of fuses 06 to 15	step 21
handle an RA or RB fuse	step 22

Ext MSP
major (continued)

21 Insert the –48 V fuse first. Insert the +15 V fuse second.

If the fuse	Do
blows (protrudes) again	step 25
does not blow	step 27

22 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

23

DANGER
Risk of fire
Replace the fuse with a fuse of the same type, rating (color code), and manufacturer. This action provides continued protection against risk of fire.

Remove the blown fuse.

24 Insert the replacement fuse.

If the fuse	Do
blows (protrudes) again	step 25
does not blow	step 27

Ext MSP
major (continued)

25 Check the drawer for loose or short-circuited wires.

If the wires	Do
are loose or short-circuited	step 84
lare not loose or short-circuited, and the fuse you handle is a ringing voltage fuse (RA or RB)	step 26
are not loose or short-circuited, the fuse you handle is a ringing voltage fuse (RA or RB), and you completed all five drawers in the shelf	step 84
are not loose or short-circuited, and the fuse you handle is one of the line drawer fuses (01 to 15)	step 84

26 Reseat all the line cards in the drawer and repeat steps 19 and 20 for the next drawer.

27

DANGER
Personal injury
Do not touch the line feed resistors on the line cards. The line feed resistors generate enough heat to burn you.

Reseat the line cards one at a time. Check the fuse after you reseat each line card.

If	Do
after you reseat a line card, the fuse blows (protrudes) again	step 28
after you reseat all the line cards, the fuse does not blow	step 83

28 Remove the line card from the drawer.

29 Obtain a replacement line card. Make sure that the replacement card has the same PEC and suffix as the card that you remove.

Ext MSP
major (continued)

30 Insert the replacement line card into the drawer.

If you	Do
handle any one of fuses 01 to 05	step 34
handle any one of fuses 06 to 15	step 31
handle an RA or RB fuse	step 34

31 Obtain a replacement fuse with the same voltage as the blown fuse.

32 Remove the blown fuse and the associated fuse. For example, if the blown fuse is 06, remove fuse 11.

33 Insert the –48 V fuse first. Insert the +15 V fuse second.

If the fuse	Do
blows (protrudes) again	step 84
does not blow	step 37

34 Obtain a replacement fuse with the same voltage and amperage ratings as the blown fuse.

35

DANGER
Personal injury
Do not touch the line feed resistors on the line cards. The line feed resistors generate enough heat to burn you.

DANGER
Risk of fire
Replace the fuse with a fuse of the same type, rating (color code), and manufacturer. This action provides continued protection against risk of fire.

Remove the blown fuse.

Ext MSP
major (continued)

36 Insert the replacement fuse.

If the fuse	Do
blows (protrudes) again	step 84
does not blow	step 37

37 Reseat all the other line cards in the drawer.

38 Push the drawer in and go to step 81.

39 Use the following table to identify which circuit breaker is associated with the RG that has a lit FAIL LED. The circuit breaker is located on the MSP.

RG	Circuit breaker number
RG in HIE slot 01	CB06
RG in HIE slot 05	CB08

40 Check the associated circuit breaker.

If the circuit breaker	Do
is ON	step 48
is OFF	step 41

41 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the FAIL LED on the RG is lit	step 42
remains ON, and the FAIL LED on the RG is not lit	step 81
remains ON, and the FAIL LED on the RG is lit	step 48

Ext MSP
major (continued)

42 Locate the fuse associated with the cabinet and shelf number.

If the fuse	Do
is blown (protruding)	step 43
is not blown	step 49

43 Remove the fuse holder with the blown fuse.

44

> **DANGER**
> **Risk of fire**
> Replace the fuse with a fuse of the same type, rating (color code), and manufacturer. This action provides continued protection against the risk of fire.

Replace the cartridge fuse inside the fuse holder.

45 Replace the blown fuse.

46 Install the fuse holder on the OPAC.

47 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the RG FAIL LED is lit	step 49
remains ON, and the RG FAIL LED is not lit	step 81
remains ON, and the RG FAIL LED is lit	step 48

48 Set the circuit breaker to OFF.

49 Refer to the correct procedure in *Card Replacement Procedures* to replace the RG. When you complete the procedure, return to this point.

Ext MSP
major (continued)

50 Check the FAIL LED on the RG you replaced.

If the FAIL LED on the RG	Do
is lit	step 80
is not lit	step 81

51 Note the number of the shelf that contains the converter with the lit CONVERTER FAIL LED.

52 Use the following table to identify which circuit breaker is associated with the shelf with the lit CONVERTER FAIL LED. The circuit breaker is located on the MSP.

Converter	Circuit breaker number
LCA 0	CB01
LCA 1	CB03

53 Check the associated circuit breaker.

If the circuit breaker	Do
is ON	step 60
is OFF	step 54

54 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 55
remains ON, and the CONVERTER FAIL LED is lit	step 60
remains ON, and the CONVERTER FAIL LED is not lit	step 81

Ext MSP
major (continued)

55 Note the numbers of the shelf that contain the converter with the lit CONVERTER FAIL LED.

56 Locate the fuse that powers the shelf.

If the fuse	Do
is blown	step 57
is not blown	step 60

57 Remove the blown fuse.

58

DANGER
Risk of fire
Replace the fuse with a fuse of the same type, rating (color code), and manufacturer. This action provides continued protection against the risk of fire.

Replace the fuse with a fuse of the same type.

59 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 61
remains ON, and the CONVERTER FAIL LED is not lit	step 81
remains ON, and the CONVERTER FAIL LED is lit	step 60

60 Set the circuit breaker to OFF.

61 To replace the converter, perform the correct procedure in *Card Replacement Procedures*. When you complete the procedure, return to this point.

Ext MSP
major (continued)

62 Check the converter you just replaced. Check the associated circuit breaker.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 64
remains ON, and the CONVERTER FAIL LED is not lit	step 81
remains ON, and the CONVERTER FAIL LED is lit	step 63

63 Set the circuit breaker to OFF.

64 Remove the NT6X51 and NT6X52 cards from the shelf with the lit CONVERTER FAIL LED.

65 Set the circuit breaker to ON.

If the CONVERTER FAIL LED	Do
is lit	step 78
is not lit	step 66

66 Set the circuit breaker to OFF.

67 Insert the NT6X51 card in the shelf.

68 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 70
remains ON, and the CONVERTER FAIL LED is not lit	step 72
remains ON, and the CONVERTER FAIL LED is lit	step 69

69 Set the circuit breaker to OFF.

Ext MSP
major (continued)

70 To replace the NT6X51 card, use the correct procedure in *Card Replacement Procedures*. When you complete the procedure, return to this point.

71 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 76
remains ON, and the CONVERTER FAIL LED is not lit	step 72
remains ON, and the CONVERTER FAIL LED is lit	step 75

72 Set the circuit breaker to OFF.

73 Insert the NT6X52 card back in the shelf.

74 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 76
remains ON, and the CONVERTER FAIL LED is not lit	step 81
remains ON, and the CONVERTER FAIL LED is lit	step 75

75 Set the circuit breaker to OFF.

76 To replace the NT6X52 card, use the correct procedure in *Card Replacement Procedures*.

When you complete the procedure, return to this point.

Ext MSP
major (continued)

77 Set the circuit breaker to ON.

If the circuit breaker	Do
goes OFF, and the CONVERTER FAIL LED is lit	step 78
remains ON, and the CONVERTER FAIL LED is not lit	step 81
remains ON, and the CONVERTER FAIL LED is lit	step 80

78 Check the backplane of the shelf for bent or short-circuited pins.

If the pins	Do
are bent or short-circuited	step 84
are not bent or short-circuited	step 79

79 Insert the NT6X51 and the NT6X52 cards in the shelf.

80 To replace the alarm card, use the correct procedure in *Card Replacement Procedures*. When you complete the procedure, return to this point.

81 Check the frame FAIL lamp on the MSP.

If the frame FAIL lamp	Do
is lit and you did not complete steps 2, 3, or 4, in this procedure	step 82
is lit and you completed steps 2, 3, and 4, in this procedure	step 84
is not lit	step 83

82 Go to the step you did not complete (step 2, 3, or 4) in this procedure.

Ext MSP
major (end)

At the MAP terminal

83 To access the Ext level of the MAP display to determine if an MSP alarm is present, type

>MAPCI;MTC;EXT
and press the Enter key.

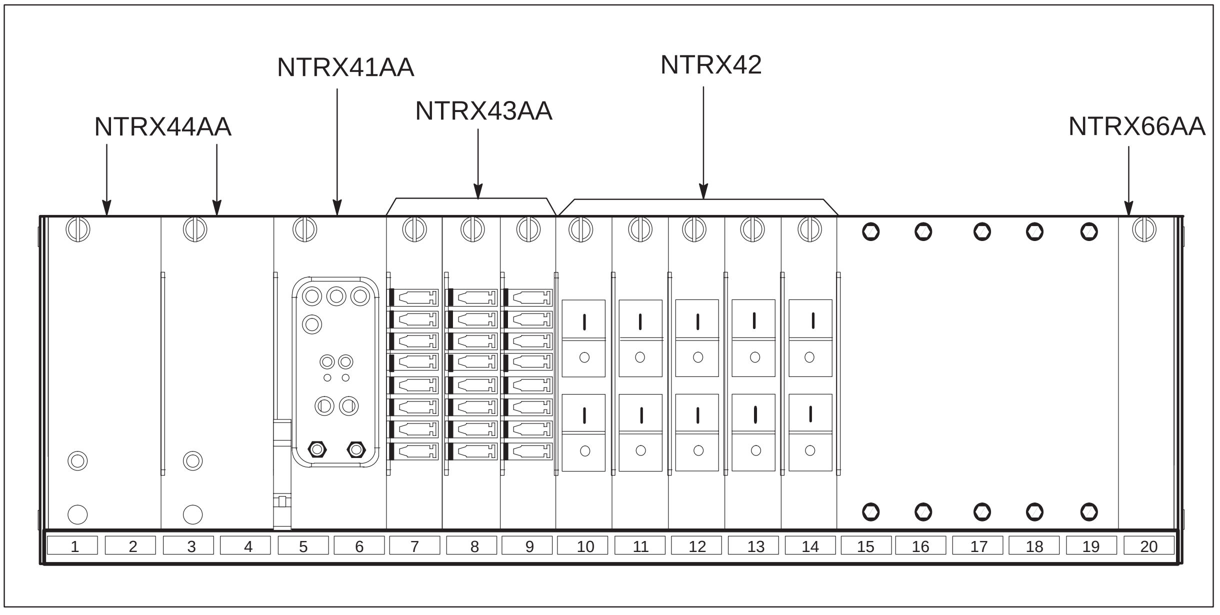
If an MSP alarm	Do
is present	step 84
is not present	step 85

84 For additional help, contact the next level of support.

85 This procedure is complete.

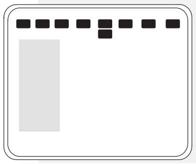
The following figure illustrates the MSP shelf of the OPAC.

MSP shelf for OPAC



RMM major

Alarm display



CM	MS	IOD	Net	**PM**	Lns	Trks	Ext	APPL
.	.	.	.	**nSysB**	.	.	.	.
				M				

Indication

The alarm code *n*SysB appears under the peripheral module (PM) subsystem header at the maintenance (MTC) level of the MAP terminal display. This code indicates an alarm for a remote maintenance module (RMM). The letter *M* indicates that the alarm class is major.

The number (*n*) that precedes SysB indicates the number of PMs associated with this alarm.

Meaning

The indicated number (*n*) of RMM units are in the system-busy (SysB) state.

Result

If an RMM unit fails, the system discontinues maintenance and line tests. This condition does not affect subscriber service.

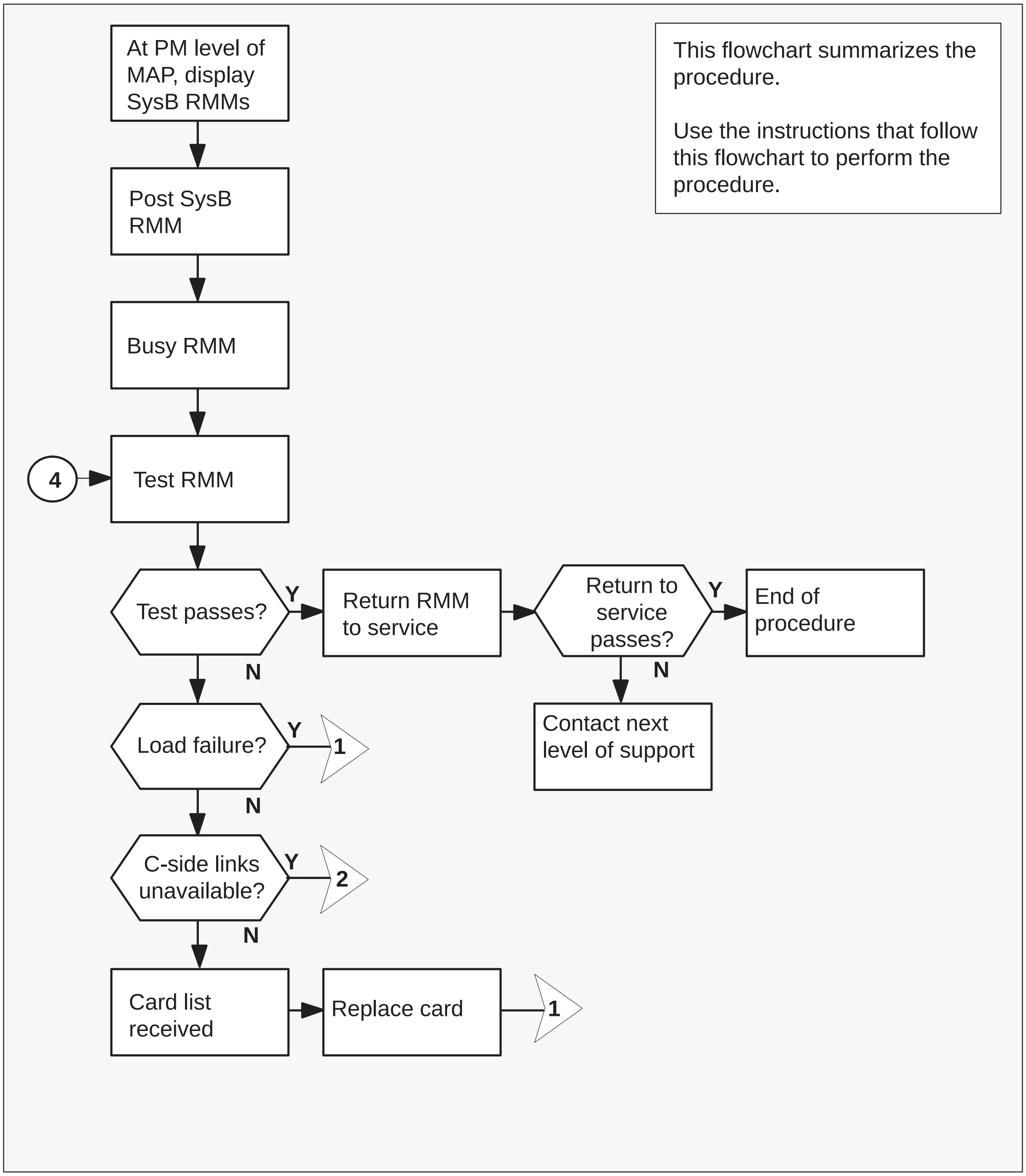
Common procedures

There are no common procedures.

Action

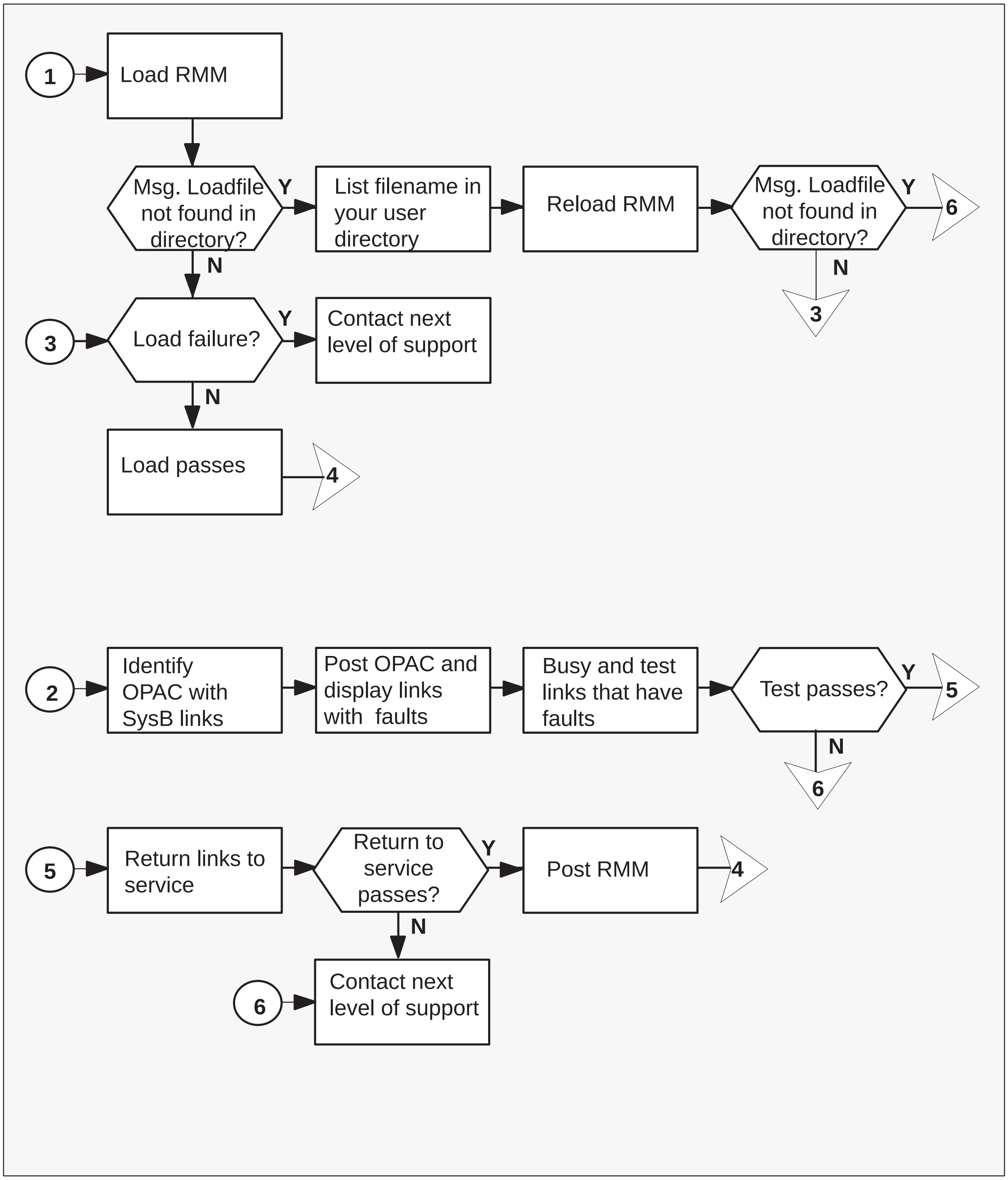
The procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Summary of RMM major alarm



RMM
major (continued)

Summary of RMM major alarm (continued)



Clearing an RMM major alarm

At the MAP terminal

1 To silence the alarm, type

>MAPCI;MTC;PM;SIL
and press the Enter key.

2 To identify the RMM that has faults, type

>DISP STATE SYSB RMM
and press the Enter key.

Example of a MAP response:

```
SysB  RMM: 2
```

3 To post the SysB RMM identified in step 2, type

>POST RMM rmm_no
and press the Enter key.

where

rmm_no is the number of the RMM that has faults

4 To manually busy the RMM posted in step 3, type

>BSY
and press the Enter key.

5 To perform a test on the RMM that has faults, type

>TST
and press the Enter key.

If test	Do
passes	step 32
fails because of load failure	step 6
fails because of C-side links unavailable	step 24
fails and the system generates a card list	step 33

RMM
major (continued)

6 To load the RMM, type

>LOADPM
and press the Enter key.

If	Do
the system responds `loadfile not found in directory`	step 7
load passes	step 31
load fails	step 35

7 Determine the type of device used to store the PM load files.

If the storage device	Do
is a tape	step 8
is an IOC disk	step 14
is an SLM disk	step 19

8 Locate the tape containing the PM load files.

At the IOE frame

9 Mount the tape on a magnetic tape drive.

At the MAP terminal

10 To download the tape, type

>MOUNT tape_no
and press the Enter key.

where

tape_no is the number of the tape containing the PM load files

11 To list the contents of the tape in your user directory, type

>LIST T tape_no
and press the Enter key.

where

tape_no is the number of the tape containing the PM load files

RMM
major (continued)

12 To demount the tape drive, type

>DEMOUNT T tape_no
and press the Enter key.

where

tape_no is the number of the tape drive containing the PM load files

13 Go to step 23.

14 From office records, determine and note the number of the input/output controller (IOC) disk. Determine and note the name of the volume containing the PM load files.

15 To access the disk utility level of the MAP terminal, type

>DSKUT
and press the Enter key.

16 To list the IOC file names in your user directory, type

>LISTVOL volume_name ALL
and press the Enter key.

where

volume_name is the name of the volume containing the PM load files obtained in step 14

17 To leave the disk utility, type

>QUIT
and press the Enter key.

18 Go to step 23.

19 From office records, determine and note the number of the system load module (SLM) disk. Determine and note the name of the volume containing the PM load files.

20 To access the disk utility level of the MAP terminal, type

>DISKUT
and press the Enter key.

RMM
major (continued)

21 To list the SLM file names into your user directory, type

>LV CM;LF file_name
and press the Enter key.

where

file_name is the name of the volume containing the PM load files obtained in step 19.

22 To leave the disk utility, type

>QUIT
and press the Enter key.

23 To reload the RMM, type

>LOADPM
and press the Enter key.

If	Do
the system responds `loadfile not found in directory`	step 35
load fails	step 35
load passes	step 31

24 To identify the LCM in the OPAC with links in a SysB condition, type

> TRNSL C
and press the Enter key.

Example of a MAP response:

```
LINK  0:  LCM REM1 14 0  0;CAP MS;STATUS:SysB,;MSGCOND:CLS
LINK  1:  LCM REM1 14 0  1;CAP MS;STATUS:SysB,;MSGCOND:CLS
```

25 To post the LCM in the OPAC identified in step 24, type

>POST LCM site frame lcm
and press the Enter key.

where

site is the site name of the OPAC (alphanumeric)
frame is the frame number of the OPAC (0 to 511)
lcm is the number of the LCM

RMM
major (continued)

26

> **CAUTION**
> **If you do not allow the time required for the system to clear the alarm, a false alarm indication can occur.**
> Allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

To identify the P-side links that have faults, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
LINK  0:  RMM 0 0;CAP MS;STATUS:SysB,;MSGCOND: CLS
LINK  1:  RMM 0 1;CAP MS;STATUS:SysB,;MSGCOND: CLS
LINK  2:  ESA 0 0;CAP  S;STATUS:  OK,;MSGCOND: OPN
LINK  4:  ESA 0 1;CAP  S;STATUS:  OK,;MSGCOND: OPN
```

27 To busy the link that has defects, type

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link that has faults identified in step 26

28 To test the ManB link, type

>TST LINK link_no
and press the Enter key.

If test	Do
passes	step 29
fails	step 35

RMM
major (continued)

29 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 (0 or 1) tested in step 28

If RTS LINK link_no	Do
passes	step 30
fails	step 35

30 To post the ManB RMM, type

>POST RMM rmm_no
and press the Enter key.

where

mm_no is the number of the RMM manually made busy in step 4

31 To test the RMM, type

>TST
and press the Enter key.

If test	Do
passes	step 32
fails, and the system generates a card list	step 33
fails, and the system does not generate a card list	step 35

RMM
major (end)

32 To return the ManB RMM to service, type

>RTS
and press the Enter key.

If RTS	Do
passed	step 36
failed	step 35

33 The card list identifies cards with possible faults. Replace the cards one at a time in the order that this procedure directs.

If you	Do
replaced all the cards on the list	step 35
did not replace all the cards on the list	step 34

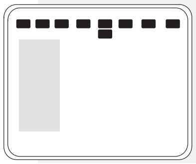
34 Perform the correct procedure in the *Card Replacement Procedures* for the next card on the card list. Complete the card replacement procedure. Go to step 6.

35 For additional help, contact the next level of support.

36 This procedure is complete. If additional alarms appear, perform the correct alarm clearing procedures.

OPAC minor

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.

Indication

The alarm code LCM under the peripheral module (PM) subsystem header indicates a line concentrating module (LCM) alarm. The absence of *C* or M under the LCM indicates a minor alarm. The number (n) before LCM indicates the number of OPACs with a minor alarm.

Meaning

The number (n) of LCMs in the in-service trouble (ISTb) state.

Impact

The ISTb condition does not directly affect service. One unit of the LCM continues to provide service.

Local backup is not available. The failure of the other unit of the LCM interrupts service.

Common procedures

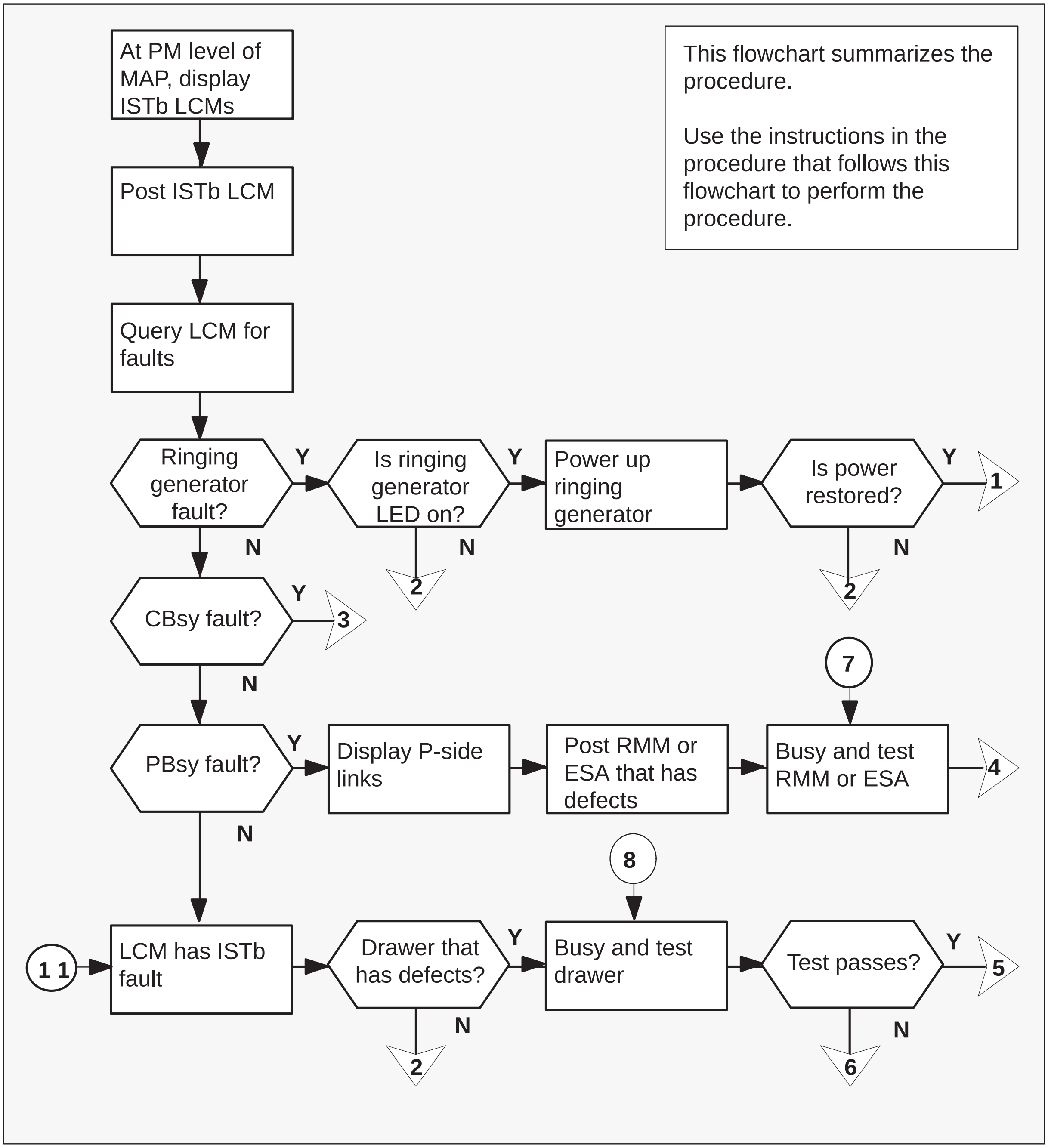
There are no common procedures.

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.

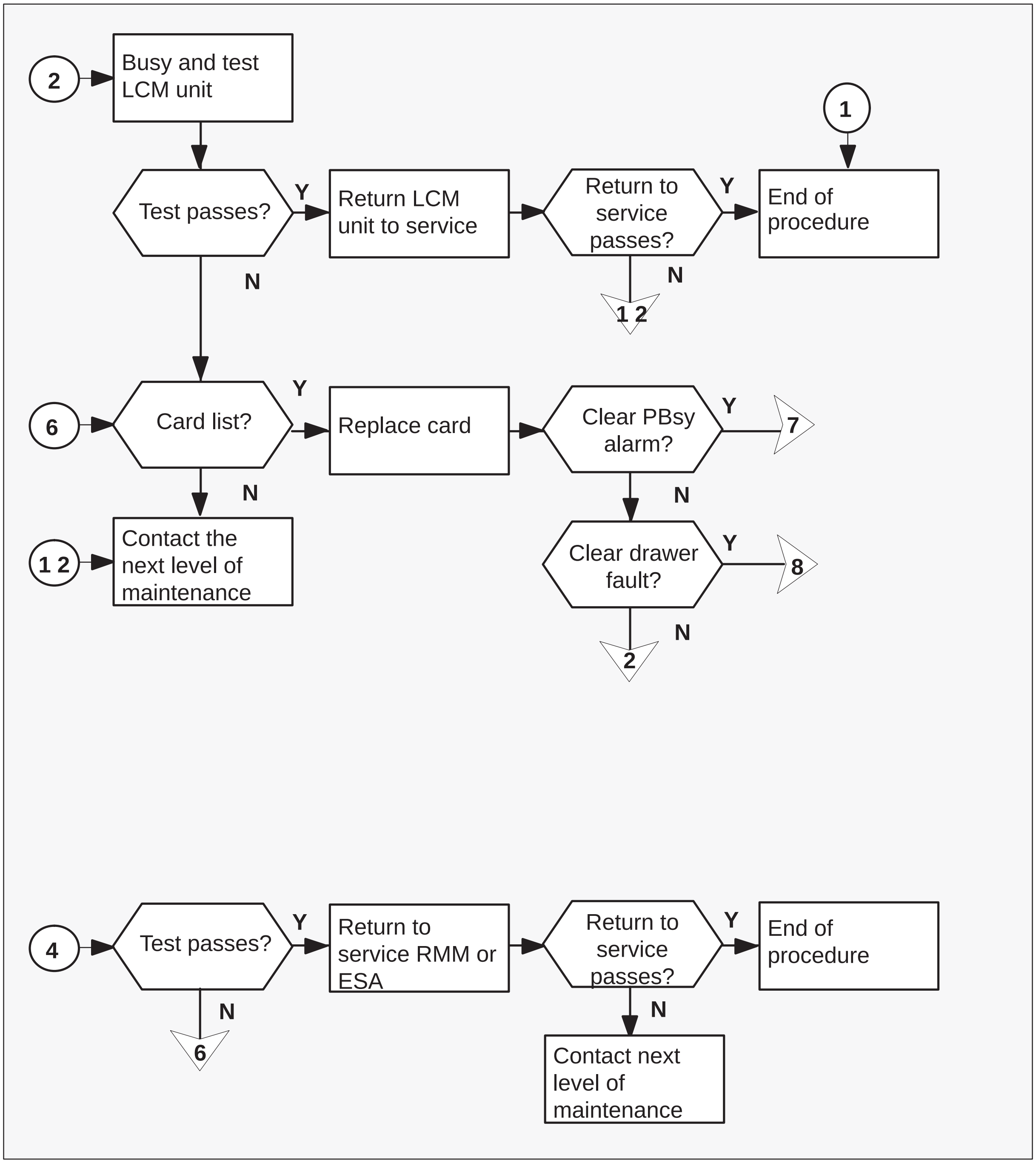
OPAC
minor (continued)

Summary of an OPAC minor alarm

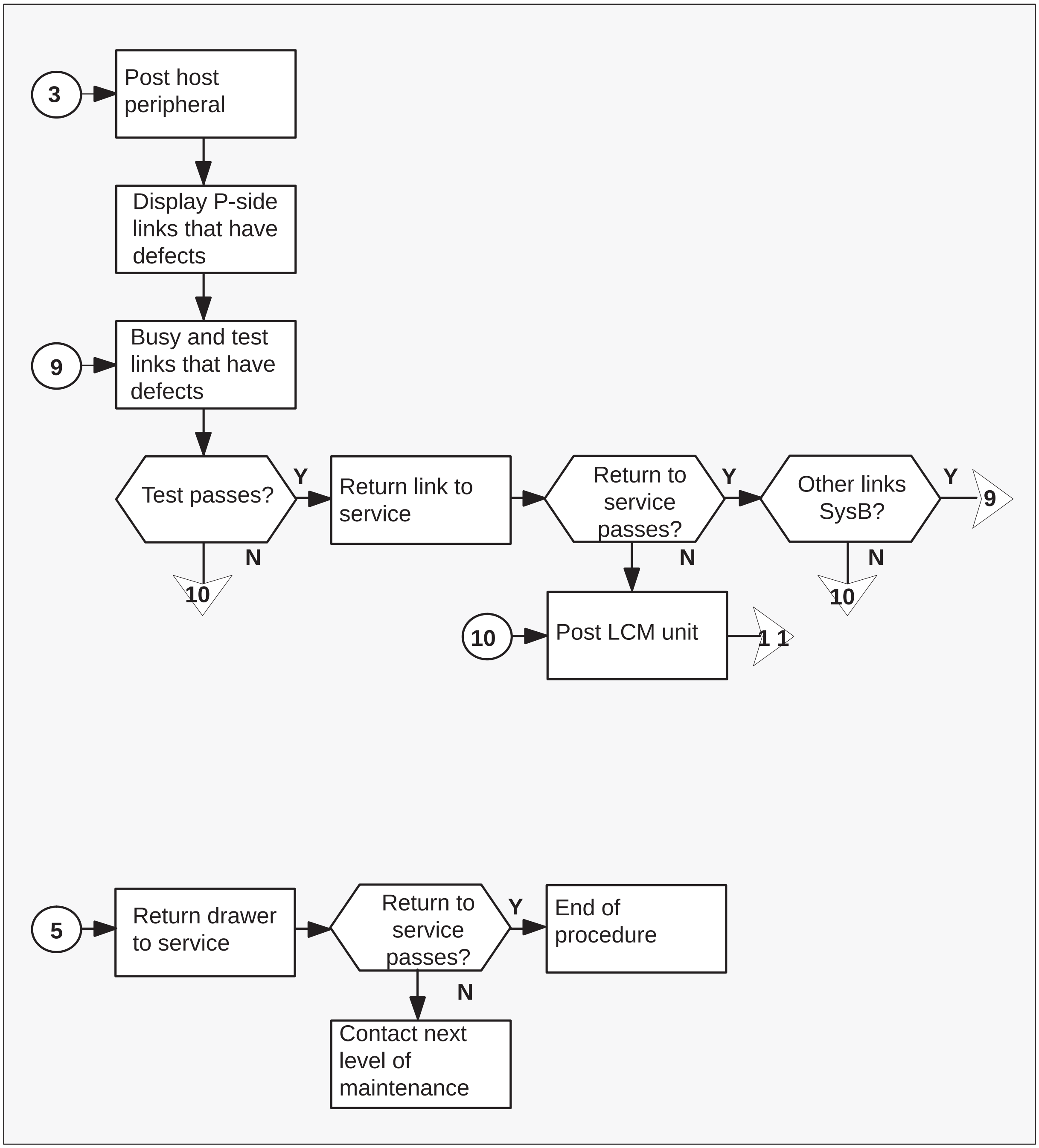


OPAC
minor (continued)

Summary of an OPAC minor alarm(continued)



Summary of an OPAC minor alarm(continued)



OPAC
minor (continued)

Clearing an OPAC minor alarm

At the MAP terminal

1 If you continue to hear the alarm, silence the alarm. To silence the alarm, type:

>MAPCI;MTC;SIL
and press the Enter key.

2 To access the PM level of the MAP display, type:

>PM
and press the Enter key.

3 To identify the defective LCM in the OPAC, type:

>DISP STATE ISTB LCM
and press the Enter key.

4 To post the LCM in the OPAC with the alarm condition, type:

>POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0-511)
lcm	is the number of the LCM

5 To determine the problem indicators, type:

>QUERYPM FLT
and press the Enter key.

If problem indicated	Do
is ringing generator	step 6
is CBsy (C-side busy)	step 9
is PBsy (P-side busy)	step 15
is DRWR FLT (drawer fault)	step 21
is ISTb (In-service trouble)	step 25

At the LCM

6 Visually inspect the ringing generator to see if the light-emitting diode (LED) light is ON.

If the LED light	Do
is ON	step 7
is OFF	step 25

7 To power up the ringing generator, move the power switch to the ON position. The LED light must go off. The switches are:

CB6 corresponds to LCM unit 0 (RG in host interfact equipment (HIE) slot 1)

CB8 corresponds to LCM unit 1 (RG in HIE slot 5)

8 Determine if the ringing generator has power.

If power	Do
is restored	step 31
is not restored	step 25

At the MAP terminal

9 To identify C-side links to the host PM, type:

> TRNSL C
and press the Enter key.

Example of a MAP response:

```
Link 0:   LTC 0          2; Cap MS; Status: OK    ;MsgCond: OPN
Link 1:   LTC 0          6; Cap MS; Status: SysB  ;MsgCond: CLS
```

10 To post the host peripheral. (a line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC)), type:

>POST pm pm_no
and press the Enter key.

where

pm is LGC, LTC, or RCC
pm_no is the number of the peripheral

OPAC
minor (continued)

11 To identify the peripheral-side (P-side) links that have defects, type:

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link 2:   LCM REM1 00 0  2; Cap MS; Status: OK    ;MsgCond: OPN
Link 6:   LCM REM1 00 0  1; Cap MS; Status: SysB  ;MsgCond: CLS
```

Record information for the links that have a state other than OK.

12 To choose and busy the link that has defects, type:

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link that has defects identified in step 11

13 To test the busied link, type:

>TST LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link that has defects busied in step 12

If test	Do
passes	step 14
fails	step 21

14 To return the busied link to service, type:

>RTS LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link that has defects busied in step12

If RTS	Do
passes and other links are not SysB	step 20
passes but other links are SysB	step 12
fails	step 21

15 To display P-side links, type:

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link  0: RMM 0      0;Cap MS;Status:PBsy     ,P;MsgCond:CLS
Link  1: RMM 0      1;Cap MS;Status:PBsy     ,P;MsgCond:CLS
Link  2: ESA 0      0;Cap M ;Status:OK       ,P;MsgCond:OPN
Link  3: ESA 0      1;Cap M ;Status:OK       ,P;MsgCond:OPN
```

16 The processor can be equipped with a remote maintenance module (RMM) or an emergency stand-alone (ESA) processor. To post the RMM or ESA processor that has defects, type:

>POST module module_no
and press the Enter key.

where

module	is the name of the P-side module (RMM or ESA)
module_no	is the number of the RMM or ESA processor

17 To busy the RMM or ESA processor, type:

>BSY
and press the Enter key.

18 To test the RMM or ESA processor, type:

>TST
and press the Enter key.

If test	Do
passes	step 19
fails, and the system produces a card list	step 28
fails, but the system does not produce a card list	step 29

OPAC
minor (continued)

19 To return to service the RMM or ESA processor, type:

>RTS
and press the Enter key.

If RTS	Do
passes	step 31
fails	step 29

20 To post the LCM in the OPAC with the alarm condition, type:

>POST LCM site frame lcm
and press the Enter key.

where

site is the site name of the OPAC (alphanumeric)
frame is the frame number of the OPAC (0-511)
lcm is the number of the LCM

21

CAUTION
If you do not allow the time required for the system to clear the allarm, a false alarm indication occurs.
Allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

Determine if the problem is a drawer that has defects. Letters that appear under the line subgroup numbers indicate a drawer that has defects. The line subgroup numbers must be associated with a physical drawer.

Example of a MAP response:

```
LCM  REM1 14 0   ISTb   Links OOS: Cside  0 Pside  0
Unit0: InSv                    /RG: 0
Unit1: InSv                    /RG: 0
                           11  11  11  11  11  RG: Pref 0 InSv
Drwr:  01  23  45  67  89  01  23  45  67  89      Stby 1 InSv
       ..  SS  ..  ..  ..  ..  ..  ..  ..  ..
```

If the system	Do
indicates that the problem is a drawer that has defects	step 22
iindicates that the problem is not a drawer that has defects	step 25

22 To busy the two line subgroups associated with the drawer that has defects, type:

>BSY DRWR lsg
and press the Enter key.

where

lsg is the number of one of the line subgroups associated with the drawer that has defects
Example of a MAP response:

```
LCM REM1 00 0   Drwr 2 will be taken out of service
Please confirm (”YES” or ”NO”):
```

>YES
and press the Enter key.

Note: Repeat this step for the other line subgroup associated with the drawer that has defects.

23 To test both line subgroups associated with the drawer that has defects, type:

>TST DRWR lsg
and press the Enter key.

where

lsg is the number of one of the line subgroups associated with the drawer that has defects

OPAC
minor (continued)

Repeat this step for the other line subgroup associated with the drawer that has defects.

If test	Do
passes	step 24
fails, and the system produces a card list	step 28
fails, but the system does not produce a card list	step 29

24 To return to service the two line subgroups, type:

>RTS DRWR lsg
and press the Enter key.

where

lsg is the number of one of the line subgroups associated with the drawer that has defects
Example of a MAP response:

```
OSvce Tests Initiated
LCM  REM1 00 0   Drwr 2 Tst Passed
LCM  REM1 00 0   Drwr 2 Rts Passed
```

Repeat this step for the other line subgroup associated with the drawer that has defects.

If return to service	Do
passes	step 31
fails	step 29

25 To busy the LCM unit associated with the alarm, type:

>BSY UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit to be busied (0 or 1)

26 To test the busied unit, type:

>TST UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit to test (0 or 1)

If test	Do
passes	step 27
fails, and the system produces a card list	step 28
fails, and the system does not produce a card list	step 29

27 To attempt to return the LCM to service, type:

>RTS UNIT lcm_unit
and press the Enter key.

where

lcm_unit is the LCM unit to return to service (0 or 1)

If RTS	Do
passes	step 31
fails	step 29

28 The card list identifies the cards that can be defective. Replace the cards one card at a time according to the procedure.

If last card on list	Do
is not replaced	step 30
is replaced	step 29

29 For additional help, contact the next level of maintenance.

30 Refer to the *Card Replacement Procedures* to replace the first card or the second card on the card list.

OPAC
minor (end)

Notify operating company personnel that you are changing the cards.

After you replace the card, return to the correct step in this procedure.

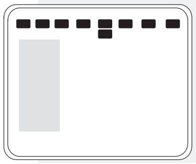
If you clear	Do
a PBsy alarm	step 18
drawer problems	step 23
other alarms	step 26

31 The procedure is complete.

If other alarms appear at the MAP display, proceed to the correct alarm clearing procedure.

RMM
minor

Alarm display



CM	MS	IOD	Net	**PM**	Lns	Trks	Ext	APPL
.	.	.	.	**nCBsy**	.	.	.	.

Indication

The alarm code *n*CBsy appears under the PM subsystem header at the MTC level of the MAP terminal display. This code indicates a minor alarm associated with an RMM. The number (*n*) before CBsy indicates the number of PMs with this alarm.

Meaning

The indicated number (*n*) of units are in the C-side busy (CBsy) state.

Result

This condition does not affect service to the subscriber. Local RMM backup is not present if the unit fails.

Common procedures

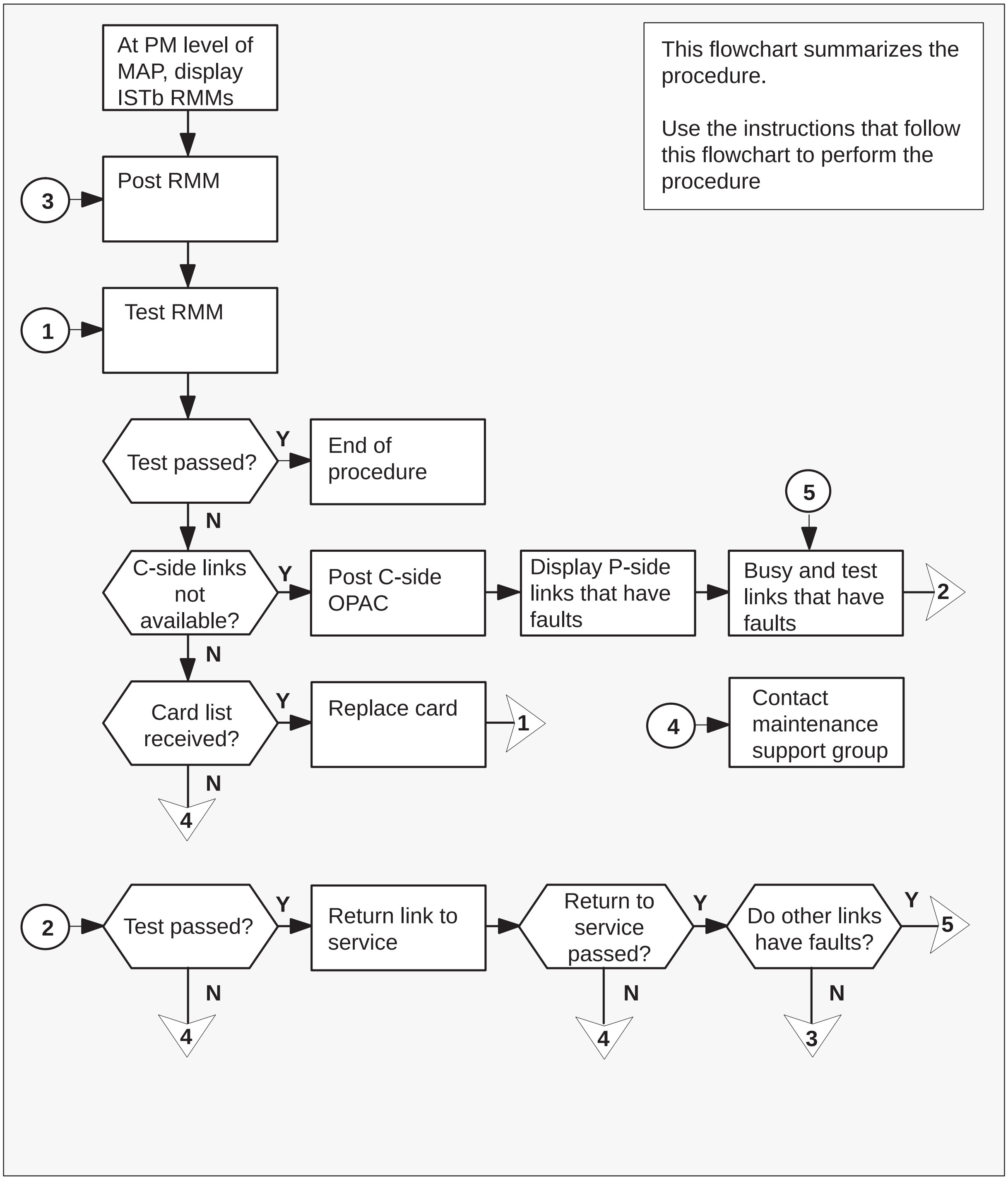
There are no common procedures.

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.

RMM
minor (continued)

Summary of RMM minor alarm



Clearing an RMM minor alarm

At the MAP terminal:

1 To silence the alarm, type

>MAPCI;MTC;PM;SIL
and press the Enter key.

2 To identify the RMM that has faults, type

>DISP STATE ISTB RMM
and press the Enter key.

Example of a MAP terminal response:

```
ISTb  RMM: 2
```

3 To post the ISTb RMM identified in step 2, type

>POST RMM rmm_no
and press the Enter key.

where

rmm_no   is the number of the RMM that has faults

4 To perform an in-service test on the RMM that has faults, type

> TST
and press the Enter key.

If test	Do
passes	step 17
fails because C-side links are not available	step 5
fails and the system generates a card list	step 14
fails and the system does not generate a card list	step 16

RMM
minor (continued)

5 To identify the LCM in the OPAC with links in a SysB condition, type

> TRNSL C
and press the Enter key.

Example of a MAP response:

```
LINK  0: LCM RLCM 00 0  0;CAP MS;STATUS:SysB,;MSGCOND:CLS
LINK  1: LCM RLCM 00 0  1;CAP MS;STATUS:  OK,;MSGCOND:OPN
```

6 To post the LCM in the OPAC identified in step 5, type

>POST LCM site frame lcm
and press the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0 to 511)
lcm	is the number of the LCM

7

CAUTION
If you do not allow the time required for the system to clear the alarm, a false alarm indication can occur.
Allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

To identify the P-side links that have faults, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
LINK  0:  RMM 0 0;CAP   MS;STATUS:SysB,;MSGCOND: CLS
LINK  1:  RMM 0 1;CAP   MS;STATUS:  OK,;MSGCOND: OPN
LINK  2:  ESA 0 0;CAP    S;STATUS:  OK,;MSGCOND: OPN
LINK  4:  ESA 0 1;CAP    S;STATUS:  OK,;MSGCOND: OPN
```

8 To busy the link that has faults, type

>BSY LINK link_no
and press the Enter key.

where

link_no	is the number of a P-side link that has faults identified by step 7.

RMM
minor (continued)

9 To test the ManB link, type

>TST LINK link_no
and press the Enter key.

where

link_no is the number of the link (0 or 1) manually busied in step 8

If test	Do
passes	step 10
fails	step 16

10 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 (0 or 1) tested in step 9

If RTS	Do
passes	step 11
fails	step 16

11 Determine if you must clear additional links.

If you	Do
cleared all the links that had faults	step 12
did not clear all the links	step 8

12 To post the RMM, type

>POST RMM rmm_no
and press the Enter key.

where

rmm_no is the number of the RMM to be posted

RMM
minor (end)

13 To test the RMM, type

>TST
and press the Enter key.

If test	Do
passes	step 17
fails, and the system generates a card list	step 14
fails, and the system did not generate a card list	step 16

14 The card list identifies cards with possible faults. Replace the cards one at a time in the order listed as directed below.

If you	Do
replaced all defective cards	step 16
did not replace all defective cards	step 15

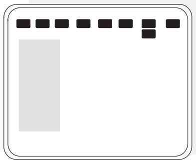
15 For the next card on the card list, go to the correct procedure in the *Card Replacement Procedures*. Complete the procedure and go to step 13 of this procedure.

16 For additional help, contact the next level of support.

17 This procedure is complete. If other alarms appear, refer to the correct alarm clearing procedure.

PMPES
critical, major, minor

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nPES**	.	.	.	.	.
				M					

Indication

The alarm code power and environmental system (PES) indicates a PES alarm. The PES appears under the peripheral module (PM) subsystem header of the alarm banner at the maintenance (MTC) level of the MAP display. The alarm code PES indicates that the alarm occurs in an Outside Plant Access Cabinet (OPAC).

The number (n) before PES indicates the number of PMs with this alarm.

The MAP terminal displays the following information under the PES alarm. Information appears according to the importance of the alarm.

Information displayed under PES	Importance
`*C*`	critical
`M`	major
a blank space	minor

At the PES level of the MAP terminal, software displays the number of OPACs in different maintenance states. The states are red, amber, green and offline (OFFL).

The following example of a display at the PES level of the MAP terminal shows that one OPAC is in the RED state. Two OPACs are in the AMBER state. Three OPACs are in the GREEN state. One OPAC is in the OFFL state:

Example of a MAP response:

```
       RED   AMBER  GREEN  OFFL
 PES    1      2      3     1
```

To obtain additional information about an OPAC with a PES alarm, enter the POST command with an appropriate parameter.

PMPES
critical, major, minor (continued)

For example, you can enter POST GREEN at the PES level of the MAP terminal. When you enter the POST command, a display like the following, appears on the MAP display:

Example of a MAP response:

```
OPMPES    2 Cond:  GREEN  REM2     2   1   RMM   2
                                     Audit  Week  HBT
  Common     Rectifiers                  .     2    .
   AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
    .        .   .   .   .      .       .      .   .
  BCC    0    1    2    3    Temp     Door    BCCFUSES
 0= W    .    .    .    .  EHT ELT  FRNT SIDE    0   1
 1= W    .    .    .    .   .   .    .    .      .   .
```

Note 1: OPAC does not contain an environmental control unit (ECU). You can continue to use the ECU alarm.

Note 2: For OPAC, the ECU indicator in the OPMPES indicates a failure in one or more fans. Fan failure occurs when the fan fails to spin above a threshold level of 2200 to 2600 rpm, when power was available.

Meaning

At the maintenance (MTC) level of the MAP display, the number that precedes the PES alarm indicates the number of OPACs with a PES alarm. The alarm can be critical, major or minor.

The following table defines critical, major and minor alarms.

Type of alarm	Definition
Critical	More than ten percent of all OPACs in the office have a maintenance state of RED.
Major	Ten percent or less of all OPACs in the office have a maintenance state of RED.
Minor	One or more OPAC has a maintenance state of AMBER. There are no OPACs with a maintenance state of RED.

At the OPMPES level of the MAP display, the numbers under RED, AMBER, GREEN or OFFL indicate the number of OPACs in the indicated state.

PMPES
critical, major, minor (continued)

The meaning of each maintenance state follows.

Maintenance states	Meaning
RED	One or more of the following faults exists in the OPAC: • ac power failure • battery string failed system, testing • door open • excessive current draw • failure of the modular supervisory panel (MSP) • rectifier failure • temperature inside OPAC is too high or too low
Amber	One or more of the following faults exists in the OPAC: • battery rotation audit disabled • environmental control (ECU) failure. A minimum of one fan does not spin while thermostat calls for cooling • fuse blown on charger 0 or charger 1 • The battery charger controller driver (BCCDVR) card or the PES alarm detector (PESALRM) card is peripheral busy (P), system busy (S) or manual busy (M).
Green	The OPACs do not have faults.
OFFL	The BCCDVR and PESALRM cards are offline.

The information that appears under each header in this display indicates the condition of items in the OPAC that you posted. This information helps locate the cause of the PES alarm.

PMPES
critical, major, minor (continued)

This information cannot appear under each header. The following table lists the information and the meaning:

Information	Meaning
`Common AC`	Condition of the ac power supply is the following: • `.` ac power present • `F` ac power absent (failed). Rectifiers 0 and 1 fail.
`Rectifiers`	Condition of the rectifiers is the following: • `FL0` condition of rectifier 0 — `.` rectifier fault is not detected — `F` rectifier fault detected • `FL1` condition of rectifier 1 — `.` rectifier fault is not detected — `F` rectifier fault detected • `CL0` current limiting condition of rectifier 0. Appears as OK or in service as follows: — `.` current limiting circuits not active • `CL1` current limiting condition of rectifier 1. Appears as OK or in service as follows: — `.` current limiting circuits not active
`Temp`	Internal temperature of the OPAC is the following: • `EHT` too high temperature in OPAC is: — `.` EHT not detected — `F` EHT detected • `ELT` too low temperature in OPAC is: — `.` ELT not detected — `F` ELT detected • `HBT` high battery temperature indicator is displays as not detected: — `.` HBT not detected

—continued—

PMPES
critical, major, minor (continued)

Information	Meaning
`Door`	Position of doors on the OPAC is the following: • `FRNT` position of the front *or rear* door is: — `.` door closed — `0` door open • `SIDE` position of the side door. SIDE alarms are not present in OPAC. Indicator displays a dot: — `.` door closed
`ECU`	Condition of environmental control unit (ECU) is the following: • `.` ECU (fans) not faulty • `F` ECU (fans) faulty
`FSP`	Condition of the modular supervisory panel (MSP) is the following: • `.` MSP not faulty • `F` MSP faulty
`BCC`	Condition of the battery charger controller is the following: • `.` normal load bus configuration in use • `W` a minimum of one battery strings does not connect to the load bus
`0123`	States of the battery string pairs are the following: • `.` string pair connects to load bus • `CHG` string pair connects to charge bus • `BSY` driver card manual busy or offline • `O/C` string pair open circuit • `DIS` string pair connects to discharge test bus • `F` string pair fails system testing • `–` string pair not equipped. String pair 3 is not equipped in OPAC. String pair 3 is entered as `–`.

—continued—

PMPES
critical, major, minor (continued)

Information	Meaning
BCCFUSES	State of the battery charger controller fuses is the following: • `.` fuses not faulty • `F` faulty fuse
BCCDVR	State of the battery charger controller driver card is the following: • `.` in service. Fault is not detected. • `M` manual busy • `S` system busy • `P` peripheral busy
PESALRM	State of the power and environmental system alarm scan card is the following: • `.` in service. Fault is not detected. • `M` manual busy • `S` system busy • `P` peripheral busy
AUDIT	State of the battery rotation and testing audit is the following: • `.` audit enabled • `F` audit disabled
WEEK	Mode of battery rotation and testing audit is the following: • `N` (1–4) audit enabled for normal rotation and test • `.` audit enabled, ac or rectifier failure • `P/S` post ac failure recovery mode (short outage) • `P/E` post ac failure recovery mode (extended outage)

Note 1: If a third rectifier is installed, the third rectifier can continue to work when rectifiers 0 and 1 fail and the system displays an F.

Note 2: If a third rectifier is installed, the alarm signal for the rectifier is wired to an additional scan card. The operating company enters data to this alarm signal as an external alarm.

—end—

PMPES
critical, major, minor (continued)

Result

The PES alarm does not directly affect subscriber service.

Common procedures

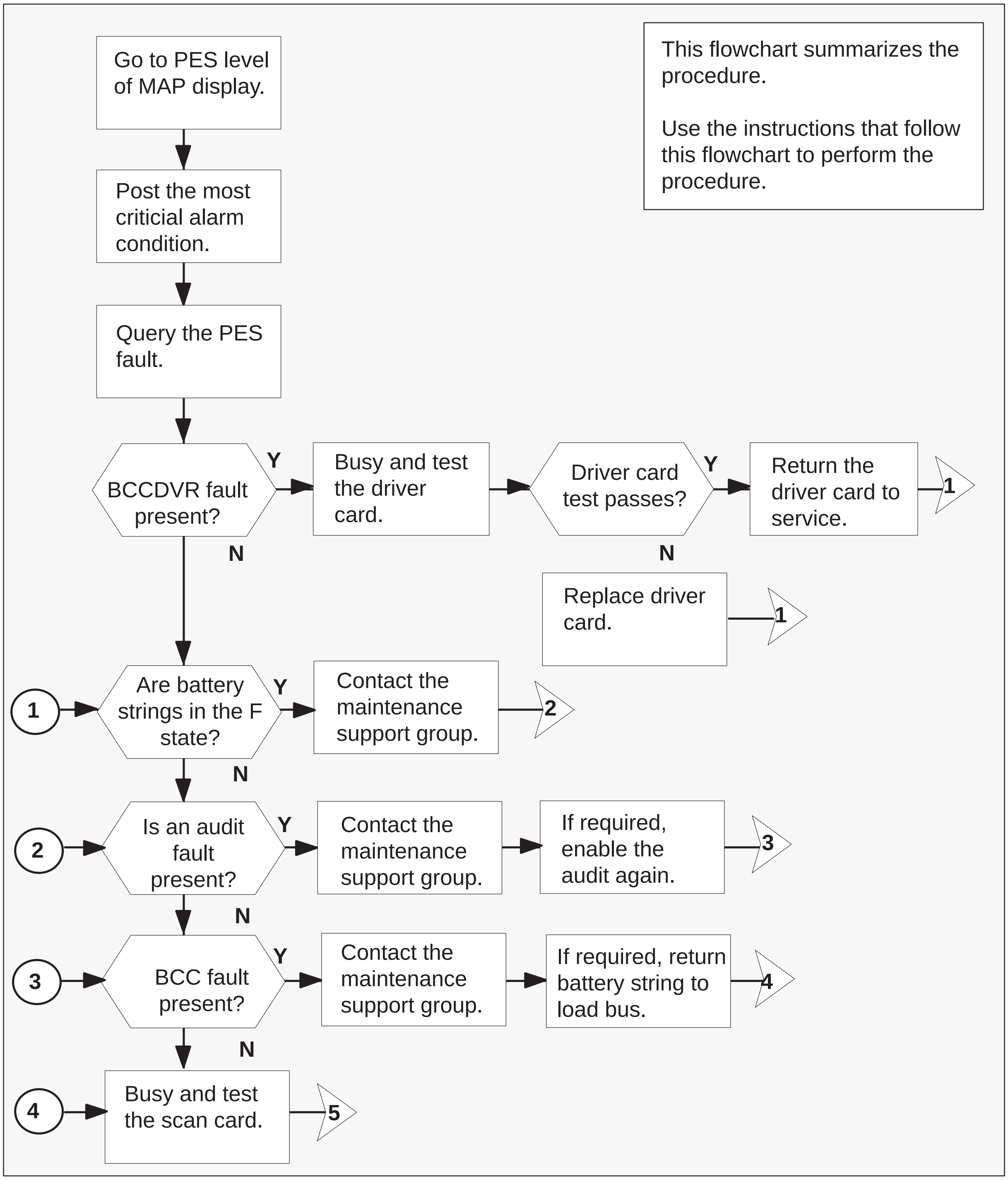
Does not apply

Action

This procedure contains a flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

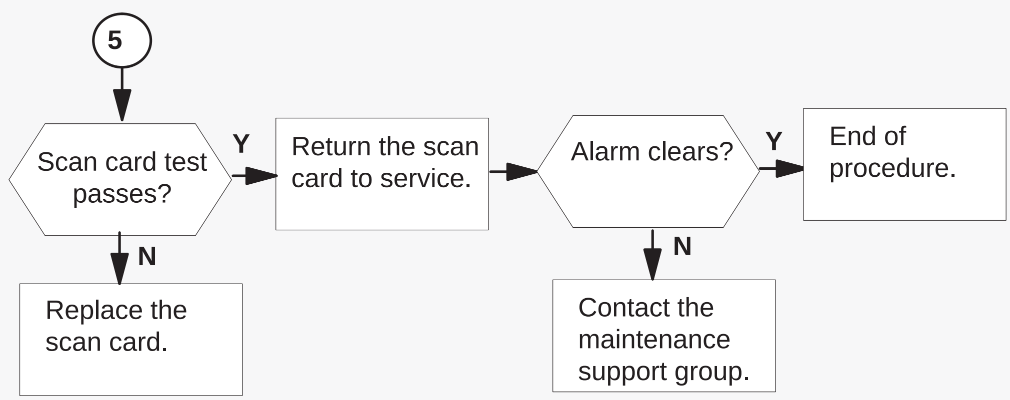
PMPES
critical, major, minor (continued)

Summary of clearing a PMPES alarm



PMPES
critical, major, minor (continued)

Summary of clearing a PMPES alarm (continued)



PMPES
critical, major, minor (continued)

Clearing PMPES critical, major, minor alarms

At the MAP terminal

1 To silence the alarm if the alarm is audible, type

>MAPCI;MTC;SIL
and press the Enter key.

2 To enter the PES MAP terminal level, type

>PM;PES
and press the Enter key.

3 Examine the display to determine the most critical alarm condition. Refer to the alarm condition description in this module.

PMPES
critical, major, minor (continued)

4 To post the most critical alarm condition, type

>POST condition
and press the Enter key.

Where

condition is the condition (red, amber, green or OFFL)

A display like the following display appears on the MAP display.

Example of a MAP display:

```
CM   MS   IOD   NET   PM   CCS  LNS   Trks   Ext   Appl
 .    .     .    .   1PES    .   .     .      .     .

OPMPES       SysB  ManB   OffL   CBSY   ISTB  InSV
 0 Quit    PM  0     3      4      0     4     30
 2 Post_
 3                 RED      AMBER     GREEN     OFFL
 4         PES       1        0         3        1
 5
 6 Tst_   OPMPES 2 Cond:RED  REM2  2  1   RMM  2
 7 Bsy_                            Audit  Week  HBT
 8 Rts_    Common   Rectifiers       .      2    .
 9 OffL_    AC   FL0 FL1 CL0 CL1 BCCDVR PESALRM ECU FSP
10           .     F   .   .   .    .      .     .   .
11 Disp_   BCC   0 1  2  3  Temp      Door     BCCFUSES
12 Next    0= W  . .  .  -  EHT ELT  FRNT SIDE    0   1
13 Audit_   1= W  . .  .  -   .  .     .    .     .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

5 To disable the audit, type

>AUDIT DISABLE
and press the Enter key.

6 To query the PES fault to determine the problem, type

>QUERYPES FLT
and press the Enter key.

PMPES
critical, major, minor (continued)

7 Select one of the alarms from step 6

If the selection	Do
is AC (common)	step 8
is `Audit`	step 5
is `BCC (0/1)`	step 18
is `BCCDVR`	step 13
is `BCCFUSES`	step 8
is `CL0/CL1`	step 8
is `ECU`	step 8
is `EHT/ELT`	step 8
is `FL0/FL1`	step 8
is `FRNT/SIDE`	step 8
is `FSP`	step 8
is `HBT`	step 8
is `PESALRM`	step 8
is 0/1/2/3 (battery string pairs) in F state	step 22

8 To busy the scan card, type

>BSY PESALRM
and press the Enter key.

The letter M appears under PESALRM on the MAP display.

Example of a MAP display:

```
CM   MS    IOD   NET   PM   CCS  LNS    Trks   Ext    Appl
 .    .      .     .  1PES   .    .      .      .      .
 OPMPES       SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit     PM  0      3       4       0       4      30
 2 Post_
 3                      RED      AMBER     GREEN     OFFL
 4        PES             0        1         3         1
 5
 6 Tst_   OPMPES  2 Cond: AMBER   REM2   2   1   RMM   2
 7 Bsy_                                  Audit  Week  HBT
 8 Rts_   Common    Rectifiers            DIS     -    .
 9 OffL_   AC    FL0 FL1 CL0 CL1 BCCDVR PESALRM  ECU FSP
10          .      .   .   .   .    .       M      .   .
11 Disp_   BCC 0   1   2    3   Temp      Door    BCCFUSES
12 Next    0=w .   .   .    -  EHT ELT  FRNT SIDE   0   1
13 Audit_  1=w  .   .   .    -  .    .    .    .    .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

9 To test the scan card, type

>TST PESALRM
and press the Enter key.

If test	Do
fails	step 10
passes	step 12

10 Replace the scan card (NT0X10). Use the *Card Replacement Procedures* to replace the card.

Notify outside operating company personnel. Go to step 11.

PMPES
critical, major, minor (continued)

11 To test the new scan card, type

>TST PESALRM
and press the Enter key.

If test	Do
fails	step 22
passes	step 12

12 To return the scan card to service, type

>RTS PESALRM
and press the Enter key.

If alarm condition	Do
is present	step 22
is not present	step 20

PMPES
critical, major, minor (continued)

13 To busy the driver card, type

>BSY BCCDVR
and press the Enter key.

The letter M appears under BCCDVR on the MAP display.

Example of a MAP display:

```
CM    MS    IOD     NET     PM    CCS    LNS    Trks    Ext    Appl
 .     .     .       .     1PES   .      .      .       .      .

OPMPES           SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit    PM      0      3       4       0       4      30
 2 Post_
 3                         RED      AMBER     GREEN     OFFL
 4         PES              0        1          3         1
 5
 6 Tst_   OPMPES  2 Cond:  AMBER   REM2   2   1   RMM   2
 7 Bsy_                                   Audit  Week  HBT
 8 Rts_      Common     Rectifiers         DIS     –    .
 9 OffL_   AC    FL0 FL1 CL0 CL1   BCCDVR  PESALRM   ECU FSP
10          .     .   .   .   .      M       .        .   .
11 Disp_   BCC   0  1    2    3   Temp      Door   BCCFUSES
12 Next    0= W  .  .    .    -  EHT ELT  FRNT SIDE   0  1
13 Audit   1= W   .  .    .    -  .   .    .    .    .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

14 To test the BCCDVR card, type

>TST BCCDVR
and press the Enter key.

If test	Do
fails	step 15
passes	step 17

PMPES
critical, major, minor (continued)

15 Replace the BCCDVR card (NT802). Use the *Card Replacement Procedures* to replace the card.

Notify outside operating company personnel. Replace the card and go to step 16.

16 To test the BCCDVR card, type

>TST BCCDVR
and press the Enter key.

If test	**Do**
fails	step 22
passes	step 17

17 To return the BCCDVR card to service, type

>RTS BCCDVR
and press the Enter key.

If the MAP display	**Do**
does not display `W` under BCC	step 21
idisplays `W` under BCC	step18

18 The system generates this alarm if more than one equipped battery string pair is not on the load bus. String pair 3 is not equipped in OPAC.

Consult office records or operating company personnel to determine why more than one battery string pair does not connect to the load bus.

If return battery to load bus	**Do**
is installed	step 19
is not installed	step 20

PMPES
critical, major, minor (end)

19 To place the battery on the load bus, type

>LOADB n
and press the Enter key.

where

n is the battery string pair number (0, 1, or 2)

If the system response	Do
is not OK	step 22
is OK	step 20

20 To enable the audit, type

>AUDIT ENABLE
and press the Enter key.

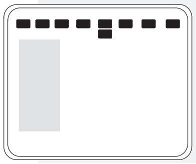
21 Go to step 23.

22 You cannot clear the condition from the office. Advise outside personnel. Contact the maintenance support group.

23 The procedure is complete. If additional alarms appear, proceed to the appropriate alarm clearing procedure.

ESA
critical, minor

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nESA**	.	.	.	.	
				C					

Indication

The alarm code ESA under the PM subsystem header indicates an emergency stand-alone (ESA) alarm. The *C* indicates a critical ESA alarm. The absence of the*C* under the ESA indicates a minor ESA alarm. The number (n) before ESA indicates the number of ESA processors with the alarm condition.

Meaning

The number (n) of ESAs that are in the system busy (SysB) or in-service trouble (ISTb) state.

Impact

The SysB condition directly affects service when the OPAC is in ESA. Local backup does not occur. An interruption of service can occur if the OPAC cannot contact the host office and the ESA processor is SysB.

The ISTb condition does not directly affect service. Operating company personnel must investigate the trouble condition to avoid a service interruption if the ESA condition deteriorates.

Common procedures

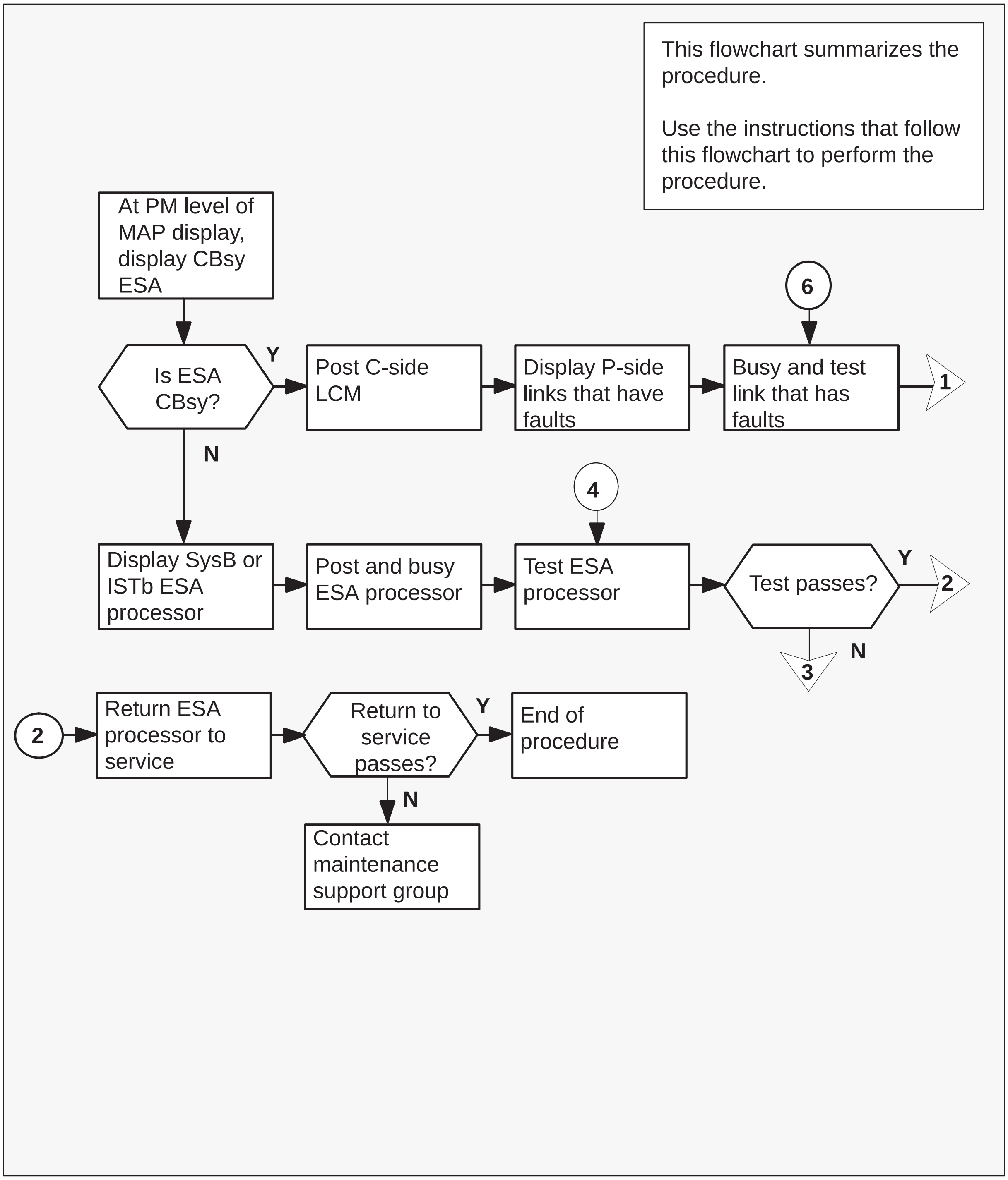
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review this procedure. Follow the steps to perform the procedure.

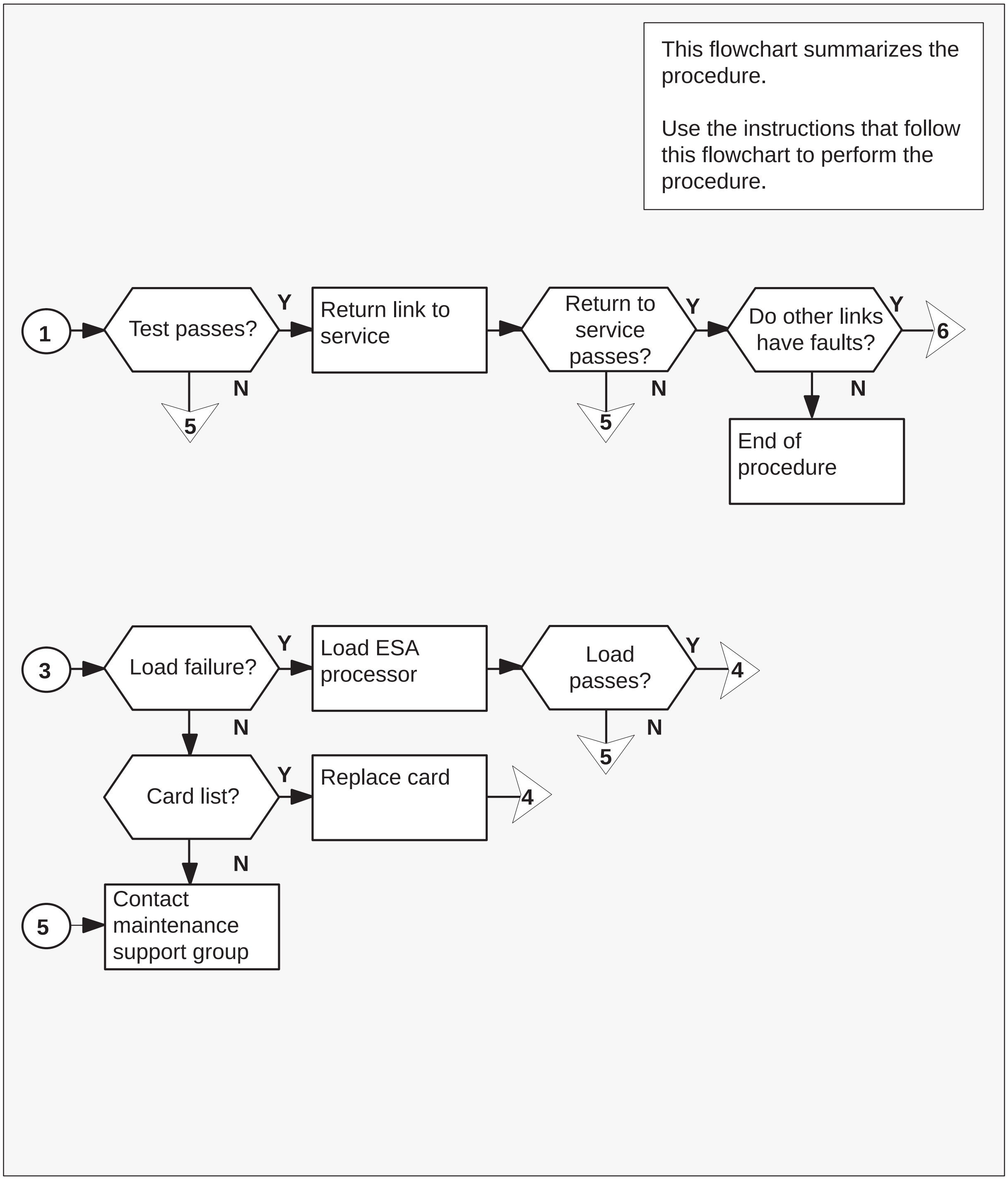
ESA
critical, minor (continued)

Summary of ESA critical, minor alarm



ESA
critical, minor (continued)

Summary of ESA critical, minor alarm(continued)



ESA
critical, minor (continued)

Clearing an ESA critical, minor alarm

At the MAP terminal

1 To silence an audible alarm, type

>MAPCI;MTC;SIL
and press the Enter key.

2 To access the PM level of MAP display, type

>PM
and press the Enter key.

3 To identify the central-side busy (CBsy) ESA processor, type

>DISP STATE CBSY ESA
and press the Enter key.

If ESA	Do
is CBsy	step 4
is not CBsy	step 10

4 To post the ESA processor, type

>POST ESA esa_no
and press the Enter key.

where

esa_no is the number of the ESA processor (0 or 1)

Example of a MAP response:

```
REM1  ESA    0 CBsy
```

5 To display the central-side (C-side) links and identify which OPAC associates with the links, type

>TRNSL
and press the Enter key.

Example of a MAP response:

```
REM1  ESA   0 CBsy
Link 0: LCM REM1 14 0  2; Cap M;Status:SysB;MsgCond:CLS
Link 1: LCM REM1 14 0  3; Cap M;Status:SysB;MsgCond:CLS
```

ESA
critical, minor (continued)

6 To identify and post the LCM in the OPAC associated with the link that has defects, type

>POST LCM site frame lcm
and press the Enter key.

where

site is the site name of the OPAC (alphanumeric)
frame is the frame number of the OPAC (0 to 511)
lcm is the number of the LCM

7 To identify peripheral-side (P-side) links that have defects associated with ESA, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
Link 0: RMM 0        0;Cap MS;Status:OK    ;MsgCond:OPN
Link 1: RMM 0        1;Cap MS;Status:OK    ;MsgCond:OPN
Link 2: ESA 0        0;Cap M ;Status:SysB  ;MsgCond:CLS
Link 3: ESA 0        1;Cap M ;Status:SysB  ;MsgCond:CLS
```

Record information for the ESA links that have a state other than OK.

8 To busy the link that has defects, type

>BSY LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link identified in step 7

9 To return the busied link to service, type

>RTS LINK link_no
and press the Enter key.

where

link_no is the number of a P-side link

If return to service	Do
passes and no other links are SysB	step 20
passes and other links are SysB	step 8
fails	step 19

ESA
critical, minor (continued)

10 To identify the SysB ESA processor, type

>DISP STATE SYSB ESA
and press the Enter key.

If ESA	Do
is SysB	step 12
is not SysB	step 11

11 To identify the ESA processor with the alarm condition, type

>DISP STATE ISTB ESA
and press the Enter key.

12 To post the ESA processor with the alarm condition, type

>POST ESA esa_no
and press the Enter key.

where

esa_no is the number of the ESA processor (0 or 1)

Example of a MAP response:

```
REM1  ESA    0 SysB
```

13 To busy the posted ESA processor, type

>BSY
and press the Enter key.

Example of MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

>YES
and press the Enter key.

ESA
critical, minor (continued)

14 To test the ESA processor, type

>TST
and press the Enter key.

If test	**Do**
passes	step 15
fails because of loading error	step 16
fails, and the system produces card list	step 17
fails, but the system does not produce card list	step 19

15 To return the ESA processor to service, type

>RTS
and press the Enter key.

If return to service	**Do**
is successful	step 20
fails because of loading error	step 16
fails because of CBsy condition	step 4
other than listed here	step 19

16 To reload the ESA processor, type

>LOADPM
and press the Enter key.

If load	**Do**
is successful	step 14
is not successful	step 19

ESA
critical, minor (end)

17 The card list identifies the cards that can have defects. Replace the cards one at a time in the order listed as directed below:

If all cards on the list	Do
are replaced	step 19
are not replaced	step 18

18 Go to the *Card Replacement Procedures* for the next card on the card list.

After you finish with the card replacement procedure, go to step 14 of this procedure.

19 Contact the next level of support to obtain additional help in clearing this alarm.

20 This procedure is complete.

If the system displays additional alarms, proceed to the correct procedure on how to clear alarms.

OPAC card replacement procedures

This chapter contains the card replacement procedures for the Outside Plant Access Cabinet (OPAC). These procedures are used by maintenance personnel to remove and replace hardware modules.

Except when used as part of verification or acceptance procedures, these procedures are used only when referred to by another maintenance procedure, such as the *Alarm Clearing Procedures*.

Procedures in the manual are named to correspond with the Northern Telecom (NT) product equipment code (PEC) and the shelf where the card is to be replaced. These procedures are arranged in alphabetical order for easy location.

NT0X10
RMM

Application

Use this procedure to replace an NT0X10 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT0X10	AA	Miscellaneous scan card

Common procedures

The procedure “Replacing a card” 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.

NT0X10
RMM (continued)

Summary of card replacement procedure for NT0X10 card in an RMM

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

At TTP level of the MAP screen post the RMM

↓

Ensure the correct card is being removed from shelf

↓

Replace card with one having identical PEC

↓

End of procedure

NT0X10
RMM (continued)

Replacing an NT0X10 in an RMM

At the MAP

1

CAUTION
Loss of service
This procedure includes directions to manually busy one or more peripheral module (PM) units. Since manually busying a PM unit can cause service degradation, perform this procedure only if necessary to restore out of service components. Otherwise. carry out this procedure during periods of low traffic.

Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 5. Otherwise, continue with step 3.

At the MAP terminal

3 Access the trunk test position (TTP) level and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no	is the number of the RMM shelf where the card is to be replaced
ckt_no	is the number of the circuit associated with the card to be replaced

4 Ensure the correct circuit card is removed from the shelf by typing

>CKTLOC
and pressing the Enter key.

At the RMM

5

WARNING
Static electricity damage
Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

NT0X10
RMM (end)

Replace the NT0X10 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

6 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 7

7 Send any faulty cards for repair according to local procedure.

8 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 9.

9 You have completed this procedure.

NT2X06
RMM

Application

Use this procedure to replace an NT2X06 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X06	AB	Power converter common features

Common procedures

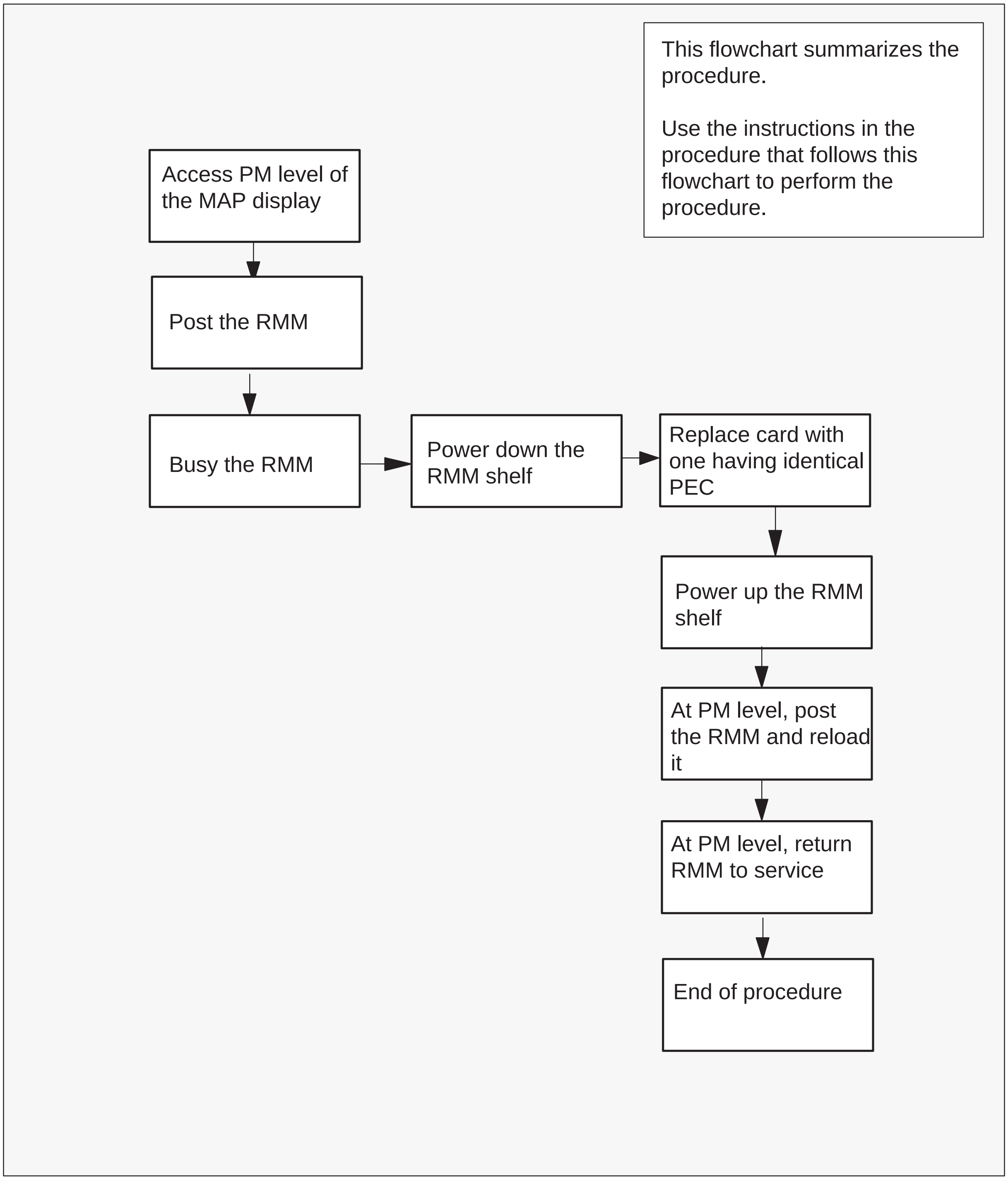
The procedure “Replacing a card” is referenced in this procedure.

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.

NT2X06
RMM (continued)

Summary of card replacement procedure for an NT2X06 in an RMM



NT2X06
RMM (continued)

Replacing an NT2X06 in an RMM

At the MAP terminal

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 3.

3 Access the peripheral module (PM) level of the MAP display by typing

>MAPCI;MTC;PM
and pressing the Enter key.

4 Post the RMM by typing

>POST RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
        SysB     ManB     Offl     CBsy     ISTb    InSv
PM         0        2        2        0        7      21
RMM        1        0        1        0        0       6

RMM     0    SysB
```

5 Busy the RMM by typing

>BSY
and pressing the Enter key.

NT2X06
RMM (continued)

At the RMM

6

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Power down the unit by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the CONVERTER FAIL LED and FRAME FAIL LED on the modular supervisory panel (MSP) will be ON.

7 Replace the NT2X06 card using the procedure “Replacing a card.” When you have completed the procedure, return to this point in the procedure.

8 Power up the RMM unit as follows:

Ensure the converter (NT2X06) is inserted. Set the POWER switch to the ON position.

9 Press the RESET button on the power converter while setting the circuit breaker on the MSP to the ON position. Both the CONVERTER FAIL LED and FRAME FAIL lamp on the MSP will be ON.

10 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 11.

NT2X06
RMM (continued)

At the MAP terminal

11 Go to the PM level and post the RMM, if not already posted, and load the RMM by typing

>PM;POST rmm_no;LOADPM
and pressing the Enter key

where

rmm_no   is the number of the RMM shelf where the card is to be replaced

If	Do
message is `loadfile not found in directory`	step 12
load passed	step 29
load failed	step 32

At the RMM

12 Determine the type of device where the PM load files are located.

If load files are located on	Do
tape	step 13
IOC disk	step 19
SLM disk	step 24

13 Locate the tape that contains the PM load files.

14 Mount the tape on a magnetic tape drive.

At the MAP terminal

15 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no   is the number of the tape containing the PM load files

16 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 containing the PM load files

17 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

18 Go to step 28.

19 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.

20 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

21 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 19.

22 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

23 Go to step 28.

24 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.

25 Access the disk utility level of the MAP display by typing

>DISKUT
and pressing the Enter key.

NT2X06
RMM (continued)

26 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the PM load files obtained in step 24.

27 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

28 Reload the RMM by typing

>LOADPM
and pressing the Enter key.

If	**Do**
load failed	step 32
load passed	step 29

29 Return the RMM to service by typing

>RTS
and pressing the Enter key.

If RTS	**Do**
passed	step 33
failed	step 32

30 Send any faulty cards for repair according to local procedure.

31 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 33.

NT2X06
RMM (end)

32 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

33 You have completed this procedure.

NT2X09
RMM

Application

Use this procedure to replace an NT2X09 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X09	AA	Multioutput power converter

Common procedures

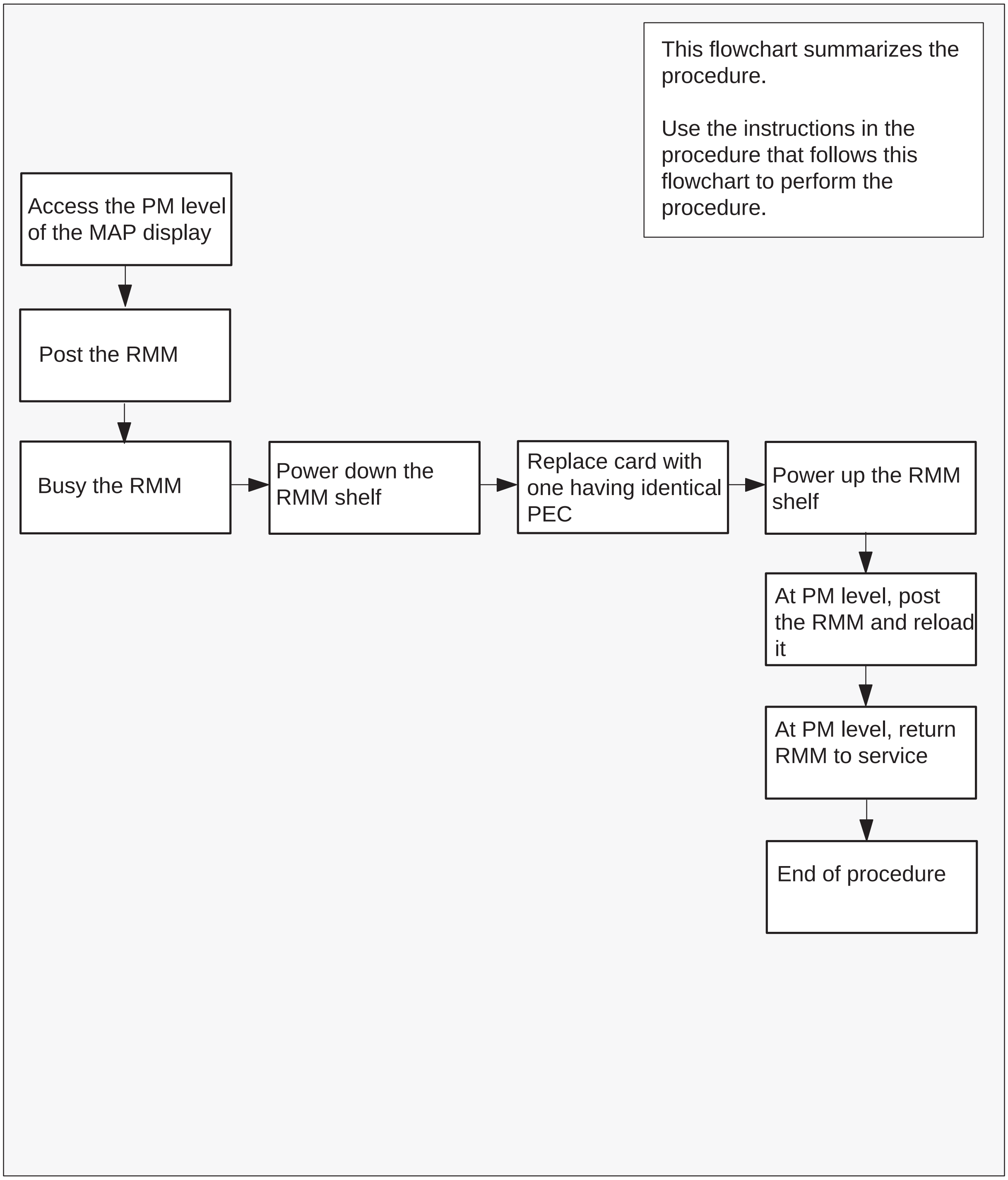
The procedure Replacing a card is referenced in this procedure.

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.

NT2X09
RMM (continued)

Summary of card replacement procedure for an NT2X09 in an RMM



NT2X09
RMM (continued)

Replacing an NT2X09 in an RMM

At your Current Location

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 3.

At the MAP terminal

3 Access the peripheral module (PM) level of the MAP display by typing

>MAPCI;MTC;PM
and pressing the Enter key.

4 Post the RMM by typing

>POST RMM rmm_no
and pressing the Enter key.

where

rmm_no   is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
        SysB     ManB     Offl     CBsy     ISTb    InSv
PM         0        2        2        0        7      21
RMM        1        0        1        0        0       6

RMM     0    SysB
```

5 Busy the RMM by typing

>BSY
and pressing the Enter key.

At the RMM

6

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

NT2X09
RMM (continued)

Power down the unit by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL lamp on the MSP will be ON.

7 Replace the NT2X09 card using the procedure Replacing a card. When you have completed the procedure, return here.

8 Power up the RMM unit as follows:

Ensure the converter (NT2X09) is inserted. Set the POWER switch to the ON position.

9 Press the RESET button on the power converter while setting the circuit breaker on the MSP to the ON position. Both the CONVERTER FAIL LED and FRAME FAIL lamp on the MSP will be ON.

10 If you were directed to this procedure from the *Alarm Clearing Procedures*, return to the alarm clearing procedure that directed you here. Otherwise, continue with step 11.

At the MAP terminal

11 Go to the PM level and post the RMM, if not already posted, and load the RMM by typing

>PM;POST rmm_no;LOADPM
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf in which the card is to be replaced

If	Do
`message Loadfile not found in directory is recieved`	step12
load passed	step29
load failed	step32

NT2X09
RMM (continued)

12 Determine the type of device where the RMM load files are located.

If load files are located on	Do
tape	step13
IOC disk	step19
SLM disk	step24

13 Locate the tape that contains the PM load files.

14 Mount the tape on a magnetic tape drive.

At the MAP terminal

15 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

16 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 containing the PM load files

17 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

18 Go to step 28.

19 From office records, determine and note the number of the input/output controller (IOC) disk and the number of the volume that contains the PM load files.

20 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

NT2X09
RMM (continued)

21 List the IOC file names into your user directory by typing

>LISTVOL 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 19.

22 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

23 Go to step 28.

24 From office records, determine and note the number of the system load module (SLM) disk and the number of the volume that contains the PM load files.

25 Access the disk utility level of the MAP display by typing

>DISKUT
and pressing the Enter key.

26 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the PM load file obtained in step 24.

27 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

28 Reload the RMM by typing

>LOADPM
and pressing the Enter key.

If	Do
load failed	step 32
load passed	step 29

NT2X09
RMM (end)

29 Return the RMM to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passes	step 33
fails	step 32

30 Send any faulty cards for repair according to local procedure.

31 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 33.

32 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

33 You have completed this procedure.

NT2X10
RMM

Application

Use this procedure to replace an NT2X10 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X10	AB	Line test unit analog card
NT2X10	BA	Multiline test unit analog card

Common procedures

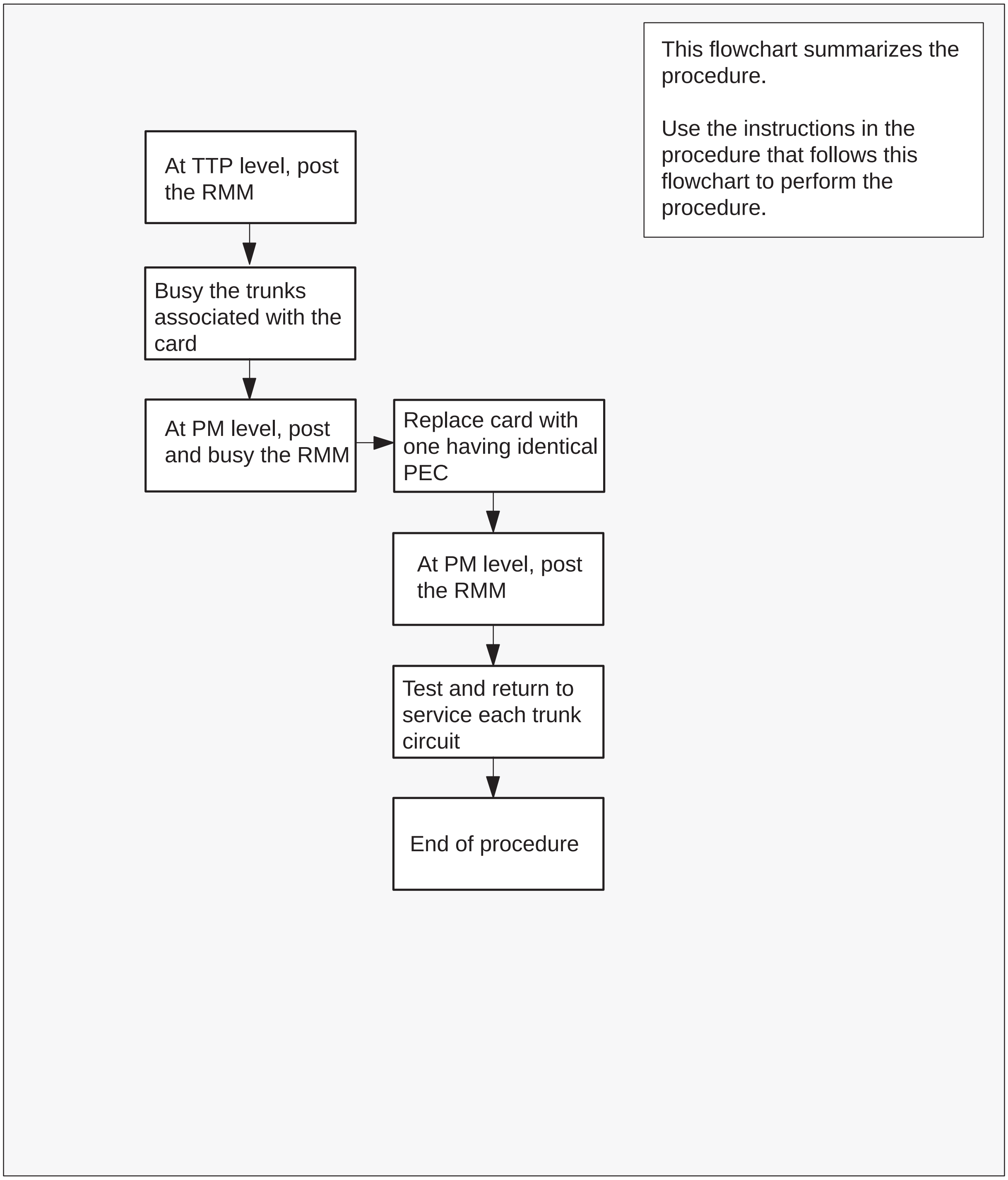
The procedure “Replacing a card” is referenced in this procedure.

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.

NT2X10
RMM (continued)

Summary of card replacement procedure for an NT2X10 card in an RMM



NT2X10
RMM (continued)

Replacing an NT2X10 in an RMM

At the MAP terminal

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the trunk test position (TTP) level of the MAP display and post the trunk circuits on the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced
ckt_no is the trunk circuit related to the card

Example of a MAP response

```
POST  20   DELQ       BUSY Q          DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE
R
OG    MF RMM 0 0  OTWAON23DA00 2001   LO
                                      P_IDL
 LAST CIRCUIT = 27
 POST CKT IDLED
 SHORT CLLI IS:  OTDA00
 OK, CLLI POSTED
```

3 Ensure the card being pulled is the correct card from the correct card slot by typing

>CKTLOC
and pressing the Enter key.

4 Busy the trunks associated with the card to be replaced by typing

>BSY ALL
and pressing the Enter key.

NT2X10
RMM (continued)

At the RMM

5

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the card using the procedure replacing a card. When you have completed this procedure, return here.

At the MAP terminal

6 Post the RMM trunk circuits by typing

>POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf in which the card is to be replaced
ckt_no is the number of the trunk circuit associated with the card

7 Go to the PM level, place the first trunk circuit on hold and test the second circuit by typing

>HOLD
and pressing the Enter key

and then typing

>TST
and press the Enter key.

If TST	**Do**
passed	step 8
failed	step 14

NT2X10
RMM (end)

8 Return to service the circuit tested by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 9
failed	step 14

9 Place the untested circuit in the control position by typing

>NEXT 1
and pressing the Enter key.

10 Test the circuit by typing

>TST
and pressing the Enter key.

If TST	Do
passed	step 11
failed	step 14

11 Return the circuit to service and clear the trunk test position by typing

>RTS;NEXT
and pressing the Enter key.

12 Send any faulty cards for repair according to local procedure.

13 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 15.

14 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

15 You have completed this procedure.

NT2X11
RMM

Application

Use this procedure to replace an NT2X11 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X11	AA	Line test unit digital card
NT2X11	AB	Multiline test unit digital card

Common procedures

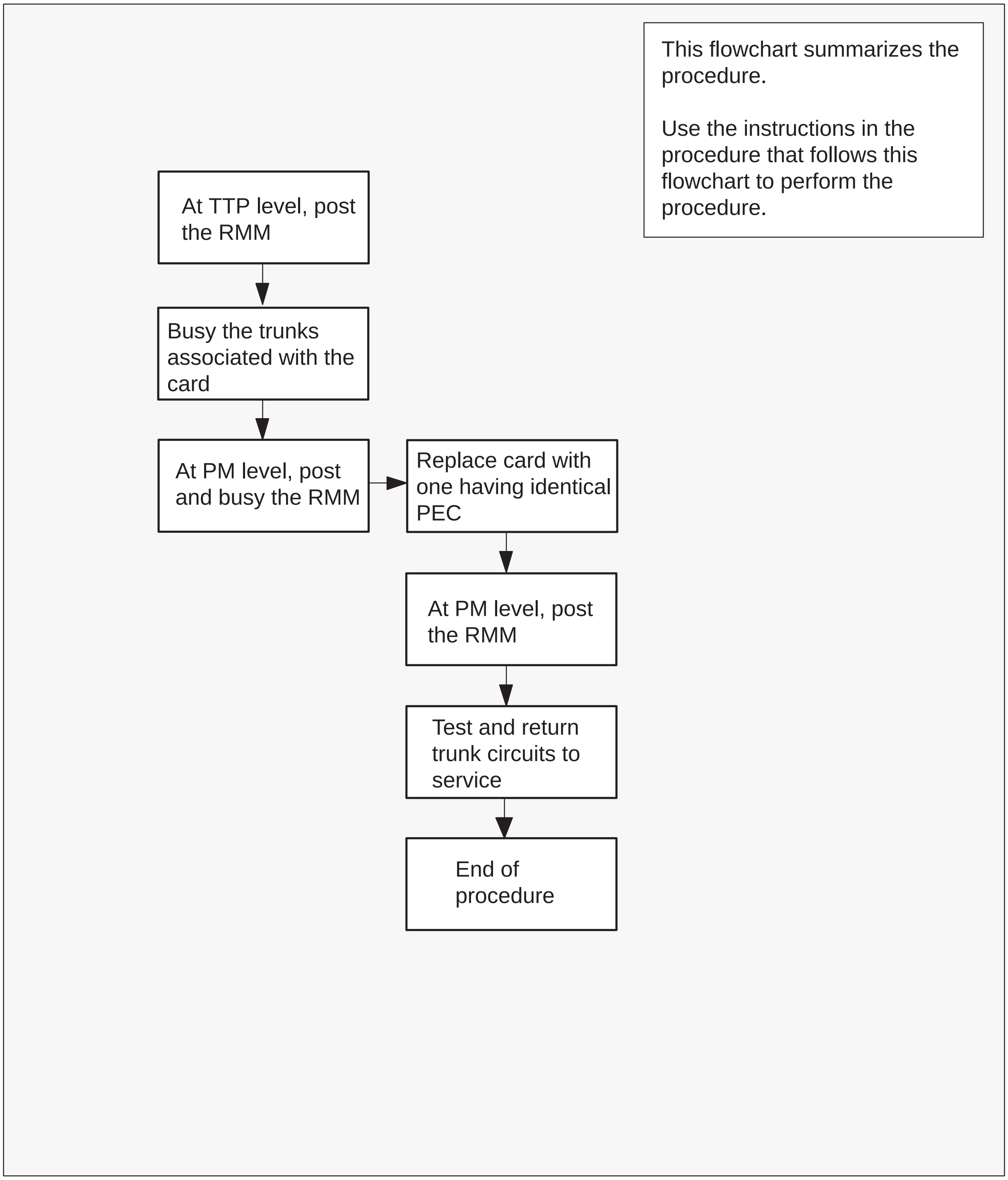
The procedure “Replacing a card” is referenced in this procedure.

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.

NT2X11
RMM (continued)

Summary of card replacement procedure for an NT2X11 in an RMM



NT2X11
RMM (continued)

Replacing an NT2X11 in an RMM

At your Current Location

1 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 terminal

2 Access the trunk test position (TTP) level of the MAP display and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no
and pressing the Enter key.

where

rmm_no   is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
POST  20   DELQ       BUSY Q          DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG        STA S R DOT
TE R
OG    MF RMM 0 0  LTU                 LO
                                      P_IDL
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  OTDA00
OK, CLLI POSTED
```

3 Ensure the card being pulled is the correct card and is pulled from the correct card slot by typing

>CKTLOC
and pressing the Enter key.

4 Busy the trunks associated with the card to be replaced by typing

>BSY ALL
and pressing the Enter key.

At the RMM

5

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X11 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

At the MAP terminal

6 Post the RMM trunk circuits by typing

>POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced
ckt_no is the number of the trunk circuit associated with the card to be replaced

7 Go to the PM level of the MAP screen, place the first circuit in a hold position and test the second circuit by typing

>HOLD
and pressing the Enter key

and then typing

>TST
and pressing the Enter key.

If TST	Do
passed	step 8
failed	step 14

NT2X11
RMM (end)

8 Return to service the circuit tested by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 9
failed	step 14

9 Place the untested circuit in the control position by typing

>NEXT 1
and pressing the Enter key.

10 Test the circuit by typing

>TST

If TST	Do
passed	step 11
failed	step 14

11 Return to service and clear the trunk tesr position by typing

>RTS;NEXT

12 Send any faulty cards for repair according to local procedure.

13 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 15.

14 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

15 You have completed this procedure.

NT2X48
RMM

Application

Use this procedure to replace an NT2X48 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X48	AB	Digitone receiver

Common procedures

The procedure “Replacing a card” is referenced in this procedure:

Action

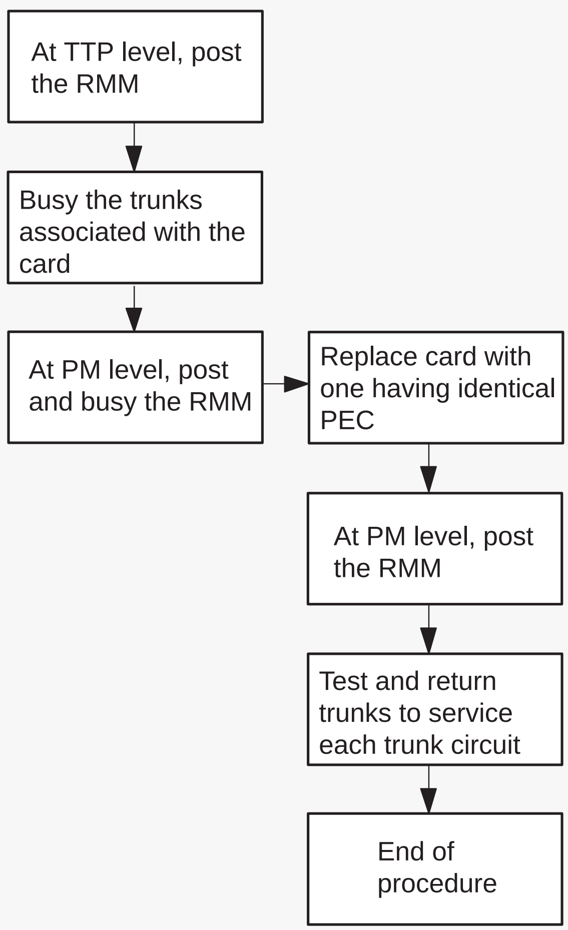
The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT2X48
RMM (continued)

Summary of card replacement procedure for NT2X48 card in an RMM

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



Replacing an NT2X48 in an RMM

At the MAP terminal

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the TTP level of the MAP display and post the RMM that contains the card to be replaced by typing

MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced
ckt_no is the number of the trunk circuit associated with the card to be replaced

Example of a MAP response:

```
POST  20   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG    MF RMM 0 0        LTU            LO
                                      P_IDL

LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  LTU
OK, CLLI POSTED
```

3 Ensure the card being pulled is the correct card and is being pulled from the correct card slot.

>CKTLOC
and pressing the Enter key.

4 Busy the trunks associated with the card to be replaced by typing

BSY ALL
and pressing the Enter key.

NT2X48
RMM (continued)

At the RMM

5

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X48 card using the procedure replacing a card. When you have completed the procedure, return here.

At the MAP terminal

6 Go to the PM level of the MAP display and post the RMM by typing

PM;POST RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced
ckt_no is the number of the trunk circuits associated with the card to be replaced

7 Go to the peripheral module (PM) level and place the first trunk circuit on hold and test the second circuit by typing

>HOLD
and pressing the Enter key

and then typing

>TST
and pressing the Enter key.

If TST	Do
passed	step8
faileed	step14

8 Return to service the tested circuit by typing

>RTS
and pressing the Enter key.

NT2X48
RMM (end)

9 Place the untested circuit in the control position by typing

>NEXT 1
and pressing the Enter key.

10 Test the circuit by typing

>TST

If TST	Do
passed	step12
failed	step14

Note: Repeat steps 10 and 11 for circuits 2 and 3.

11 Return the circuit to service and clear the trunk test position by typing

>RTS;NEXT
and pressing the Enter key.

12 Send any faulty cards for repair according to local procedure.

13 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 15.

14 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

15 You have completed this procedure.

NT2X57
RMM

Application

Use this procedure to replace an NT2X57 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X57	AA	Signal distribution card (type 1)

Common procedures

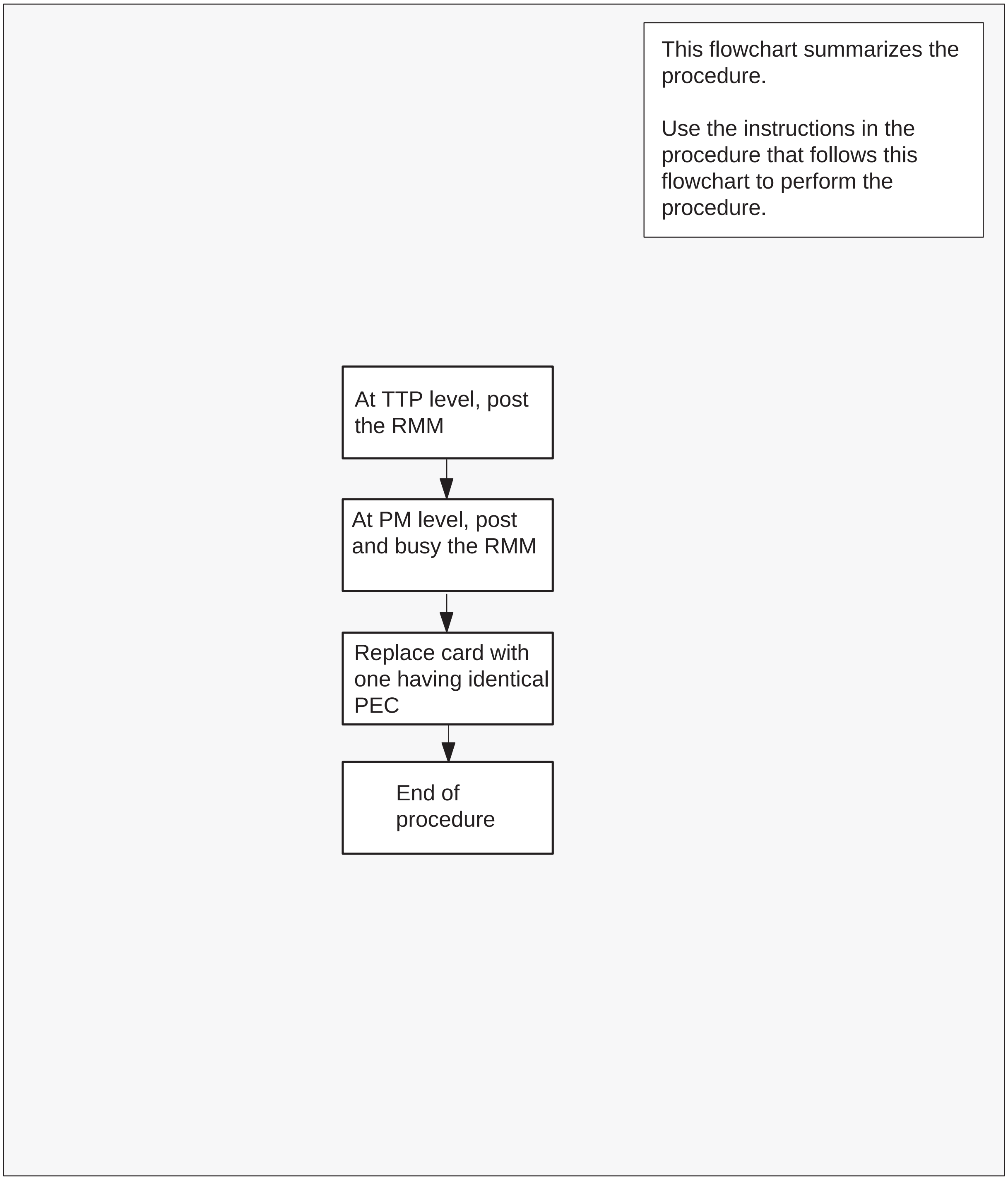
The procedure “Replacing a card” is referenced in this procedure.

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.

NT2X57
RMM (continued)

Summary of card replacement procedure for NT2X57 card in an RMM



NT2X57
RMM (continued)

Replacing an NT2X57 in an RMM

At the MAP terminal

1 Get a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the trunk test position (TTP) level of the MAP display and post the RMM that contains the card to be replaced by typing

MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no	is the number of the RMM shelf where the card is to be replaced
ckt_no	is the number of the circuit associated with the card to be replaced

3 Ensure the correct circuit card is removed from the shelf by typing

>CKTLOC
and pressing the Enter key.

At the RMM

4

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X57 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

5 If you were directed to this procedure from the *Alarm Clearing Procedures,* return to the alarm clearing procedure that directed you here. Otherwise, continue with step 6.

6 Send any faulty cards for repair according to local procedure.

7 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 9.

NT2X57
RMM (end)

8 Get more assistance in replacing this card by contacting the personnel responsible for higher-level support.

9 You have completed this procedure.

NT2X59
RMM

Application

Use this procedure to replace an NT2X59 in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X59	AA	Group CODEC DMS-100/200

Common procedures

The procedure “Replacing a card” is referenced in this procedure.

Action

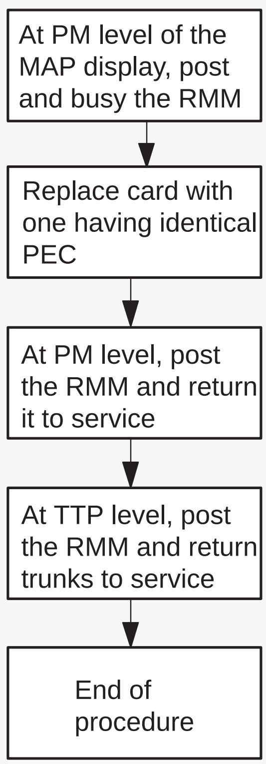
The following flowchart is a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT2X59
RMM (continued)

Summary of card replacement procedure for an NT2X59 card in an RMM

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



NT2X59
RMM (continued)

Replacing an NT2X59 in an RMM

At the MAP terminal

1 Get a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Go to the peripheral module (PM) level of the MAP display and post the RMM by typing

>PM;POST RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
        SysB    ManB    Offl    CBsy    ISTb   InSv
PM         0       2       2       0       7     21
RMM        1       0       1       0       0      6

RMM     0    SysB
```

3 Busy the RMM by typing

BSY
and pressing the Enter key.

At the RMM

4

WARNING
Static electricity damage
Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X59 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

NT2X59
RMM (end)

At the MAP terminal

5 Go to the PM level and post the RMM, if not already posted, and return the RMM to service by typing

PM;POST RMM rmm_no;RTS
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf in which the card is to be replaced

If RTS	Do
passed	step 6
failed	step 8

6 Send any faulty cards for repair according to local procedure.

7 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 9.

8 Get more assistance in replacing this card by contacting the personnel responsible for higher level of support.

9 You have completed this procedure.

NT2X70
HIE

Application

Use this procedure to replace an NT2X70 in the host interface equipment (HIE) shelf.

PEC	Suffix	Name
NT2X70	AE	Power converter (±5V/±12V)

Common procedures

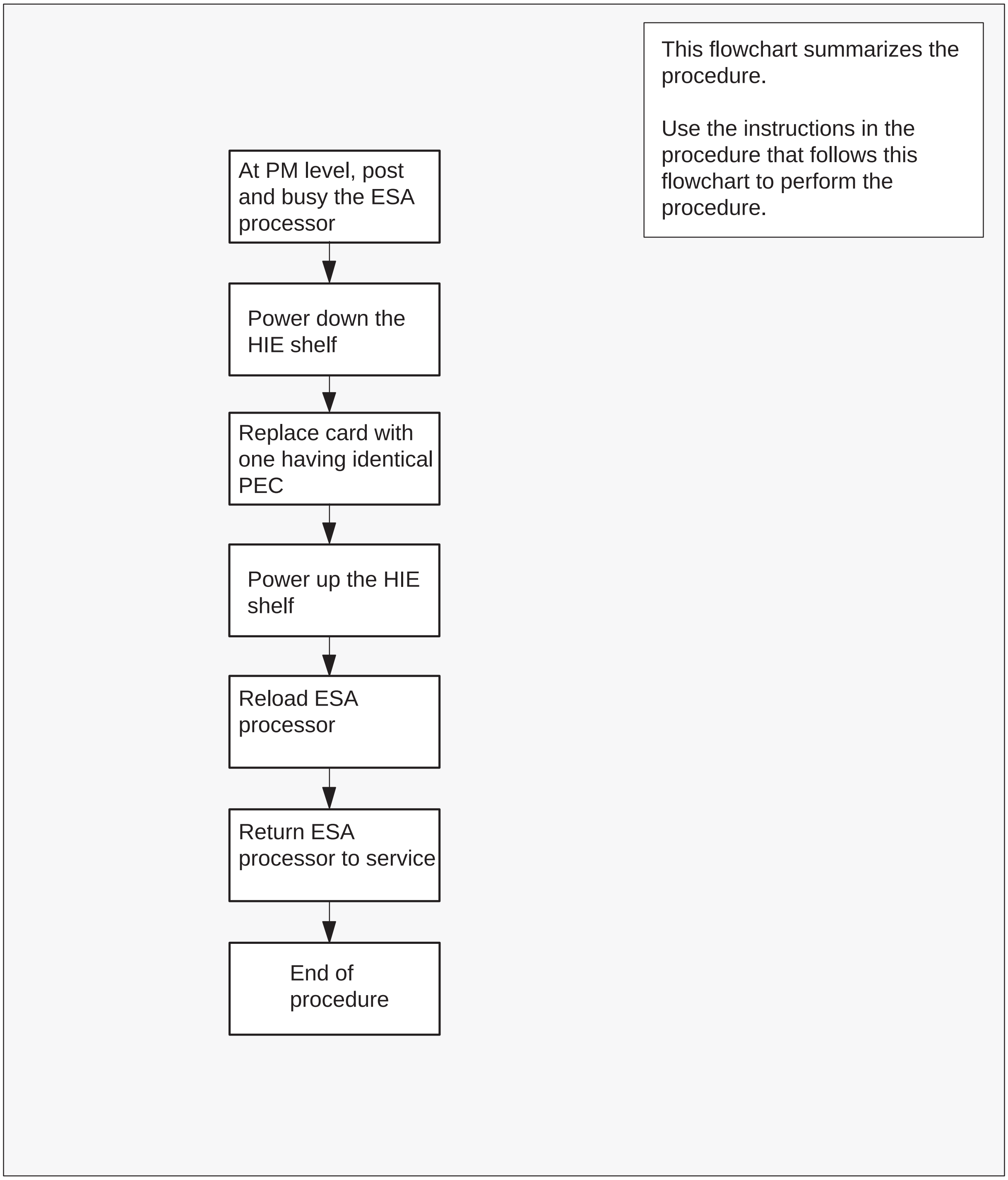
The procedure “Replacing a card” is referenced in this procedure.

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
HIE (continued)

Summary of card replacement procedure for an NT2X70 in an HIE



NT2X70
HIE (continued)

Replacing an NT2X70 in an HIE

At the MAP terminal

1 Get a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from the *Alarm Clearing Procedures,* go to step 5. Otherwise, continue with step 3.

3 Access the peripheral module (PM) level of the MAP terminal and post the Emergency Stand-Alone (ESA) processor by typing

>MAPCI;MTC;PM;POST ESA esa_no
and pressing the Enter key.

where

esa_no is the number of the ESA processor

4 Busy the ESA processor by typing

>BSY
and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES
and pressing the Enter key.

At the HIE

5

WARNING
Static electricity damage
Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Power down the HIE shelf by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL lamp on the MSP will be ON.

NT2X70
HIE (continued)

6 Replace the NT2X70 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

7 Power up the HIE.

- Ensure the converter (NT2X70) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.
- Set the POWER switch to the ON position.

8 Check the suffix on the NT2X70 card.

If NT2X70 suffix is	Do
AE	step 9
AA, AB, AC, AD	step 10

9 Toggle the ON/OFF/RESET switch on the power converter faceplate to the RESET position and hold while setting the circuit breaker on the MSP to the ON position.

Both the converter FAIL LED and FRAME FAIL lamp on the MSP will go OFF. Release the ON/OFF/RESET switch. Go to step 11.

10 Press the RESET button on the power converter while setting the circuit breaker on the MSP to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the MSP will be ON.

11 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 12.

12 Load the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	Do
the message `loadfile not found in directory` is received	step 13
load passes	step 28
load fails	step 33

NT2X70
HIE (continued)

13 Determine the type of device where the PM load files are located.

If load files are located on	Do
tape	step 14
IOC disk	step 21
SLM disk	step 25

14 Locate the tape that contains the PM load files.

15 Mount the tape on a magnetic tape drive.

16 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

17 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 containing the PM load files

18 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

19 Go to step 29.

20 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.

21 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

22 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

23 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

24 Go to step 29.

25 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.

26 Access the disk utility level of the MAP terminal by typing

>DISKUT
and pressing the Enter key.

27 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the file to be loaded

28 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

29 Reload the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	Do
load failed	step 33
load passed	step 30

NT2X70
HIE (end)

30 Return the ESA processor to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 31
failed	step 33

31 Send any faulty cards for repair according to local procedure.

32 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 34.

33 Get more assistance in replacing this card by contacting the personnel responsible for higher level of support.

34 You have completed this procedure.

NT2X90
RMM

Application

Use this procedure to replace an the following card in a remote maintenance module (RMM).

PEC	Suffix	Name
NT2X90	AD	Incoming/outgoing test trunk

Common procedures

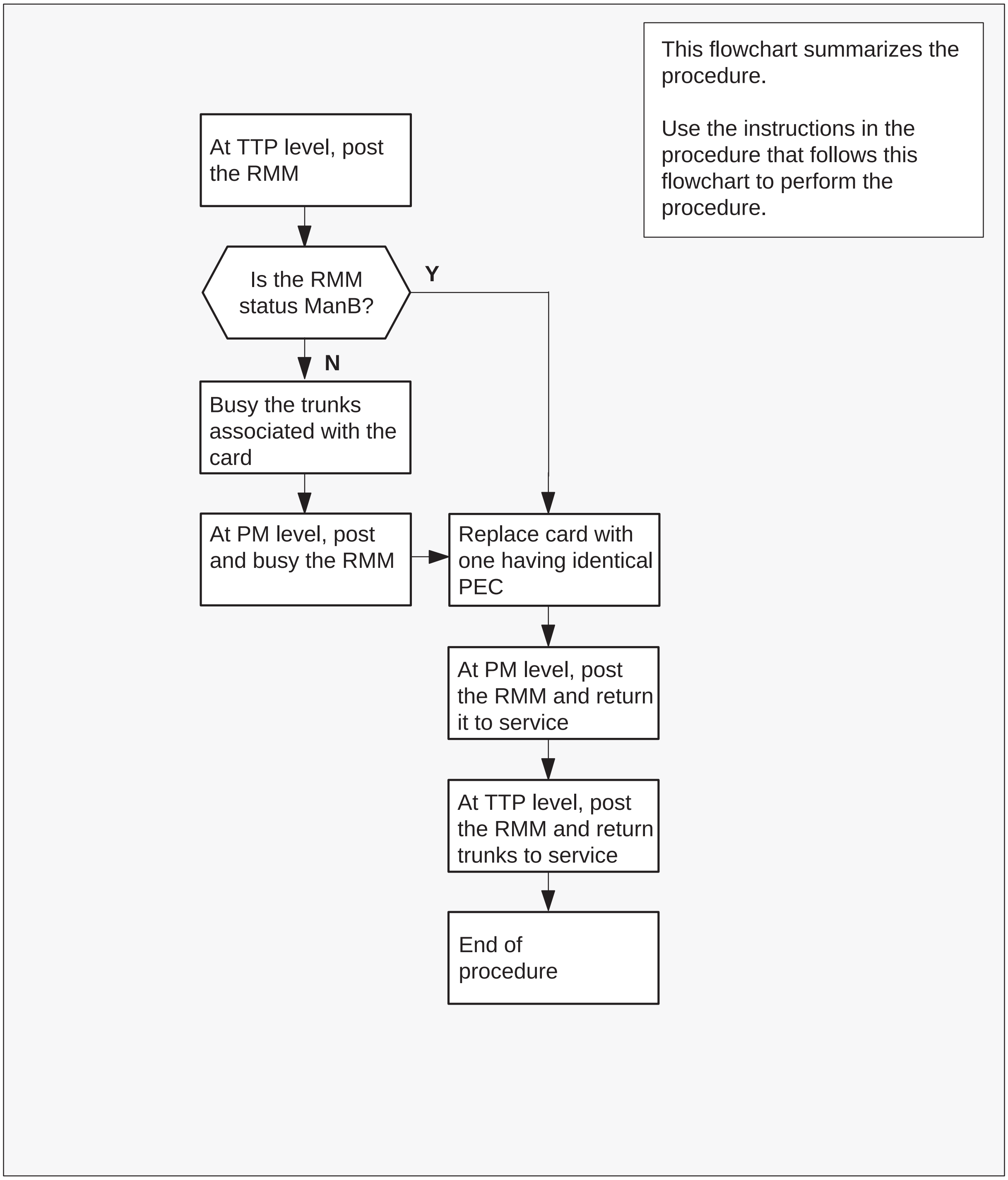
The procedure “Replacing a card” is referenced in this procedure.

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.

NT2X90
RMM (continued)

Summary of card replacement procedure for an NT2X90 in an RMM



Replacing an NT2X90 in an RMM

At your Current Location

1 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 terminal

2 Access the trunk test position (TTP) level of the MAP display and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no	is the number of the RMM shelf where the card is to be replaced
ckt_no	is the number of the trunk circuit associated with the card to be replaced

Example of a MAP response:

```
POST  20   DELQ       BUSY Q          DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG    MF RMM 0 0          LTU          LO
                                      P_IDL

LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  LTU
OK, CLLI POSTED
```

3 Ensure the correct card is being pulled from the correct card slot by typing

>CKTLOC
and pressing the Enter key.

4 Busy the trunks associated with the card to be replaced by typing

>BSY ALL
and pressing the Enter key.

NT2X90
RMM (continued)

At the RMM

5

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X90 card using the procedure replacing a card. When you have completed the procedure, return here.

At the MAP terminal

6 Go to the peripheral module (PM) level of the MAP terminal and post the RMM trunk circuits by typing

>PM;POST P RMM rmm_no ckt_no to ckt_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced
ckt_no is the number of the trunk circuit associated with the card to be replaced

7 At the PM level, place the first circuit on hold and test the second circuit by typing

>HOLD
and pressing the Enter key.

and then typing

>TST
and pressing the Enter key

If TST	Do
passed	step 8
failed	step14

NT2X90
RMM (end)

8 Return to service the tested circuit by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 9
failed	step14

9 Place the untested circuit in the control position by typing

>NEXT 1
and pressing the Enter key.

10 Test the circuit by typing

>TST

If TST	Do
passed	step11
failed	step14

11 Return to service and clear the trunk test position by typing

>RTS;NEXT
and pressing the Enter key.

12 Send any faulty cards for repair according to local procedure.

13 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 15.

14 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

15 You have completed this procedure.

NT3X09
RMM

Application

Use this procedure to replace the following card in an RMM..

PEC	Suffix	Name
NT3X09	AA	Remote metallic test access card (4x8)
NT3X09	BA	8x8 metallic test access card

Common procedures

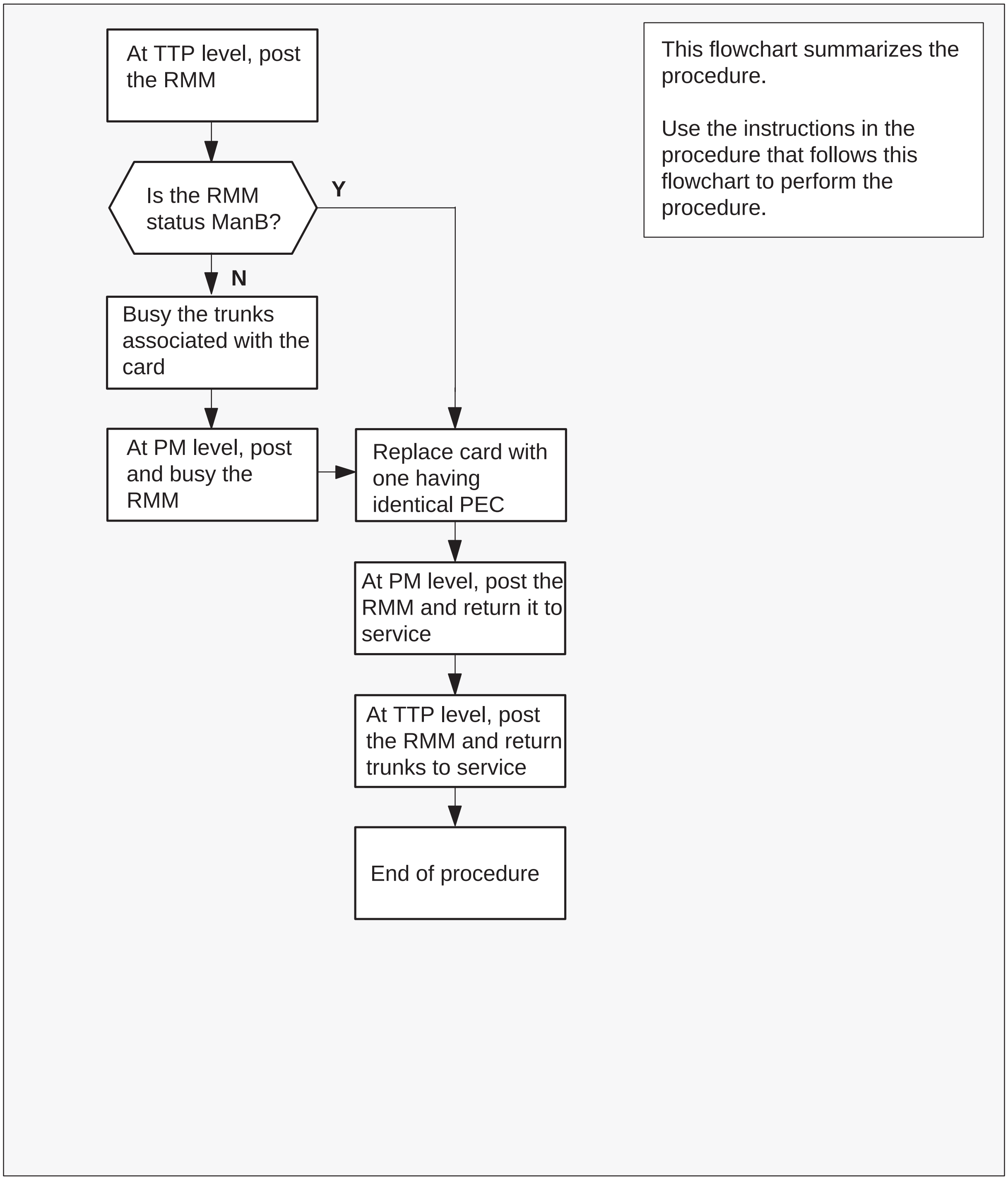
The procedure “Replacing a card” is referenced in this procedure.

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.

NT3X09
RMM (continued)

Summary of card replacement procedure for NT3X09 card RMM



NT3X09
RMM (continued)

Replacing an NT3X09 in an RMM

At the MAP

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At your MAP terminal

2 Access the trunk test position (TTP) level of the MAP display and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
POST  20   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG    MF RMM 0 0  OTWAON23DA00 2001   LO
                                      P_IDL

LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  OTDA00
OK, CLLI POSTED
```

3 Check the status of the RMM.

If RMM status is	Do
ManB, PMB, RMB	step 7
other	step 4

4 Busy the trunks associated with the card to be replaced by typing

>BSY ALL
and pressing the Enter key.

NT3X09
RMM (continued)

5 Go to the peripheral module (PM) level of the MAP display and post the RMM by typing

>PM;POST RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
          SysB     ManB     Offl     CBsy     ISTb    InSv
PM           0        2        2        0        7      21
RMM          0        0        0        0        0       6

RMM       0    InSv
```

At the RMM

6

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Busy the RMM by typing

>BSY
and pressing the Enter key.

7 Replace the NT3X09 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

NT3X09
RMM (continued)

At the MAP terminal

8 Go to the PM level and post the RMM, if not already posted, and return the RMM to service by typing

>PM;POST RMM rmm_no;RTS
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

If RTS	Do
passed	step 9
failed	step 13

9 Go to the TTP level of the MAP display and post the RMM by typing

>TRKS;TTP;POST P RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

10 Return to service the circuits busied in step 4 by typing

>RTS ALL
and pressing the Enter key.

If RTS	Do
passed	step 11
failed	step 13

11 Send any faulty cards for repair according to local procedure.

12 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 14.

NT3X09
RMM (end)

13 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

14 You have completed this procedure.

NT6X17
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X17	AB	Type A line card
NT6X17	BA	World line card

Common procedures

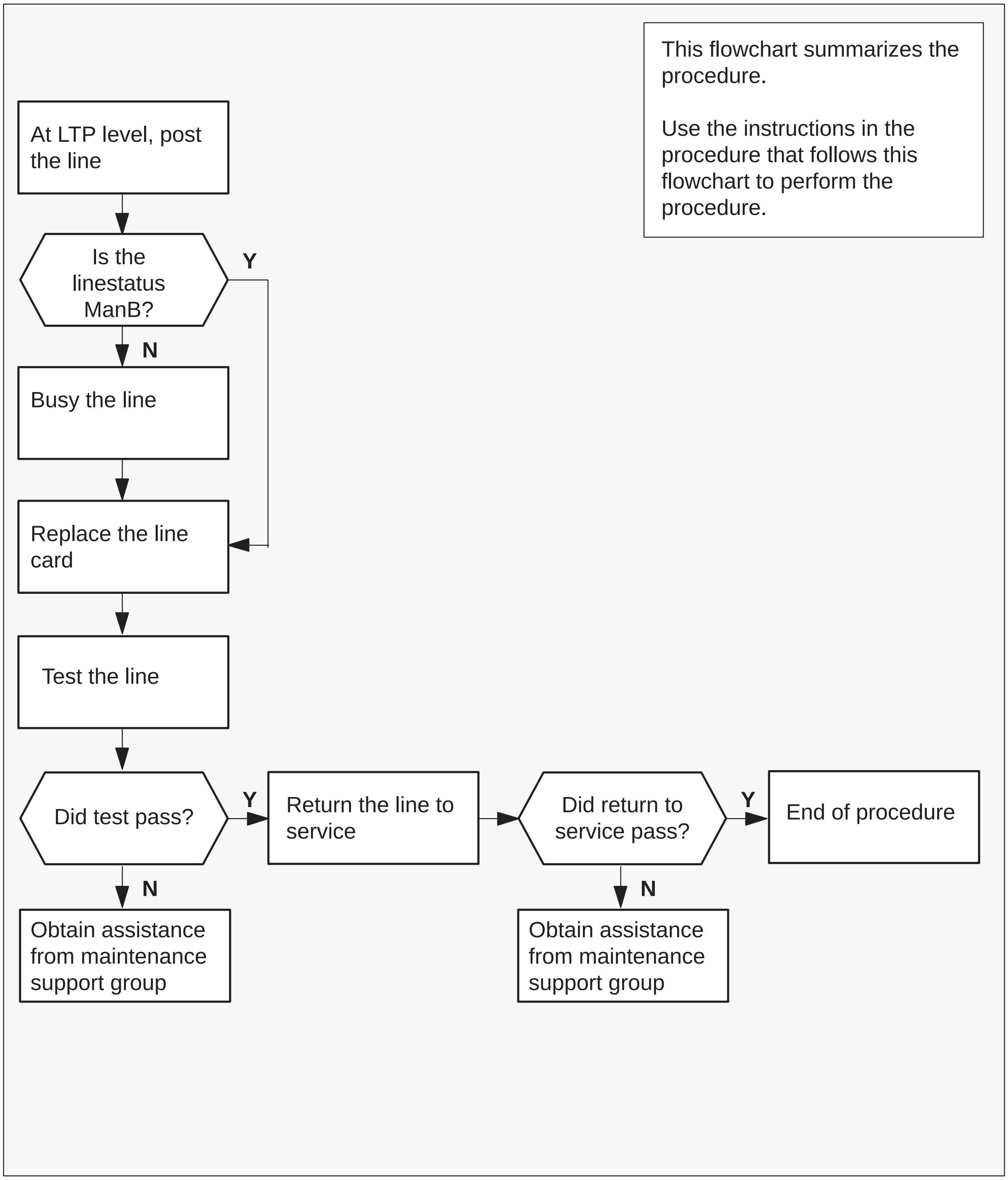
The procedure “Replacing a line card” is referenced in this procedure.

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.

NT6X17
LCM (continued)

Summary of card replacement procedure for an NT6X17 card in an LCM



NT6X17
LCM (continued)

Replacing an NT6X17 in an LCM

At the MAP terminal

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the line test position (LTP) level of the MAP display and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
rlcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN..........  DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY
and pressing the Enter key.

At the LCM

5 Go to the procedure replacing a line card. When you have completed the procedure, return here.

NT6X17
LCM (end)

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 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 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X18
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X18	AA, AB	Line card type B (Coin/Ground Start)
NT6X18	BA	World Line Card Type B

Common procedures

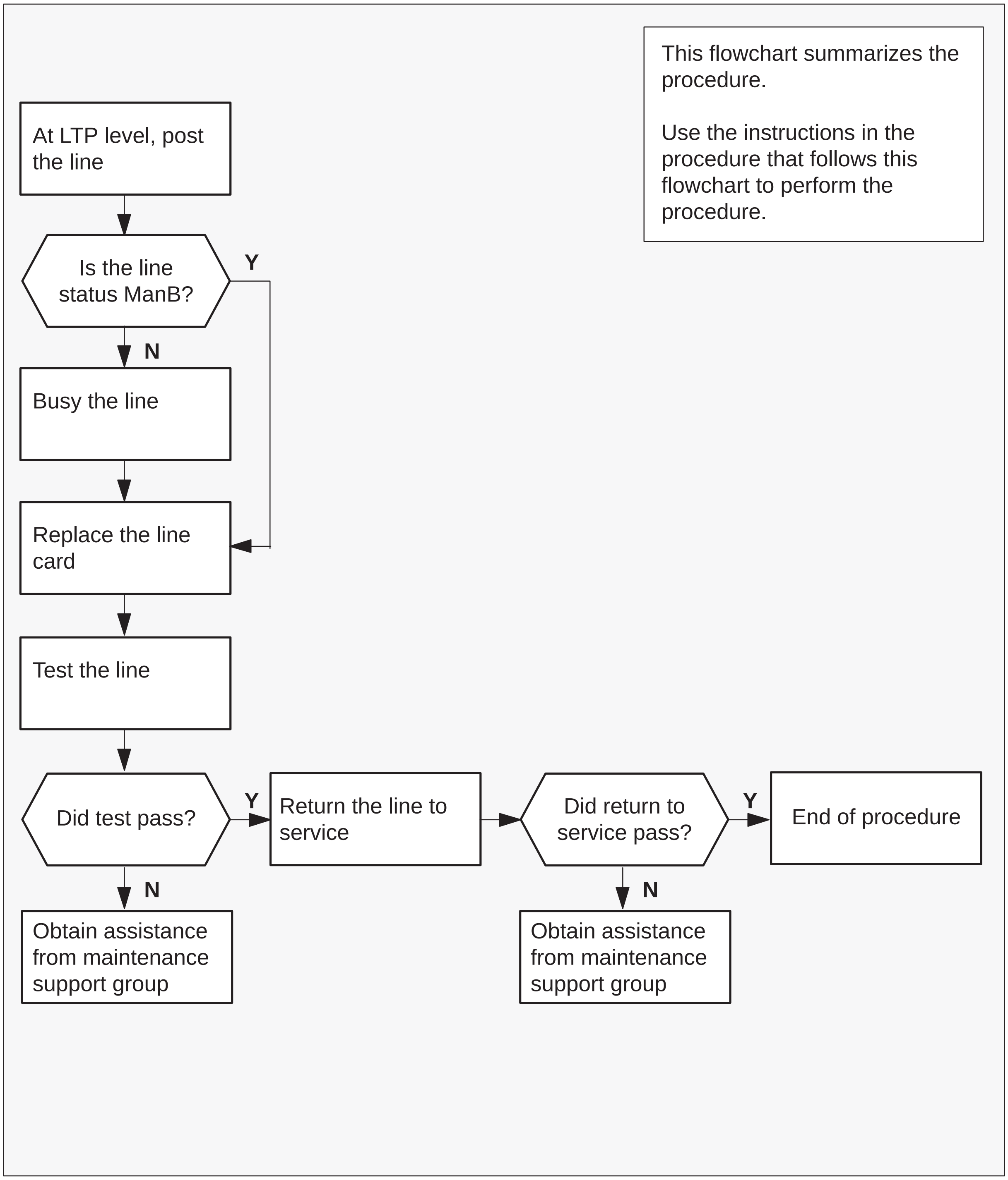
The procedure “Replacing a line card” is referenced in this procedure.

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.

NT6X18
LCM (continued)

Summary of card replacement procedure for an NT6X18 in an LCM



NT6X18
LCM (continued)

Replacing an NT6X18 in an LCM

At the MAP

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

2 Access the line test position (LTP) level of the MAP display and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
rlcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN..........  DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355 MB
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not Man B	step 4

4 Busy the line by typing

>BSY
and pressing the Enter key.

At the LCM

5 Go to the procedure replacing a line card. When you have completed the procedure, return here.

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	Do
passed	step 7
failed	step 10

7

ATTENTION
There is a new diagnostics test for NT6X18AA/AB cards. This NT6X18 card may be good. See the NT6X18 line card description in the general maintenance section of this book for information on running an enhanced diagnostics.

Return the line card to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 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 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

NT6X18
LCM (end)

11 You have successfully completed this procedure.

NT6X19
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X19	AA	Message waiting line card

Common procedures

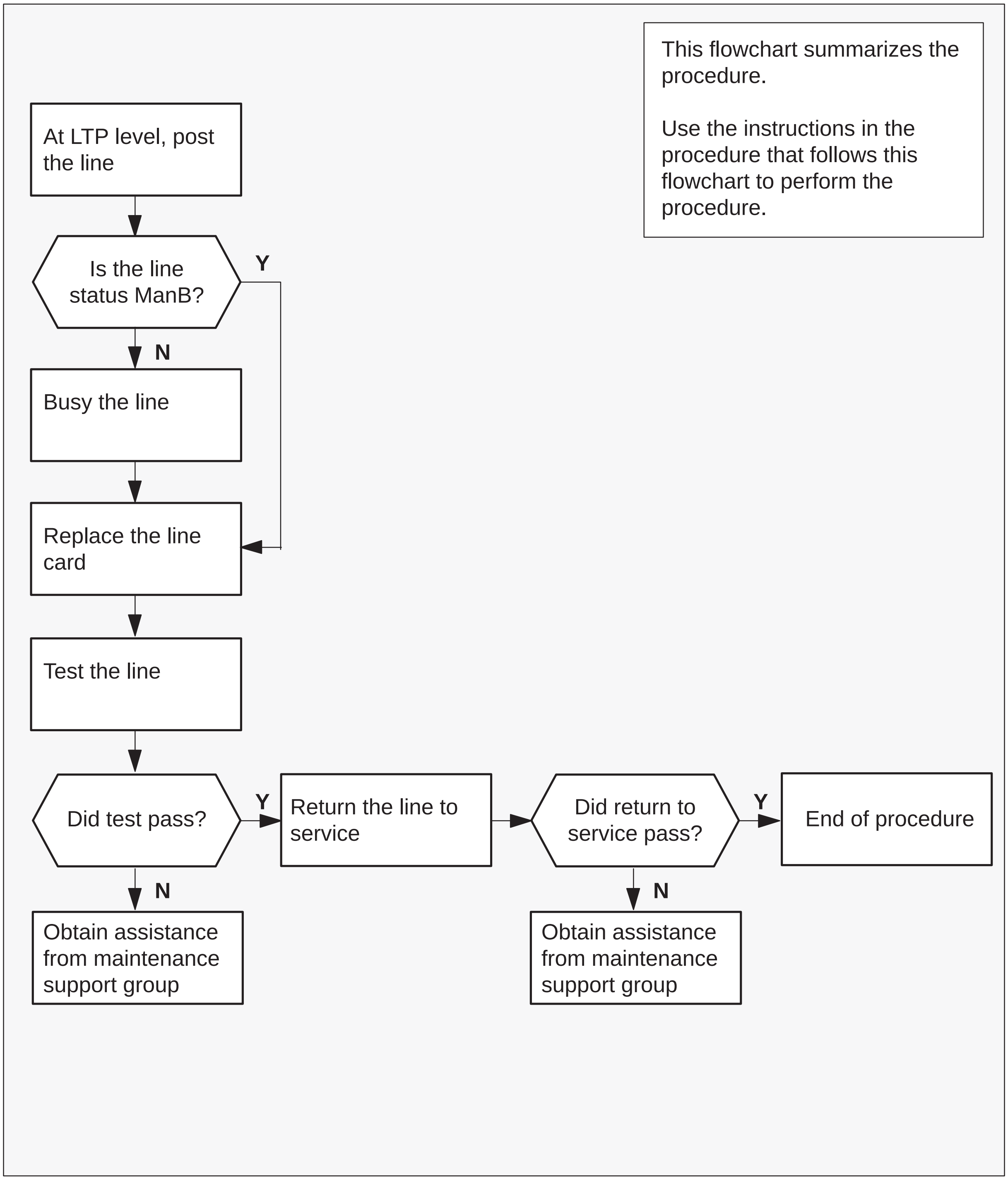
The procedure “Replacing a line card” is referenced in this procedure.

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.

NT6X19
LCM (continued)

Summary of card replacement procedure for NT6X19 card in an LCM



NT6X19
LCM (continued)

Replacing an NT6X19 in an LCM

At your Current Location

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

2 Access the line test position (LTP) level of the MAP terminal and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
rlcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN........  DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03   7213355
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step5
not ManB	step4

4 Busy the line by typing

>BSY
and pressing the Enter key.

At the LCM

5 Go to the procedure “Replacing a line card.” When you have completed the procedure, return here.

NT6X19
LCM (end)

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	Do
passed	step7
failed	step10

7 Return the line card to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step8
failed	step10

8 Send any faulty cards for repair according to local procedure.

9 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 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X20
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X20	AA	Message waiting converter

Common procedures

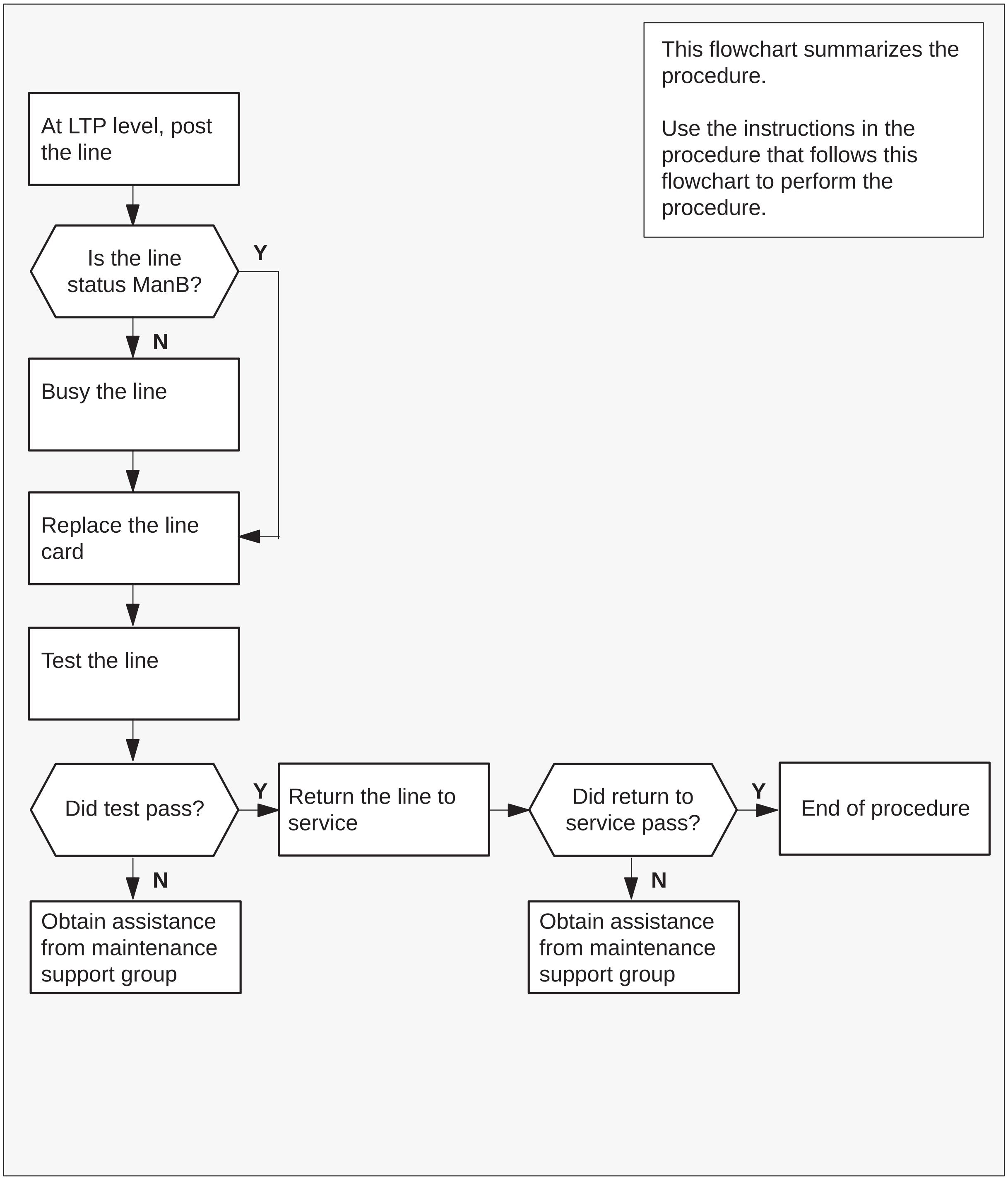
The procedure “Replacing a line card” is referenced in this procedure:

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.

NT6X20
LCM (continued)

Summary of card replacement procedure for NT6X20 card in an LCM



Replacing an NT6X20 in an LCM

At the MAP terminal

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the line test position (LTP) level of the MAP terminal and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
rlcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN........  DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03   NODIRN IDL
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY
and pressing the Enter key.

At the LCM

5 Go to the procedure “Replacing a line card.” When you have completed the procedure, return here.

NT6X20
LCM (end)

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

RTS
and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 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 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X21
LCM

Application

Use this procedure to replace the following card in an ouside plant access cabinet (OPAC) line concentrating module (LCM).

PEC	Suffixes	Name
NT6X21	AA, AB, AC, AD	Line card type C, Meridian Digital Centrex (MDC), electronic business set

Common procedures

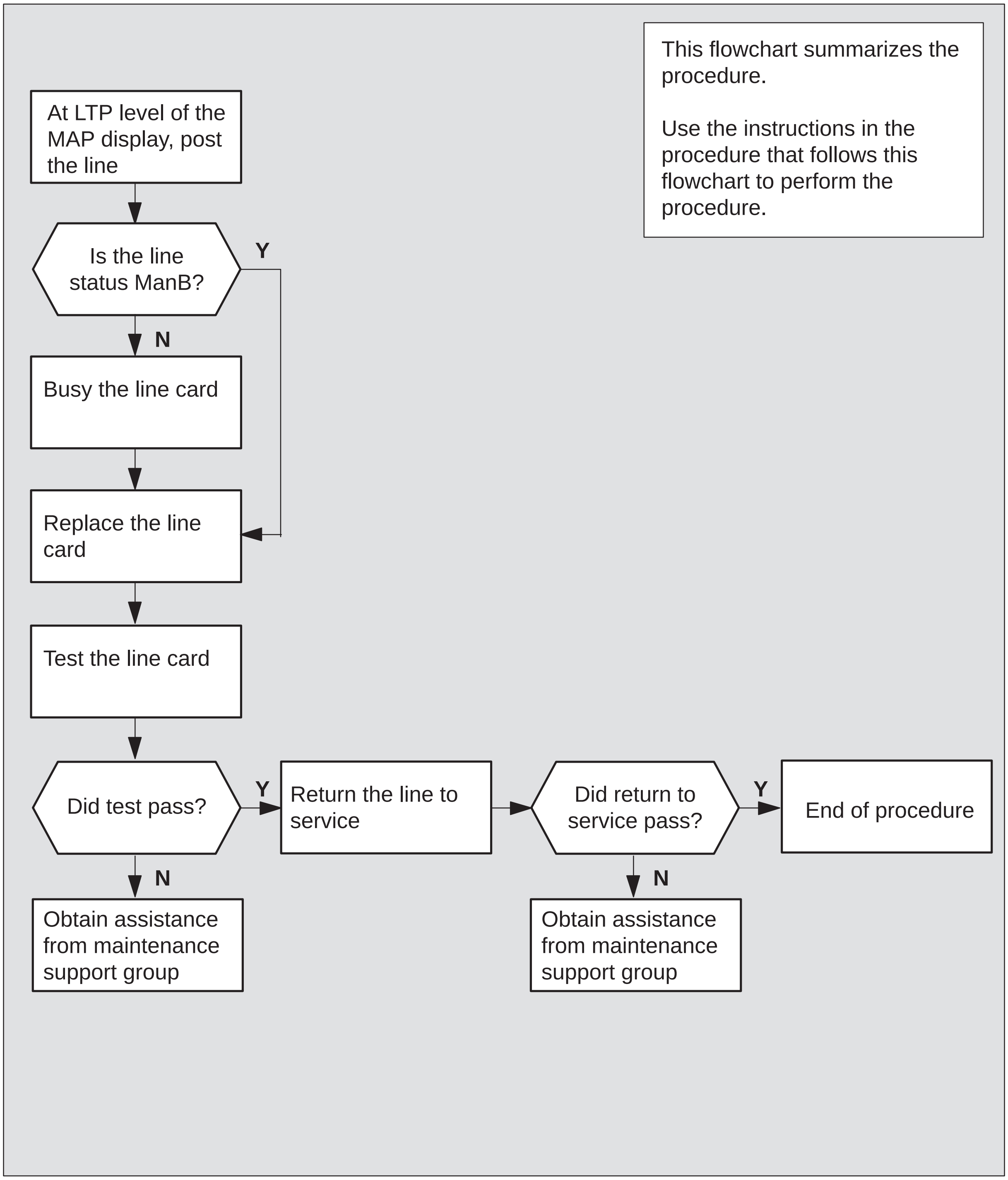
The procedure *Replacing a line card* is referenced in this procedure.

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.

NT6X21
LCM (continued)

Summary of card replacement procedure for NT6X21 card in an LCM



Replacing an NT6X21 in an LCM

At your Current Location

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Make DIP switch changes for the line card.

If the line card code is	Do
AA, AB, AC	step 4
AD	step 3

3 Make DIP switch settings as referenced in the *Maintenance* section of this manual or set them to match the line card being replaced.

At the MAP terminal

4 Access the line test position (LTP) level of the MAP terminal. Post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
lcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP display:

```
LCC PTY RNG .....LEN.......  DN   STA F S LTA TE RESULT
1FR       REM1 00 0 03 03  7213335 MB
```

5 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 7
not ManB	step 6

NT6X21
LCM (continued)

6 Busy the line by typing

>BSY
and pressing the Enter key.

At the LCM

7 Go to the procedure for *Replacing a line card.* When you have completed the procedure, return to this point.

At the MAP terminal

8 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	Do
passed	step 9
failed	step 12

9 Return the line card to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 10
failed	step 12

10 Send any faulty cards for repair according to local procedure.

11 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 13.

12 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

NT6X21
LCM (end)

13 You have successfully completed this procedure.

NT6X45
HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE) shelf.

PEC	Suffix	Name
NTX645	AF	ESA processor

Common procedures

The procedure “Replacing a card” is referenced in this procedure.

Action

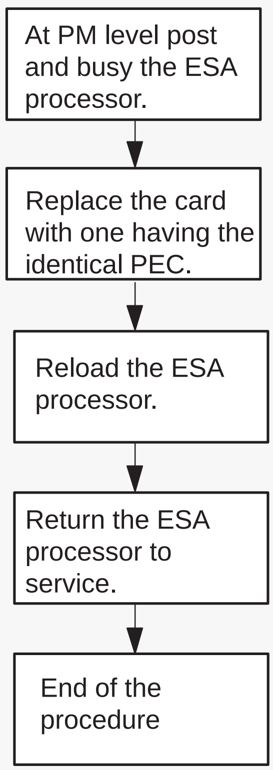
The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X45
HIE (continued)

Summary of card replacement procedure for an NT6X45 card in an HIE

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



NT6X45
HIE (continued)

Replacing an NT6X45 in an HIE

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.

Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6.

Otherwise, continue with step 4.

At the MAP terminal

4 Post the Emergency Stand-Alone (ESA) processor by typing

>MAPCI;MTC;PM;POST ESA esa_no
and pressing the Enter key.

where

esa_no   is the number of the ESA processor

5 Busy the ESA processor by typing

>BSY
and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES
and pressing the Enter key.

At the HIE

6 Replace the NT6X45 card using the procedure replacing a card.

When you have completed the procedure, return here.

7 If you were directed to this procedure from the *Alarm Clearing Procedures*, return to the alarm clearing procedure that directed you here. Otherwise, continue with step 8.

At the MAP terminal

8 Load the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	**Do**
The message `loadfile not found in directory` is received.	step 9
load passes	step 26
load fails	step 29

9 Determine the type of device on which the PM load files are located.

If load files are located on	**Do**
tape	step 10
IOC disk	step 16
SLM disk	step 21

10 Locate the tape that contains the PM load files.

11 Mount the tape on a magnetic tape drive.

12 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

13 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 containing the PM load files

NT6X45
HIE (continued)

14 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

15 Go to step 25.

16 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.

17 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

18 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 16.

19 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

20 Go to step 25.

21 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.

22 Access the disk utility level of the MAP by typing

>DISKUT
and pressing the Enter key.

23 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the file obtained in step 21.

NT6X45
HIE (end)

24 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

25 Reload the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	Do
load failed	step 29
load passed	step 26

26 Return the ESA processor to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 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 30.

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have completed this procedure.

NT6X47
HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE) shelf.

PEC	Suffixes	Name
NT6X47	AC	Master processor memory circuit card (see note below)

Note: This card is also referred to as the ESA memory card.

Common procedures

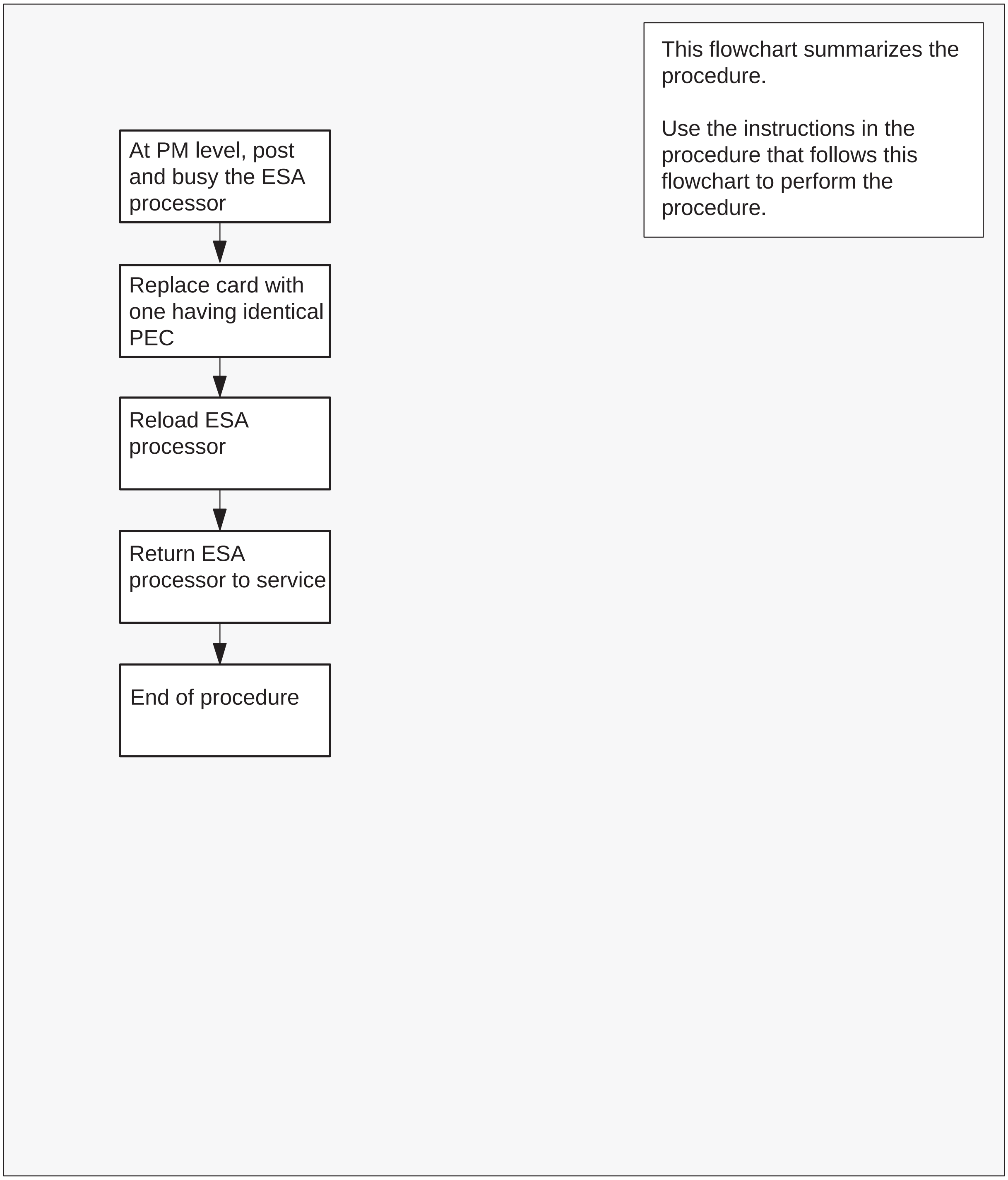
The procedure “Replacing a card” is referenced in this procedure.

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.

NT6X47
HIE (continued)

Summary of card replacement procedure for an NT6X47 in an HIE



NT6X47
HIE (continued)

Replacing an NT6X47 in an HIE

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. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 4.

At the MAP terminal:

4 Post the Emergency Stand-Alone (ESA) processor by typing

>MAPCI;MTC;PM;POST ESA esa_no
and pressing the Enter key.

where

esa_no   is the number of the ESA processor

5 Busy the ESA processor by typing

>BSY
and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES
and pressing the Enter key.

At the OPAC:

6 Replace the NT6X47 card using the procedure “Replacing a card. When you have completed the procedure, return here.

7 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 8.

NT6X47
HIE (continued)

At the MAP terminal

8 Load the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	**Do**
message `loadfile not found in directory` is received	step 9
load passed	step 26
load failed	step 29

9 Determine the type of device where the peripheral module (PM) load files are located.

If load files are located on	**Do**
tape	step 10
IOC disk	step 16
SLM disk	step 21

10 Locate the tape that contains the PM load files.

11 Mount the tape on a magnetic tape drive.

At the MAP terminal:

12 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

13 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 containing the PM load files

NT6X47
HIE (continued)

14 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

15 Go to step 25.

16 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.

17 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

18 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 16.

19 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

20 Go to step 25.

21 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.

22 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

23 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the PM load files obtained in step 21.

NT6X47
HIE (end)

24 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

25 Reload the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	Do
load failed	step 29
load passed	step 26

26 Return the ESA processor to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 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 30.

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have completed this procedure.

NT6X50
HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE) shelf.

PEC	Suffix	Name
NT6X50	AB	DS-1 EFF card (See notes below.)

Note 1: EFF is the acronym for “extended frame format.”

Note 2: This card has also been referred to as the “DS-1 interface card.”

Common procedures

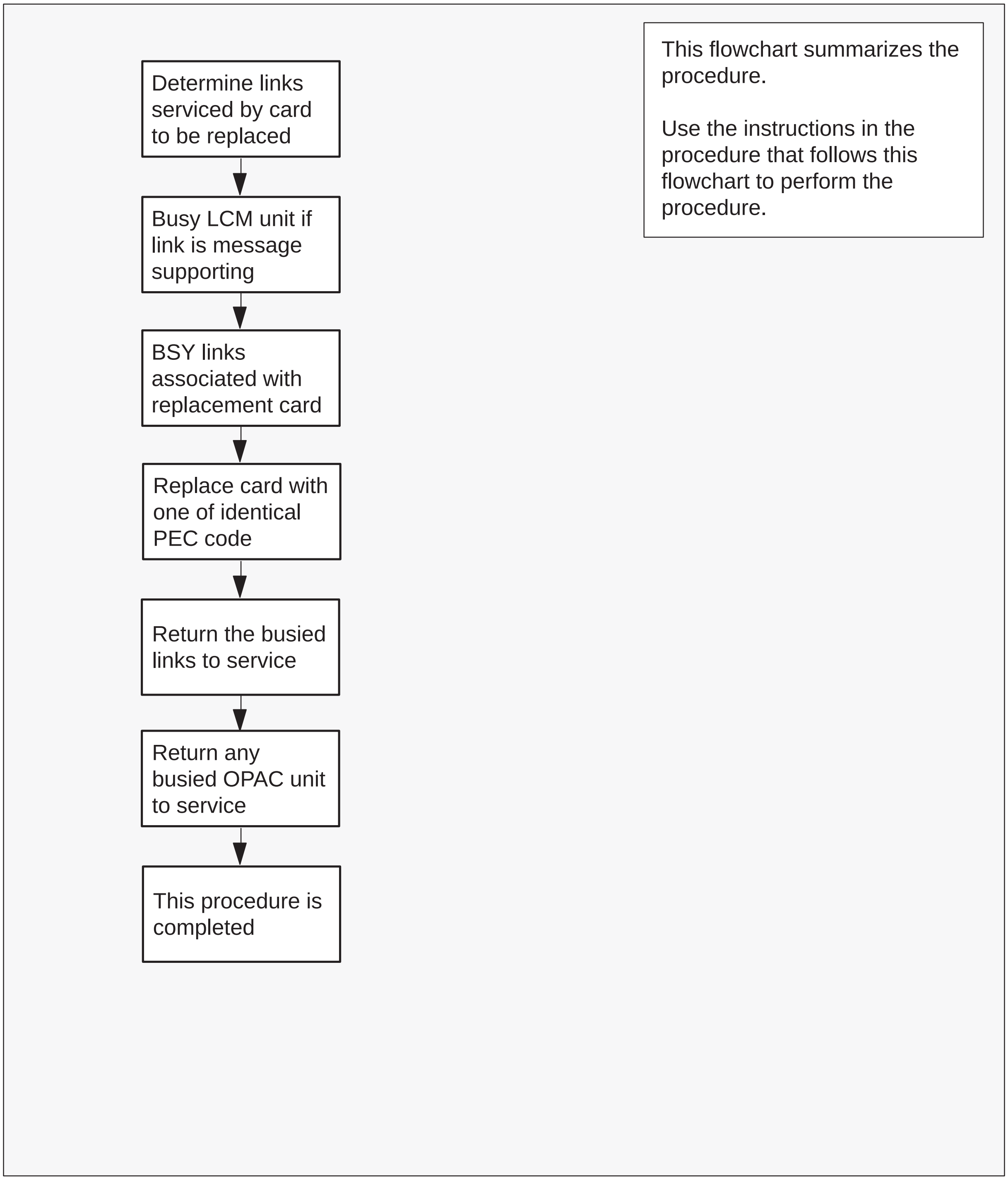
The procedure “Replacing a card” is referenced in this procedure.

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.

NT6X50
HIE (continued)

Summary of card replacement procedure for NT6X50 in an HIE



NT6X50
HIE (continued)

Replacing an NT6X50 in an HIE

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 equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 5. Otherwise, continue with step 4.

At the MAP terminal:

4 Access the peripheral module (PM) level and post the line concentrating module (LCM) by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0–99)
lcm	is the number of the LCM

5 Display central side (C-side) link information by typing

>TRNSL C
and pressing the Enter key.

Example of a MAP response:

```
Link 0: LTC 0       2; Cap MS; Status:   OK;MsgCond: OPN
Link 1: LTC 0       6; Cap MS; Status: SysB;MsgCond: OPN
```

6 From the display in step 5, determine the control side (C-side) PM (LTC, LGC, or RCC) to which the OPAC is connected and post it by typing

>POST pm pm_no
and pressing the Enter key.

where

pm	is the name of the host PM (LTC, LGC, or RCC)
pm_no	is the number of the host PM (0 to 127)

Note: LTC is the acronym for line trunk controller; LGC is the acronym for line group controller; and RCC is the acronym for remote cluster controller.

NT6X50
HIE (continued)

7 Display P-side link information by typing

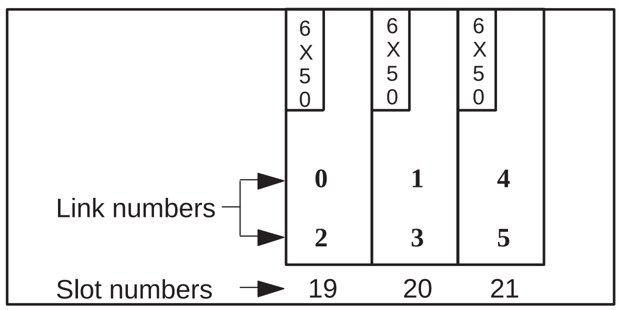
>TRNSL P
and pressing the Enter key.

Example of a MAP response:

```
Link 2: LCM REM1 00 0  0;Cap MS;Status:  OK;MsgCond:OPN
Link 6: LCM REM1 00 0  1;Cap MS;Status:SysB;MsgCond:CLS
```

8 Record the numbers of the links with status not OK.

9 Use the diagram below to determine which DS-1 interface card or cards corresponds to the links identified as faulty in step 8. Note that each NT6X50 card has 2 ports.



Note: Links 0 and 1 are message supporting, links 2 through 5 are speech only.

10 Determine the slot location of the faulty card.

If faulty card is in slot	Do
19 or 20 of the HIE	step 11
21 of the HIE	step 14

11 Post the LCM by typing

>POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0–99)
lcm	is the number of the LCM

NT6X50
HIE (continued)

12 Busy LCM unit 0 for the card in slot 19 or LCM unit 1 for the card in slot 20 by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no is the LCM unit to be busied (0 or 1)

Note: Extended DS-1 maintenance is applied to DS-1 message supporting links, the unit these links support must be manually busied before the DS-1 link can be busied.

13 Post the host peripheral module (LTC, LGC, or RCC) to which the OPAC is connected by typing

POST pm pm_no
and pressing the Enter key.

where

pm is the name of the host PM (LTC, LGC, or RCC)
pm_no is the number of the host PM (0 to 127)

14 Using the information collected in step 8, busy both links associated with the faulty card by typing

>BSY LINK link_no
and pressing the Enter key.

where

link_no is one of two links associated with the faulty NT6X50 card

Repeat this entry for the other link associated with the faulty NT6X50 card.

At the HIE:

15

WARNING
Calls in progress may be interrupted.
Wait at least 15 min to allow calls in progress to be completed before removing the NT6X50 DS-1 interface card, because these are simplex links.

Chane the dip switch settings on the new replacement card to match the faulty card being removed.

16 Replace the NT6X50 card using the procedure “Replacing a card. When the card has been replaced, Go to step 17.

NT6X50
HIE (continued)

At the MAP terminal:

17 Test the links busied in step 14 by typing

>TST LINK link_no
and pressing the Enter key.

where

link_no is one of two links associated with the replacement card

Repeat this entry for the other link associated with the replacement card.

If test	Do
failed	step 25
passed	step 18

18 Return to service the links busied in step 14 by typing

>RTS LINK link_no
and pressing the Enter key.

where

link_no is one of two links associated with the replacement card

Repeat this entry for the other link associated with the replacement card.

If RTS	Do
failed	step 25
passed	step 19

19 Determine if there are remaining links to clear.

If there are	Do
remaining links to clear	step 9
no remaining links to clear	step 20

20 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 21.

NT6X50
HIE (end)

21 Post the LCM by typing

>POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0–99)
lcm	is the number of the LCM

22 Return-to-service the LCM unit busied in step 12 by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the LCM unit to be RTSed (0 or 1).

If RTS	Do
failed	step 25
passed	step 23

23 Send any faulty cards for repair according to local procedure.

24 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Proceed to step 26.

25 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

26 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X51
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X51	AB, AC	Extended LCM processor

Common procedures

The procedure “Replacing a card” is referenced in this procedure.

Action

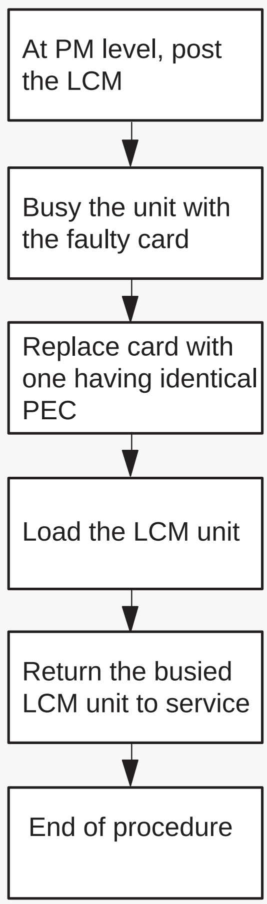
The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X51
LCM (continued)

Summary of card replacement procedure for NT6X51 card in an LCM

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



NT6X51
LCM (continued)

Replacing an NT6X51 in an LCM

> **ATTENTION**
> 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.

At your Current Location

1

> **CAUTION**
> **Loss of service**
> This procedure includes directions to manually busy one or more peripheral module (PM) units. Since manually busying a PM unit can cause service degradation, perform this procedure only if necessary to restore out-of-service components. Otherwise, carry out this procedure during periods of low traffic.

Obtain 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.

2 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 3.

At the MAP terminal

3 Access the peripheral module (PM) level and post the LCM by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC
frame	is the frame number of the OPAC (0 to 99)
lcm	is the number of the LCM

NT6X51
LCM (continued)

4 Determine the state of the PM unit associated with the card you are replacing.

If the state of the PM unit is	Do
SysB , CBsy, ISTb, InSv	step 5
ManB	step6
Offl	step 30

5 Busy the LCM unit containing the faulty card by typing

>BSY UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit   is the LCM unit to be busied (0 or 1)

At the LCM

6

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.

Go to the procedure “Replacing a card” to replace the NT6X51 card. When the card is replaced, return to this step.

7 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 8.

NT6X51
LCM (continued)

At the MAP terminal

8 Load the LCM unit by typing

>LOADPM UNIT lcm_unit CC
and pressing the Enter key.

where

lcm_unit   is the LCM unit to be loaded (0 or 1)

If	Do
message loadfile not found in directory is received	step 9
load passed	step 26
load failed	step29

9 Determine the type of device on which the PM load files are located.

If load files located on	Do
tape	step10
IOC disk	step16
SLM disk	step 21

10 Locate the tape that contains the PM load files.

At the IOE frame

11 Mount the tape on a magnetic tape drive.

At the MAP display

12 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no   is the number of the tape containing the PM load files

13 List the contents of the tape in your user directory by typing

>LIST T tape_no
and pressing the Enter key.

NT6X51
LCM (continued)

where

tape_no is the number of the tape containing the PM load files

14 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

15 Go to step 25.

16 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.

17 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

18 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 16.

19 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

20 Go to step 25.

21 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.

22 Access the disk utility level of the MAP terminal by typing

>DISKUT
and pressing the Enter key.

23 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

NT6X51
LCM (continued)

file_name is the name of the SLM disk volume containing the file to be loaded, obtained in step 21.

24 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

25 Reload the LCM unit by typing

>LOADPM UNIT lcm_unit CC
and pressing the Enter key.

where

lcm_unit is the LCM unit to be loaded (0 or 1)

If	Do
load failed	step 29
load passed	step 26

26 Return the LCM unit to service by typing

>RTS UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM busied in step 5 (0 or 1)

If RTS	Do
passed	step27
failed	step29

27 Send any faulty cards for repair according to local procedure.

28 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 31.

NT6X51
LCM (end)

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 Consult office personnel to determine why the component is offline. Continue as directed by office personnel.

31 You have successfully completed this procedure.

NT6X52
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X52	AA, AB	Digroup control card

Common procedures

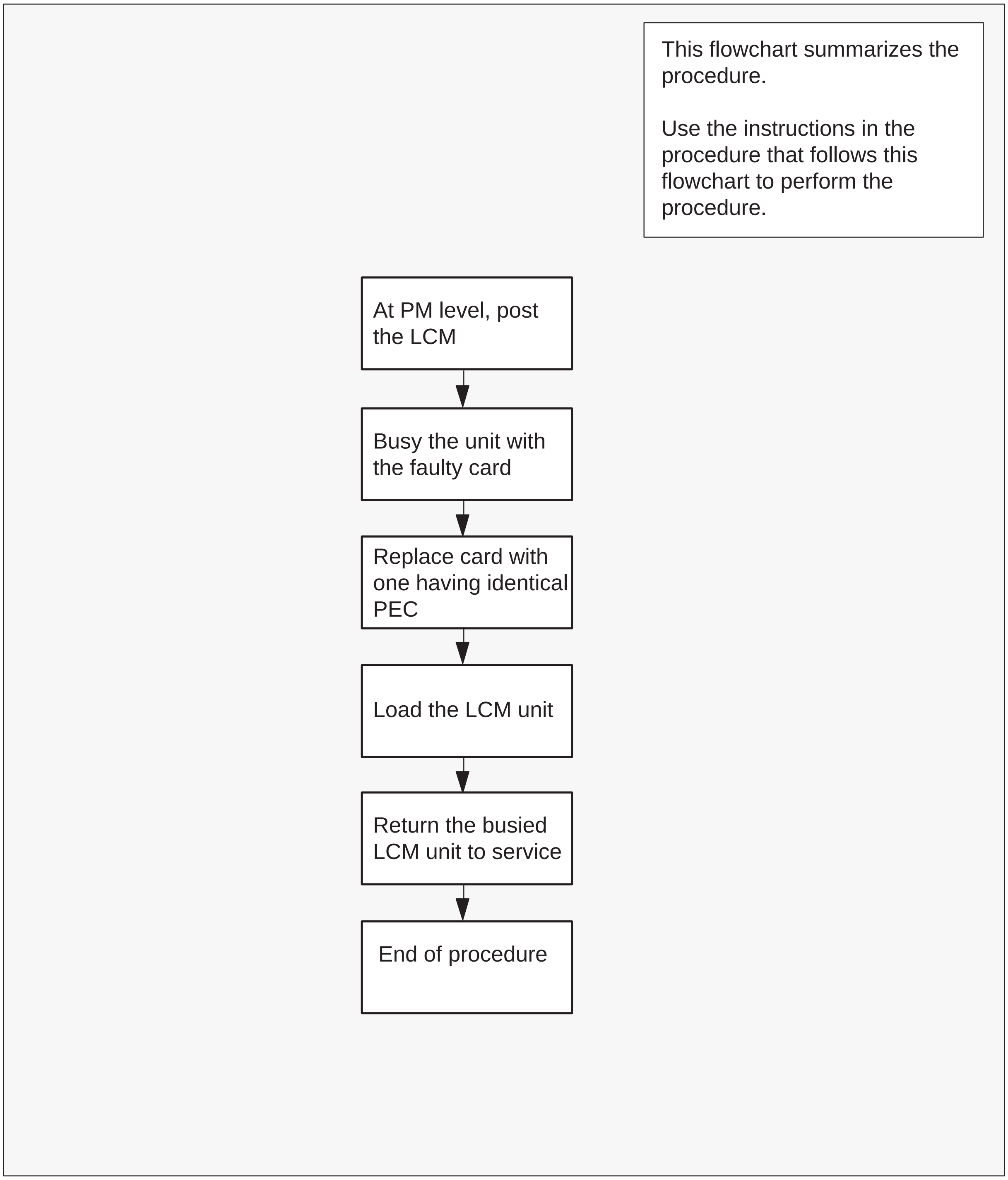
The procedure "Replacing a card" is referenced in this procedure.

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.

NT6X52
LCM (continued)

Summary of card replacement procedure for NT6X52 card in an LCM shelf



NT6X52
LCM (continued)

Replacing an NT6X52 in an LCM

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 equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 4.

At the MAP terminal

4 Access the peripheral module (PM) level and post the LCM by typing

MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC
frame	is the frame number of the OPAC (0 to 99)
lcm	is the number of the LCM

5 Busy the LCM unit containing the faulty card by typing

BSY UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit	is the LCM unit to be busied (0 or 1)

At the LCM

6 Replace the NT6X52 card using the procedure Replacing a card.

7 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 8.

NT6X52
LCM (continued)

8 Load the LCM unit by typing

LOADPM UNIT lcm_unit CC
and pressing the Enter key.

where

lcm_unit is the LCM unit to be loaded (0 or 1)

If	Do
message loadfile not found in directory is received	step 9
load passes	step 26
load fails	step 29

9 Determine the type of device on which the PM load files are located.

If load files located on	Do
tape	step10
IOC disk	step16
SLM disk	step 21

10 Locate the tape that contains the PM load files.

11 Mount the tape on a magnetic tape drive.

12 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

13 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 containing the PM load files

NT6X52
LCM (continued)

14 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

15 Go to step 25.

16 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.

17 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

18 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 16.

19 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

20 Go to step 25.

21 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.

22 Access the disk utility level of the MAP terminal by typing

>DISKUT
and pressing the Enter key.

23 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the file to be loaded, obtained in step 21.

NT6X52
LCM (continued)

24 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

25 Reload the LCM unit by typing

>LOADPM UNIT lcm_unit CC
and pressing the Enter key.

where

lcm_unit is the LCM unit to be loaded (0 or 1)

If	Do
load failed	step 29
load passed	step 26

26 Return the LCM unit to service by typing

>RTS UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM busied in step 5 (0 or 1)

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 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 30.

NT6X52
LCM (end)

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have successfully completed this procedure.

NT6X53
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X53	AA	Power converter (5V/15V)

Common procedures

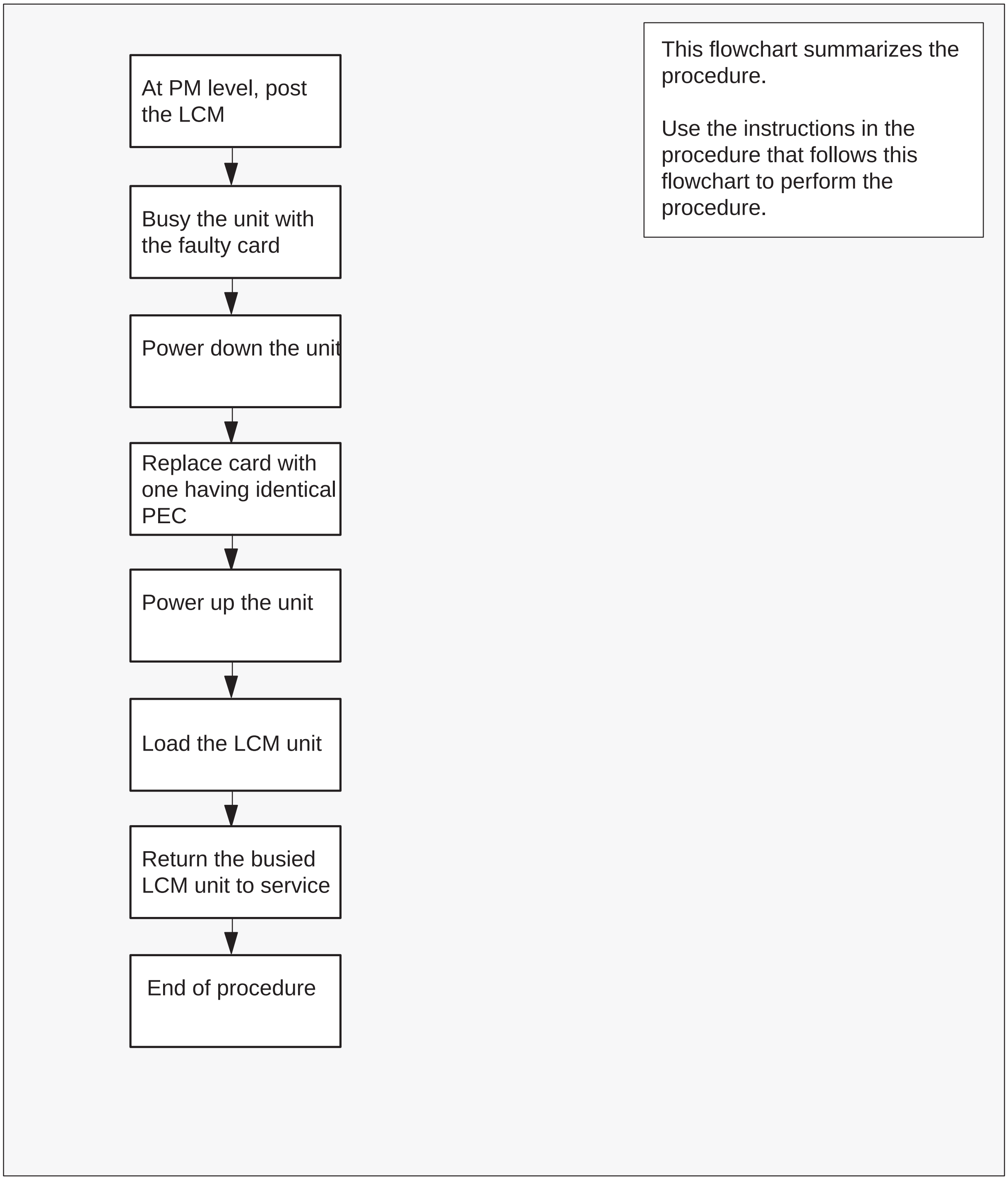
The procedure “Replacing a card” is referenced in this procedure.

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.

NT6X53
LCM (continued)

Summary of card replacement procedure for an NT6X53 in an LCM



NT6X53
LCM (continued)

Replacing an NT6X53 in an LCM

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 equipment code (PEC), including suffix, as the card that is to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 4.

At the MAP terminal

4 Access the peripheral module (PM) level and post the LCM by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site is the site name of the OPAC
frame is the frame number of the OPAC (0 to 511)
lcm is the number of the LCM

5 Busy the LCM unit containing the faulty card by typing

>BSY UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM unit to be busied (0 or 1)

At the OPAC site

6 Turn the circuit breaker off for the unit in which the power converter is being replaced. Use the table below to determine which MSP circuit breaker serves the unit.

Circuit breaker	Unit	Locations
CB1	LCA 0	Bay 0 slot 19–02
CB3	LCA 1	Bay 0 slot 32–02

7 Replace the NT6X53 card using the procedure Replacing a card.

8 Power up the NT6X53 converter just inserted.

Determine the correct MSP switch for the shelf in which the power converter was replaced from the diagram below. The switches are numbered corresponding to the shelf position.

Circuit breaker	Unit FED	Locations
CB1	LCA 0	Bay 0 slot 19–02
CB3	LCA 1	Bay 0 slot 32–02

Turn the circuit breaker on for the unit with the new power converter.

- The converter fail LED on the converter will be extinguished.
- The frame fail lamp on the converter will be extinguished.

9 If you were directed to this procedure from the *Alarm Clearing Procedure* return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 10.

At the MAP terminal

10 Load the LCM unit by typing

>LOADPM UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM unit to be loaded (0 or 1)

If	Do
message loadfile not found in directory is received	step11
load passed	step28
load failed	step 31

NT6X53
LCM (continued)

11 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step12
IOC disk	step18
SLM disk	step 23

12 Locate the tape that contains the PM load files.

13 Mount the tape on a magnetic tape drive.

14 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

15 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 containing the PM load files

16 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

17 Go to step 27.

18 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.

19 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

20 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

21 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

22 Go to step 27.

23 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.

24 Access the disk utility level of the MAP terminal by typing

>DISKUT
and pressing the Enter key.

25 List the SLM file names into your user directory by typing

>LV CM;LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the file to be loaded

26 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

27 Reload the LCM unit by typing

>LOADPM UNIT lcm_unit CC
and pressing the Enter key.

where

lcm_unit is the LCM unit to be loaded (0 or 1)

If	Do
load failed	step 31
load passed	step 28

NT6X53
LCM (end)

28 Return the LCM unit to service by typing

>RTS UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM busied in step 5 (0 or 1)

If RTS	Do
passed	step 29
failed	step 31

29 Send any faulty cards for repair according to local procedure.

30 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 32.

31 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

32 You have successfully completed this procedure.

NT6X54
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X54	AA	Bus interface card (BIC)
NT6X54	DA	ISDN drawer controller (IDC) card (BIC) ***Note:*** Peripherals with ISDN line drawer for remotes (ILDR) must use the NT6X54DA card. ILDR is first available for remote switching center-SONET (RSC-S) and remote switching center (RSC) configurations in the NA007/XPM08 timeframe. ILDR is first available for remote line concentrating module (RLCM), outside plant module (OPM), and outside plant access cabinet (OPAC) configurations in the NA008/XPM81 timeframe.

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.

NT6X54
LCM (continued)

Summary of card replacement procedure for NT6X54 card in an LCM

At PM level, post the LCM

↓

Busy LSGs of drawer containing faulty card

↓

Remove –48, +15, and +5 volt fuses

↓

Replace the faulty card with one of same PEC

↓

Replace +5, +15, and –48 volt fuses

↓

Return the drawer to service

↓

End of procedure

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Replacing an NT6X54 in an LCM

At your Current Location

1

> **ATTENTION**
> If you are entering this procedure due to a loss of power in the LCM's controller (LGC/LTC/RCC), check logutil for PM181 log with reason text of: `DCC BIC Looparound` and go to step 10.

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 equipment code (PEC), including suffix, as the card that is to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 10. Otherwise, continue with step 4.

At the MAP terminal

4 Access the peripheral module (PM) level of the MAP (maintenance and administration position) display and post the LCM by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name (alphanumeric) of the OPAC
frame	is the frame number (0 through 511) of the OPAC
lcm	is the number (0 through 511) of the LCM

NT6X54
LCM (continued)

Example of a MAP display:

```
 CM    MS    IOD    Net    PM   CCS   LNS   Trks    Ext    Appl
  .     .     .      .    1LCM   .      .     .      .      .

LCM            SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM    0        1        0        0        0       130
 2 Post_   LCM   0        1        0        0        0         0
 3
 4 SwRg          LCM   Rem1  OO 0 ISTb   Links_OOS: CSide 0 PSide 0
 5 Trnsl         Unit-0:  InSv  Mtce       /RG:  0
 6 Tst           Unit-1:  InsV  Mtce       /RG:  0
 7 Bsy                              11 11 11 11 11 RG:Pref:0 InSv
 8 RTS           Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL                .. .. SS .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

Note: ILDR drawers are identified in reverse video on the MAP display.

5 Determine whether or not you need to access the ILD level on the MAP terminal.

If the card you are replacing is	Do
NT6X54DA	step 6
NT6X54AA	step 9

6 Access the ILD level on the MAP terminal by typing

>ILD
and pressing the Enter key.

7 Post the ILDR drawer in which the card is being replaced by typing

>POST drawer_no
and pressing the Enter key.

where

drawer_no   is the ILD drawer number (0 through 19) in the LCM

NT6X54
LCM (continued)

8 Busy both line subgroups associated with the LCM drawer in which the card is being replaced by typing

>BSY DRWR
and pressing the Enter key.

Example of a MAP response;

```
Please confirm (“YES,” “Y,” “NO,” or “N”):
```

Confirm the system prompt by typing

>YES
and pressing the Enter key.

Go to step 10.

9 Busy both line subgroups associated with the LCM drawer in which the card is being replaced by typing

>BSY DRWR lsg
and pressing the Enter key.

where

lsg is one of two line subgroups (0 through 19) associated with the drawer

Example of a MAP response;

```
LCM REM1 00 0  Drwr 4 will be taken out of service
Please confirm (“YES,” “Y,” “NO,” or “N”):
```

Confirm the system prompt by typing

>YES
and pressing the Enter key.

Note: Repeat this step for the other line subgroup associated with the line drawer.

Example of a MAP display:

```
 CM    MS    IOD    Net    PM   CCS   LNS   Trks    Ext    Appl
  .     .     .      .    1LCM   .      .     .      .      .

LCM            SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM    0        1        0        0        0       130
 2 Post_   LCM   0        1        0        0        0         0
 3
 4 SwRg         LCM   Rem1  OO O ISTb   Links_OOS: CSide 0 PSide 0
 5 Trnsl        Unit-0:  InSv  Mtce       /RG:  0
 6 Tst          Unit-1:  InsV  Mtce       /RG:  0
 7 Bsy                               11 11 11 11 11 RG:Pref:0 InSv
 8 RTS          Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL               .. .. MM .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the OPAC

10 Remove the –48V fuse for the line drawer containing the faulty bus interface card.

11 Remove the +15V fuse for the line drawer containing the faulty bus interface card.

12 Remove the +5V fuse for the line drawer containing the faulty bus interface card.

If entry into this procedure is due to	Do
replacement of BIC	step 13
loss of power in LCM’s controller	step 17

NT6X54
LCM (continued)

13

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 (FSP) of the RLCM. This protects the equipment against damage caused by static electricity.

WARNING
Card damage—transport
Take the following precautions to protect circuit cards from electrical and mechanical damage during transport:

When handling a circuit card not in an electrostatic discharge (ESD) protective container, stand on a conductive floor mat. Wear a wrist strap connected, through a 1-megohm resistor, to a suitably grounded object, such as a metal workbench or a DMS switch cabinet (Nortel [Northern Telecom] Corporate Standard 5028). Store and transport circuit cards in an ESD protective container.

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.

NT6X54
LCM (continued)

> **WARNING**
> **Hot materials**
> Exercise care when handling the line card. The line feed resistor may be very hot.

Put on a wrist strap.

14 Open the line drawer by following these substeps:

a. Face the drawer shelf and grasp the lip at the bottom of the drawer.

b. Push up on the drawer latch with your thumb and pull the drawer out approximately 15.0 cm (about 6.0 in).

15 Remove the BIC to be replaced by following these substeps:

a. Open the locking levers on the BIC.

b. Grasping the open locking levers, remove the card from the line drawer in one steady motion. The card will unplug from its socket.

Note: Do not use a rocking motion to remove the card.

16 Replace the faulty card by following these substeps:

a. Remove the replacement card from the ESD container.

b. Open the locking levers on the card.

c. Position the card in its backplane socket. In one steady motion, push against the top and bottom of the card with your thumbs until the card plugs fully into the backplane socket, close and lock the locking levers.

Note: Do not use a rocking motion to insert the card.

d. Close the line drawer.

17 Replace the +5V fuse for the line drawer containing the faulty bus interface card.

18 Replace the +15V fuse for the line drawer containing the faulty bus interface card.

19 Replace the –48V fuse for the line drawer containing the faulty bus interface card.

20 If you were directed to this procedure from the *Alarm Clearing Procedures,* return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 21.

At the MAP terminal

21 Determine which procedure to use to return the line subgroups to service.

If the card you are replacing is	Do
NT6X54AA	step 22
NT6X54DA	step 23

22 Return the line subgroups to service by typing

>RTS DRWR lsg
and pressing the Enter key.

where

lsg is one of two line subgroups (0 through 19) associated with the drawer

Note: Repeat this step for the other line subgroup associated with the line drawer.

If RTS	Do
passed	step 24
failed	step 26

23 Return the line subgroups to service by typing

>RTS DRWR
and pressing the Enter key.

If RTS	Do
passed	step 24
failed	step 26

24 Send any faulty cards for repair according to local procedure.

NT6X54
LCM (end)

25 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 27.

26 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

27 You have successfully completed this procedure.

NT6X60
HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE).

PEC	Suffixes	Name
NT6X60	AA, BA, CA,DA	North American ring generator (RG)

Common procedures

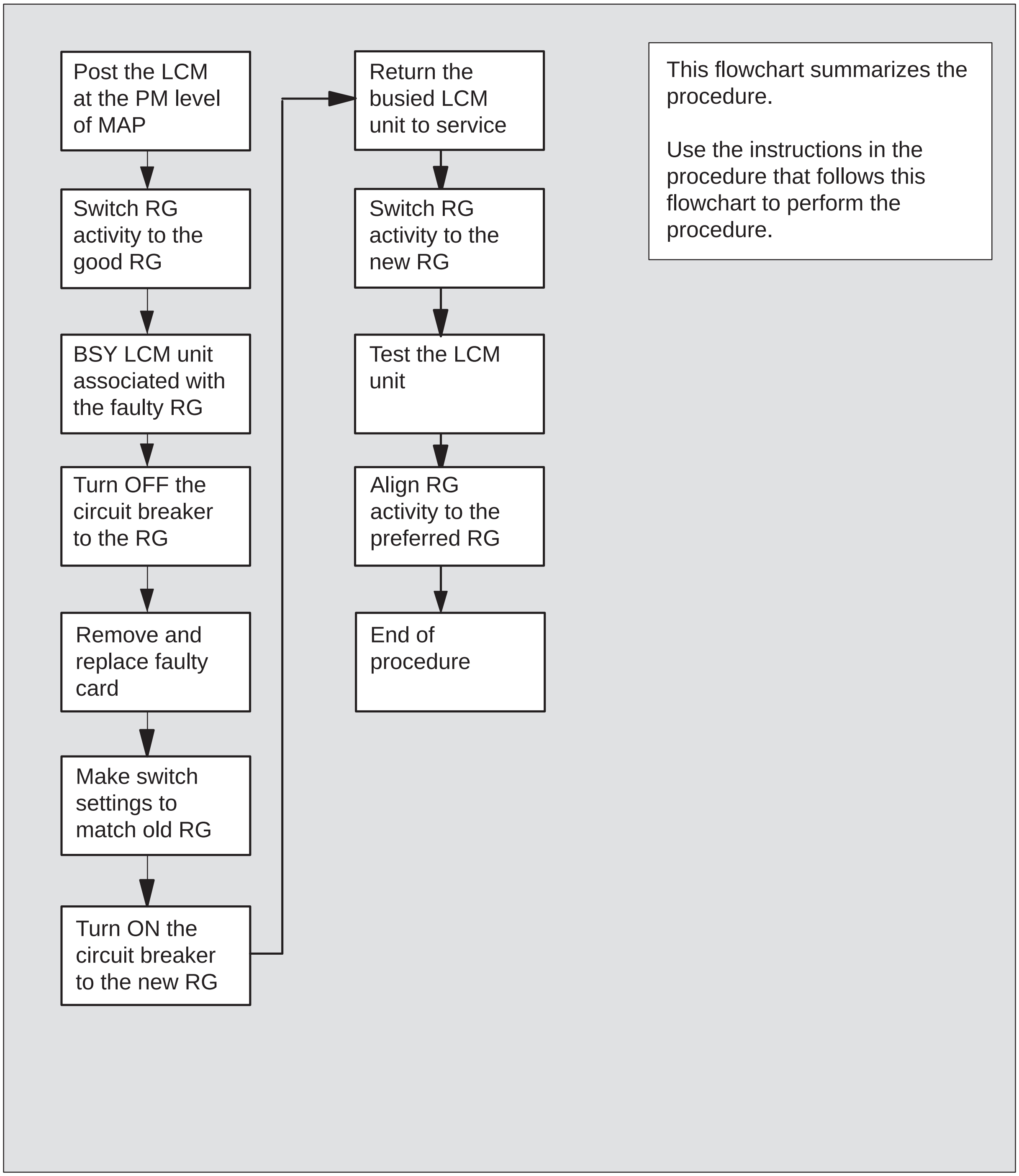
None

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.

NT6X60
HIE (continued)

Summary of card replacement procedure for NT6X60 card in an HIE



Replacing an NT6X60 in an HIE

At your Current Location

1

> **CAUTION**
> **Loss of service**
> This procedure includes directions to manually busy one or more peripheral module (PM) units. Since manually busying a PM unit can cause service degradation, perform this procedure only if necessary to restore out-of-service components. Otherwise, carry out this procedure during periods of low traffic.

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 equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 9. Otherwise, continue with step 4.

At the MAP terminal

4 Post the line concentrating module (LCM) with the HIE shelf containing the card to be replaced by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (00–511)
lcm	is the number of the LCM in the OPAC cabinet

Example of a MAP response:

```
LCM REM1 00 0 ISTb Links  OOS: Cside 0 Pside 0
Unit 0: ISTb      /RG:1
Unit 1: InSv      /RG:1
                           11  11  11  11  11  RG: Pref 0 ISTb
Drwr:  01  23  45  67  89  01  23  45  67  89      Stby 1 InSv
       ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
```

NT6X60
HIE (continued)

5 Determine the line concentrating array (LCA) associated with the NT6X60 card to be replaced by using the following table.

LCM unit	RG card	HIE slot
LCA–0	RG–0	1, 2, 3, 4
LCA–1	RG–1	5, 6, 7, 8

6 Check the state of the PM units.

If the PM units are	Do
`OFFL or SysB`	step 8
One unit is `InSv or ISTb` the other unit is `ISTB or SysB`	step 7

7 Switch RG activity for the LCM unit assigned to the faulty RG by typing

>SWRG UNIT unit_no
and pressing the Enter key.

where

unit_no is the PM unit number (0 or 1)

Example of a MAP response:

```
LCM REM1 00 0 Unit 0 SWRG Passed
```

8 Busy the LCM unit associated with the faulty RG by typing

>BSY UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM unit to be busied (0 or 1)

At the MSP

9 Turn OFF the circuit breaker for the ringing generator to be replaced by using the information in the following table:

Circuit breaker	Ringing generator	Locations
CB06	RG–0	HIE slots 1, 2, 3, 4
CB08	RG–1	HIE slots 5, 6, 7, 8

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 modular supervisory panel of the OPAC cabinet. This protects the equipment against damage caused by static electricity.

> **WARNING**
> **Equipment damage**
> Take these 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.

At the HIE

11 Remove the NT6X60 card as follows:

1. Locate the card to be removed on the appropriate shelf.
2. Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.
3. Place the card you have removed in an electrostatic discharge (ESD) protective container.
4. Examine the switch settings (if any) of the card just removed. Ensure that the switch settings on the replacement card match those of the card being replaced.
5. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card you just removed.

NT6X60
HIE (continued)

12 Open the locking levers on the replacement card. Align the card with the slots in the shelf and gently slide the card into the shelf.

13 Seat and lock the card.

1. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.
2. Close the locking levers.

At the MSP

14 Turn ON the circuit breaker turned OFF in step 9.

15 Remove the wrist strap.

16 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 17.

At the MAP terminal

17 Return the LCM unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no is the number of the LCM unit (0 or 1)

If RTS	Do
passed	step 18
failed	step 23

NT6X60
HIE (continued)

18 Switch RG activity to the new RG by typing

>SWRG UNIT unit_no
and pressing the Enter key.

where

unit_no is the PM unit number (0 or 1)

Example of a MAP response:

```
LCM REM1 00 0 InSv Links  OOS: Cside 0 Pside 0
Unit 0: InSv      /RG:0
Unit 1: InSv      /RG:0
                           11  11  11  11  11  RG: Pref 0 InSv
Drwr:  01  23  45  67  89  01  23  45  67  89      Stby 1 InSv
       ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
```

If SWRG	Do
passed	step 19
failed	step 23

19 Test the new RG by typing

>TST UNIT unit_no
and pressing the Enter key.

where

lcm_unit is the number of the LCM unit busied in step 8 (0 or 1)

where

```
LCM REM1 00 0 Unit 0  InSvce Tests Initiated
LCM REM1 00 0 Unit 0  Tst Passed
```

If test	Do
passed	step 20
failed	step 23

NT6X60
HIE (end)

20 Align RG activity to the preferred RG by typing

>SWRG UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the number of the LCM unit (0 or 1)

Note: Repeat this step until both units of the LCM are aligned to the preferred RG.

If RTS	Do
passed	step 21
failed	step 23

21 Send any faulty cards for repair according to local procedure.

22 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 24.

23 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

24 You have successfully completed this procedure.

NT6X71
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffixes	Name
NT6X71	AA	Data line card DMS-100/SL-100

Common procedures

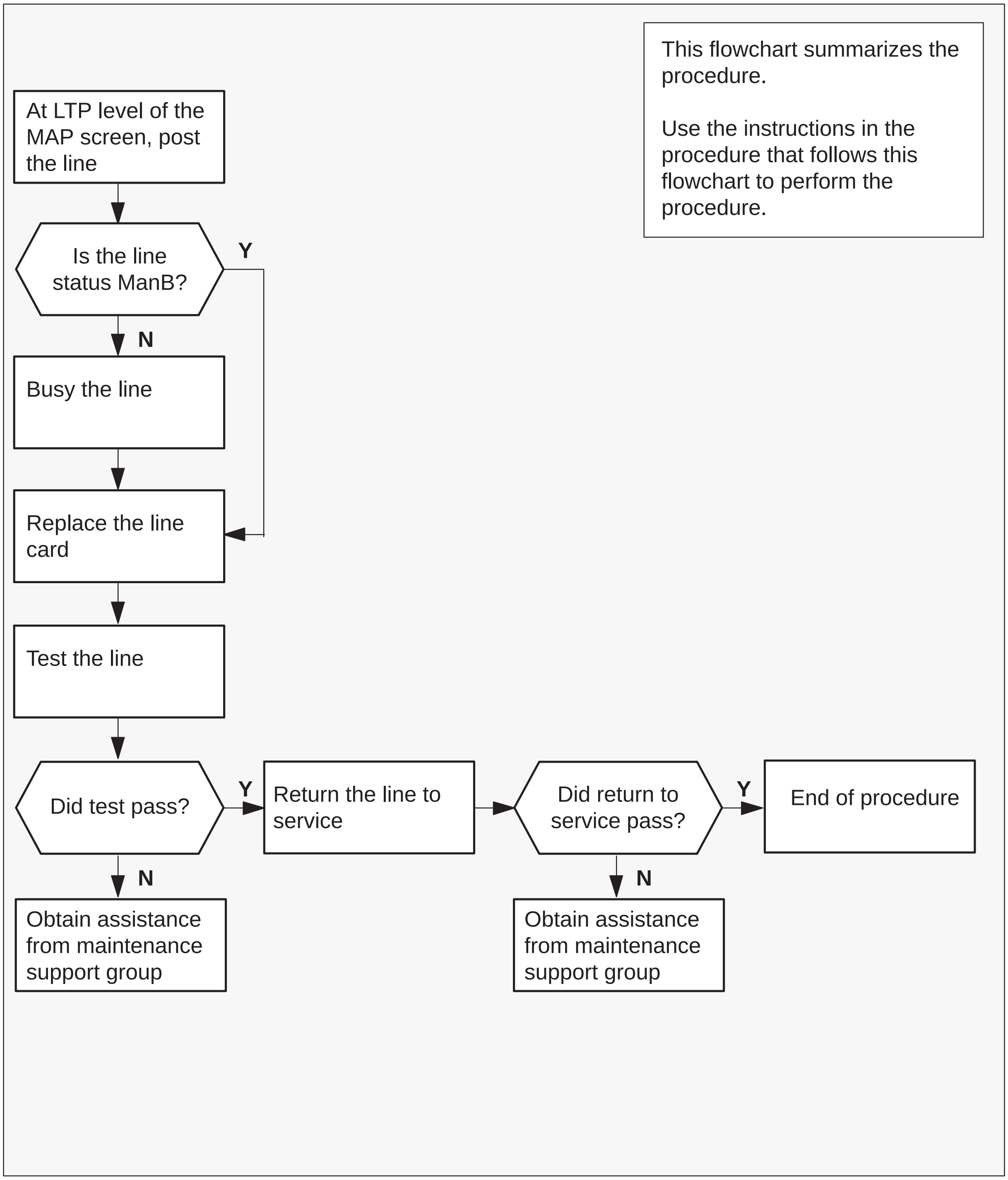
The procedure “Replacing a line card” is referenced in this procedure:

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.

NT6X71
LCM (continued)

Summary of card replacement procedure for an NT6X71 card in an LCM



NT6X71
LCM (continued)

Replacing an NT6X71 in an LCM

At your Current Location

1 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 terminal

2 Access the line test position (LTP) level of the MAP display and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
rlcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC  PTY     RNG .....LEN..........  DN   STA F S LTA TE RESULT
CKT TYPEFL  REM1  00 0 03 03        NODIRN MB
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY
and pressing the Enter key.

5 Go to the procedure “Replacing a line card.” When you have completed the procedure, return here.

NT6X71
LCM (end)

6 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	**Do**
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS
and pressing the Enter key.

If RTS	**Do**
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 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 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X73
HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE) shelf.

PEC	Suffixes	Name
NT6X73	AA	Link control card

Common procedures

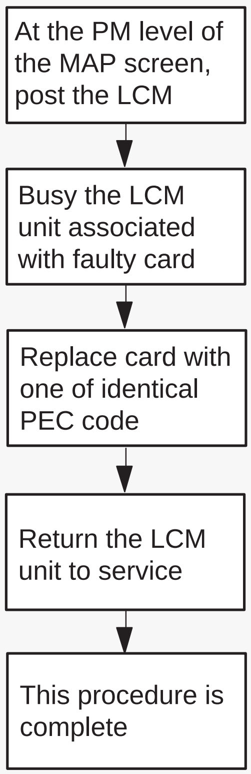
The procedure “Replacing a card” is referenced in this procedure:

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.

NT6X73
HIE (continued)

Summary of card replacement procedure for an NT6X73 card in an HIE



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT6X73
HIE (continued)

Replacing an NT6X73 in an HIE

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 equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 7. Otherwise, continue with step 4.

At the MAP terminal

4 Access the peripheral module (PM) level and post the line concentrating module (LCM) by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name of the OPAC (alphanumeric)
frame	is the frame number of the OPAC (0 to 99)
lcm	is the number of the LCM

5 Use the following table to determine which LCM unit is associated with the faulty NT6X73.

LCM unit	LCC card	HIE slot
0	LCC 0	17
1	LCC 1	18

NT6X73
HIE (continued)

6

> **CAUTION**
> **Loss of service**
> This procedure contains directions to busy one or more peripheral modules (PM) in a frame. Since busying a PM affects subscriber service, replace the link control card (LCC) only during periods of low traffic

Busy the LCM unit associated with the faulty NT6X73 by typing

>BSY UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM unit number (0 to 1)

At the HIE

7 Replace the NT6X73 card using the procedure “Replacing a card.”

8 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 9.

At the MAP terminal

9 Return the busied unit to service by typing

>RTS UNIT lcm_unit
and pressing the Enter key.

where

lcm_unit is the LCM unit busied in step 6 (0 or 1)

If RTS	Do
Failed	step 12
Passed	step 10

10 Send any faulty cards for repair according to local procedure.

11 Record the following items in office records:

- date the card was replaced
- serial number of the card

NT6X73
HIE (end)

- symptoms that prompted replacement of the card

Proceed to step 13.

12 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

13 You have successfully completed this procedure.

NT6X74
RMM

Application

Use this procedure to replace the following card in a remote maintenance module (RMM) shelf.

PEC	Suffix	Name
NT6X74	AB	RMM control card

Common procedures

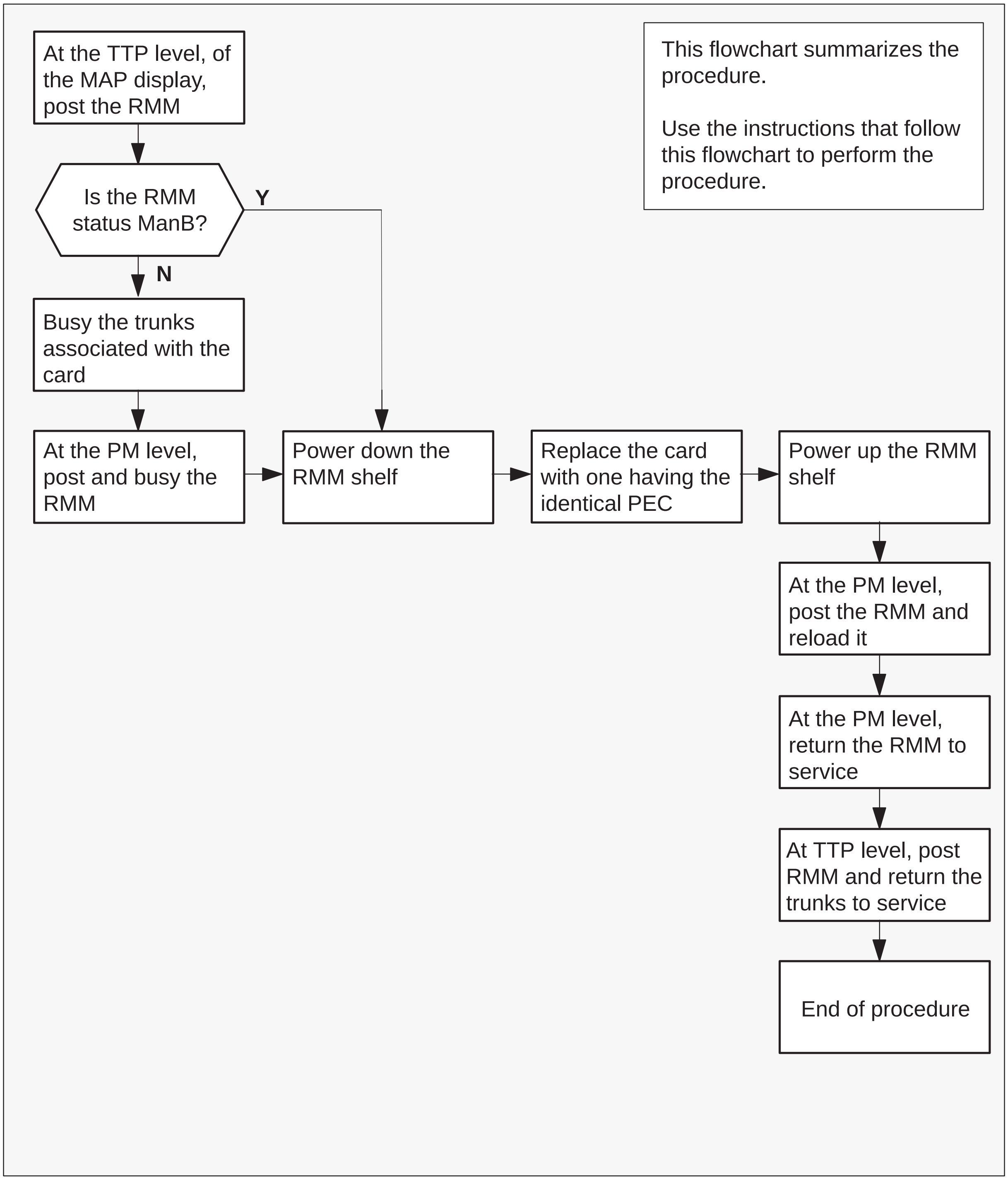
The procedure “Replacing a card” is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X74
RMM (continued)

Summary of replacing an NT6X74 in an RMM



NT6X74
RMM (continued)

Replacing an NT6X74 in an RMM

At your Current Location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 5.

Otherwise, continue with step 3.

At the MAP terminal

3 Go to the peripheral module (PM) level of the MAP display and post the RMM by typing

>MAPCI;MTC;PM;POST RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM shelf where the card is to be replaced

Example of a MAP response:

```
        SysB     ManB     Offl     CBsy     ISTb    InSv
PM         0        2        2        0        7      21
RMM        1        0        1        0        0       6

RMM     0    SysB
```

4 Busy the RMM by typing

>BSY
and pressing the Enter key.

At the RMM

5 Replace the NT6X74 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

6 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 7.

At the MAP terminal

7 Reload the RMM by typing

>LOADPM
and pressing the Enter key.

If	Do
The message `loadfile not found in directory` is received.	step 8
load passed	step 26
load failed	step 29

8 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 9
IOC disk	step 15
SLM disk	step 20

9 Locate the tape that contains the PM load files.

10 Mount the tape on a magnetic tape drive.

11 Download the tape by typing

>MOUNT tape_no
and pressing the Enter key.

where

tape_no is the number of the tape containing the PM load files

12 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 containing the PM load files

NT6X74
RMM (continued)

13 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

14 Go to step 25.

15 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.

16 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

17 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 15.

18 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

19 Go to step 25.

20 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.

21 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

22 List all Disk volumes to user Directory by typing

>LV CM
and pressing the Enter key.

NT6X74
RMM (continued)

23 List the SLM file names into your user directory by typing

>LF file_name
and pressing the Enter key.

where

file_name is the name of the SLM disk volume containing the PM load files obtained in step 20.

24 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

25 Reload the RMM by typing

>LOADPM
and pressing the Enter key.

If	Do
load failed	step 29
load passed	step 26

26 Return the RMM to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 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 30.

NT6X74
RMM (end)

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have completed this procedure.

NT6X75
HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE) shelf.

PEC	Suffix	Name
NT6X75	AA	ESA tone and clock card

Common procedures

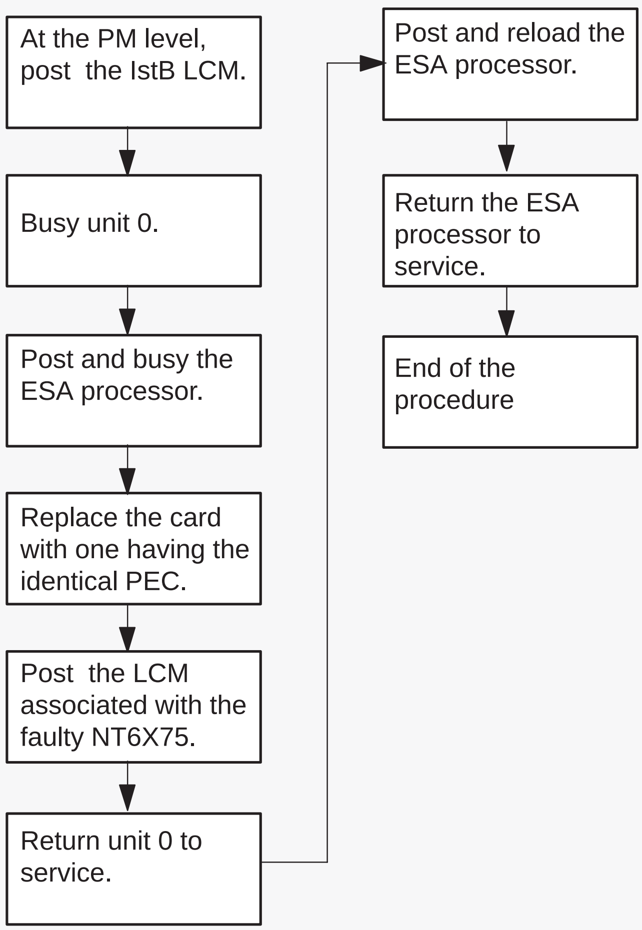
The procedure “Replacing a card” is referenced in this procedure.

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.

NT6X75
HIE (continued)

Summary of card replacement procedure for an NT6X75 in an HIE



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT6X75
HIE (continued)

Replacing an NT6X75 in an HIE

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. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 10. Otherwise, continue with step 4.

At the MAP terminal

4 Post the LCM associated with the faulty NT6X75 card by typing

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the name of the location of the OPAC
frame	is the number of the OPAC cabinet
lcm	is the number of the LCM in the OPAC cabinet

5 Translate the links to the P-side peripherals by typing

>TRNSL P
and pressing the Enter key.

6 Post the Emergency Stand-Alone (ESA) processor by typing

>POST ESA esa_no
and pressing the Enter key.

where

esa_no	is the number of the ESA processor identified in step 5.

NT6X75
HIE (continued)

7 Busy the ESA processor by typing

>BSY
and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES
and pressing the Enter key.

8 Post the LCM associated with the faulty NT6X75 card by typing

>POST LCM site frame lcm
and pressing the Enter key.

where

site	is the name of the location of the OPAC
frame	is the number of the OPAC cabinet
lcm	is the number of the LCM in the OPAC cabinet

9 Busy unit 0 by typing

>BSY UNIT 0
and pressing the Enter key.

At the OPAC

10 Replace the NT6X75 card using the procedure “Replacing a card.” When you have completed the procedure, return here.

11 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 12.

At the MAP terminal

12 Return to service unit 0 by typing

>RTS UNIT 0
and pressing the Enter key.

If RTS	Do
passed	step 13
failed	step 35

13 Post the Emergency Stand-Alone (ESA) processor identified in step 5 by typing

>POST ESA esa_no
and pressing the Enter key.

where

esa_no is the number of the ESA processor

14 Load the ESA processor by typing

>LOADPM
and pressing the Enter key.

If	Do
The message `loadfile not found in directory` is received.	step 15
load passes	step 32
load fails	step 35

15 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 16
IOC disk	step 22
SLM disk	step 27

16 Locate the tape that contains the PM load files.

At the IOE frame

17 Mount the tape on a magnetic tape drive.

at the MAP terminal

18 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.

NT6X75
HIE (continued)

19 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 containing the PM load files

20 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.

21 Go to step 31.

22 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.

23 Access the disk utility level of the MAP terminal by typing

>DSKUT
and pressing the Enter key.

24 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 identified in step 22.

25 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

26 Go to step 31.

27 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.

28 Access the disk utility level of the MAP terminal by typing

>DISKUT
and pressing the Enter key.

29 List the SLM file names into your user directory by typing

>LV CM;LF volume_name
and pressing the Enter key.

where

volume_name is the name of the disk volume that contains the PM load files identified in step 27.

30 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

31 Reload the ESA processor by typing

>LOADPM
and pressing the Enter key.

If loadpm	Do
passed	step 32
failed	step 35

32 Return the ESA processor to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 33
failed	step 35

33 Send any faulty cards for repair according to local procedure.

34 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 36.

NT6X75
HIE (end)

35 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

36 You have completed this procedure. If you were directed here from an alarm clearing procedure, return to the maintenance procedure that directed you to this procedure and continue as directed.

NT6X99
LCM

Application

Use this procedure to replace the following card in a line concentrating module (LCM).

PEC	Suffix	Name
NT6X99	AA	Datapath bit error rate tester line card (2 slot)

Common procedures

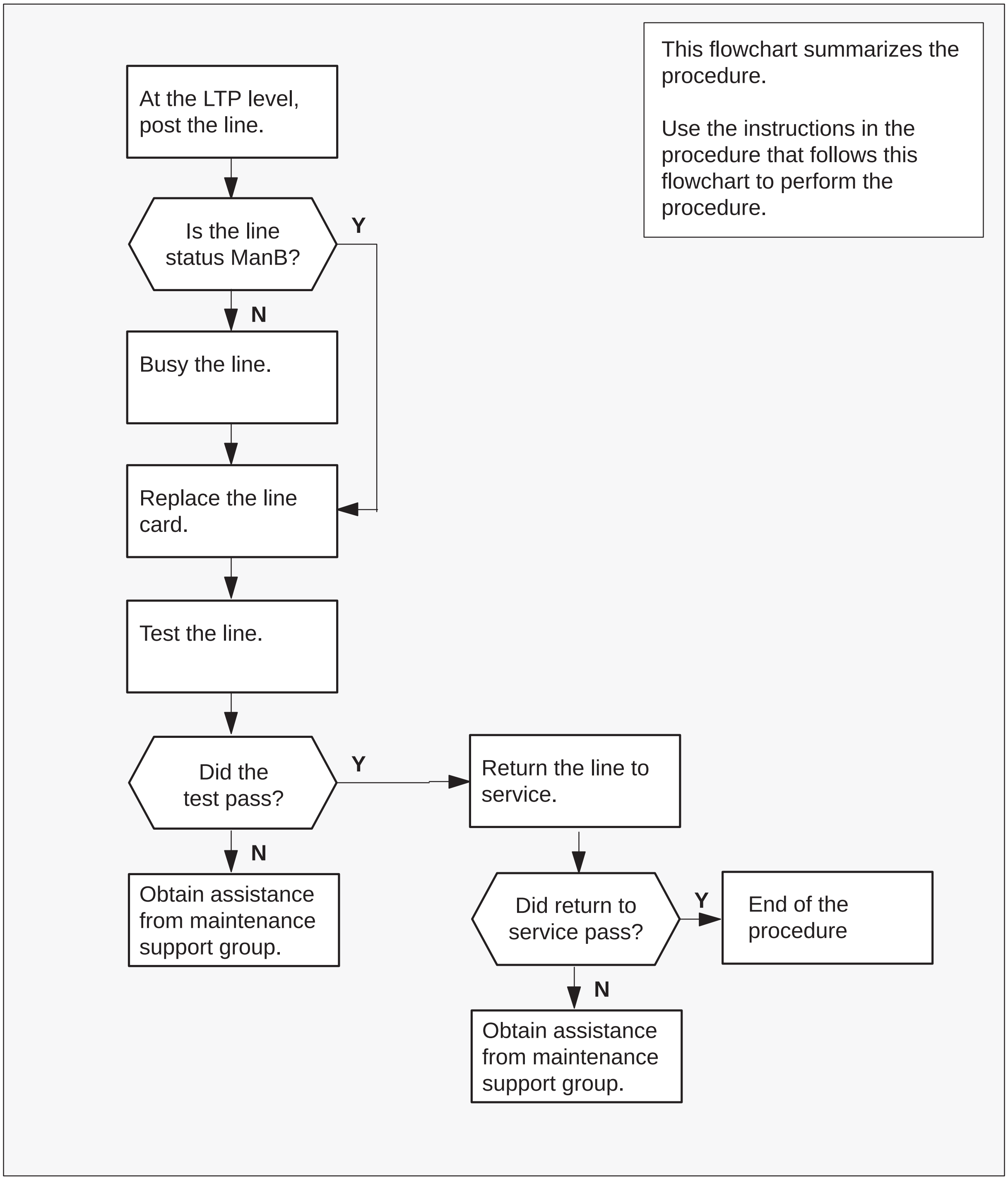
The procedure “Replacing a line card” is referenced in this procedure.

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.

NT6X99
LCM (continued)

Summary of card replacement procedure for NT6X99 card in an LCM



Replacing an NT6X99 in an LCM

At your Current Location

1 Obtain a replacement card.

Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP terminal

2 Access the line test position (LTP) level of the MAP display and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site rlcm lsg ckt
and pressing the Enter key.

where

site is the name of the site where the OPAC is located
rlcm is the number of the OPAC with the faulty card
lsg is the number of the line subgroup with the faulty card
ckt is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY       RNG .....LEN........  DN   STA F S LTA TE RESULT
CKT TYPEFL     REM1 00 0 03 03     IBERT
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY
and pressing the Enter key.

5 Go to the procedure “Replacing a line card.” When you have completed the procedure, return here.

NT6X99
LCM (end)

6 Test the line card just replaced by typing

>DIAG
and pressing the Enter key.

If the DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 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 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT8X02
BCU

Application

Use this procedure to replace the following card in a battery control unit (BCU).

PEC	Suffix	Name
NT8X02	AB	Battery charger controller card

Common procedures

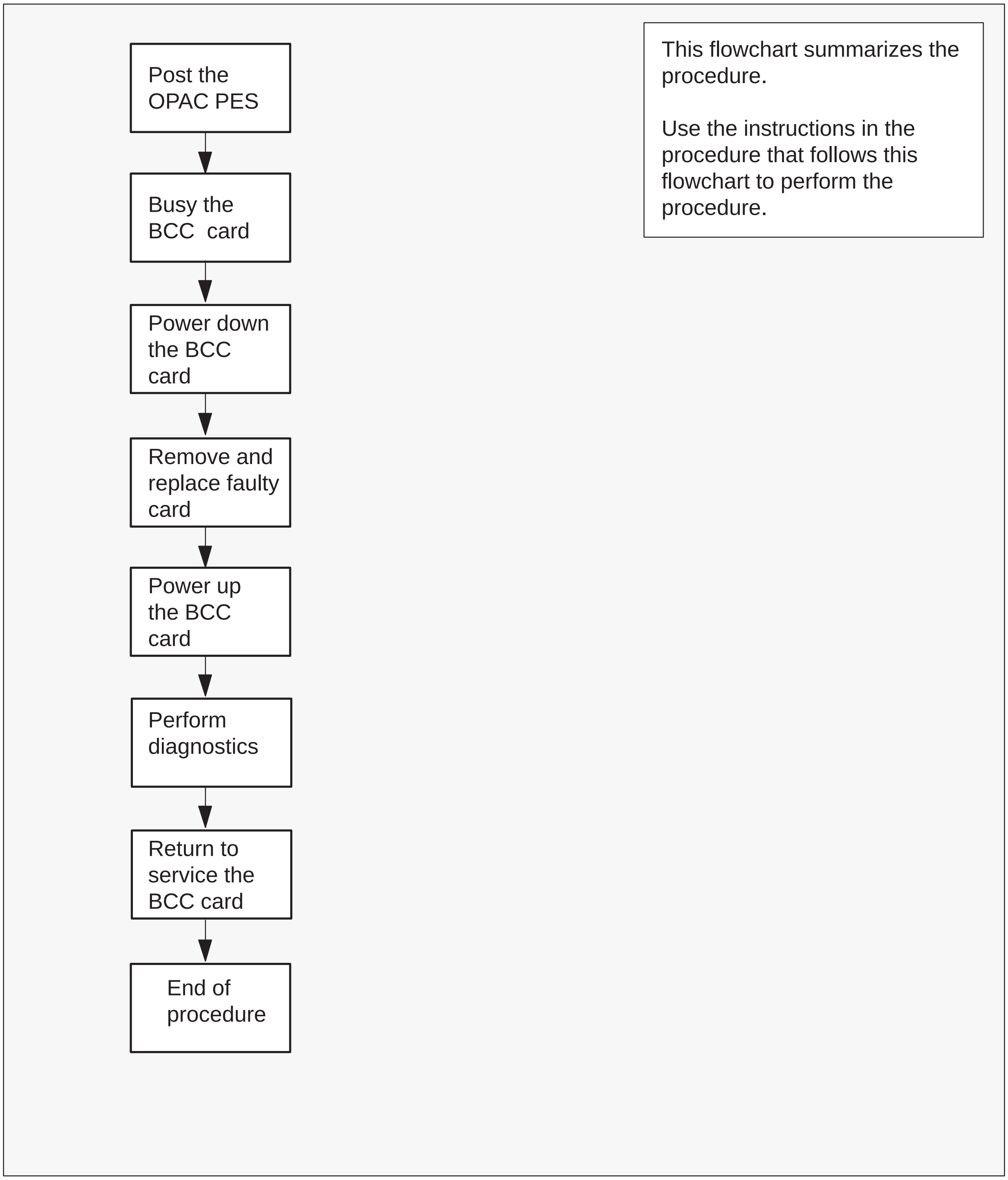
The procedure “Replacing a card” is referenced in this procedure.

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.

NT8X02
BCU (continued)

Summary of card replacement procedure for NT8X02 card in a BCU



Replacing an NT8X02 card in a BCU

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 equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 4.

At the MAP terminal

4 Post the OPAC PES with the BCU containing the battery charger controller (BCC) card to be replaced by typing

>MAPCI;MTC;PM;PES;POST opmpes
and pressing the Enter key.

where

opmpes is the OPAC PES duscrimination number (0–253)
Example of a MAP response:

```
              RED     AMBER     GREEN     OFFL
     OPMPES     0         0         3        0

     OPMPES  2 Cond: GREEN   REM2    2  1   RMM  2
                                Audit Week  HBT
  Common    Rectifiers              .    2    .
  AC    FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
   .      .   .   .   .       .      .       .   .
BCC   0   1   2   3   Temp     Door     BCCFUSES
0=.   .   .   .   . EHT ELT  FRNT SIDE     0  1
1=.   .   .   .   .  .   .      .    .      .  .
```

5 Busy the BCC driver (BCCDVR) card by typing

>BSY BCCDVR

At bay 1 of the OPAC

6 Turn switch on front of the BCC (NT8X02) card to the OFF position.

7 Replace the NT8X02 card by using the procedure “Replacing a card.” When the card is replaced, return to this step.

8 Turn the switch on the BCC (NT8X02) card to the ON position.

NT8X02
BCU (end)

9 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, go to step 10.

At the MAP terminal

10 Perform diagnostics by typing

>TST
and pressing the Enter key

If test	Do
passed	step11
failed	step14

11 Return the BCCDVR card to service by typing

>RTS BCCDVR

If RTS	Do
passed	step12
failed	step14

12 Send any faulty cards for repair according to local procedure.

13 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 15.

14 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

15 You have successfully completed this procedure.

NTMX45
HIE

Application

Use this procedure to replace an NTMX45 in host interface equipment (HIE) shelf.

PEC	Suffixes	Name
NTMX45	AA	Emergency Stand-Alone (ESA) processor (EP)

If you cannot identify the PEC, suffix, and shelf or frame for the card you want to replace, refer to the “Index” in this document. The index lists the cards, shelves, and frames in this card replacement NTP.

Common procedures

This procedure does not refer to any common procedures.

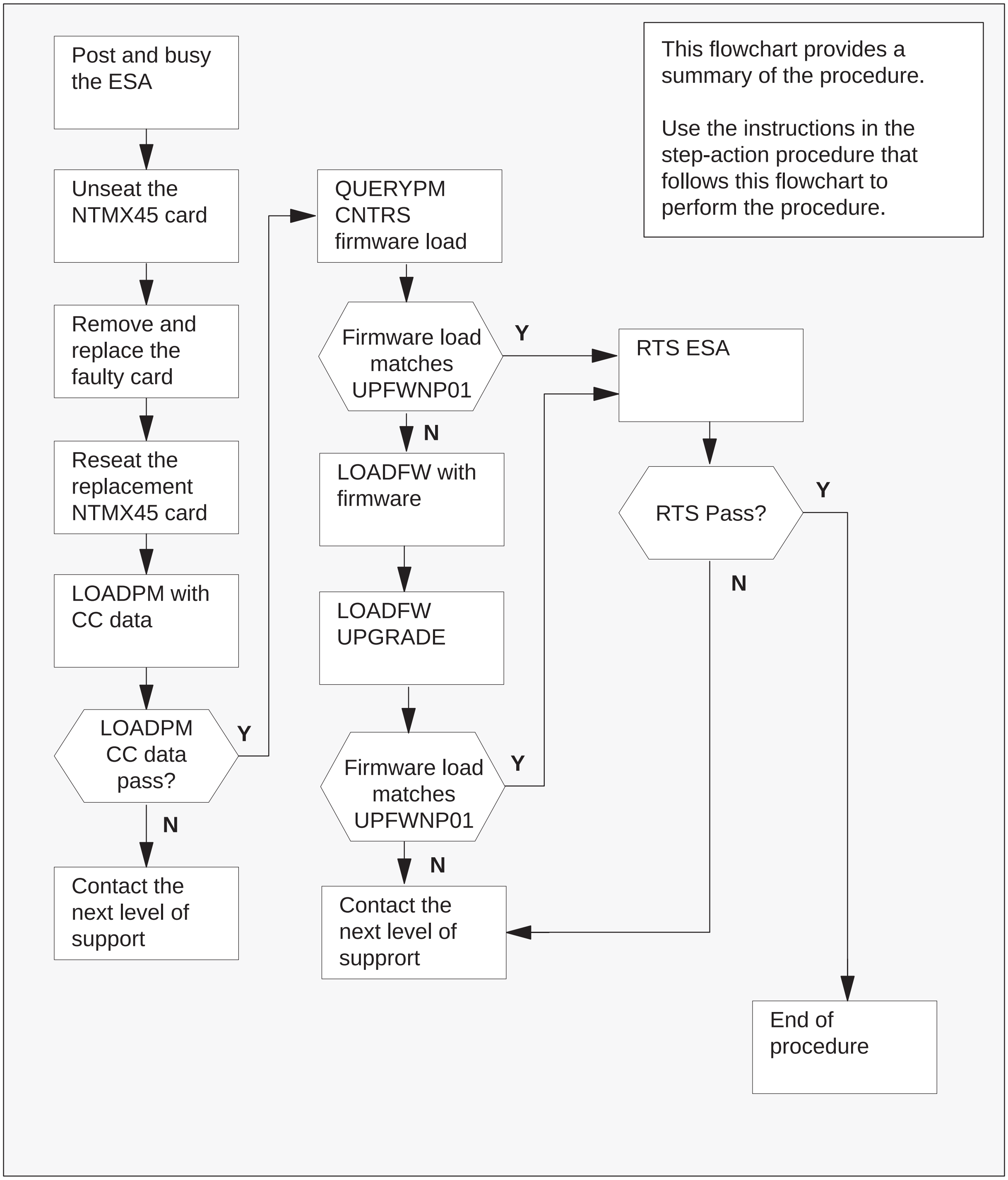
Next level of maintenance

A problem can occur that requires the help of the local maintenance personnel. Gather all important logs, reports, and system information (that is, product type and current software load) for analysis. The related logs, maintenance notes, and system information help make sure that the next level of maintenance and support can find the problem. More detail about logs appears in the *Log Report Reference Manual*.

Action

The flowchart that follows provides a summary of this procedure. Use the instructions in the step-action procedure that follows the flowchart to replace the card.

NTMX45
HIE (continued)



Replacing an NTMX45 HIE

At your Current Location

1 Continue if you were referred to this card replacement procedure

- from a step in a maintenance procedure
- to verify or accept cards
- by your maintenance support group

2 Get a replacement card. Make sure the replacement card has the same product equipment code (PEC) including suffix, as the original card.

At the MAP terminal

3 Access the PM level of the MAP and post the ESA by typing

>MAPCI;MTC;PM;POST ESA esa_no
and pressing the Enter key.

where

esa_no is the number of the ESA unit to be busied (0 to 255)

Example of a MAP display:

```
  CM    MS   IOD   Net    PM    CCS    LNS    Trks    Ext    APPL
   .     .     .     .   1RLCM   .      .      .       .      .

 ESA              SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit     PM     0        0        2        0        2         25
 2 Post_    ESA    0        0        0        0        1          1
 3 ListSet
 4                               Links_OOS: CSide  0
 5 Trnsl          RLCM  ESA    4 Sysb
 6 Tst
 7 Bsy_
 8 RTS_
 9 OffL
10 LoadPM
11 Disp_
12 Next_
13
14 QueryPM
15
16
17
18
```

NTMX45
HIE (continued)

At the MAP terminal

4 Busy the inactive ESA processor by typing

>BSY
and pressing the Enter key.

Example of a MAP response:

```
ESA 4      This action will take this PM
           out of service
Please confirm (“YES”, “Y”, “NO”, or “N”):
```

Respond by typing

>YES

At the RLCM frame

5

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 LCM. This protects the equipment against damage caused by static electricity.

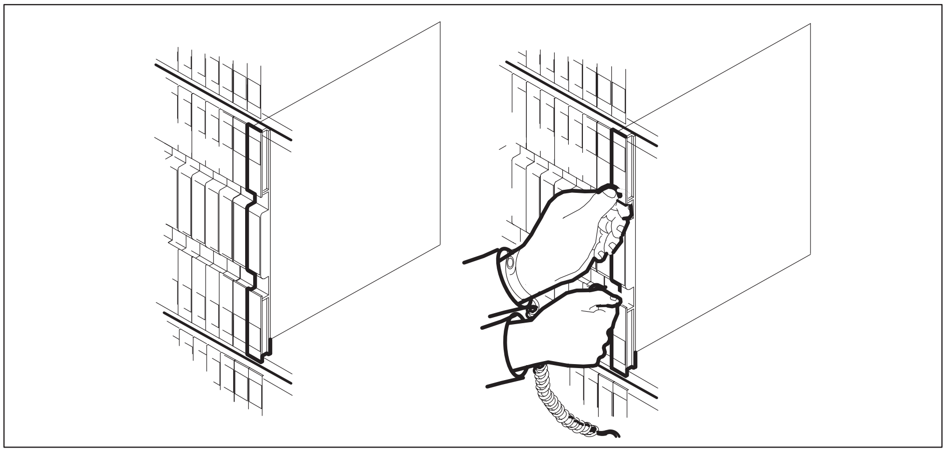
WARNING
Equipment damage
Take the following precautions when removing or inserting a card:
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

Put on a wrist strap.

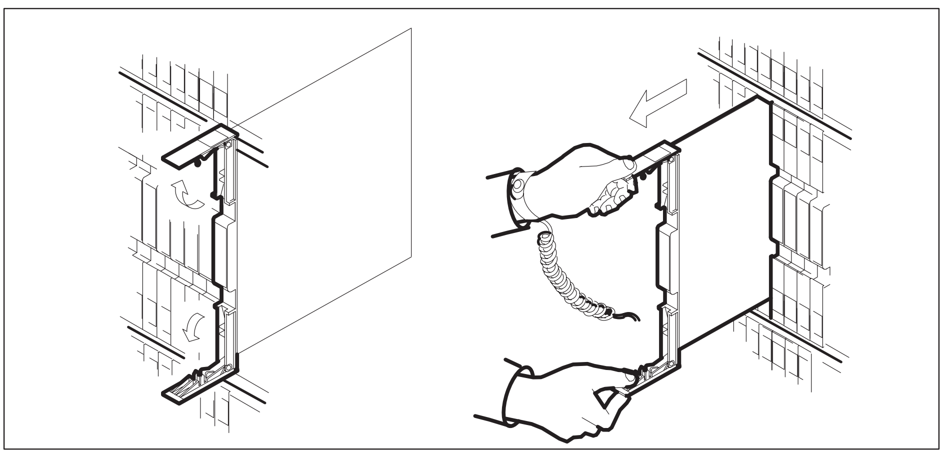
6 Remove the NTMX45 card as shown in the following figures.

NTMX45
HIE (continued)

a. Locate the damaged card on the appropriate shelf.



b. Open the locking levers on the damaged card and carefully pull the card towards you until it clears the shelf.

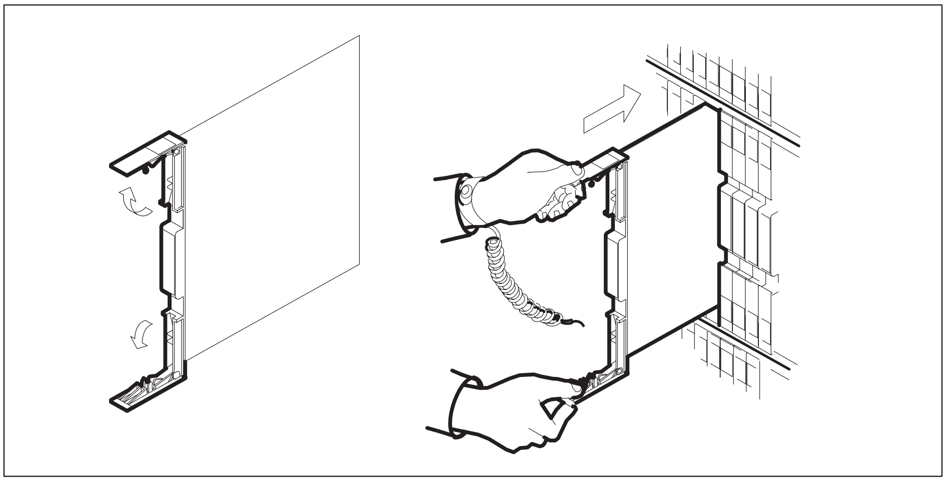


c. Make sure that the replacement card has the same PEC and suffix as the card you just removed. Also make sure that all DIP switches on the replacement card match settings of the card just removed.

7 Open the locking levers on the replacement card.

NTMX45
HIE (continued)

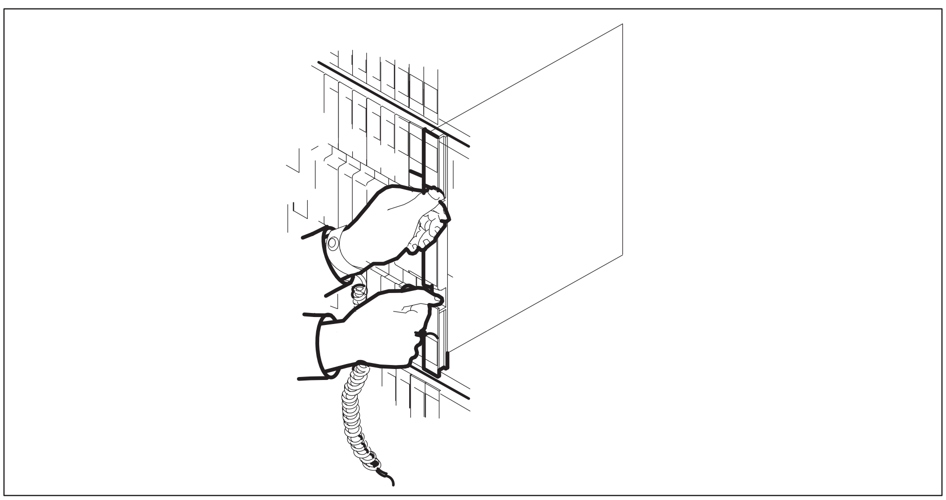
a. Align the card with the slots in the shelf and carefully slide the card into the shelf.



Seat and lock the card.

b. Use your fingers or thumbs to push on the upper and lower edges of the faceplate.

c. Close the locking levers.



8 Use the following table to determine the next step in this procedure.

If you entered this procedure from	**Do**
an alarm clearing procedure	step 34
other	step 9

9 Load the ESA processor by typing

>LOADPM
and pressing the Enter key.

If the load	**Do**
message “loadfile not found in directory” is received	step 10
load passes	step 28
load fails	step 35

10 Determine the type of device on which the PM load files are located.

If load files are located on	**Do**
tape	step 11
IOC disk	step 17
SLM disk	step 22

11 Locate the tape that contains the PM load files.

12 Mount the tape on a magnetic tape drive.

At the MAP terminal

13 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

NTMX45
HIE (continued)

14 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

15 Demount the tape 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

16 Go to step 27.

17 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.

18 Access the disk utility level of the MAP display by typing

>DSKUT
and pressing the Enter key.

19 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 17

20 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

21 Go to step 27.

22 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.

23 Access the disk utility level of the MAP display by typing

>DISKUT
and pressing the Enter key.

24 List all SLM disk volumes into your user directory by typing

>LV CM
and pressing the Enter key.

25 List the SLM file names into your user directory by typing

>LF 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 22

26 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

27 Reload the ESA processor by typing

>LOADPM
and pressing the Enter key.

If loadpm	Do
passes	step 28
fails	step 35

NTMX45
HIE (continued)

28 Query the PM counters for the firmware load on the NTMX45 by typing

>QUERYPM CNTRS
and pressing the Enter key.

Example of a MAP display:

```
Unsolicitited MSG limit = 250, count = 0
Ram Load: MSA12AM1
EPRom Version: Ac01
EEPRom Load: Loadable NP02 , Executable: NP02
EP:MX45AA
```

NTMX45 Firmware loadname

If firmware is	Do
valid	step 31
invalid	step 29

29 Load the NTMX45 firmware by typing

>LOADFW
and pressing the Enter key.

Note: The command applies the firmware file provisioned in table XESAINV unless the firmware load is indicated with the command.

If load	Do
passes	step 30
fails	step 35

30 Upgrade the firmware in the NTMX45AA by typing

>LOADFW UPGRADE
and pressing the Enter key.

If the LOADFW UPGRADE	Do
passes	step 31
fails	step 35

NTMX45
HIE (end)

31 Return the ESA to service by typing

>RTS
and pressing the Enter key.

If the RTS	Do
passes	step 32
fails	step 35

32 Send any damaged cards for repair according to local procedure.

33 Record the following items in office records:

- date the card was replaced
- serial number of the card
- problems that required replacement of the card

Go to step 36.

34 Return to the *Alarm Clearning Procedure* that referred you to this procedure. If necessary, go to the point where the damaged card list was produced, identify the next damaged card on the list, and go to the appropriate procedure for that card in this manual.

35 Contact the next level of support for additional help to replace this card.

36 You have completed this procedure. Return to the maintenance procedure that referred you to this card replacement procedure and continue.

NTRX41
MSP

Application

Use this procedure to replace an NTRX41 card in an MSP.

PEC	Suffixes	Name
NTRX41	AA	Alarm Module

Common procedures

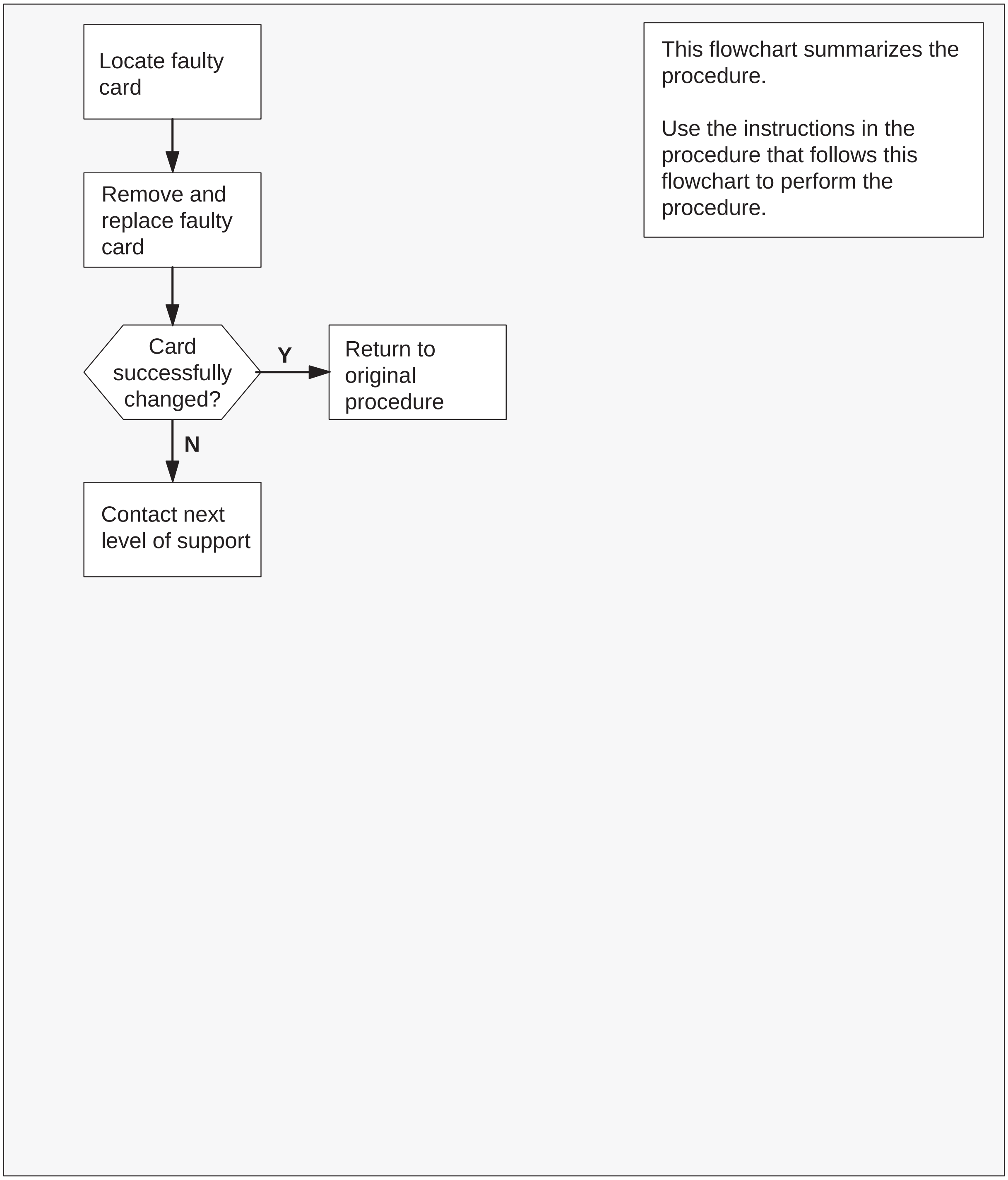
None

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.

NTRX41
MSP (continued)

Summary of card replacement procedure for an NTRX41 card in an MSP



NTRX41
MSP (continued)

Replacing an NTRX41 in an MSP

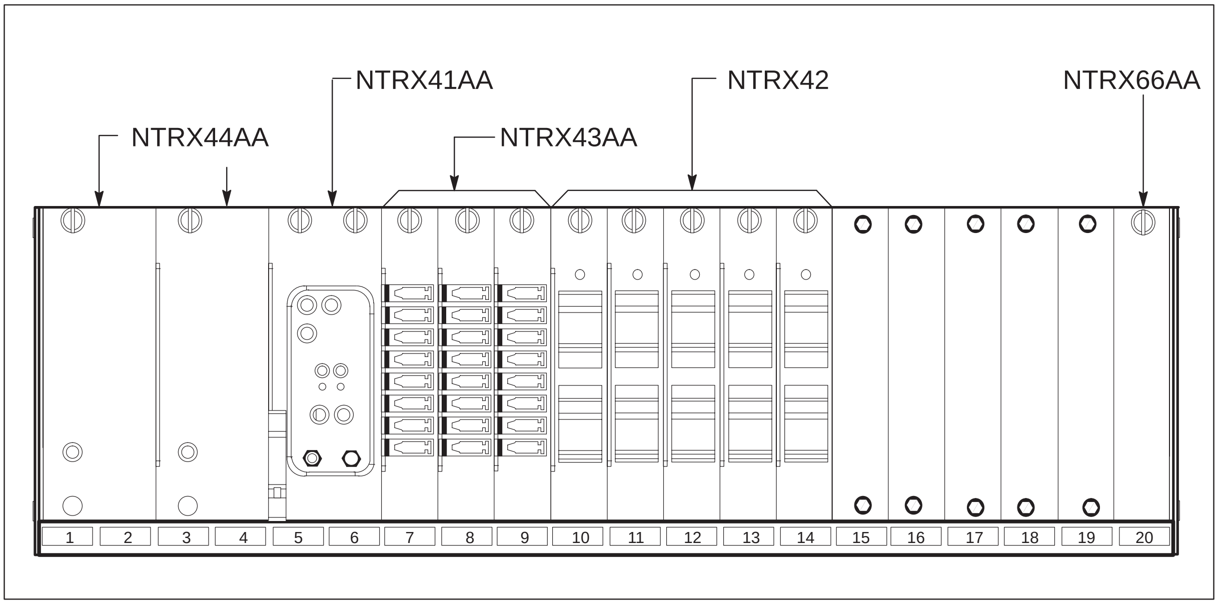
At your Current Location

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 that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At Bay 1 of the OPAC:

3 Open the front cover of the MSP by pulling outward firmly at the finger holes provided and swing the cover down to the open position.



NTRX41
MSP (continued)

4

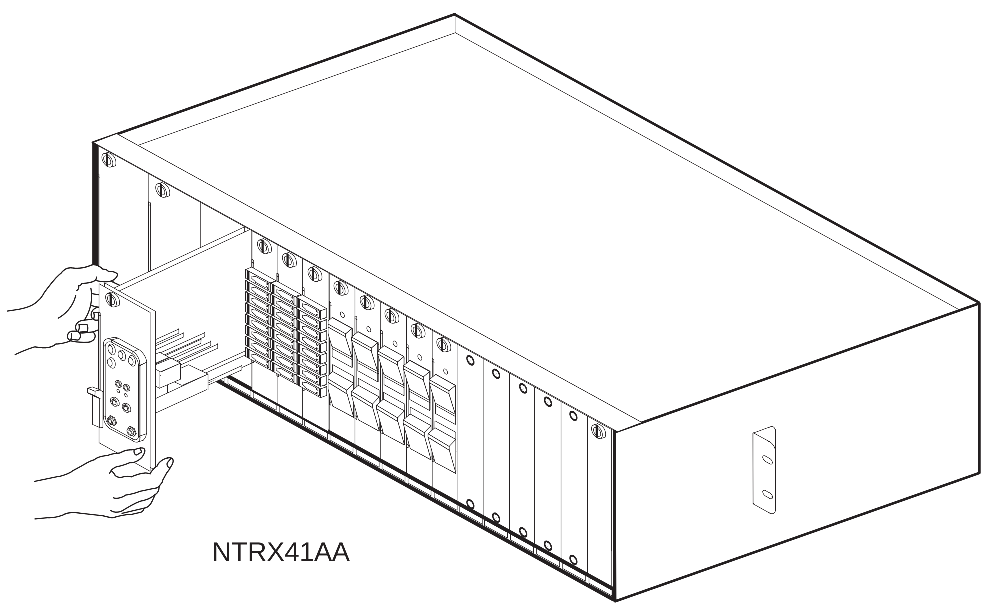
> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to a wrist strap grounding point while handling circuit cards. This protects the cards against damage caused by static electricity.

> **WARNING**
> **Risk of injury from high energy levels, equipment damage**
> When removing or inserting a card, do not apply direct pressure to the components and do not force the cards into the slots.

Put on a wrist strap.

5 Remove the NTRX41 circuit card as shown in the following figures.

a. Locate the circuit card. It will be in slots 05 and 06.



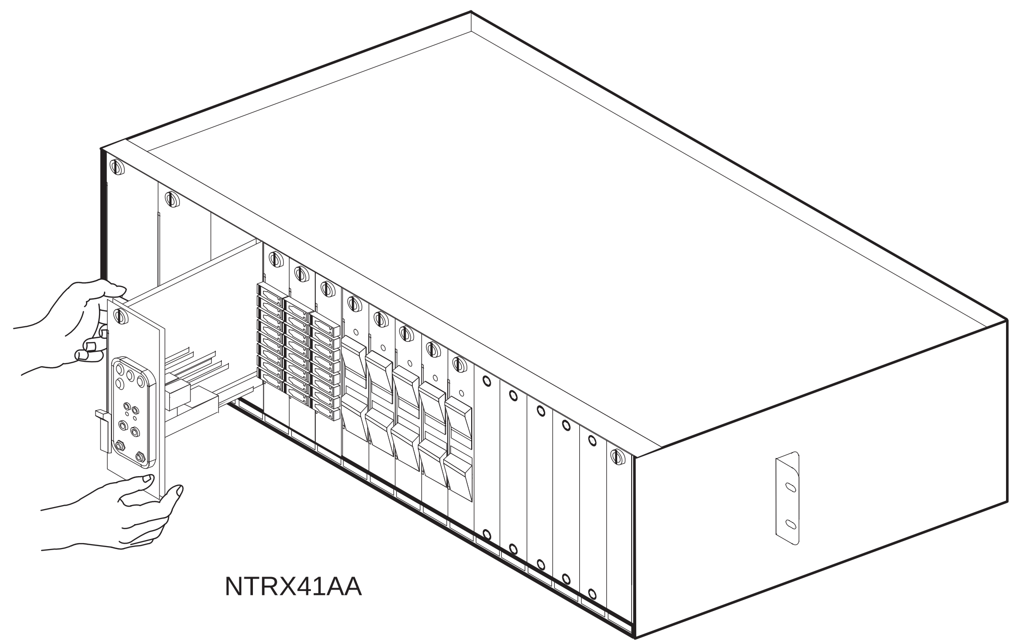
NTRX41
MSP (continued)

b. At the front of the MSP, disengage the captive screw at the top of the circuit card.

c. Pull out the lever on the lower left side of the alarm module.

d. Gently pull the circuit card toward you until it clears the shelf.

6 Ensure the replacement circuit card has the same PEC, including suffix, as the circuit card just removed.



a. Align the circuit card with the slots in the shelf and gently slide the circuit card into the shelf.

b. Gently but firmly seat the circuit card.

c. Push in lever on the lower left side of alarm module.

NTRX41
MSP (end)

d. Tighten the captive screw at the top of the circuit card.

If alarm lights	Do
remain off	step 7
light up	step 9

7 Send any faulty cards for repair according to local procedure.

8 Record the date the card was replaced, the serial number of the card, and the symptoms that prompted replacement of the card. Go to step 10.

9 Obtain further assistance in replacing this card by contacting the personnel responsible for the next higher level of support.

10 You have completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NTRX42
MSP

Application

Use this procedure to replace an NTRX42 card in an MSP.

PEC	Suffixes	Name
NTRX42	AA, BA, CA, DA, EA	Breaker Module

Common procedures

None

Action

A connector removal tool is available to facilitate removal of the AMP Faston receptacles from the power input and output connectors of the MSP modules. This tool comes in two lengths: P0746192 152 mm (6 in.) and P0747552 254 mm (10 in.). The shorter tool is used when access to the rear of the MSP is very limited.

This tool is approximately 2 mm (.090 in.) thick and 17 mm (.65 in.) wide, with a jaw-like cut-out at each end. The cut-out profile conforms to the shape of the Faston receptacle. The shorter tip of each profile is used to position the receptacle in the tool.

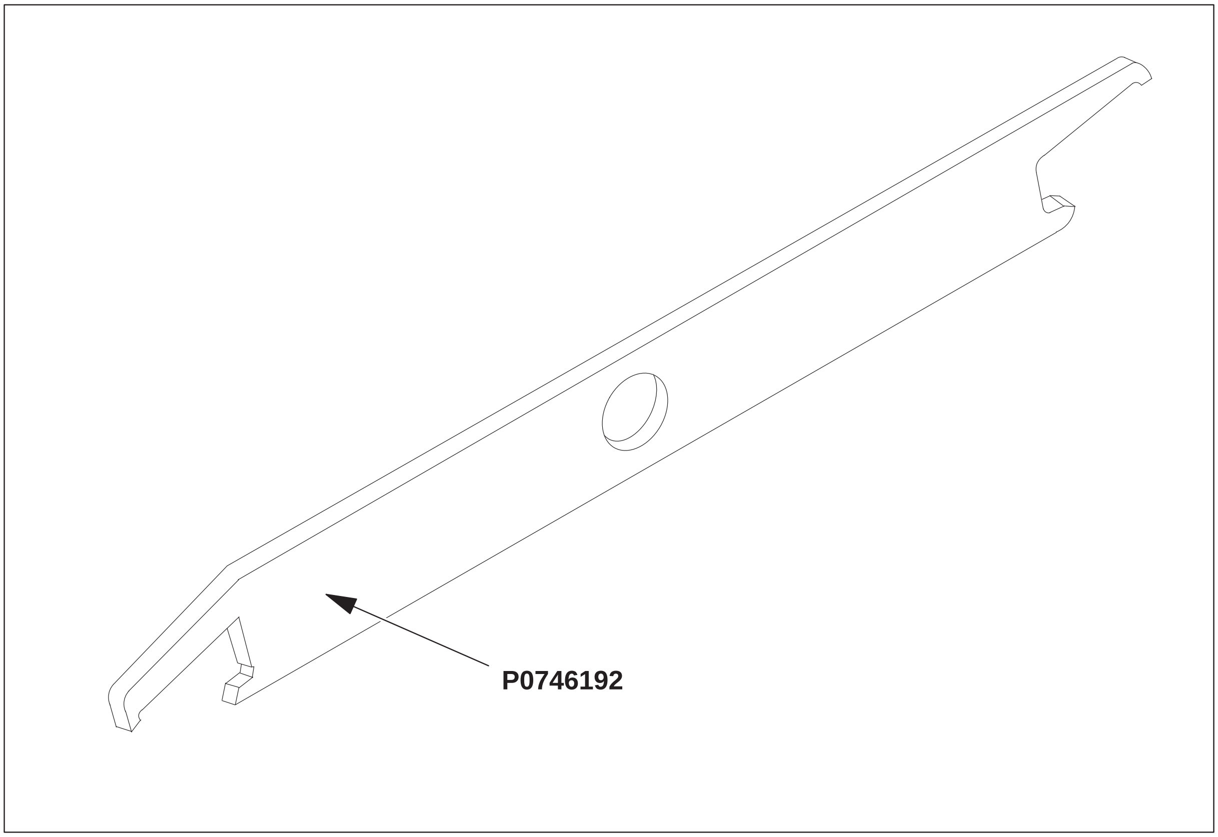
The first meeting point of the tool serves as the pivot point. By rotating the tool around this pivot point, the longer tip of the profile which has a hook on its end is engaged with the action-arm of the power connector. As the action-arm of the connector is depressed, the receptacle is disengaged from the connector tab. The receptacle is removed by pulling the tool with the receptacle trapped in its jaw, away from the connector. The tool is disengaged from the receptacle by rotating the tool's hook off the action-arm of the receptacle.

Although the shape of the cut-out is the same on each end of the tool, the orientation of the profile is off by 15 degrees. This difference allows for the use of the tool at different angles, which may be required due to limited access to the connectors.

The following is an illustration of the connector removal tool.

NTRX42
MSP (continued)

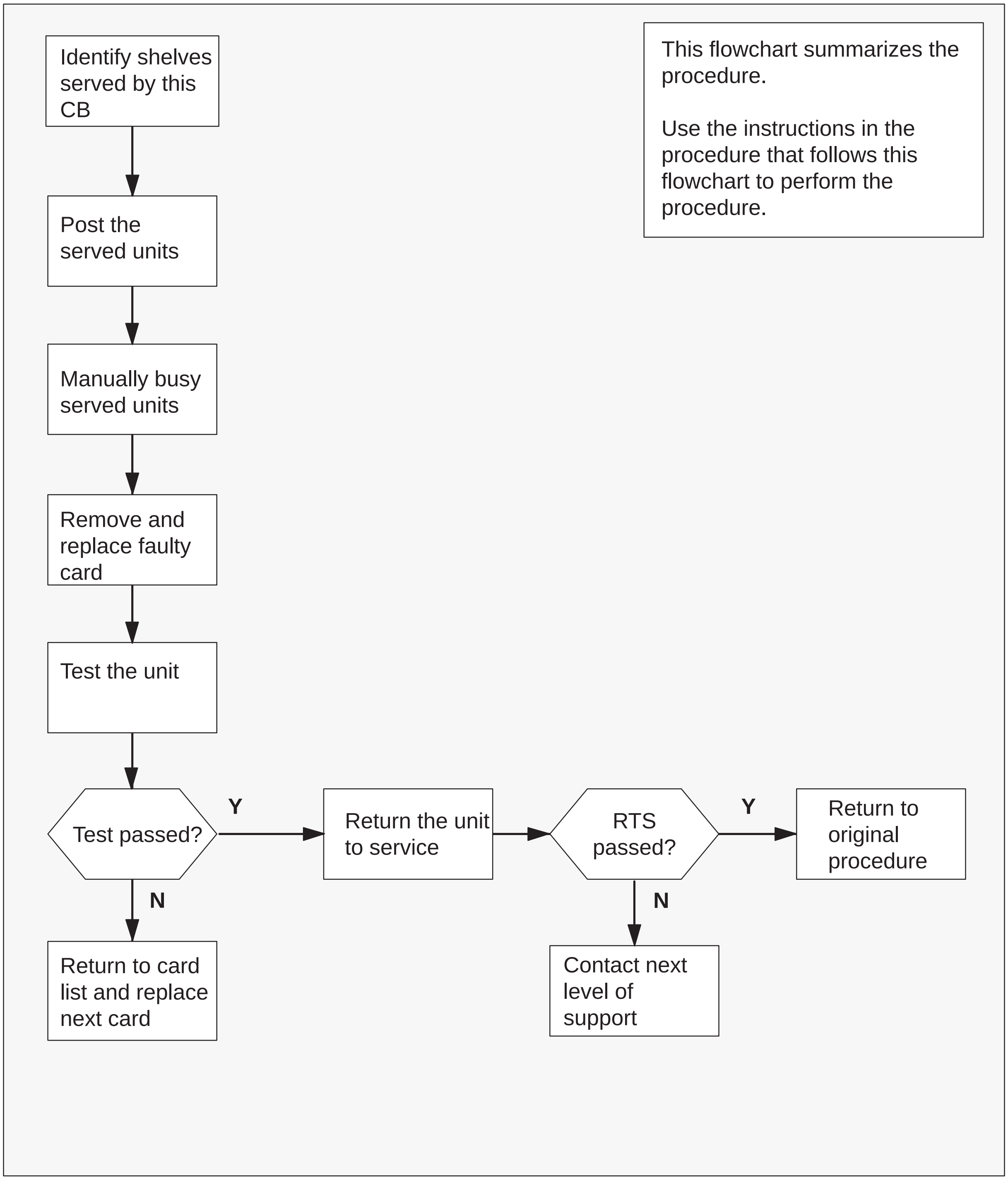
Connector removal tool



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. The detailed procedure depends on which circuit cards are served by the breaker module circuit card (NTRX42). You will be directed to the appropriate steps depending on your configuration.

NTRX42
MSP (continued)

Summary of card replacement procedure for an NTRX42 card in an MSP



NTRX42
MSP (continued)

Replacing an NTRX42 in an MSP

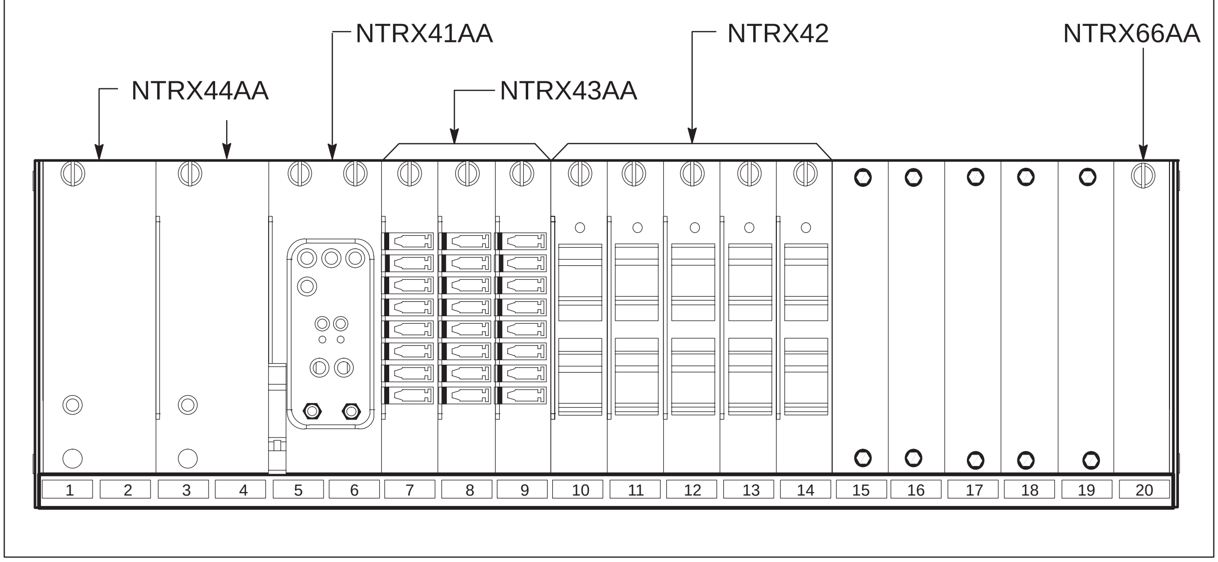
At your Current Location

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. Verify that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At Bay 1 of the OPAC

3 Open the front cover of the MSP by pulling outward firmly at the finger holes provided and swing the cover down to the open position.



4 Use the breaker designation label to identify which cards are serviced by each circuit breaker (CB). For example, the label CB01–0/18–01 identifies circuit breaker 01 as controlling circuit card position 01 on shelf location 18 in bay 0. Many RX42 modules service two separate devices or units; both units must be powered down prior to removal of the associated RX42 circuit card.

If CB powers	Go to
RMM shelf	step 5
LCM	step 9

NTRX42
MSP (continued)

At the MAP display

5 Set the MAP display to the PM level and post the RMM by typing the following string:

>MAPCI;MTC;PM;POST RMM rmm_no
and pressing the Enter key.

where

rmm_no is the number of the RMM unit from which the card is to be removed

Example of a MAP display:

```
 CM    MS    IOD    Net    PM    CCS     LNS     Trks      Ext     Appl
 .     .      .      .      .     .       .       .         .       .

RMM                 SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM        0        0        10       0        3        130
 2 Post_   RMM       0        0         1       0        0          2
 3
 4         RMM  5  INSV
 5 Trnsl
 6 Tst
 7 Bsy
 8 RTS
 9 OffL
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

NTRX42
MSP (continued)

6 Busy the RMM by typing the following string:

>BSY
and pressing the Enter key.

Example of a MAP display:

```
 CM    MS    IOD    Net    PM    CCS    LNS    Trks     Ext     Appl
 .     .      .      .      .     .      .      .        .       .

RMM                 SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM        0        0        10       0        3        130
 2 Post_   RMM       0        1         1       0        0          1
 3
 4         RMM  5  ManB
 5 Trnsl
 6 Tst
 7 Bsy
 8 RTS
 9 OffL
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the RMM shelf

7 Power down the unit by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the CONVERTER FAIL LED and FRAME FAIL LED on the MSP will be ON.

8 Go to step 11.

At the MAP terminal

9 Set the MAP display to the PM level and post the LCM powered by the circuit breaker by typing the following string:

>MAPCI;MTC;PM;POST LCM lcm_site_name lcm_frame_no lcm_no
and pressing the Enter key.

where

lcm_site_name	is the name of the site at which the LCM is located
lcm_frame_no	is the number of the frame in which the LCM is located
lcm_no	is the number of the LCM the circuit breaker supplies power to

Example of a MAP display:

```
 CM    MS    IOD    Net     PM     CCS     LNS     Trks      Ext    Appl
 .     .      .      .       .      .       .       .         .      .
LCM                  SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM      0        0        10        0        3        130
 2 Post_   LCM     0        0         0        0        1          9
 3
 4 Swrg_     LCM    REM1  14 0 ISTb  Links_OOS:  CSide 1
 5 Trnsl_    Unit-0:  InSv                    /RG:  0
 6 Tst_      Unit-1:  InSv                    /RG:  0
 7 Bsy_                        11 11 11 11 11     RG:Pref:0 InSv
 8 RTS_      Drwr: 01 23 45 67 89 01 23 45 67 89        Stby:1 InSv
 9 OffL_           .. .. .. .. .. .. .. .. .. ..
10 LoadPM_
11 Disp_
12 Next_
13
14 QueryPM
15
16
17
18
```

10 Busy the LCM unit powered by the circuit breaker, by typing the following string:

>BSY UNIT lcm_unit_no
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit with the circuit card powered from the circuit breaker

Example of a MAP display:

```
 CM     MS     IOD     Net     PM     CCS     LNS     Trks     Ext   Appl
 .      .       .       .     1LCM    .        .       .        .     .
LCM.              SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM        4        1       10        3        3       130
 2 Post_   LCM.      1        1        5        0        1         9
 3
 4 SwRg      LCM    REM1  14 0 ISTb   Links_OOS:  CSide 1
 5 Trnsl     Unit-0:  InSv  Mtce TakeOver  /RG:  0
 6 Tst       Unit-1:  ManB Mtce            /RG:  0
 7 Bsy                           11 11 11 11 11 RG:Pref:0 InSv
 8 RTS       Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL            .. .. .. .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the front of the MSP

11 Locate the faulty circuit breaker card on the MSP and switch both breakers on that circuit card to the OFF position. Safety tag the front of the circuit breaker.

NTRX42
MSP (continued)

At the rear of the MSP

12

> **WARNING**
> **Risk of injury from high energy levels, static electricity damage**
> Wear a wrist strap connected to a wrist strap grounding point. This protects the equipment against damage caused by static electricity.

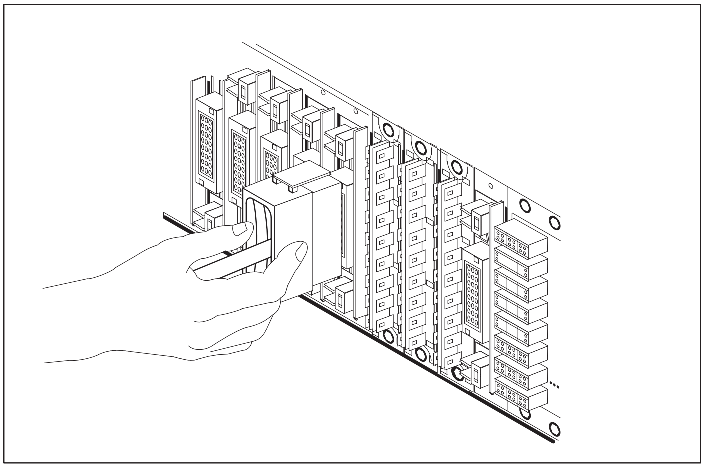
> **WARNING**
> **Risk of injury from high energy levels, equipment damage**
> When removing or inserting a card, do not apply direct pressure to the components and do not force the cards into the slots.

> **WARNING**
> **Risk of injury from high energy levels, voltage present**
> Do not insert metallic objects into the black connectors. Voltage is present and equipment damage could result.

Put on a wrist strap.

13 Swing the frame out and locate the NTRX42 circuit card. Ensure the card location by checking the slot number stamped into the chassis.

a. Note wire color and location to facilitate reconnection.



b. Safety tag the front of the circuit breaker to indicate maintenance activity.

c. Using the connector removal tool, manually disconnect the power connectors to the circuit card. Working from the bottom of the MSP shelf to the top of the MSP shelf, manually disconnect and tag the smaller black power connectors located below the larger blue power connector. Manually disconnect and tag the large blue power connector. Disconnect and tag the smaller black power connectors located above the large blue power connector. Ensure you disconnect the black connectors before removing the circuit card.

d. Although the connectors have voltage present on them, they are insulated. Secure the connectors to the power-connector bundle with a line-tie until it is time to reconnect them.

14 Disconnect and tag any jumper connectors and cables which may be present and set them aside for use on the replacement unit.

At the front of the MSP

15

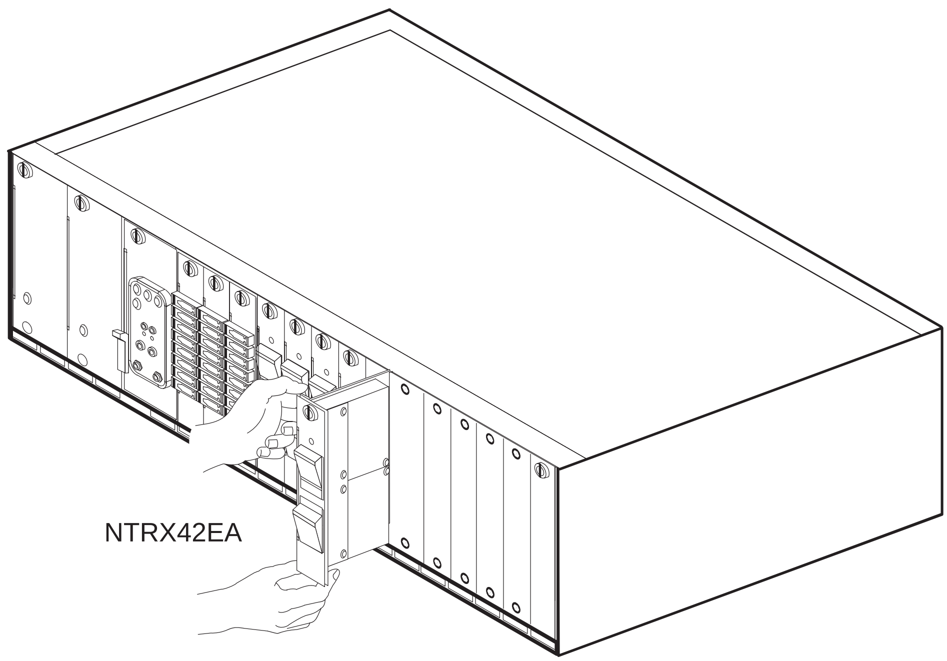
WARNING
Risk of injury from high energy levels, equipment damage
When removing or inserting a card, do not apply direct pressure to the components and do not force the cards into the slots.

Remove the faulty circuit card.

NTRX42
MSP (continued)

a. Disengage the spring-loaded captive screw at the top of the circuit card.

b. Grasping the top and bottom of unit, gently pull the circuit card towards you until it clears the shelf.



16 Ensure the replacement circuit card has the same PEC, including suffix, as the circuit card just removed.

a. Align the circuit card with the slots in the shelf and gently slide the circuit card into the shelf.

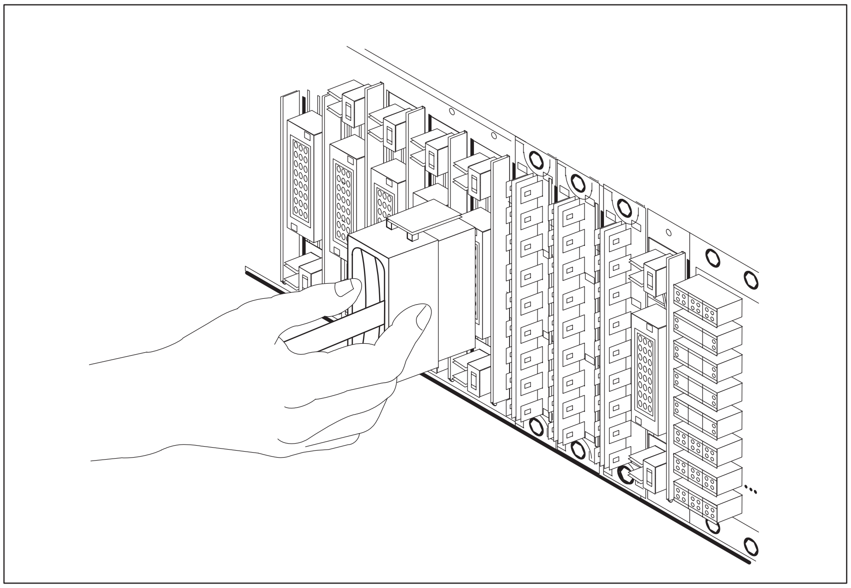
b. Gently but firmly seat the circuit card.

c. Tighten the captive screw at the top of the circuit card.

At the rear of the MSP

17 Locate the replaced circuit card and reattach the power connectors.

18 Replace any jumper connectors and cables removed in step 14. Reinsert the power connectors at the rear of the circuit card.



At the front of the MSP

19 Apply appropriate label from spare parts on replacement NTRX42 circuit card.

20 Switch on associated power converter.

21 Reset the circuit breakers to ON (upward). If any card controlled by this breaker includes a reset switch, hold the RESET button downward while setting the circuit breaker to the ON position.

22 Remove safety tag from front of circuit breaker.

23 Close the front cover of the MSP. Swing the cover up to the closed position and lock the two cover latches.

If CB powers	Go to
LCM	step 24
RMM	step 47

NTRX42
MSP (continued)

At the MAP terminal

24 Load the LCM unit by typing

>LOADPM UNIT lcm_unit_no CC
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit to loaded (0 or 1)

If	Do
message “`loadfile not found in directory`” is not received	step 25
load passes	step 42
load fails	step 70

25 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 49
IOC disk	step 55
SLM disk	step 60

26 Locate the tape that contains the PM load files.

27 Mount the tape on a magnetic tape drive.

At the MAP display

28 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

29 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.

30 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

31 Go to step 64.

32 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.

33 Access the disk utility level of the MAP by typing

>DSKUT
and pressing the Enter key.

34 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 32.

35 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

36 Go to step 64.

37 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.

38 Access the disk utility level of the MAP by typing

>DISKUT
and pressing the Enter key.

NTRX42
MSP (continued)

39 List the SLM file names into your user directory by typing

>LV CM
and pressing the Enter key.

>LF load_file_name
and pressing the Enter key.

where

load_file_name is the name of the volume that contains the PM load files, obtained in step 37.

40 Leave the disk utility by typing

QUIT
and pressing the Enter key.

41 LOAD the PM by typing

>LOADPM UNIT unit_no CC
and pressing the Enter key.

If LOADPM	Do
passed	step 42
failed	step 70

42 Test the LCM unit by typing

>TST UNIT lcm_unit_no
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit busied.

If TST	Do
passed	step 43
failed	step 70

NTRX42
MSP (continued)

43 Return the LCM unit to service by typing the following string:

>RTS UNIT lcm_unit_no
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit tested in step 42

If RTS	Do
passed	step 44
failed	step 70

44 Send any faulty cards for repair according to local procedure.

45 Record the following items in office records:

a. date the card was replaced.

b. serial number of the card.

c. symptoms that prompted replacement of the card.

46 Go to step 71.

47 Load the RMM by typing

>LOADPM
and pressing the Enter key.

If	Do
message “loadfile not found in directory” is not received	step 48
load passes	step 65
load fails	step 70

NTRX42
MSP (continued)

48 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 49
IOC disk	step 55
SLM disk	step 60

49 Locate the tape that contains the PM load files.

50 Mount the tape on a magnetic tape drive.

At the MAP display

51 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

52 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.

53 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

54 Go to step 64.

55 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.

NTRX42
MSP (continued)

56 Access the disk utility level of the MAP by typing

>DSKUT
and pressing the Enter key.

57 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 55.

58 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

59 Go to step 64.

60 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.

61 Access the disk utility level of the MAP by typing

>DISKUT
and pressing the Enter key.

62 List the SLM file names into your user directory by typing

>LV CM
and pressing the Enter key.

>LF S00Dload_file_name
and pressing the Enter key.

where

load_file_name is the name of the volume that contains the PM load files, obtained in step 60.

63 Leave the disk utility by typing

QUIT
and pressing the Enter key.

NTRX42
MSP (continued)

64 Load the RMM by typing

>LOADPM
and pressing the Enter key.

If load	Do
passed	step 65
failed	step 70

65 Test the RMM by typing

>TST
and pressing the Enter key.

If TST	Do
passed	step 66
failed	step 70

66 Return the RMM to service by typing

>RTS
and pressing the Enter key.

If RTS	Do
passed	step 67
failed	step 70

67 Send any faulty cards for repair according to local procedure.

68 Record the date card was replaced, the serial number of the card, and the symptoms that prompted replacement of the card.

69 Go to step 71.

70 Obtain further assistance in replacing this card by contacting the personnel responsible for the next higher level of support.

NTRX42
MSP (end)

71 You have completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NTRX43
MSP

Application

Use this procedure to replace NTRX43 card in an MSP.

PEC	Suffixes	Name
NTRX43	AA	Fuse Module

Common procedures

None

Action

A connector removal tool is available to facilitate removal of the AMP Faston receptacles from the power input and output connectors of the MSP modules.

This tool comes in two lengths: P0746192 152 mm (6 in.), and P0747552 254 mm (10 in.). The shorter tool is used when access to the rear of the MSP is very limited.

This tool is approximately 2 mm (.090 in.) thick and 17 mm (.65 in.) wide, with a jaw-like cut-out at each end. The cut-out profile conforms to the shape of the Faston receptacle. The shorter tip of each profile is used to position the receptacle in the tool.

The first meeting point of the tool serves as the pivot point. By rotating the tool around this pivot point, the longer tip of the profile which has a hook on its end, is engaged with the action-arm of the power connector.

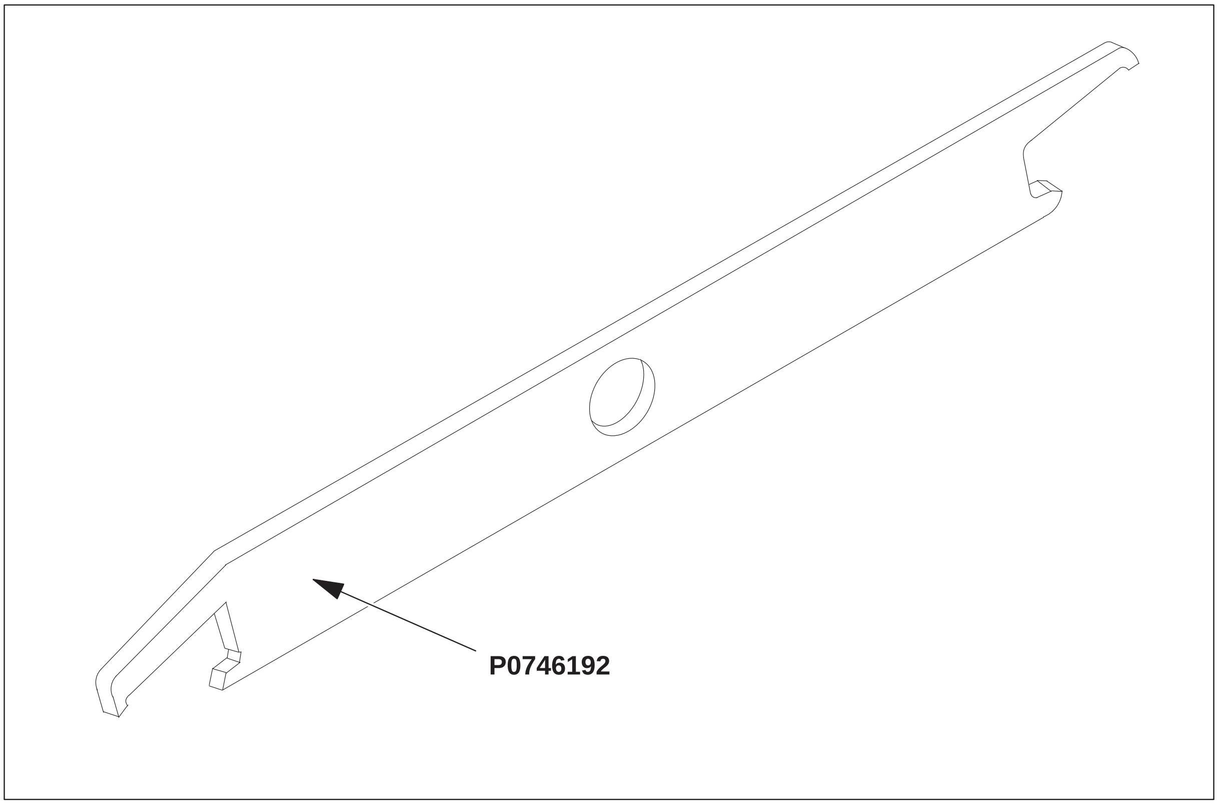
As the action-arm of the connector is depressed, the receptacle is disengaged from the connector tab. The receptacle is removed by pulling the tool with the receptacle trapped in its jaw, away from the connector. The tool is disengaged from the receptacle by rotating the tool’s hook off the action-arm of the receptacle.

Although the shape of the cut-out is the same on each end of the tool, the orientation of the profile is off by 15 degrees. This difference allows for the use of the tool at different angles, which may be required due to limited access to the connectors.

The following is an illustration of the connector removal tool.

NTRX43
MSP (continued)

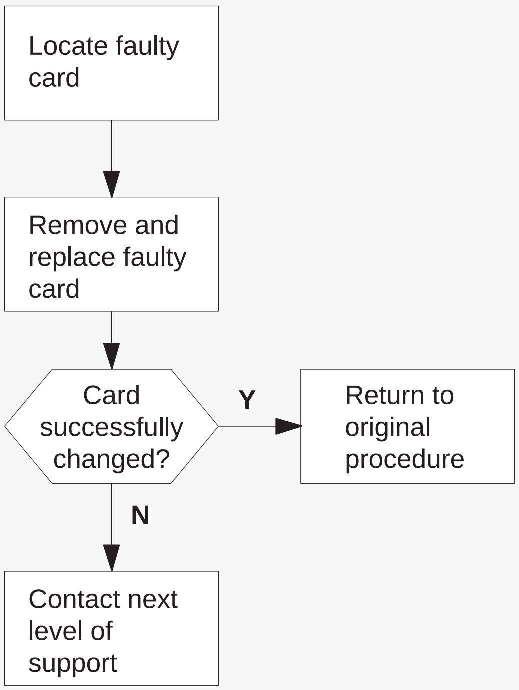
Connector removal tool



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.

NTRX43
MSP (continued)

Summary of card replacement procedure for an NTRX43 card in an MSP



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NTRX43
MSP (continued)

Replacing an NTRX43 in an MSP

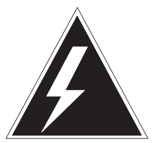
At your Current Location

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 that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

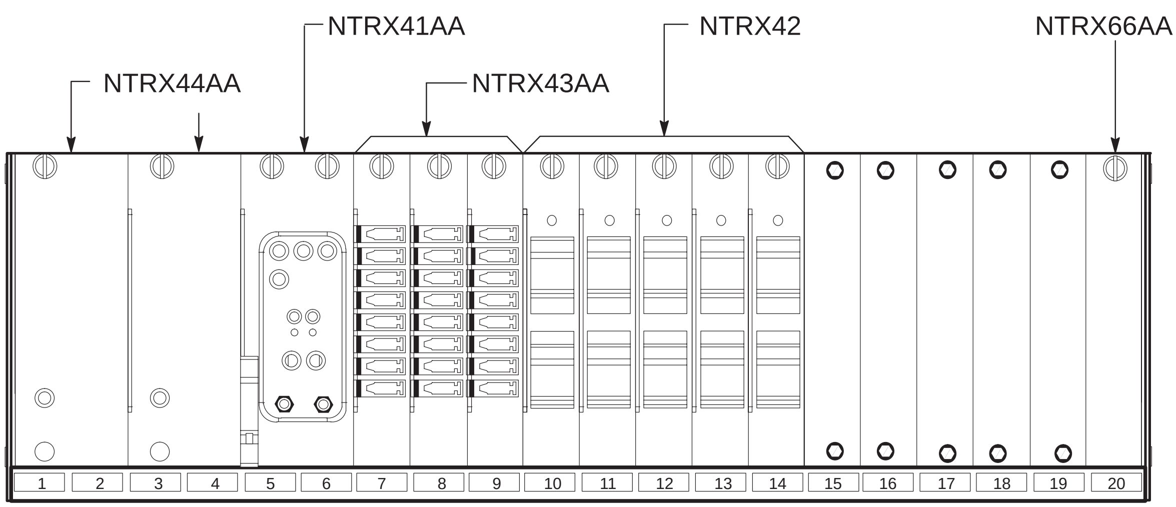
At the front of the MSP

3



WARNING
Risk of injury from high energy levels, static electricity damage
Wear a wrist strap connected to a wrist strap grounding point to protect equipment against damage caused by static electricity.

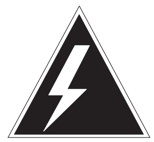
Open the front cover of the MSP. Release the two cover latches and swing the cover down to the open position.



NTRX43
MSP (continued)

At the rear of the MSP

4



WARNING
Risk of injury from high energy levels, voltage present
Do not insert metallic objects into the black connectors. Voltage is present and equipment damage could result.

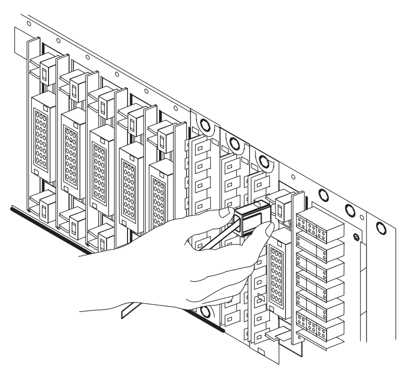
Put on a wrist strap.

Before removing fuses from fuse module, observe fuse colors, values, and positions. Remove fuses from fuse module. When servicing the fuse module, fans may shut down, alarms may be activated, and there may be a loss of alarms.

5 Disconnect the NTRX43 circuit card as shown in the following figure.

a. Swing the frame out and locate the back of the card to be replaced.

b. Note wire color and location to facilitate reconnection.



c. Using the connector removal tool, manually disconnect the power connectors to the circuit card. Working from the bottom of the MSP shelf to the top of the MSP shelf, manually disconnect the smaller black power connectors located below the larger blue power connector. Manually disconnect the large blue power connector. Disconnect the smaller black power connectors located above the large blue power connector. Ensure you disconnect the black connectors *before* removing the circuit card.

NTRX43
MSP (continued)

d. Although the connectors have voltage present on them, they are insulated. Secure the connectors to the power-connector bundle with a line-tie until it is time to reconnect them.

e. Remove and tag jumper connectors and cables, which may be present on the back of the circuit card and save for use on the replacement circuit card.

At the front of the MSP

6

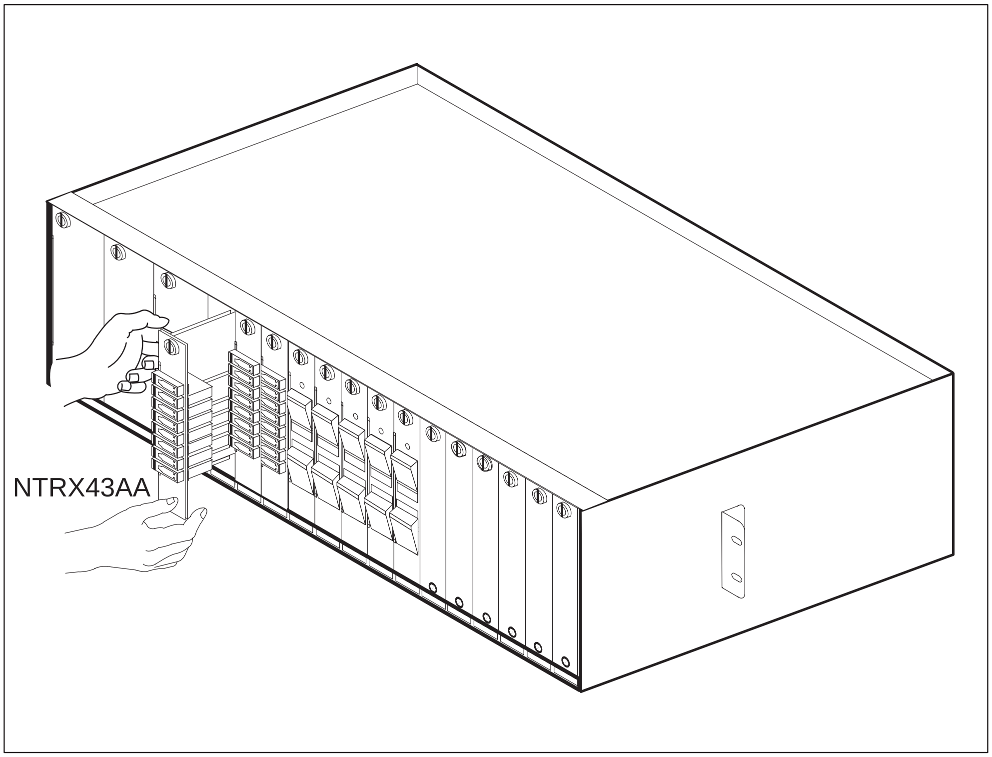
> **WARNING**
> **Risk of injury from high energy levels, equipment damage**
> When removing or inserting a card, do not apply direct pressure to thecomponents and do not force the cards into the slots.

Remove the NTRX43 circuit card as shown in the following figure.

a. Disengage the captive screw at the top of the circuit card.

NTRX43
MSP (continued)

b. Gently pull the circuit card towards you until it clears the shelf.



7 Ensure the replacement circuit card has the same PEC, including suffix, as the circuit card just removed.

a. Align the circuit card with the slots in the shelf and gently slide the circuit card into the shelf.

b. Gently but firmly seat the circuit card.

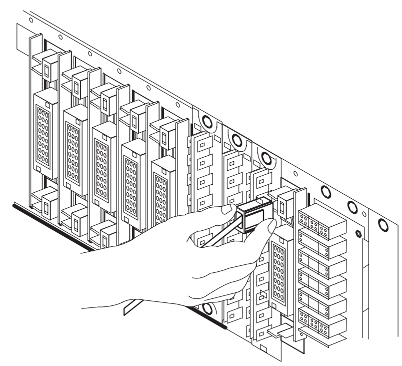
c. Tighten the captive screw at the top of the circuit card.

At the rear of the MSP

8 Locate the replaced circuit card and reattach the power connectors.

NTRX43
MSP (end)

Install the jumper connectors and cables removed in step 5 onto the replacement circuit card.



At the front of the MSP:

9 Replace fuses removed in step 4.

If Fuses	Do
do not blow	step 10
blow (protrude)	step 12

10 Send any faulty cards for repair according to local procedure.

11 Record the date the card was replaced, the serial number of the card, and the symptoms that prompted replacement of the card. Go to step 13.

12 Obtain further assistance in replacing this card by contacting the personnel responsible for the next higher level of support.

13 You have completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure, and continue as directed.

NTRX44
MSP

Application

Use this procedure to replace the following card in an MSP.

PEC	Suffixes	Name
NTRX44	AA	Talk Battery Module

Common procedures

None

Action

A connector removal tool is available to facilitate removal of the AMP Faston receptacles from the power input and output connectors of the MSP modules.

This tool comes in two lengths: P0746192 152 mm (6 in.) and P0747552 254 mm (10 in.). The shorter tool is used when access to the rear of the MSP is very limited.

An example of limited access is MSP modules located directly behind the cabinet bulkhead.

This tool is approximately 2 mm (.090 in.) thick and 17 mm (.65 in.) wide, with a jaw-like cut-out at each end. The cut-out profile conforms to the shape of the Faston receptacle. The shorter tip of each profile is used to position the receptacle in the tool.

The first meeting point of the tool serves as the pivot point. By rotating the tool around this pivot point, the longer tip of the profile which has a hook on its end is engaged with the action-arm of the power connector.

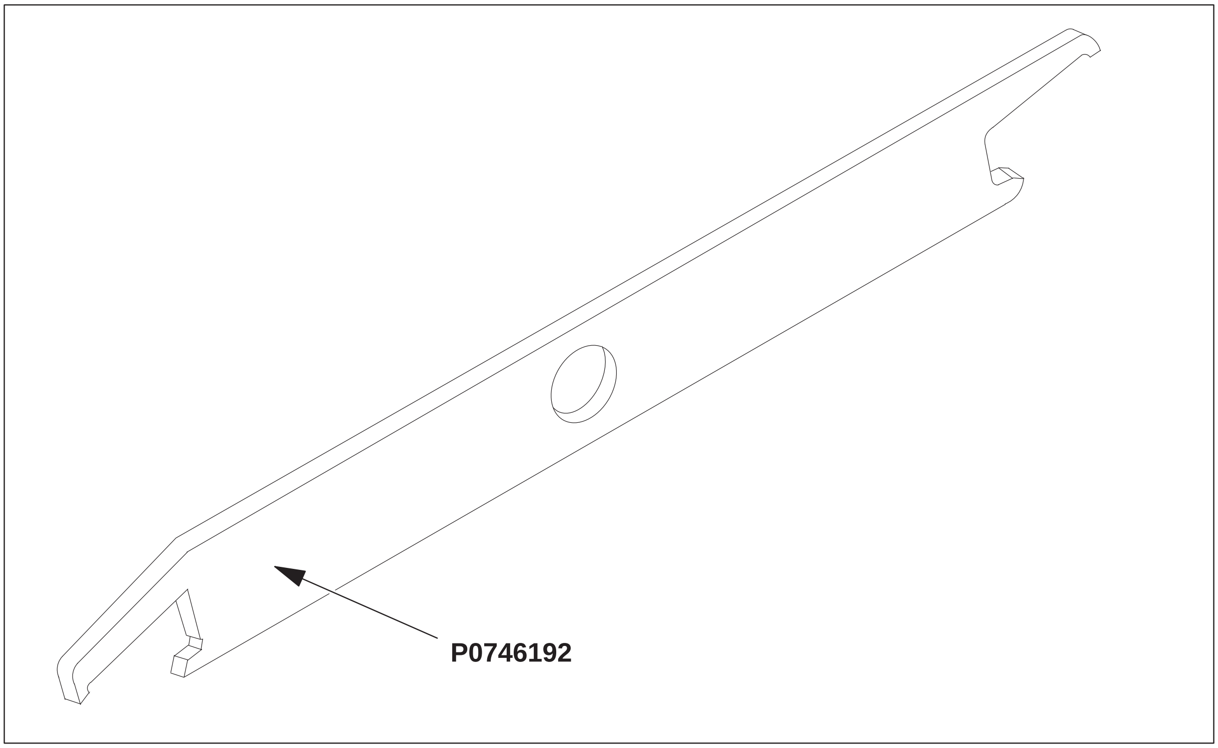
As the action-arm of the connector is depressed, the receptacle is disengaged from the connector tab. The receptacle is removed by pulling the tool with the receptacle trapped in its jaw, away from the connector. The tool is disengaged from the receptacle by rotating the tool’s hook off the action-arm of the receptacle.

Although the shape of the cut-out is the same on each end of the tool, the orientation of the profile is off by 15 degrees. This difference allows for the use of the tool at different angles, which may be required due to limited access to the connectors.

NTRX44
MSP (continued)

The following is an illustration of the connector removal tool.

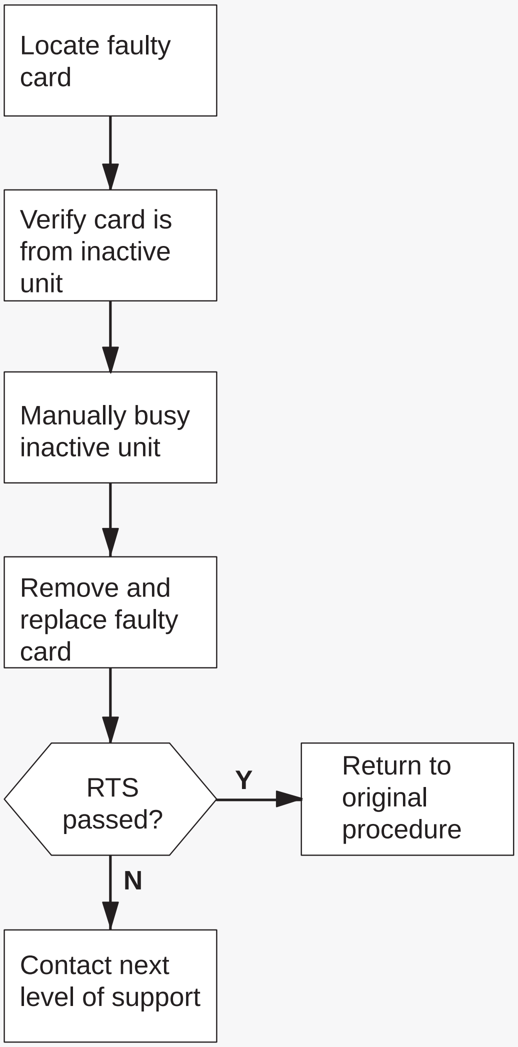
Connector removal tool



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.

NTRX44
MSP (continued)

Summary of card replacement procedure for an NTRX44 card in an MSP



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NTRX44
MSP (continued)

Replacing an NTRX44 in an MSP

At your current location:

1

> **CAUTION**
> **Loss of service**
> A loss of service *will* occur when this procedure is used as an acceptance procedure or when talk battery is already available on the affected LCM unit. Busying the LCM unit is a precaution only and does not transfer talk battery to the other LCM unit. Talk battery is *not redundant,* and therefore a loss of service occurs on the affected LCM unit. Perform this procedure only during periods of low traffic.

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 equipment code (PEC), including suffix, as the card that is to be removed.

NTRX44
MSP (continued)

At the MAP terminal:

3 Access the PM level and post the LCM by typing:

>MAPCI;MTC;PM;POST LCM site frame lcm
and pressing the Enter key.

where

site	is the site name (alphanumeric) of the OPAC
frame	is the frame number (0-511) of the OPAC
lcm	is the number (0 to 1) of the LCM

Example of a MAP display:

```
   CM    MS    IOD    Net    PM    CCS    Lns    Trks    Ext    APPL
   .     .      .      .    1LCM    .      .       .      .      .

LCM.              SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit     PM     1        0        0         0       0         126
 2 Post_    LCM.   0        0        0         0       1           9
 3 ListSet
 4 SwRG     LCM.   REM1   14 1 ISTb  Links_OOS:  CSide 0   PSide 0
 5 Trnsl_   Unit0:   InSv                 /RG: 1
 6 Tst_     Unit1:   InSv                 /RG: 1
 7 Bsy_                              11  11  11 11 11 RG:Pref 1 ISTB
 8 RTS_     Drwr: 01  23  45  67  89  01  23  45 67 89    Stby 0 InSv
 9 OffL           ..  ..  ..  ..  ..  ..  ..  .. .. ..
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

4 Busy the affected in-service LCM unit by typing

>BSY UNIT lcm_unit_no
and pressing the Enter key.

where

lcm_unit_no	is the number of the INACTIVE LCM unit (0 or 1)

Note: The Talk Battery Module in slots 1 and 2 controls unit number 0; the Module in slots 3 and 4 controls unit number 1.

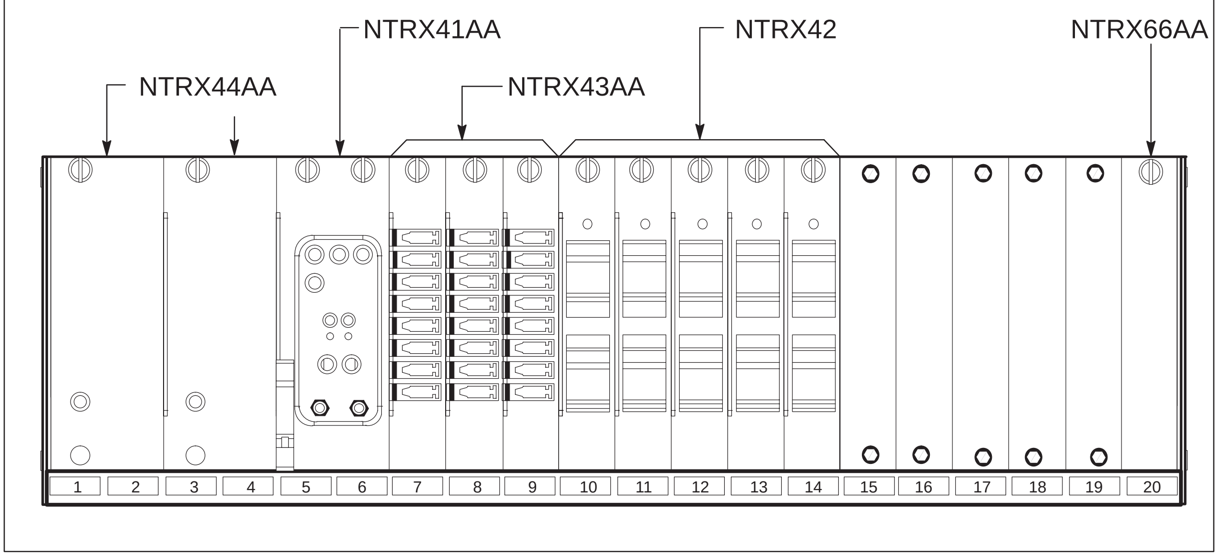
NTRX44
MSP (continued)

At Bay 1 of the OPAC:

5

> **WARNING**
> **Risk of injury from high energy levels, static electricity damage**
> Wear a wrist strap and connect it to a wrist strap grounding point. This protects the equipment from damage caused by static electricity. A wrist strap grounding point is located at the top of each frame near the hinge.

Open the front cover of the MSP by pulling outward firmly at the finger holes provided and swing the cover down to the open position.



6 The circuit breaker designation may vary. Verify the circuit breaker designation, front and rear of MSP, before replacing the talk battery module.

7 Turn OFF the associated circuit breaker in slot 10 (circuit breaker 02) if replacing the talk battery module in slots 1 and 2. Turn OFF the associated circuit breaker at slot 11 (circuit breaker 04) if replacing the talk battery module in slots 3 and 4.

NTRX44
MSP (continued)

At the rear of the MSP

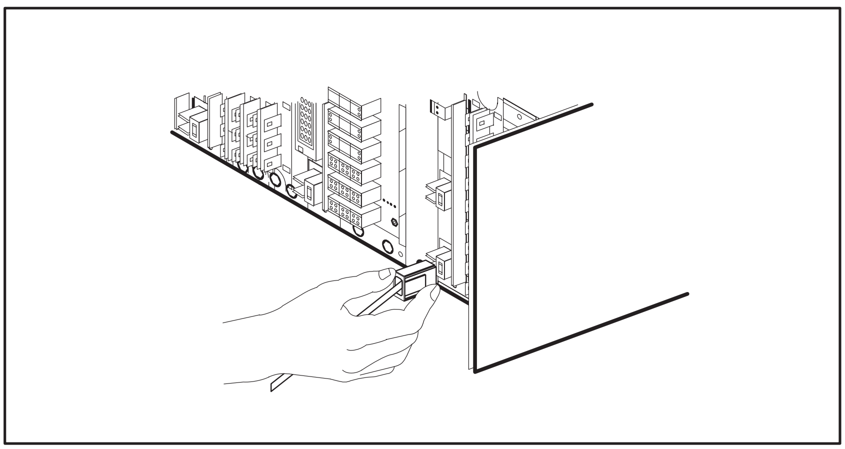
8

WARNING
Risk of injury from high energy levels, voltage present
Do not insert metallic objects into the black connectors. Voltage is present and equipment damage could result.

Disconnect the NTRX44 card as shown in the following figure.

a. Swing the frame out and locate the back of the card to be replaced. The card is located in slots 1 and 2 for talk battery "A" or in slots 3 and 4 for talk battery "B".

b. Note wire color and location to facilitate reconnection.

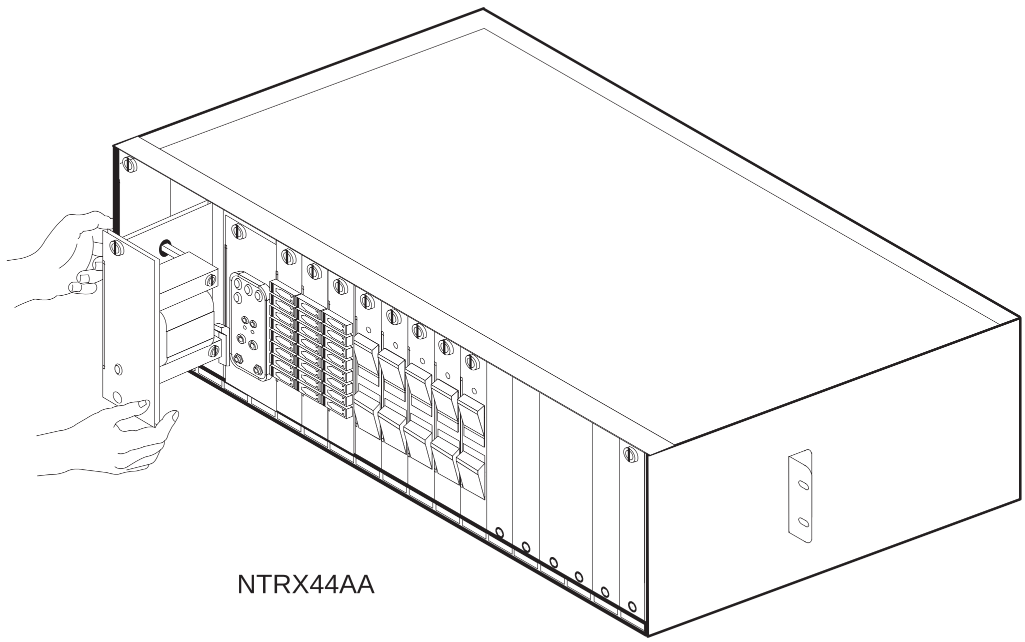


c. Using the connector removal tool, manually disconnect the power connectors to the circuit card. Working from the bottom of the MSP shelf to the top of the MSP shelf, manually disconnect the smaller black power connectors located below the larger blue power connector. Manually disconnect the large blue power connector. Disconnect the smaller black power connectors located above the large blue power connector. Ensure you disconnect the black connectors before removing the circuit card.

d. Although the connectors have voltage present on them, they are insulated. Secure the connectors to the power-connector bundle with a line-tie until it is time to reconnect them.

At the front of the MSP

9 Remove the NTRX44 card as shown in the following figure.



a. Disengage the captive screw at the top of the card.

b. Gently pull the card toward you until it clears the shelf.

10

> **WARNING**
> **Risk of injury from high energy levels, equipment damage**
> When inserting a card, do not apply direct pressure to the components and do not force the cards into the slots.

Ensure the replacement card has the same PEC, including suffix, as the card you just removed.

a. Align the card with the slots in the shelf and gently slide the card into the shelf.

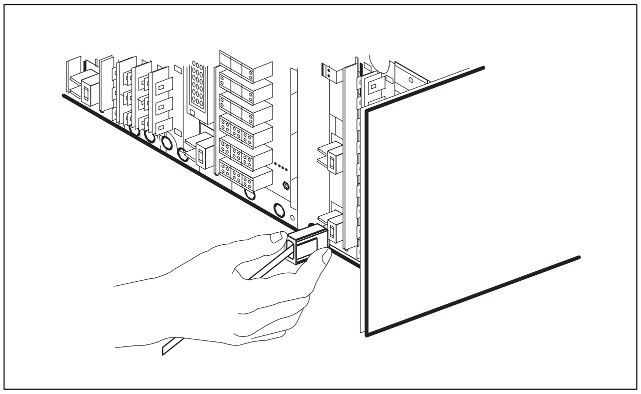
b. Gently but firmly seat the card.

NTRX44
MSP (continued)

c. Tighten the captive screw at the top of the card.

At the rear of the MSP

11 Locate the replaced card and reattach the power connectors, as noted in step 8.



At the front of the MSP

12 If talk battery A, in slots 1 and 2, was replaced, turn on the circuit breaker at slot 10 (circuit breaker 02). If talk battery B, in slots 3 and 4, was replaced, turn on the circuit breaker at slot 11 (circuit breaker 04).

At the MAP terminal

13 Load the PM by typing

>LOADPM UNIT lcm_unit_no CC
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit to be loaded
and pressing the Enter key.

If	Do
message “loadfile not found in directory” is not received	step 14
load passed	step 31
load failed	step 34

14 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 15
IOC disk	step 21
SLM disk	step 26

15 Locate the tape that contains the PM load files.

16 Mount the tape on a magnetic tape drive.

At the MAP display

17 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

18 List the contents of the tape in your user directory by typing

>TLIST T tape_no
and pressing the Enter key.

where

tape_no is the number of the tape drive containing the PM load files.

19 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

20 Go to step 30.

21 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.

NTRX44
MSP (continued)

22 Access the disk utility level of the MAP by typing

>DSKUT
and pressing the Enter key.

23 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 21.

24 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

25 Go to step 30.

26 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.

27 Access the disk utility level of the MAP by typing

>DISKUT
and pressing the Enter key.

28 List the SLM file names into your user directory by typing

>LV CM
and pressing the Enter key.

>LF load_file_name
and pressing the Enter key.

where

load_file_name is the name of the volume that contains the PM load files, obtained in step 26.

29 Leave the disk utility by typing

>QUIT
and pressing the Enter key.

NTRX44
MSP (end)

30 Load the LCM unit by typing

>LOADPM UNIT lcm_unit_no CC
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit to be loadeded
and pressing the Enter key.

If	Do
load passed	step 31
load failed	step 34

31 Return the busied LCM unit to service by typing the following string:

>RTS UNIT lcm_unit_no
and pressing the Enter key.

where

lcm_unit_no is the number of the LCM unit to be returned to service

If RTS	Do
passed	step 32
failed	step 34

32 Send any faulty cards for repair according to local procedure.

33 Record the date card was replaced, the serial number of the card, and the symptoms that prompted replacement of the card. Go to step 35.

34 Obtain further assistance in replacing this card by contacting the personnel responsible for the next higher level of support.

35 You have completed this procedure. Remove the sign from the active unit and return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NTRX66
MSP

Application

Use this procedure to replace NTRX66 card in an MSP.

PEC	Suffix	Name
NTRX66	AA	Fan Alarm Module

Common procedures

None

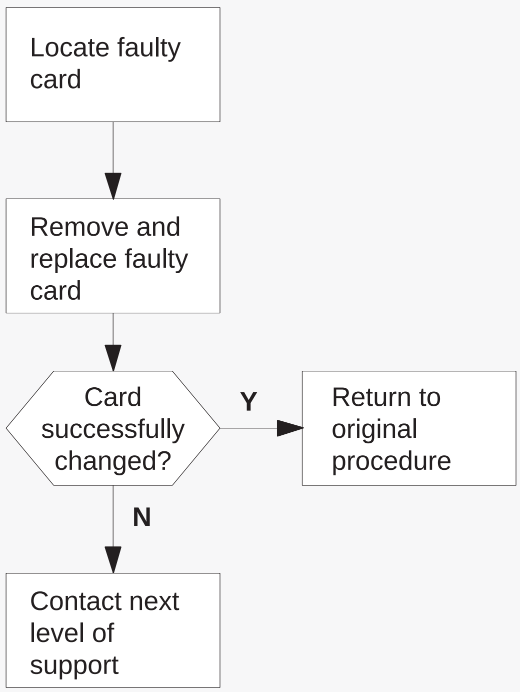
Action

None

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.

NTRX66
MSP (continued)

Summary of card replacement procedure for an NTRX66 card in an MSP



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NTRX66
MSP (continued)

Replacing an NTRX66 in an MSP

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.

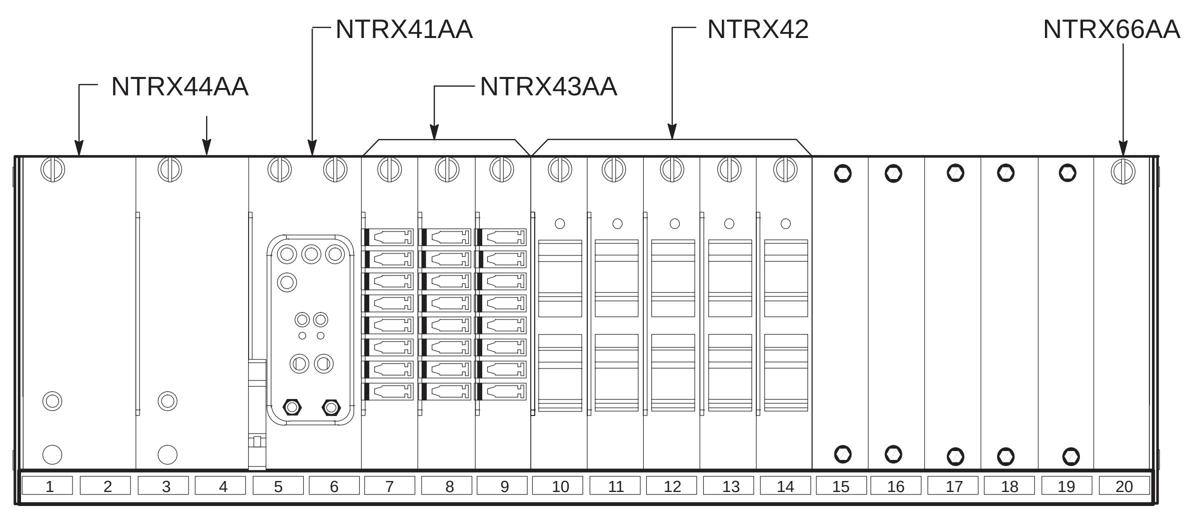
2 Get a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the front of the MSP

3

> **WARNING**
> **Risk of injury from high energy levels, static electricity damage**
> Wear a wrist strap connected to a wrist strap grounding point. This protects the equipment against damage caused by static electricity.

Open the front cover of the MSP by pulling outward firmly at the finger holes provided and swing the cover down to the open position.



4

> **WARNING**
> **Risk of injury from high energy levels, equipment damage**
> Take these precautions when removing or inserting a card. Do not apply direct pressure to the components and do not force the cards into the slots.

Put on a wrist strap.

At the rear of the MSP

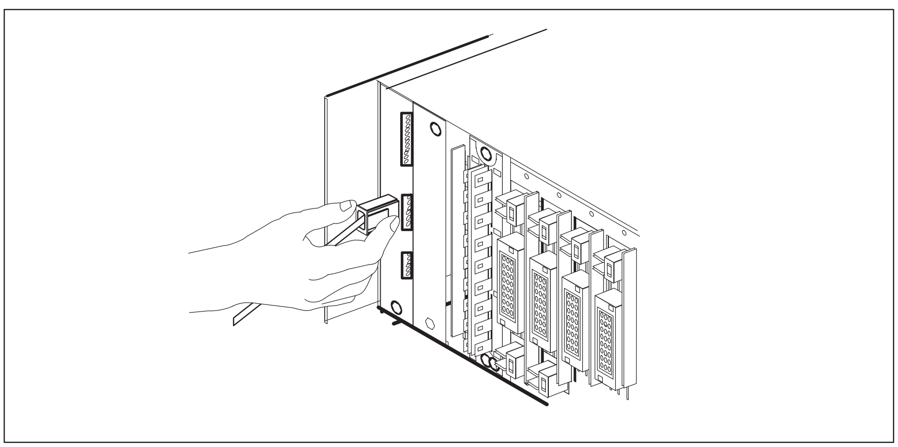
5

> **WARNING**
> **Risk of injury from high energy levels, voltage present**
> Do not insert metallic objects into the black connectors. Voltage is present and equipment damage could result.

Disconnect the NTRX66 circuit card as shown in the following figure.

a. Swing the frame out and locate the back of the circuit card to be replaced. The circuit card is in slot 20.

b. Note the wire color and location to facilitate reconnection.



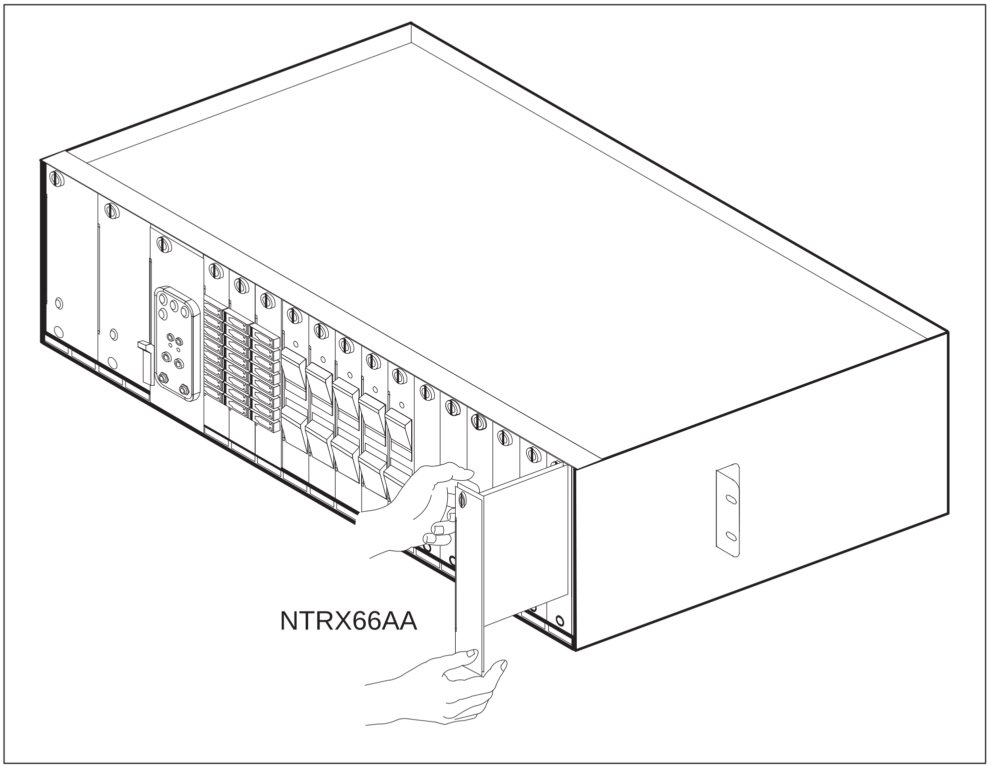
c. Manually disconnect all connectors from the circuit card.

NTRX66
MSP (continued)

d. Although the connectors have voltage present on them, they are insulated. Secure the connectors to the power-connector bundle with a line-tie until it is time to reconnect them.

At the front of the MSP

6 Remove the NTRX66 as shown in the following figure.



a. Disengage the captive screw at the top of the circuit card.

b. Gently pull the circuit card towards you until it clears the shelf.

7 Ensure the replacement circuit card has the same PEC, including suffix, as the circuit card just removed.

a. Align the circuit card with the slots in the shelf and gently slide the circuit card into the shelf.

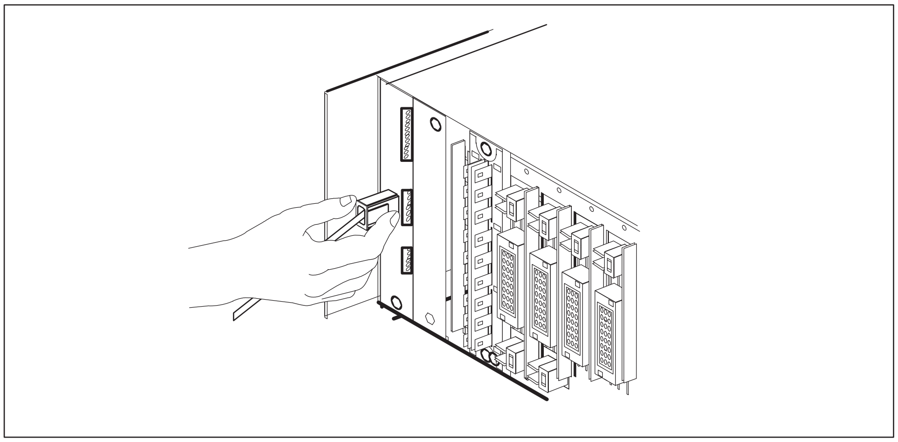
b. Gently but firmly seat the circuit card.

c. Tighten the captive screw at the top of the circuit card.

NTRX66
MSP (end)

At the rear of the MSP

8 Locate the replaced circuit card and reattach the connectors, as noted in step 5.



9 Send any faulty cards for repair according to local procedure.

10 Record the date the card was replaced, the serial number of the card, and the symptoms that prompted replacement of the card. Go to step 11.

11 You have completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

Replacing a card

Application

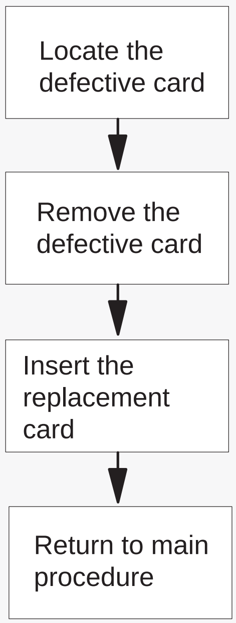
Use this procedure to unseat, remove, and reseat cards.

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.

Replacing a card (continued)

Summary of Replacing a card



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Replacing a card (continued)

Replacing a card

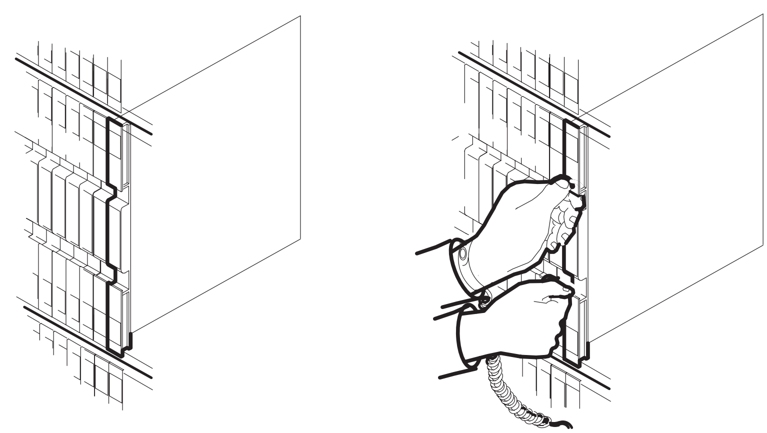
At your Current Location

1 Proceed only if you have been directed to this procedure from a step in a maintenance procedure. Using this procedure independently may cause equipment damage or loss of service.

2

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point at the top of each equipment rack, (Bay 0, 1, 2, and 3), while handling circuit cards. This protects the cards against damage caused by static electricity.

Locate the card to be removed on the appropriate shelf if you have not already done so.

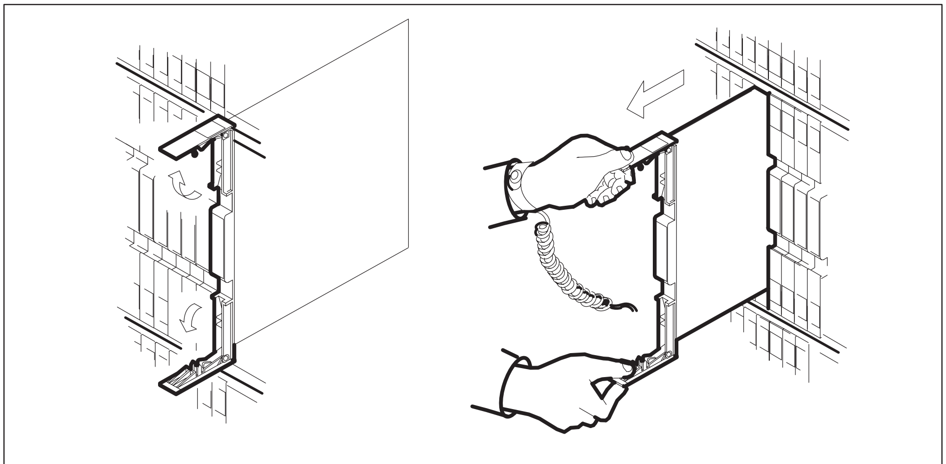


Replacing a card (continued)

3

WARNING
Do not hold card by levers only
Holding a card only by the levers may result in lever breakage. After the card has been pulled halfway out of the shelf, carefully grasp the card underneath for more secure support and continue to remove the card from the shelf. Avoid touching any wires or internal parts on the card.

Open the locking levers on the card to be replaced. Gently pull the card toward you until it clears the shelf.



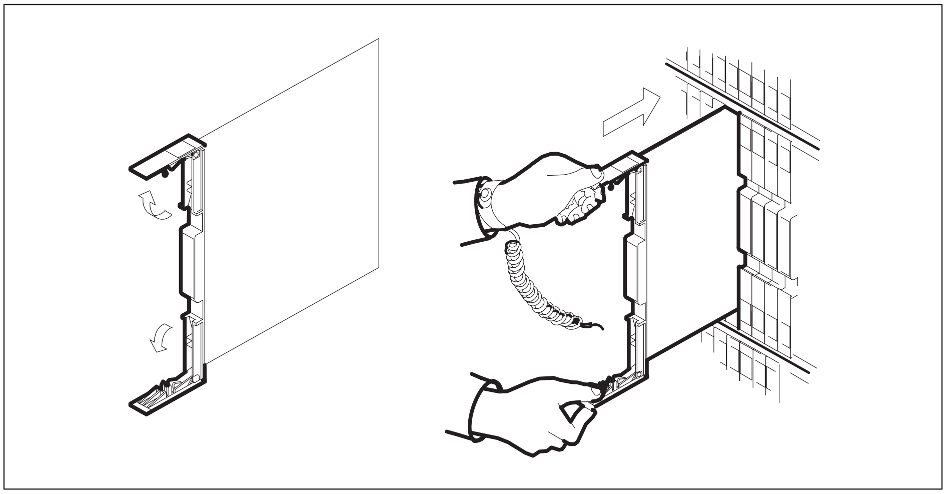
4 Examine the switch settings (if any) of the card just removed. Ensure that the switch settings on the replacement card match those of the card being replaced.

5 Place the card you have removed in an electrostatic discharge (ESD) protective container.

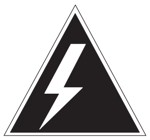
6 Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card you just removed.

Replacing a card (continued)

7 Open the locking levers on the replacement card. Align the card with the slots in the shelf and gently slide the card into the shelf.



8



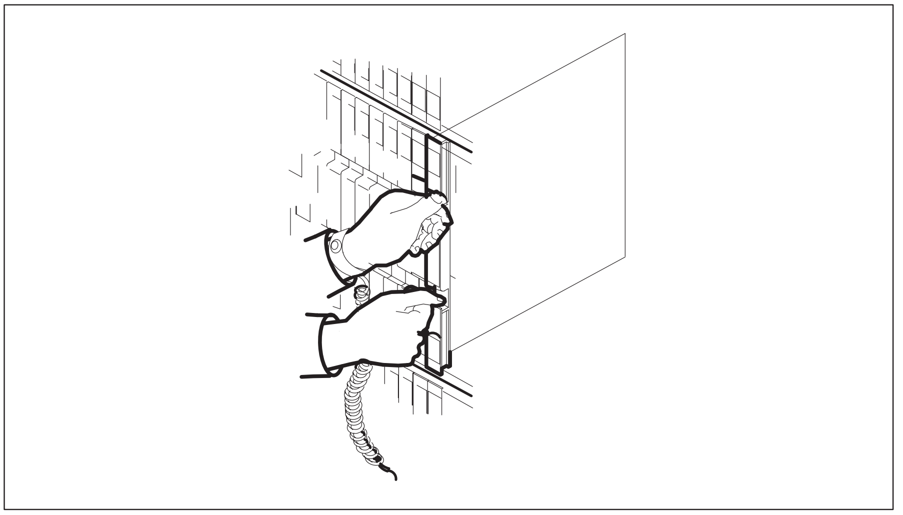
WARNING
Improper insertion may damage circuit packs
Do not apply direct pressure to the components. Do not force the circuit packs into the slots.

Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

Replacing a card (end)

b. Close the locking levers.



9 You have completed this procedure. Return to the main procedure that sent you to this procedure and continue as directed.

Replacing a line card

Application

Use this procedure to unseat, remove, and reseat line cards if you have been directed from a maintenance 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.

Replacing a line card (continued)

Summary of Replacing a line card

1. Locate the defective line card
2. Remove the defective line card
3. Insert the replacement line card
4. Return to main procedure

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Replacing a line card (continued)

Replacing a line card

At your current location:

1 Proceed only if you have been directed to this procedure from a step in a maintenance procedure. Using this procedure independently may cause equipment damage or loss of service.

Note: Card shrouds are required for inserting or removing cards in line drawers. Two sizes are available for use with three-inch and six-inch cards. Descriptions of these shrouds are as follows:

Line card insertion / withdrawal tool for	Apparatus code	Common product code
three-inch cards	QTH56A	A0298291
six-inch cards	QTH58A	A0313317

Note: Card removal tools are required for removing cards from line drawers. Two sizes are available. Descriptions of these tools are as follows:

Card removal tool for	Apparatus code	Common product code
three- and four-inch cards	QTH57A	A0298292
Note: For four-inch or larger cards, use the large grip tool ITA9953.		

Replacing a line card (continued)

2

> **WARNING**
> **Improper handling could possibly damage cards**
> Store and transport circuit cards in electrostatic discharge (ESD) protective containers to prevent electrical and mechanical damage.
> When handling circuit cards not in ESD protective containers, stand on a conductive floor mat and wear a wrist strap, connected through a 1-megohm resistor, to a suitably-grounded object such as a metal workbench or a DMS frame. (Refer to Nortel [Northern Telecom] Corporate Standard 5028.)

> **WARNING**
> **Equipment damage**
> Take these precautions when removing or inserting a card:
> Do not apply direct pressure to the components.
> Do not force the cards into the slots.

> **WARNING**
> **Hot materials**
> Exercise care when handling the line card. The line feed resistor may be very hot.

> **Caution**
> **Special tools required**
> Card shrouds and removal tools are required for removing cards from the line drawers. For descriptions of these tools, refer to the notes at the end of this procedure.

Locate the line drawer containing the line card to be removed.

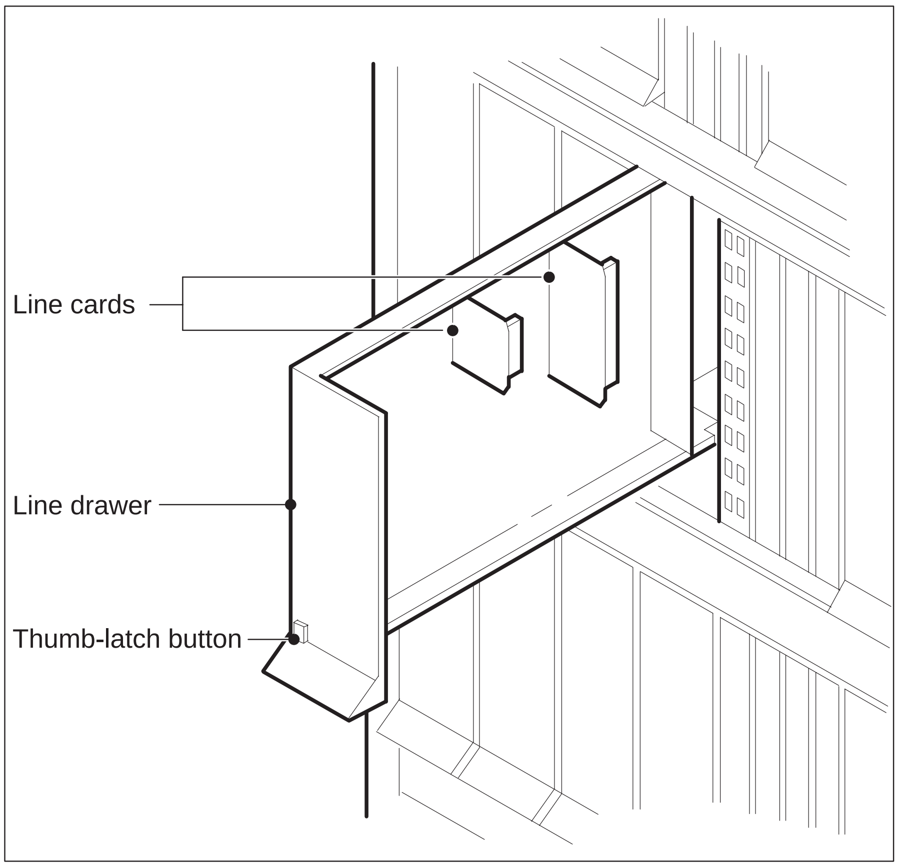
Replacing a line card (continued)

3 Open the line drawer to prepare to remove the faulty card by following the steps below:

a. Face the drawer shelf and grasp the handle at the bottom of the drawer with the right hand.

b. Push up on the drawer latch with your thumb and pull the drawer out until fully withdrawn. It is fully withdrawn when the drawer stop, at the top, prevents further travel.

c. Ensure that a card shroud and line card extractor are available. (See notes 1 and 2 at end of this procedure.)



4 Remove the line card to be replaced by using the following steps:

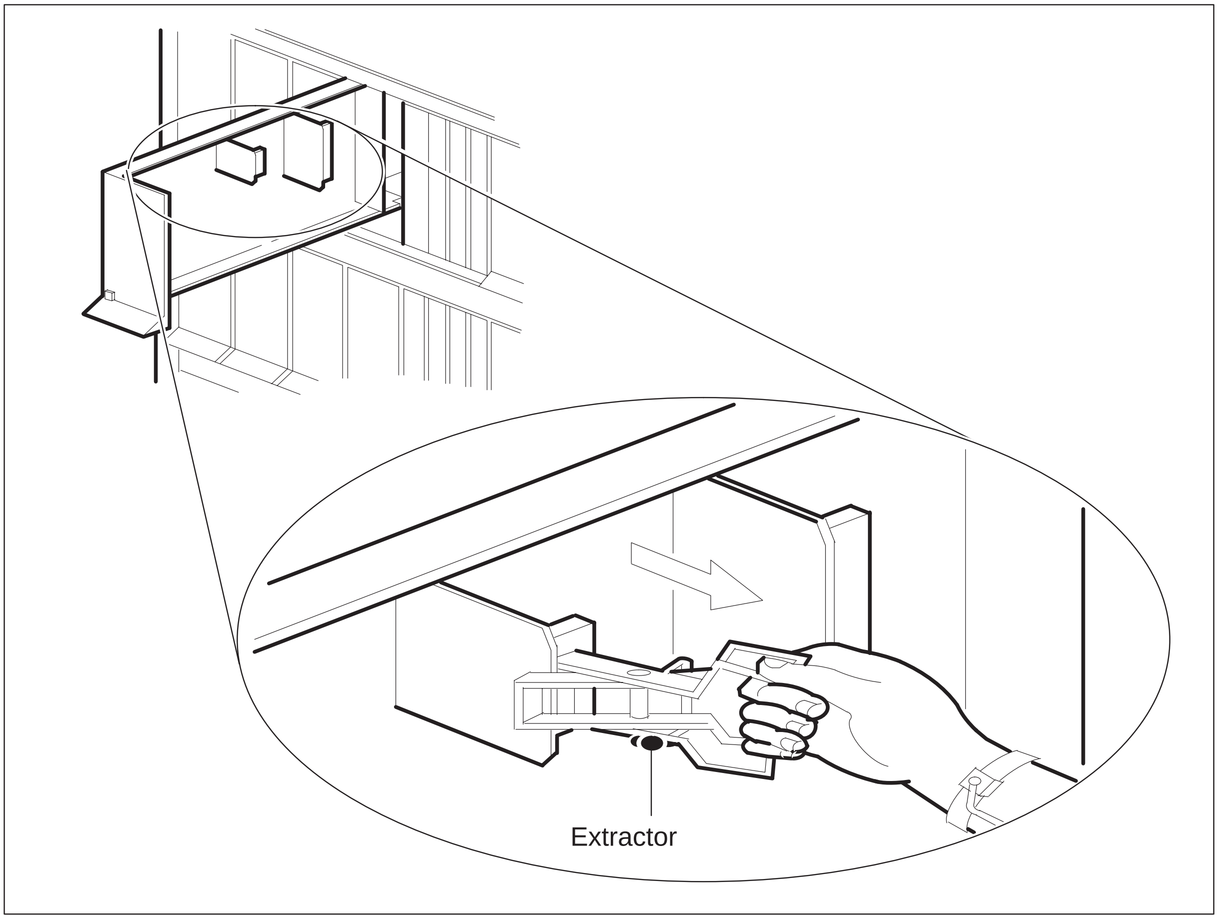
a. Slide a card shroud over the card to be removed and an adjacent card. (If there is not an adjacent card on either side, do not use the card shroud.)

b. Grasp the edge of the card with a line card extractor at a point midway between the top and bottom edges. Hold the extractor in your right hand.

c.

Replacing a line card (continued)

Squeeze the handles of the extractor together to grasp the card tightly.



d. Hold the front cover of the line drawer to steady it with your left hand.

e. Pull the extractor away from the drawer and the card will come unplugged from its socket on the drawer backplane.

f. Continue pulling the card with the extractor until the card is clear of the shroud.

g. Insert the removed card into an ESD container and store according to local procedures.

5 Verify that the product equipment codes on the nameplate of the removed card and the replacement card are the same.

Replacing a line card (end)

6 Replace the faulty card using the following steps:

a. Remove the replacement card from its ESD container.

b. Slide the card in shroud guide slots toward the drawer backplane.

c. Hold the front cover of the line drawer with your left hand to steady it.

d. Grasp the top and bottom edges of the card with the fingers of your right hand.

e. Push the card toward the backplane until it plugs fully into the backplane socket.

7 You have completed this procedure. Return to the main procedure that sent you to this procedure and continue as directed.

Locating and clearing OPAC trouble

This Outside Plant Access Cabinet (OPAC) trouble locate and clear section is for use by telephone operating company maintenance personnel. Telephone operating company maintenance personnel already have a basic knowledge of the DMS-100 series of switches and of the OPAC. This section is not for operating company personnel that need exact procedures when they perform maintenance tasks.

Trouble isolation and correction

Description of troubleshooting procedures

Basic troubleshooting procedures consist of the following:

- how to locate and clear faults
- fault isolation tests
- diagnostic tests
- product-specific test tools

Performance indicators

The first step in how to locate faults is to examine the performance indicators the system normally generates. Operational measurements (OM), log reports, and alarms indicate if fault conditions are present.

Operational measurements

The OMs are a system that collects data that track specified events and how often these events occur. The OM data indicates performance and use. The OM data can detect both accurate and potential system problems.

The OM thresholding feature can monitor and report key Outside Plant Access Cabinet (OPAC) activity. Make these reports daily or weekly. These reports are the primary method of trouble detection.

Refer to *XPM OM Reference Manual* for more information about the OMs that are associated with the OPAC.

Log reports

Use logs as an analysis tool to provide detailed information on call errors, diagnostic results, and system status. Logs can indicate trouble conditions when any of the following conditions exist:

- sudden increase in volume of logs
- message not printed reports
- large number of logs that are the same.

Alarms

Audible and visual alarms indicate that correcting action is required. Correct performance of normal system maintenance and use of OMs and logs can decrease the occurrence of alarms.

The level of the alarm indicates alarm severity and priority for correcting action. The level of the alarm can be minor, major, or critical. Alarm conditions appear in the following table.

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 outage or potential service outage

Follow the following guidelines when you respond to alarms:

- When more than one alarm of the same severity appears on the MAP display, clear the alarms. Clear the alarms from the left of the screen to the right.
- If an alarm of greater severity occurs while you fix an alarm, respond to the new alarm. Do not continue attempts to clear the less severe alarm.

For procedures to clear alarms, refer to *Alarm Clearing Procedures*.

Locating and clearing faults

The standard troubleshooting steps to locate and clear alarms follow:

1. Silence audible alarms the system causes when the system detects alarm conditions.
2. Read status displays and trace fault codes to the menu level needed to isolate and clear the fault.
3. Busy the hardware to eliminate system access to the defective component. When you busy the hardware, maintenance activity occurs without system interference.
4. Test the defective component. Identify the card to replace. Replace the defective card. Test the card again.
5. Return the hardware to service.

Fault isolation tests

When the system detects a fault condition in the OPAC, a maintenance action is required. Fault isolation tests determine which component causes the fault. Fault isolation tests determine how to correct the fault condition. Fault isolation tests determine how to report the fault condition to the correct maintenance support organization.

The following sections list the procedures to isolate and correct faults with specified OPAC components.

Defective line drawer

To handle a defective line drawer:

1. Post, busy, test, and return the drawer to service.
2. When a test or return to service (RTS) fails and a card list appears, replace the cards with a correct card replacement procedure. Test and return the drawer to service.
3. When a test or RTS fails without a card list, perform the correct tests that the MAP display response indicates. Return the drawer to service.

Defective shelf circuit pack

To handle a defective shelf circuit pack:

1. Post the line concentrating module (LCM).
2. Determine fault indicators that exist.
3. Busy the unit with the damaged card.
4. Perform the correct card replacement procedures.
5. Test and return the LCM unit to service.

Defective line card

During line card diagnostics, if a single card fails, the card causes a complete LCM unit to fail. Finding the single damaged card can be difficult. Normally, one unit of the LCM is affected.

Two procedures can identify the damaged card.

Procedure 1

Perform procedure 1 during a maintenance window to avoid service interruptions. Qualified technicians can perform this procedure during the day if the technicians take correct precautions.

1. Find the vertical connection to the LCM in trouble. Use table MTAVERT.
2. Carefully use a buttset on the backplane of the MTADRIVER.

3 Operating company personnel can hear the following:

— dial tone—when this event occurs, operating company personnel draws dial tone from a 6X17 card. Dial the operator and ask the number you called from. This number is your defective line.

— 8khz tone—this is a data line card 6X71 or 6X76.

— talk battery—if possible, try to connect to a proprietary phone. Call the operator to indicate the directory number (DN) in use.

Procedure 2

Perform procedure 2 during a maintenance window to avoid service interruptions. Qualified technicians can perform this procedure during the day if the technicians take correct precautions.

1 Access the line test position (LTP) level of the MAP display. Post any line equipment number (LEN) located on the defective LCM.

2 Put a tone on the posted LEN. Go to the main frame with the buttset. Listen to all other LENs on the LCM.

3 Operating company personnel will find two LENs with tone. One LEN is the original LEN posted at the LTP level. The second LEN is the defective line card.

Defective DS-1 link

To handle a defective DS-1 link:

1 Post the OPAC.

2 Determine fault indicators that exist.

3 Display the central side (C-side) links.

4 Post the host XMS-based peripheral module (XPM). Determine the peripheral module (PM) state of the host XPM.

5 If the host XPM is in service (InSv), display peripheral side (P-side) links. Busy, test and return the host XPM to service.

6 If host XPM is in service trouble (ISTb), busy and test the host PM in search of the correct card list.

7 Perform the correct card replacement procedures.

8 Return the host XPM to service.

Defective ringing generator (RG) frequency generator circuit

To handle a defective RG frequency generator circuit:

1 Test the RG.

2 If the test fails, replace the RG.

Load file mismatch

To handle a load file mismatch:

1. Post the OPAC.
2. Use the QUERYPM command to display the PM load that resides in the OPAC.
3. Determine correct OPAC PM load.
4. Correct table LCMINV if the table has the wrong PM load for the OPAC.
5. If the table has the correct PM load for the OPAC, obtain the correct PM load. Load the OPAC again.

Diagnostic tests

OPAC line trunk controller (LTC) diagnostics

The LTC diagnostic tests consist of the following two parts:

- Speech path diagnostic (SPCHDIAG). The SPCHDAIG tests all internal components of the LTC or line group controller (LGC) speech path for data integrity. The SPCHDIAG tests C-side and P-side loop-arounds and speech bus time slots.
- The P-side link diagnostic (PLNKDIAG). The PLNKDIAG tests links between the LTC and any secondary peripherals. The PLNKDIAG tests the OPAC. The PLNKDIAG checks all links or single selected links.

Speech path diagnostic for the LTC

The speech path diagnostic consists of four separate tests:

- hardware presence test
- P-side interface presence test
- P-side loop test
- internal loop test

The system initiates each test if all the preceding tests pass. The following paragraphs describe these four tests.

Hardware presence test

This test makes sure that the LTC contains the formatter (6X41), message (6X69), and timeswitch (6X44) cards. The remainder of the tests require this hardware.

If any of these cards are not present, the diagnostic returns a `No Resources` error message. The diagnostic produces a PM181 log report.

P-side interface presence test

This test makes sure that DS-1 interface (6X50) cards entered for the LGC or LTC continue to be present. This test is used to prepare the following P-side loop test.

The P-side interface test ends when a 6X50 card is detected or removed. At this time, the diagnostic returns a `No Resources` error. The diagnostic produces a PM181 log report.

P-side loop test

The P-side interface test checks for the presence of all 6X50 cards. The P-side loop test checks the correct operation of these 6X50 cards. The P-side interface test checks for the presence of other dedicated P-side loop-around circuits for the LTC. The P-side interface cards supported in the LTC are as follows.

When the LTC is in inactive mode, the P-side loop test checks only 6X48 P-side loops. The inactive mode is when one unit is inactive and the other is manual busy (ManB), system busy (SysB) or InSv.

When the LTC is in active mode, the system tests both 6X48 and 6X50 P-side loops. The active mode is when one unit is active and the other unit is in SysB, ManB or InSv. The P-side interface test also checks the LTC multiplexer.

Internal loop test

This test checks the integrity of LTC speech channels. When the LTC is out of service (OOS), the system runs a full test on every channel.

If the LTC is InSv, the test checks two speech channels selected at random. The internal loop test also checks the operation of LTC PCM enable/disable gates.

LTC P-side link diagnostic

The P-side link diagnostic consists of three separate tests:

- hardware presence test
- P-side interface presence test (DS30A and DS-1 link interfaces)
- full peripheral test

Hardware presence test

This test checks for the message (6X69) and timeswitch (6X44) cards in the LTC or LGC. These cards are necessary for the other P-side link diagnostic tests to run.

If any of these cards are not present, the diagnostic returns a `No Resources` error message. The diagnostic produces a PM181 log report.

P-side interface presence test

This test and the speech path diagnostic test are the same. This test makes sure that all LTC P-side links the system tests are present. This test flags missing or failed 6X48 or 6X50 cards in the LTC.

Full peripheral test

The first two tests in the P-side link diagnostic make sure that the necessary hardware is present. The full peripheral test checks one speech channel on each specified LTC P-side link to the OPAC. The system runs this test if the LTC is in active mode.

OPAC facility maintenance

When the line diagnostics are initiated for lines OPAC supports and the OPAC is without a serving line test unit (LTU) or metallic test unit (MTU), the OPAC initiates the no-LTU diagnostic.

This software establishes a connection to a transmission test unit (TTU) in the host office. The TTU uses this circuit for limited line testing in place of the LTU or MTU.

Bit error rate performance testing

Bit error rate performance (BERP) tests test transmission paths through the network. The BERP tests provide the operating company with a tool that can assess the bit error performance of the DMS-100 switch. The operating company can assess the bit error performance of the subtending nodes of the DMS-100 switch.

The BERP testing provides with feature package NTX881AB. The BERP testing requires the NT6X99AA Datapath bit error rate tester line card that the LCM of the OPAC provisions.

Many separate bit error rate tests (BERT) compose the BERP test. Operating company personnel can connect an integrated bit error rate tester (IBERT) to an IBERT or to a specified end point like a data line card (DLC). Operating company personnel can transmit a known bit pattern. Operating company personnel perform these actions to perform a BERT.

The system reflects this bit pattern back to the IBERT and compares the IBERT to the sent bit pattern. The system records any errors in the returned bit stream. The result of the BERP test contains the results of these separate BERTs.

The user can access the BERP test from the maintenance (MTC) level of the MAP terminal. Commands at the BERP level prepare tests continuously or for a fixed duration.

Link testing

The BERP testing can occur on the DS-1 links that connect the host controller to the RLCM. To perform the BERP test on a DS-1 link, a loopback must be present on the transmission path.

The DS-1 loopback is at the P-side of the host XPM and all 24 channels on the DS-link are looped back. When a DS-1 loopback is used, the tested DS-1 link must be removed from service.

XPM bit error ratio test

The host XPM performs the XPM bit error ratio test (XBERT) for the RLCM subsystem. The XBERT is a diagnostic test that performs the following:

- detects and measures pulse code modulation (PCM) bit errors that occur in XPM and OPAC cards
- commissions DS-1 and PCM-30 links and trunks that the system physically loops back at the remote end without the use of a remote node.

The XBERT detects bit errors in the transmission of high speed data in the cards of the host XPM. The host XPM is an LGC, LTC, or remote cluster controller (RCC), and cards in the OPAC.

Note: To use XBERT, the XPM must be equipped with an NT6X69AB message protocol card or an NT6X69AA message protocol card with an NT6X79 tone card.

Test conditions

For accurate fault detection, the system runs the XBERT tests on an active InSv XPM unit. The system can run these XBERT tests on an OOS unit. At least one unit of the LCM must be InSv.

Note: The user must not use the XBERT as a tool to provide accurate bit error ratio evaluation. The XBERT does not use the CCITT standard test patterns in the test procedure of the XBERT. The XBERT uses XPM tone PCM to provide the 64 kbps test bit stream.

Test types

The XBERT runs two tests that involve the LCM in the OPAC. The test names and the corresponding cards of the test names appear in the following table.

XBERT tests

Test name	Related card
XPMDCC	NT6X44, NT6X50, NT6X69, NT6X52, NT6X73
XPMBIC	NT6X44, NT6X50, NT6X69, NT6X52, NT6X54, NT6X73

The ISOLATE command automatically runs tests to isolate a fault to a specified set of cards. The number of cards in the card list varies from one to three, depending upon the separate test results.

The system can test the P-side ports of the XPM or the LCM bus interface cards (BIC) in order, by one manual request.

Test XPMDCC (digroup control cards)

To test the digroup control cards (DCC), the XPMDCC test path travels through the following cards:

- Timeswitch card, NT6X44
- DS-1 interface card, NT6X50
- DCC, NT6X52
- Message card, NT6X69
- Link control card (LCC), NT6X73

The XPMDCC attempts to establish a looparound of a manually specified P-side port at the OPAC DCC to prepare the test path. The XPMDCC attempts to establish a looparound of a manually specified P-side port at the OPAC DCC.

If the attempt is not successful, a response appears and the test is aborted.

If the OPAC looparound is allocated, the test runs.

Test XPMBIC (bus interface cards)

To test BICs, the XPMBIC test path travels through the following cards:

- Timeswitch card, NT6X44
- DS-1 interface card, NT6X50
- DCC, NT6X52
- BIC, NT6X54
- Message card, NT6X69

- LCC, NT6X73

The XPMBIC attempts to establish a looparound of the manually specified P-side port at an OPAC BIC to set up a test path. The BIC on which the test loop ends must be manually specified.

If the attempt is not successful, a response appears and the test is aborted.

If the NT6X54 looparound completely allocates, the system runs the test.

Lines maintenance

The lines maintenance subsystem (LNS) tests line circuits, subscriber loops, and stations. The LNS tests line circuits and subscriber loops manually and automatically.

Line testing determines if a line circuit, loop, or line circuit and loop combination function correctly.

If the line is defective, line tests determine if the fault occurs in the line circuit or the attached loop. When a fault is in the loop, another department handles the fault.

When the fault occurs in the line circuit, the line card is replaced. The system tests the line again to check that the fault clears.

The commands available at the sublevels of the LNS appear in the following figure.

Automatic line testing

Automatic line tests (ALT) occur on line circuits and loops, normally on a scheduled basis. The ALT occurs without any switch operator involvement other than an initial scheduling. The ALTs occur when a line shows a fault.

The ALT in a DMS-100 office occurs under the LNS. The commands available at the ALT level of the LNS level that define the ALT appear in the following figure.

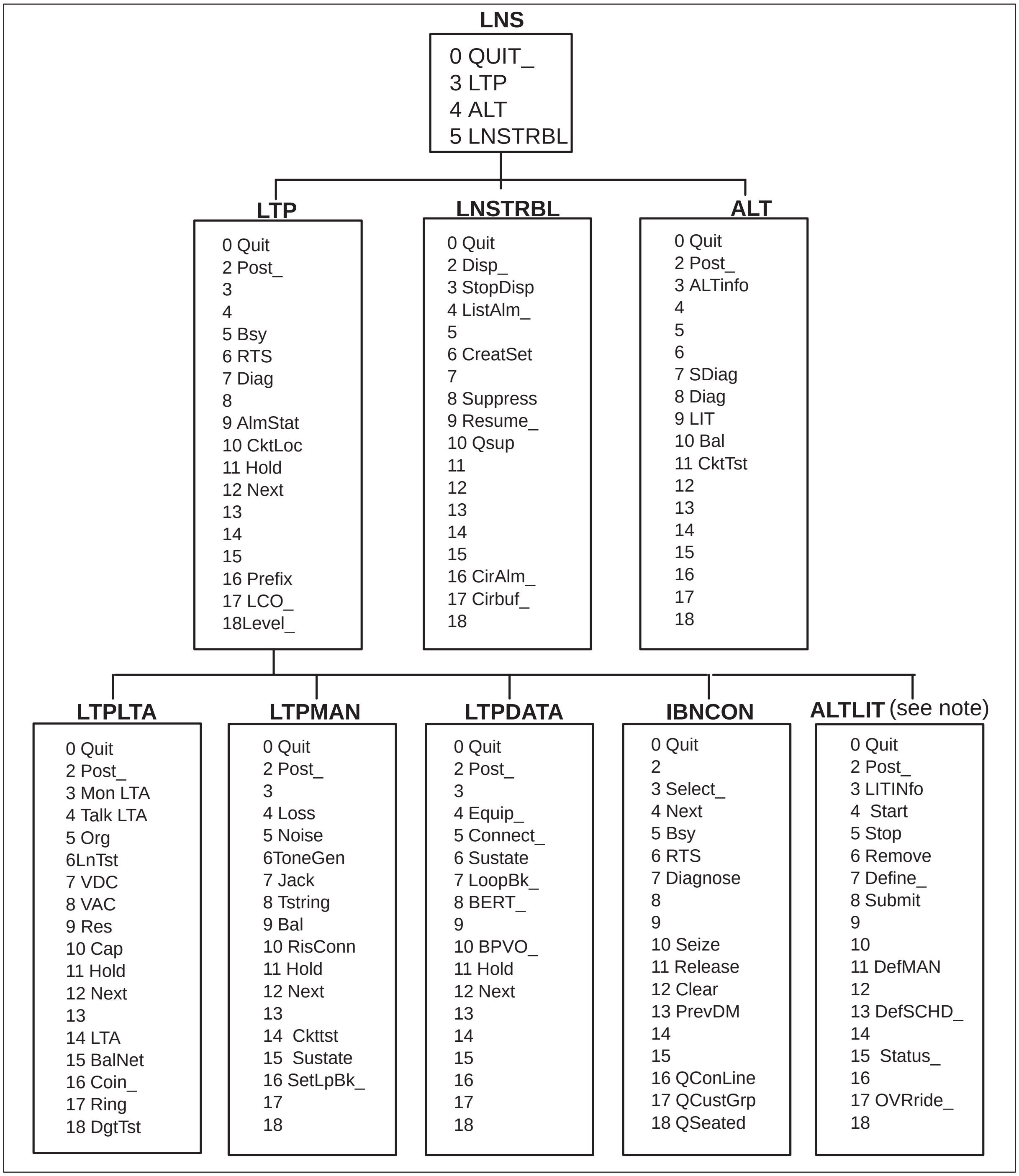
A description of these commands follows:

- The DIAGN executes a full diagnostic test on the line card circuits. The DIAGN identifies defective line cards before these defective line cards cause customer reports. The DIAGN command uses the LTU of the OPAC RMM to implement tests. If the LTU is not provisioned, this command implements the no-LTU diagnostic.
- The SDIAG is a subset of the DIAG test. The SDIAG makes sure that most of the line card circuitry operates correctly.

- The BAL automatically sets the balance network in the line card to provide transmission balance. The BAL provides transmission balance between the four-wire side of the switch and the two-wire loop. Transmission balance minimizes subscriber reports of noise, echo, and garbled speech.
- The LIT implements an automatic test that detects cable pair faults. An automatic test detects cable pair faults so that these cable pair faults can be cleared. These cable pair faults must be cleared before faults affect service and subscribers report problems like hum, noise, grounds, or false ring trip.
- The CKTTST applies to loops that use the following:
  - — Meridian business sets (MBS)
  - — data units (DU) associated with Datapath
  - — asynchronous interface modules (AIM)
  - — IBERT line cards

The CKTTST performs circuit tests to confirm the ability of the set or line card to transmit and receive messages correctly. The CKTTST performs circuit tests to confirm the ability of the set or line card to adhere to message protocol.

Line maintenance commands



Note: The menu of commands for the ALTLIT level and for other ALT sublevels are the same, with one exception. Command LITINFO in the ALTLIT level does not appear at any other ALT sublevel.

Post the failures at the LTP or output reports that the ALT log subsystem generates. This action identifies the lines that do not meet standards of quality to the switch operator. The failures identified are tested manually and corrected.

Station testing

Station testing can occur under the LNS at a MAP terminal. Station testing for the Silent Switchman (SSMAN) and Station Ringer (SR) tests can occur from a station. Stations are tested manually.

Station test results appear at the VDU, except for the Station Ringer and Silent Switchman tests. The station receives the results of these tests.

Station testing helps determine if a station functions correctly while connected to a loop and line circuit combination.

Manual line testing

The switch operator performs manual line tests on line circuits, loops, and stations. The switch operator tests line circuits and loops separately. The results of the test appear to the switch operator at a visual display unit (VDU). The results of the test appear immediately after testing.

Lines are tested manually as part of routine maintenance, when a customer report is generated, or when an ALT failure occurs. Manual line testing occurs at the LTP level and uses any of the four levels of the LNS. The four levels of the LNS are: ALT, LTP, LTP manual (LTPMAN), and LTP line test access (LTPLTA).

Manual line testing at the ALT level defines one line to test immediately.

At the other three levels, place the line in the control position to perform manual testing. The switch operator controls this line, which can be manipulated. Post a line before you place the line in the control position.

Ring pretrip on LCM lines

A ring pretrip is a premature ring trip. It is a false indication that the ringing phone was answered.

In NA009, the PRETRIP nonmenu command is added to the LCM level. The PRETRIP command provides operating company personnel the

- option to enable or disable pretrip log reports on the posted LCM or all LCMs in the posted set
- option to enable or disable extension of the ring trip filter timing on all 4FR lines on the posted LCM or all LCMs in the posted set

- ability to query the status of the two previous pretrip options

Note: When a new LCM tuple is entered in table LCMINV, the value for LOGS and 4FR are set to DISABLE by default.

In response to the command string HELP PRETRIP, the command syntax is displayed at the MAP terminal as follows.

```
>help pretrip
PRETRIP : AVAILABLE RINGING PRETRIP OPTIONS
    LOGS: Enable/Disable Pretrip LOG Reporting for
          the posted PM or posted set of PMs.
    4FR:  Used to reduce Ring Pretrip occurrences on
          long loop length 4FR lines.  Enabling this
          command results in extension of the Ring
          Trip filter timing for ALL lines serviced
          by the posted PM or posted set of PMs.
 Query:   Displays the status of Pretrip options
Parms: <OPTION>     {LOGS     <ACTION>  {ENABLE   [<OPTION> {ALL}],
                                         DISABLE   [<OPTION> {ALL}]} [<NOWAIT>{NOWAIT}],
                    4FR       <ACTION> {ENABLE    [<OPTION> {ALL}],
                                         DISABLE   [<OPTION> {ALL}]} [<NOWAIT> {NOWAIT}]
                    QUERY}
```

Pretrip log reports

Pretrip log reports are enabled or disabled for a posted LCM or all LCMs in the posted set. If the LCM is in service, the effect is immediate. Otherwise, the LCM is updated during the next RTS. You must enter one of the following actions with the command string PRETRIP LOGS.

- ENABLE – This enables recording of LINE113 log reports for the posted LCM when the system detects a pretrip.
- DISABLE – This prevents any LINE113 log reports from being generated when the system detects a pretrip on a posted LCM.

You can enter the following optional parameters with either of the previous actions.

- ALL – This results in the selected action being applied to all LCMs in the posted set.
- NOWAIT – This option prevents waiting for confirmation that the command has been completed.

For example, to record LINE113 logs for all pretrips detected on all LCMs in the posted set, activate the logs feature by typing

>PRETRIP LOGS ENABLE ALL

and pressing the Enter key.

When a pretrip occurs and the pretrip logs are enabled, a LINE113 log is output. An example of a LINE113 log follows.

```
LINE113  JAN27 09:14:14 6220 TBL
   KRCM 03 0 19 04    DN 6195441578
   TROUBLE CODE = RINGING_FAILED
   RINGING TROUBLE = PRETRIP
   CALLID = 98776
```

When a pretrip occurs on a line that connects to an LCM, a LINE138 log is output. A LINE138 log identifies the call that was routed to a treatment. An example of a LINE138 log follows.

```
LINE138 JAN27 09:14:14 6321 INFO TRMT
   KRCM 03 0 00 08    DN 6195441579
   TREATMENT SET = SYFL   CALLED NO = 5441578
   CALLID= 01D8 0003
```

After two pretrips occur, the line is scheduled for a diagnostic. If the diagnostic fails, a LINE101 log is generated. An example of a LINE101 log follows.

```
LINE101 JAN27 09:16:05 3782 FAIL LN_DIAG
   KRCM 03 0 01 06    DN 6195441586
   DIAGNOSTIC RESULT  Ringing Failed Pre Trip
   ACTION REQUIRED  Chk Ringing
   CARD TYPE  6X17AC
```

Pretrip on 4FR lines

The command string PRETRIP 4FR ENABLE is used to reduce ring pretrip occurrences on long loop length 4FR lines served from the posted LCM or all LCMs in the posted set. The effect of this command is not immediate and will not be realized until the next RTS of the LCM. You must enter one of the following actions with the command string PRETRIP 4FR.

- ENABLE – This extends 4FR line ring filter timing.
- DISABLE – This returns to non-extended 4FR line ring filter timing.

The following optional parameters can be entered with either of the previous actions.

- ALL – This results in the selected action being applied to all LCMs in the posted set.
- NOWAIT – This option prevents waiting for confirmation that a command has been completed.

For example, entend 4FR line ring filter timing for all LCMs in the posted set by typing

>PRETRIP 4FR ENABLE ALL

and pressing the Enter key.

Display status of pretrip options logs and 4FR

Display the status of options LOGS and 4FR by typing

>PRETRIP QUERY

and pressing the Enter key.

An example of a system response to the PRETRIP QUERY command string follows.

```
  CM    MS     IOD     Net     PM     CCS     Lns     Trks     Ext  APPL
   .     .      .       .     1LCM     .       .        .       .     .
                               *C*

 LCM                SysB     ManB     OffL     CBsy     ISTb      InSv
  0 Quit       PM    0         0        2        0        2         42
  2 Post_      LCM   0         0        0        0        2          9
  3 ListSet
  4 SwRG     LCM  HOST 00 0  InSv     Links_OOS:  CSide  0   PSide   0
  5 Trnsl_   Unit0:   InsV                 /RG: 1
  6 Tst_     Unit1:   InsV                 /RG: 1
  7 Bsy_                                11  11  11  11  11  RG:Pref 1 InsV
  8 RTS_     Drwr:  01  23  45  67  89  01  23  45  67  89     Stby 0 Insv
  9 OffL            ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
 10 LoadPM_  pretrip query
 11 Disp_    LCM HOST 00 0 – PRETRIP LOGS are DISABLED
 12 Next                     PRETRIP 4FR is DISABLED
 13
 14 QueryPM
 15
 16
 17
 18
```

Product-specific test tools

Line maintenance cutover (LMCUT)

With feature package NTX057, the Automatic Board to Board Testing (ABBT) feature uses the line maintenance cutover (LMCUT) facility during commissioning. The ABBT uses the LMCUT to transfer or cut over in-service lines from a current switch to a DMS-100 switch.

This feature also provides message recording of all the LMCUT command executions in a progress file.

The LMCUT commands are supported on LCMs. The LMCUT commands are correct only on LCMs while a DN cuts over the switch. The cutover occurs according to DNs or LENs.

The commands for cutover by DN and LEN cannot occur at the same time. The commands OPRTCO, RLSCO, and NOBST can occur at the same time.

The LMCUT commands allow the user to do the following:

- set or query the cutover mode of the switch (by DN or LEN)
- enable, disable, clear, or query the progress message recording
- operate, release, or verify the cutover relays on a range of DNs or LENs
- operate, release, or query the HOLD relay setting on a drawer

Troubleshooting chart

The following table describes the basic troubleshooting procedures for Outside Plant Access Cabinet (OPAC) alarms.

OPAC alarm clearing

Alarm condition	Possible cause	Action
Critical	Defective line concentrating module (LCM) processor cards in both LCM units Defective power converter cards in both LCM units All DS30A message ports are closed	Identify and post the system busy (SysB) the LCM. Busy both units of the defective LCM. Return the defective LCM to service. If a return to service (RTS) fails, load the defective LCM. Test and return the defective LCM to service.

—continued—

OPAC alarm clearing (continued)

Alarm condition	Possible cause	Action
Major	Defective LCM processor Defective digroup control card Defective power converter Defective ringing generator (RG) circuit Closed DS30A message port Line group controller (LGC) or line trunk controller (LTC) forces activity switch in LCM	Identify and post the in-service trouble (ISTb) LCM. Use the command string QUERYPM FLT to identify fault indicators. If the LCM is C-side busy (CBsy), identify central-side (C-side) links to host peripheral module (PM). Post host PM for defective peripheral side (P-side) links. Busy, test, and return the defective P-side links to service. Post, busy, test, and return the defective LCM to service. If the LCM is SysB, busy and test the defective LCM unit. If the test fails, with a card list, replace any defective cards. Test and return the defective LCM unit to service. If the test fails, with no card list, test the LCM unit again and return the LCM unit to service. If the LCM state is manual busy (ManB), test the defective LCM unit. If the test fails, with a card list, replace any defective cards. Test, and return the defective LCM unit to service. If the test fails, with no card list, test the LCM and return the LCM unit to service.

—continued—

OPAC alarm clearing (continued)

Alarm condition	Possible cause	Action
Minor	Defective RG frequency generator circuit Activity mismatch Data error Diagnostic failure Load file mismatch Self-test failure	Identify and post ISTb the LCM. Use the command string QUERYPM FLT to identify fault indicators. If the LCM is CBsy, identify C-side links to the host PM. Post the host PM for defective P-side links. Busy, test, and return the defective P-side links to service. Post, busy, test, and return the defective LCM to service. If the LCM is SysB, busy and test the defective LCM unit. If the test fails, with a card list, replace any cards. Test and return the defective LCM unit to service. If the test fails, with no card list, test the defective LCM unit and return the LCM unit to service. If the LCM is ManB, test the defective LCM unit. If the test fails, with a card list, replace any defective cards. Test and return the LCM unit to service. If the test fails, with no card list, test the defective LCM unit and return the LCM unit to service.
	—end—	

Refer to *Alarm Clearing Procedures* for more complete troubleshooting methods for OPAC alarms.

Advanced troubleshooting procedures

The system displays a list of cards at the MAP terminal after the tests complete. The card at the top of the list is often the cause of the problem.

After you replace the problem card, test the defective unit again. If the unit passes this test, return the unit to service. The troubleshooting procedure is complete.

If normal troubleshooting procedures do not restore a unit to service, advanced troubleshooting procedures are required.

Operating company personnel can use MAP terminal responses from failed troubleshooting attempts to formulate a maintenance plan. Use more advanced step-action procedures to repair a problem.

Powering-up the OPAC

In the event of an anticipated power outage, operating company personnel must power-down the Outside Plant Access Cabinet (OPAC). An example of this type of power outage is an anticipated natural disaster. Operating company personnel power-down the OPAC for the duration of the event to minimize equipment damage. This action allows the operating company to return power in an ordered fashion.

To power-up the OPAC, perform the following steps:

1. Post the OPAC from the MAP terminal.
2. At the remote site, set the switch on the line concentrating module (LCM) power converter to the ON position.
3. Hold in the reset button on the LCM power converter, and flip the appropriate circuit breaker up. Do not hold the circuit breaker up. If the OPAC receives power, the circuit breaker stays in the ON position. If a problem occurs with the power, the circuit breaker returns to the OFF position.
    a. Repeat steps 2 and 3 for the other LCM unit.
    b. Busy both LCM units.

4 List the peripheral module (PM) loads at the input/output (I/O) device used to return the units to service. List the PM loads at the I/O if did not perform this action during the power-up procedure. To list the PM loads, type

>DSKUT;LISTVOL volume name ALL

and press the Enter key.

If you load from a DMS-100 Supernode switch, type

>DISKUT;LF volume name

and press the Enter key.

where

volume name is the volume where the PM loads are found

For example:

>DSKUT;LISTVOL DXPM ALL

Note: List the PM loads one time only.

5 Use the LOADPM command to load the LCM in the OPAC.

6 Test the LCM in the OPAC.

7 Return the LCM in the OPAC to service.

Powering-down the OPAC

CAUTION
Loss of service
Use this procedure in severe conditions like anticipated natural disasters. This procedure causes complete loss of service to the subscriber.

Perform the following steps at the MAP terminal to power-down the OPAC:

1 Post the LCM in the OPAC.

2 Identify the LCM unit to power down.

3 Use the command string BSY UNIT unit_no to busy the LCM unit.

4 Set the switch on the power converter to OFF to remove power from the busied LCM unit. This action powers the LCM unit down.

5 Repeat this procedure for the mate unit.

Common procedures

The following sections provide common troubleshooting procedures for loading, returning to service, dial tone, and ringing generators.

Troubleshooting a loading failure

The steps for troubleshooting a failure to load the peripheral program files for the LCM in the OPAC are as follows:

1 Verify that no blown fuses are present. Verify that the power converters are powered-up and supply the correct voltages.

2 Unseat the following cards:

— 6X51, 6X52, 6X53 from unit 1

— 6X50 (slot 20 of HIE shelf)

— 6X73 (slot 18 of HIE shelf)

— 2X70 (slot 22 of the HIE shelf)

3 Attempt to load unit 0.

4 If unit 0 fails to load, reseat the cards removed for unit 1. Unseat the following cards:

— 6X51, 6X52, 6X53 from unit 0

— 6X50 (slot 19 of HIE shelf)

— 6X73 (slot 17 of HIE shelf)

— 2X70 (slot 25 of the HIE shelf)

following procedure outlines the Attempt to load unit 1.

5 If both units fail to load, attempt to load the PM from another device. Attempt to load the PM from the following devices in the order listed:

— the input/output controller (IOC) disk drive

— the system load module (SLM)

— the original PMLOAD tape

6 Replace the 6X51, 6X52, and 6X53 cards in unit 0 and unseat the same cards in unit 1. Attempt to load unit 0.

7 If unit 0 fails, replace the 6X51, 6X52, and 6X53 cards in unit 1 and unseat the same cards in unit 0. Attempt to load unit 1.

8 If both units fail to load, replace the 6X73 (slot 17 of HIE shelf). Replace the 6X50 (slot 19 of HIE shelf) cards. Attempt to load unit 0.

9 If unit 0 fails to load, replace the 6X73 (slot 18 of HIE shelf). Replace the 6X50 (slot 20 of HIE shelf) cards. Attempt to load unit 1.

10 If both units fail to load, replace the associated 6X50 cards in the host XPM.

11 Power-down and unseat the 2X59, 6X74, 2X09, and 2X06 cards. These cards are located in the remote maintenance module (RMM) shelf. Attempt to load each unit.

12

> **CAUTION**
> **Possible service interruption**
> Use caution when you use PMDEBUG on a peripheral that functions. Only use the commands shown.

Perform the following steps to determine if links to the OPAC are defective:

1 QUERYPM the OPAC. Note the node number of the OPAC. Enter the command string TRNSL C and note the host XPM. Examples of the host XPM are LGC, LTC, or RCC.

a. Enter the command string PMDEBUG host xpm to PMDEBUG the host XPM. An example of the command string PMDEBUG is PMDEBUG LTC 0.

b. Enter <mp * * * * * cp e nn 0> to determine the internal node number. In this command, nn equals the external node number obtained from QUERYPM in step 1

c. Enter <sp * * * * * n>. This command accesses the signal processor new messaging level.

d. Enter <n>. This command accesses the netlayer sublevel.

e. Enter <neta>. This command accesses the net address sublevel.

f. When prompted, enter the internal node number obtained in step a.

g. Enter the unit that corresponds to the messaging link in question.

h. Note the data link number specified as open.

i. Enter <* d>. This command accesses the dl data level.

j. Enter <v dl>. For this command, dl equals the data link number obtained in steps h and i. This command verifies if you have the correct link. The output indicates the same type PM as the remote you work with. An example of output is rlcm_fmt.

k. Enter <r dl> (same as above). This command displays hex values that correspond to control bytes received from the remote. Enter Return two times to halt the display.

l. Remove the DS-1 interface card for the link at the remote end.

m. Verify hex values equal #FF. If the hex values do not equal #FF, make sure you removed the correct DS-1 interface card and the correct data link number is monitored. If you removed the DS-1 interface card and the correct data link number is monitored, check for miswires or shorts on the link. To check for miswires or shorts on the link, remove repeater cards until the values equal #FF. Correct the problem. If all actions are correct, proceed to step n.

n. At the remote, loop back the link to test toward the host.

o. When the span loops back, verify the values equal one of the following DMS-X control byte values. The normal value is #1E.

DMS-X Control Byte	Value	Meaning
MIS	#8D	May I send
SOM	#4B	Start of message
PACK	#1E	Positive acknowledgement
NACK	#55	Negative acknowledgement
EOM	#4B	End of message
ESC	#4B	Escape character

If the values are the same as the preceding values, the link functions.

If values are different than the above values, the link or host equipment is defective.

If the values are correct, remove loopback, verify values equal #FF, and reseat DS-1 interface card.

If the values are not correct, check loopback again to verify correct loop. Troubleshoot the link or switch the link with the nonmessaging link at both ends. Verify if the hex values are correct.

p. Enter <* * mp>.

q. Enter <quit>.

2 Check for bent pins behind the 6X51, 6X52, 6X53, 6X73, and 6X50 cards. Verify the connector on slot 5 of each shelf on the backplane is tight.

3 If the LCM in the OPAC fails to load, initiate a warm switch activation (SWACT) on the host XPM. Contact the next level of support.

Troubleshooting RTS failure

Enter the command string RTS FORCE if the LCM in the OPAC fails to return to service (RTS). The following steps describe the RTS Force procedure.

1 Check LOGUTIL for reasons for RTS failure.

2 Replace any cards on the card list displayed at the MAP display or in the logs.

3 Unseat the following cards:

— 6X51, 6X52, 6X53 cards from unit 1

— 6X50 (slot 20 of HIE shelf)

— 6X73 (slot 18 of HIE shelf)

— 2X70 (slot 25 of the HIE shelf)

Attempt to RTS FORCE unit 0.

4 If unit 0 fails to RTS, seat the cards in unit 1 again. Unseat the following cards:

— 6X51, 6X52, 6X53 cards from unit 0

— 6X50 (slot 19 of HIE shelf)

— 6X73 (slot 17 of HIE shelf)

— 2X70 (slot 22 of the HIE shelf)

Reload unit 1 and enter the command string RTS FORCE.

5 The system can return the LCM in the OPAC to service and place the ILCM in a CBsy state. Perform a SWACT on the LGC. Enter the command string RTS FORCE again.

6 The system can return the LCM to service and place the ILCM in a SysB state. In this event, there is a defective 6X54 card, line card, or drawer. Check LOGUTIL for a possible card list.

7 If any light-emitting diodes (LED) on the RGs are illuminated, refer to the procedure *Troubleshooting ringing generator problems*.

8 If both units fail to RTS, contact the next level of support.

Troubleshooting dial tone problems

Power-up the OPAC. When one or both LCM units are in service, check the line subgroups (LSG) to verify that they have dial tone.

If the LSGs do not have dial tone, use the following procedure to troubleshoot the source of dial tone failure.

1 If the even-numbered LSGs do not have dial tone, reseat and/or replace the 6X52 card in unit 0.

2 If the odd-numbered LSGs do not have dial tone, reseat and/or replace the 6X52 card in unit 1.

3 If LSGs 0 through 9 do not have dial tone, verify that TB1 lug 7 reads –48 V with a voltmeter. This terminal block is located on the back of the modular supervisory panel (MSP).

   This voltage is the talk-battery supply for these drawers and comes from the MSP for this frame. Determine if a breaker on the front of the MSP is tripped if the voltage is not available.

4 If LSGs 10 through 19 do not have dial tone, verify that TB1 lug 8 reads –48 V with a voltmeter. This voltage is the talk-battery supply for these drawers.

5 If you do not have dial tone, contact the next level of support.

Troubleshooting ringing generator problems

If one or both ringing generators (RGs) fail, perform the following procedure to isolate and correct the problem.

If the LED on the 6X30 RGs are illuminated, perform the following:

1 Replace the RG first.

   Note: When the user powers-down an RG, the system removes the associated LCM units from service. When you power-down RG-0, the system removes both unit 0s from service.

2 Remove the RA and RB fuses located in the fuse panel at the top of bay 0. Remove the fuses one shelf at a time and observe the LEDs. The RA fuse supplies ringing to the even-numbered subgroups for the specified shelf. The RB fuse supplies ringing to the odd-numbered subgroups for the specified shelf.

   If the LED disappears when you remove a fuse, proceed to step 4. If the LED remains, proceed to step 3.

3 Busy one unit at a time. Unseat the 6X51, 6X52, and 6X53 cards and watch for the cycling to stop. This action isolates the trouble to the unit. Replace the 6X51, 6X52, AND 6X53 cards.

4 Reseat the cards in the troubled unit. Remove the fuses for each drawer in the shelf. Make sure you pull all three fuses (5 V, 15 V, and 48 V) for the drawer. If the cycling does not stop, replace the fuses for the drawer. Proceed to the next drawer until the cycling stops.

5 If you remove all the fuses and the cycling does not stop, more than one drawer is defective. In this event, remove all fuses for all drawers in the shelf at the same time. Replace the three fuses for each drawer and note when the cycling starts.

   When the cycling starts for a specified drawer, remove the fuses again and proceed to the next drawer. This action isolates all the drawers that cause the problem.

6 When you isolate the drawer, insert the fuses again for the drawer or drawers. Unplug the controller cable on the back of the line drawer. The controller cable is the center cable, labeled C and D.

7 Replace the 6X54 card in the isolated drawer and connect the controller cable back in position.

8 If the cycling continues, unseat the line cards one at a time in the suspect subgroups to locate the defective line card. The line drawer can require replacement.

9 Contact the next level of support.

OPAC routine maintenance procedures

This section contains routine procedures for the Outside Plant Access Cabinet (OPAC). These procedures cover preventive maintenance tasks performed at regular intervals. Maintenance engineering and field maintenance personnel can use these procedures.

Battery capacity test
OPAC

Application

Use this procedure to check the capacity of Eagle Picher batteries in an outside plant access cabinet (OPAC). The OPAC has a multiline test unit (MTU).

Interval

Perform this procedure at intervals of six months when MTU measurements comply to specifications. Perform this procedure at intervals of three months if the MTU measurements do not comply to specifications.

Do not perform this procedure at the same time as the automatic battery test procedure.

Common procedures

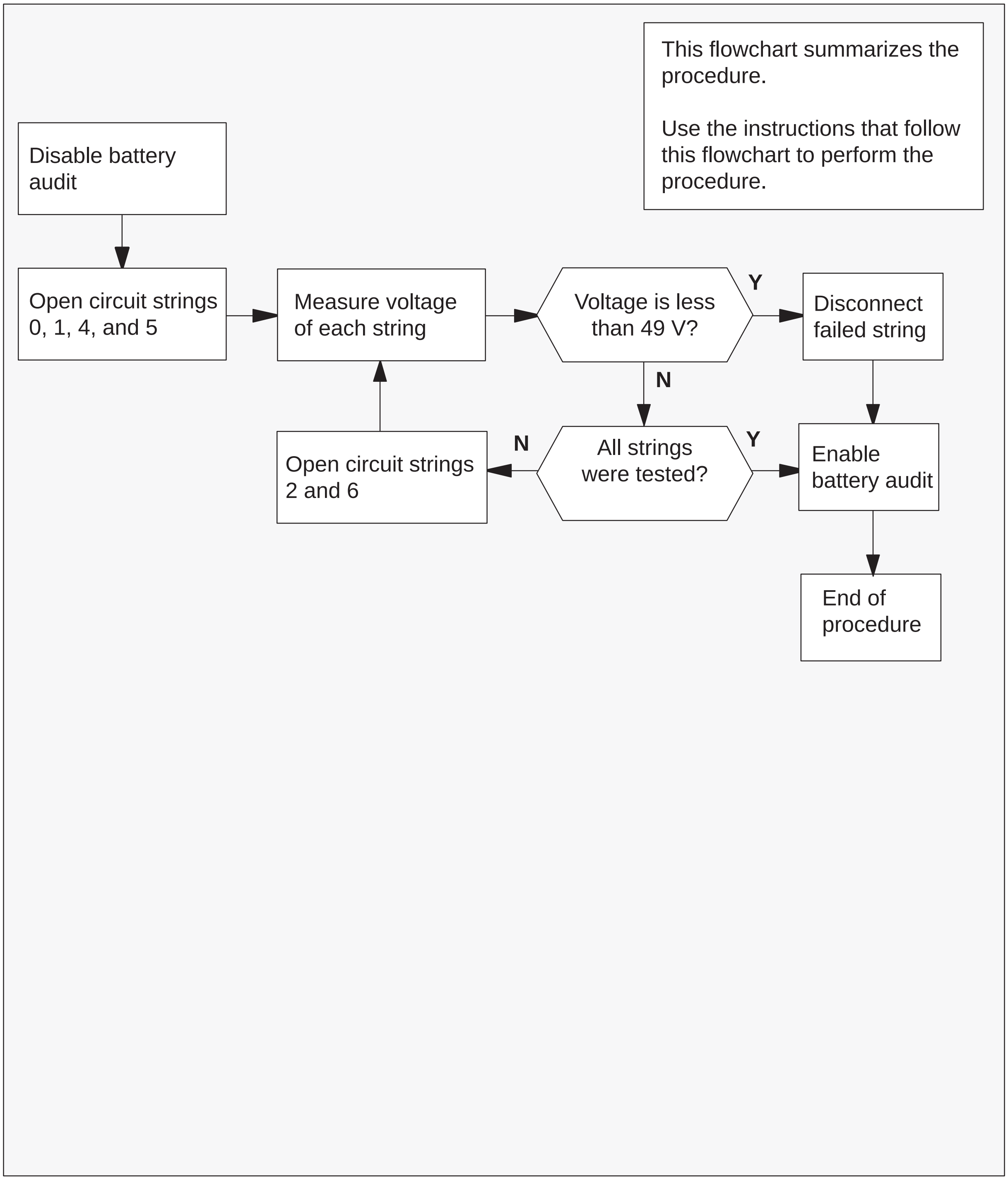
There are no common procedures.

Action

This procedure contains a summary flowchart and a step action procedure. The summary flowchart provides an overview of the procedure. Use the list of steps following the flowchart to perform this procedure.

Battery capacity test
OPAC (continued)

Summary of Battery capacity test



Battery capacity test
OPAC (continued)

Battery capacity test

At the MAP terminal

1 Make sure extended power failures did not occur at the OPAC site in the last 72 hours. Make sure that the OPAC is not in post-ac failure recovery mode.

2 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES
and press the Enter key.

3 To post the correct alarm state, type

>POST alarm_state
and press the Enter key.

where

alarm_state is RED, AMBER, GREEN, or OFFL

Note: This command posts all the peripheral modules (PM) in the named alarm state, and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the correct OPAC appears in the MAP terminal.

4 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE
and press the Enter key.

Battery capacity test
OPAC (continued)

5 To open battery string pairs 0 (strings 0 and 4) and 1 (strings 1 and 5), perform the following steps:

a. Type

>OPENCKT 0
and press the Enter key.

where

0 is the number of battery string 0 and 4

b. Type

>OPENCKT 1
and press the Enter key.

where

1 is the number of battery string pair 1 and 5

Example of a MAP display

```
 CM    MS    IOD    NET    PM    CCS     LNS     Trks     Ext   Appl
  .     .     .      .    1PES    .       .       .        .     .
 PES                     SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM            0      3       4       0       4      30
 2 Post_
 3                        RED      AMBER     GREEN     OFFL
 4           PES           0         1         6         0
 5
 6 Tst_      PES       2 Cond:  RED    REM2     2   1   RMM   2
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common      Rectifiers               DIS     -    .
 9 OffL_       AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .       .   .   .   .   .   .       .        .   .
11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
12 Next      0= W   O/C  O/C   .    .   EHT ELT  FRNT SIDE    0   1
13           1= W   O/C  O/C   .    .   .   .    .    .       .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

Indicates the open circuited string pairs.

6 Allow a six hour wait time to allow the battery to equalize before you proceed to the next step.

At the OPAC site

7

> **WARNING**
> **Risk of battery cracking**
> When the measured voltage is less than 49 V, disconnect the battery string. If you do not disconnect the battery string, the batteries can crack before you can install new batteries. Replace the battery string as soon as possible.

Use a voltmeter with 0.2 percent or greater accuracy to measure the voltage of battery strings 0, 1, 4, and 5.

If measured voltage is	Do
greater than 50.4V	step 10
between 49 V and 50.4 V	step 9
less than 49 V	step 8

8 Use the *Battery replacement procedure* to disconnect the low-voltage battery string. The batteries can crack if the battery string is not disconnected. Replace the battery string as soon as possible.

Go to step 10.

9 Use the *Battery replacement procedure* to replace the battery string in the maximum time of one month.

At the MAP terminal

10 To return battery string pairs 0 and 1 to the load bus, perform the following steps:

a. Type

>LOADB 0
and press the Enter key.

where

0 is battery string pair 0

Battery capacity test
OPAC (continued)

b. Type

>LOADB 1
and press the Enter key.

where

1 is battery string pair 1

11 Open battery string pair 2 (strings 2 and 6), type

>OPENCKT 2
and press the Enter key.

where

2 is the battery string pair 2

Example of a MAP display:

```
 CM     MS     IOD     NET     PM     CCS     LNS     Trks    Ext     Appl
  .      .      .       .     1PES     .       .       .       .       .
  PES                     SysB    ManB     OffL     CBSY     ISTB     InSV
  0 Quit      PM            0       0        0        0        0       30
  2 Post_
  3                         RED       AMBER      GREEN      OFFL
  4           PES           0           0          7          0
  5
  6 Tst_      PES       2 Cond:  GREEN  REM2     2   1   RMM   2
  7 Bsy_                                          Audit  Week  HBT
  8 Rts_       Common     Rectifiers                 .       2     .
  9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
 10              .       .   .   .   .   .   M        M        .   .
 11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
 12 Next      0= W    .    .   O/C   –   EHT ELT  FRNT SIDE    0   1
 13           1= W    .    .   O/C   –    .   .     .    .     .   .
 14 QueryPES
 15 OpenCkt_
 16 Charge_
 17 LoadB_
 18 MEASure_
```

Indicates the open circuited string pairs.

Battery capacity test
OPAC (continued)

At the OPAC site:

12

> **WARNING**
> **Risk of battery cracking**
> Disconnect the battery string. If you do not disconnect the battery string, the batteries can crack before you can install new batteries. Replace the pair of batteries as soon as possible.

Use a voltmeter with 0.2 percent or greater accuracy to measure the voltage of battery strings 2 and 6.

If measured voltage is	Do
greater than 50.4 V	step 15
between 49 V and 50.4 V	step 14
less than 49 V	step 13

13 Use the *Battery replacement procedure* to disconnect the low-voltage battery string immediately. The batteries can crack if the battery string is not disconnected. Replace the battery string as soon as possible.

Go to step 15.

14 Use the *Battery replacement procedure* to replace the battery string in the maximum time of one month.

At the MAP terminal

15 To return battery string pair 2 to the load bus, type

>LOADB 2
and press the Enter key.

where

2 is battery string pair 2

16 To enable automatic battery rotation and testing, type

>AUDIT ENABLE
and press the Enter key.

Battery capacity test
OPAC (end)

17 This inspection procedure is complete.

Note: If an ac failure lasts more than 5 min during this procedure, repeat the full procedure.

Battery inspection and cleaning
OPAC

Application

Use this procedure to inspect and clean the batteries in an outside plant access cabinet (OPAC).

Interval

Perform this procedure every six months.

Common procedures

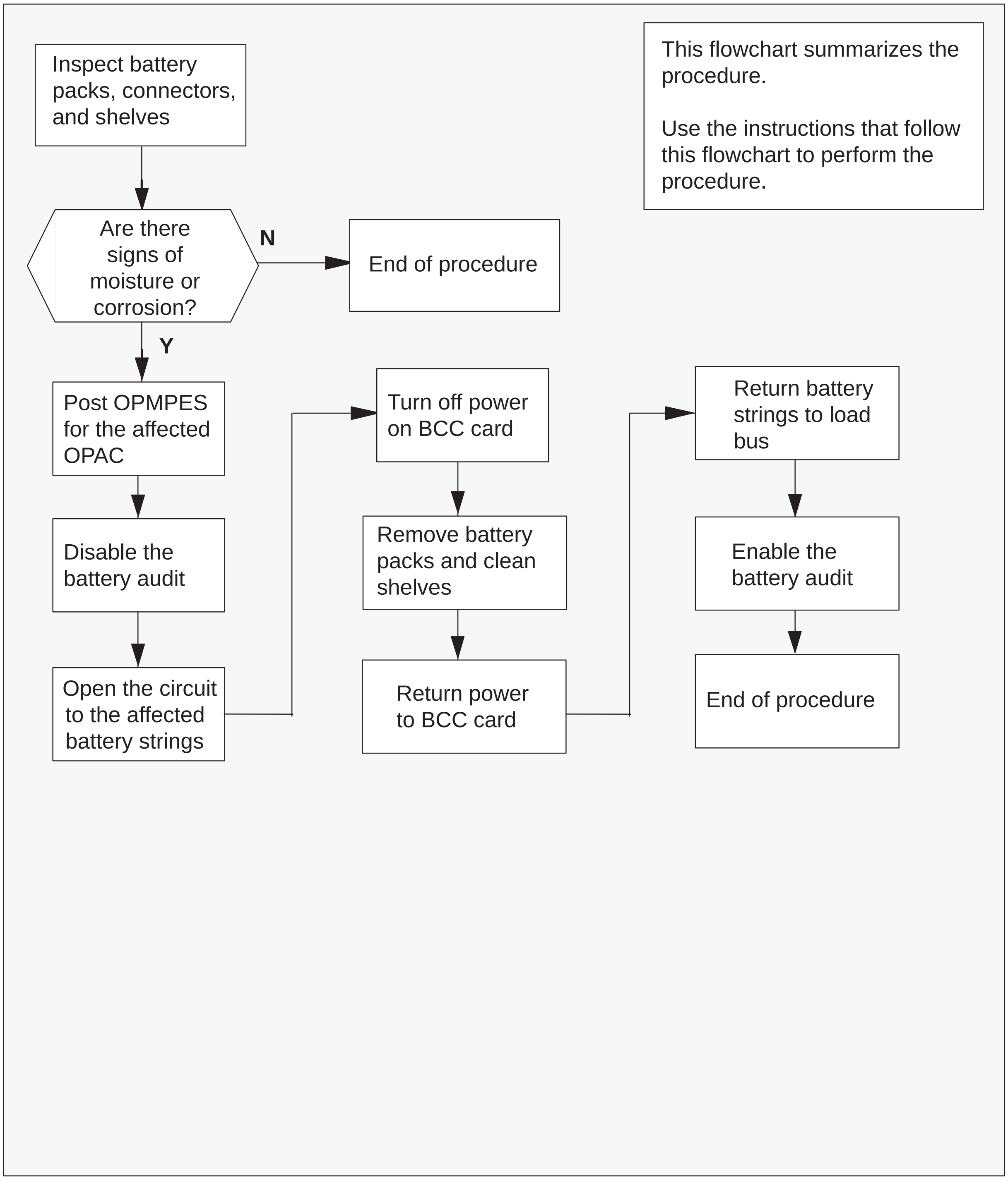
There are no common procedures.

Action

This procedure contains a summary flowchart that provides an overview of the procedure. Use the steps that follow to perform this procedure.

Battery inspection and cleaning
OPAC (continued)

Summary of battery inspection and cleaning



Battery inspection and cleaning
OPAC (continued)

Battery inspection and cleaning

At the OPAC site

1

DANGER
Hazardous chemicals
Battery chemicals can be dangerous and potentially explosive. Use caution.

Inspect battery packs, connectors, floor, and shelves for moisture or corrosion.

If moisture or corrosion	Do
is present	step 2
is not present	step 14

At the MAP terminal

2 To access the OPMPES MAP display, type

>MAPCI;MTC;PM;PES
and press the Enter key.

3 To post the appropriate alarm state, type

>POST alarm_state
and press the Enter key.

where

alarm_state   is RED, AMBER, GREEN, or OFFL

Note: This command posts the alarm state and all the PMs in the alarm state, and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the MAP terminal displays the appropriate OPAC.

4 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE
and press the Enter key.

Battery inspection and cleaning
OPAC (continued)

5 To open the circuit to the battery strings to replace, type

>OPENCKT n
and press the Enter key.

where

n is the string pair 0–2, as follows:
0 is pair 0, 4
1 is pair 1, 5
2 is pair 2, 6

Example of a MAP display:

```
  CM    MS     IOD    NET    PM    CCS    LNS    Trks   Ext    Appl
   .     .      .      .      .     .      .      .      .      .

  OPMPES                SysB   ManB    OffL    CBSY    ISTB    InSV
  0 Quit      PM          0      0       0       0       0      30
  2 Post_
  3                      RED      AMBER     GREEN     OFFL
  4           OPMPES      0          0         7        0
  5
  6 Tst_      OPMPES    2 Cond:  GREEN  REM2     2   1   RMM   2
  7 Bsy_                                          Audit  Week  HBT
  8 Rts_       Common     Rectifiers                DIS    .     .
  9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
 10              .      .   .   .   .   .   M       M        .   .
 11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
 12 Next      0= W   O/C   .    .    -  EHT ELT  FRNT SIDE    0   1
 13           1= W   O/C   .    .    -   .   .    .    .      .   .
 14 QueryPES
 15 OpenCkt_
 16 Charge_
 17 LoadB_
 18 MEASure_
```

Indicates the open-circuited string pair.

Battery inspection and cleaning
OPAC (continued)

At the OPAC site

6

> **WARNING**
> **Possible system damage**
> You can add or remove battery strings from an active OPAC. If you perform this action make sure the battery strings are in the open circuit state from the MAP terminal. Turn off the associated battery charger controller (BCC) card NT8X02AB. Connect or disconnect the battery cables at the back of the cabinet. After you connect the affected battery strings, return the battery strings to the load bus one string at a time.If there is no MAP terminal control, turn off the BCC before you connect or disconnect any battery strings..

> **CAUTION**
> **Possible loss of service during battery replacement**
> Do not turn off more than one NT8X02 at a time. If you turn off more than one NT8X02 at a time service is lost if ac power is interrupted. Turn off BCC0 when you perform work on battery strings 0, 1, or 2. Turn off BCC1 when you perform work on battery string 4, 5 or 6.

Turn the appropriate BCC NT8X02 power switch to the OFF position.

7 Disconnect and remove matched battery string or strings from the affected shelf or floor area.

8 Clean the affected areas with baking soda and water. Continue until the cleaning solution does not foam when you apply the cleaning solution.

9 Dry all cleaned areas completely and replace the batteries.

10 Reconnect the battery string or strings.

11 Turn the BCC NT8X02 power switch to the ON position.

Battery inspection and cleaning
OPAC (end)

At the MAP terminal

12 To return the battery strings to the load bus, type

>LOADB n
and press the Enter key.

where

n is the string pair 0–2, as follows:
0 is pair 0, 4
1 is pair 1, 5
2 is pair 2, 6

Example of a MAP display:

```
CM    MS     IOD    NET    PM    CCS    LNS    Trks   Ext    Appl
.      .      .      .      .     .      .      .      .      .

 OPMPES               SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM         0      0       0       0       0      30
 2 Post_
 3                     RED      AMBER     GREEN     OFFL
 4           OPMPES     0          0         7        0
 5
 6 Tst_      OPMPES    2 Cond:  GREEN  REM2     2   1   RMM   2
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers                DIS     .    .
 9 OffL_       AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .       .   .   .   .   .   M        M        .   .
11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
12 Next      0= W    .    .    .    –  EHT ELT  FRNT SIDE    0   1
13           1= W    .    .    .    –   .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

Indicates the string pair is no longer in the open-circuit state.

13 To activate the automatic battery rotation and testing, type

>AUDIT ENABLE
and press the Enter key.

14 This inspection procedure is complete.

Battery replacement
OPAC

Application

Use this procedure to replace batteries in an outside plant access cabinet (OPAC).

Interval

Follow this procedure when you perform one of the following operations:

- install the OPAC
- replace battery strings for maintenance
- add battery strings
- remove batteries for cleaning

Common procedures

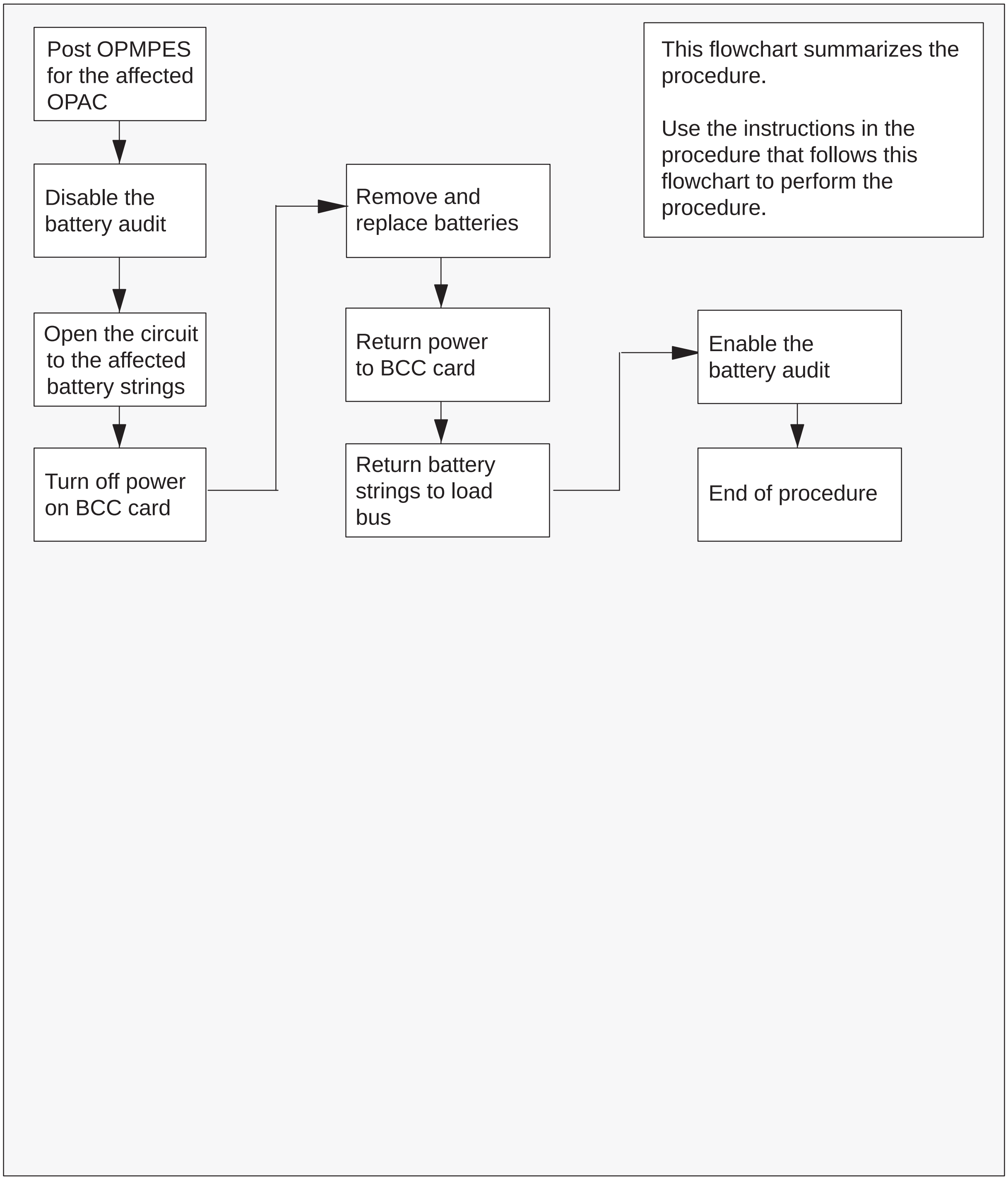
There are no common procedures.

Action

This procedure contains a summary flowchart. Use the summary flowchart to review the procedure. Follow the specified steps to perform this procedure.

Battery replacement
OPAC (continued)

Summary of battery replacement



Battery replacement
OPAC (continued)

Battery replacements

At the MAP terminal

1 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES
and press the Enter key.

2 To post the alarm state, type

>POST alarm_state
and press the Enter key.

where

alarm_state is RED, AMBER, GREEN. or OFFL

Note: This command posts all the PMs in the named alarm state and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs. The MAP terminal displays the OPAC.

3 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE
and press the Enter key.

Battery replacement
OPAC (continued)

4 To open the circuit to the battery strings to replace, type

>OPENCKT n
and press the Enter key.

where

n is the string pair 0–2, as follows:
0 is pair 0,4
1 is pair 1,5
2 is pair 2,6

Example of a MAP display:

```
 CM     MS       IOD      NET      PM      CCS      LNS      Trks    Ext      Appl
 .      .        .        .        .       .        .        .       .        .

 OPMPES                    SysB    ManB     OffL     CBSY     ISTB     InSV
 0 Quit      PM              0       0        0        0        0       30
 2 Post_
 3                          RED       AMBER      GREEN      OFFL
 4           OPMPES          0          0          7         0
 5
 6 Tst_      OPMPES     2 Cond:  GREEN  REM2      2   1    RMM   2
 7 Bsy_                                              Audit  Week  HBT
 8 Rts_        Common      Rectifiers                  .      2     .
 9 OffL_        AC      FL0 FL1 CL0 CL1    BCCDVR  PESALRM    ECU FSP
10              .        .   .   .   .   .    M        M         .   .
11 Disp_       BCC     0    1    2    3     Temp      Door     BCCFUSES
12 Next       0= W   O/C    .    .    -   EHT ELT  FRNT SIDE    0   1
13            1= W   O/C    .    .    -    .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

Indicates the open-circuited string pair.

Battery replacement

OPAC (continued)

At the OPAC site

5

WARNING
Possible system damage
When you add or remove battery strings from an active OPAC, make sure the battery strings are in the open circuit state. Check the state of the battery strings at the MAP terminal.
Turn off the associated battery charger controller card BCC NT8X02.
Connect or disconnect the battery cables at the back of the cabinet.
After you connect the affected battery strings, return the battery strings to the load bus one string at a time.
If there is no MAP terminal control, turn off the BCC before you connect or disconnect any battery strings.

CAUTION
Possible loss of service during battery replacement
Do not turn off more than one BCC NT8X02 at a time. If you turn off more than one BCC NT8X02, service is lost if ac power is interrupted. Turn off BCC0 when you work on battery strings 0, 1, or 2. Turn off BCC1 when you work on battery string 4, 5, or 6.

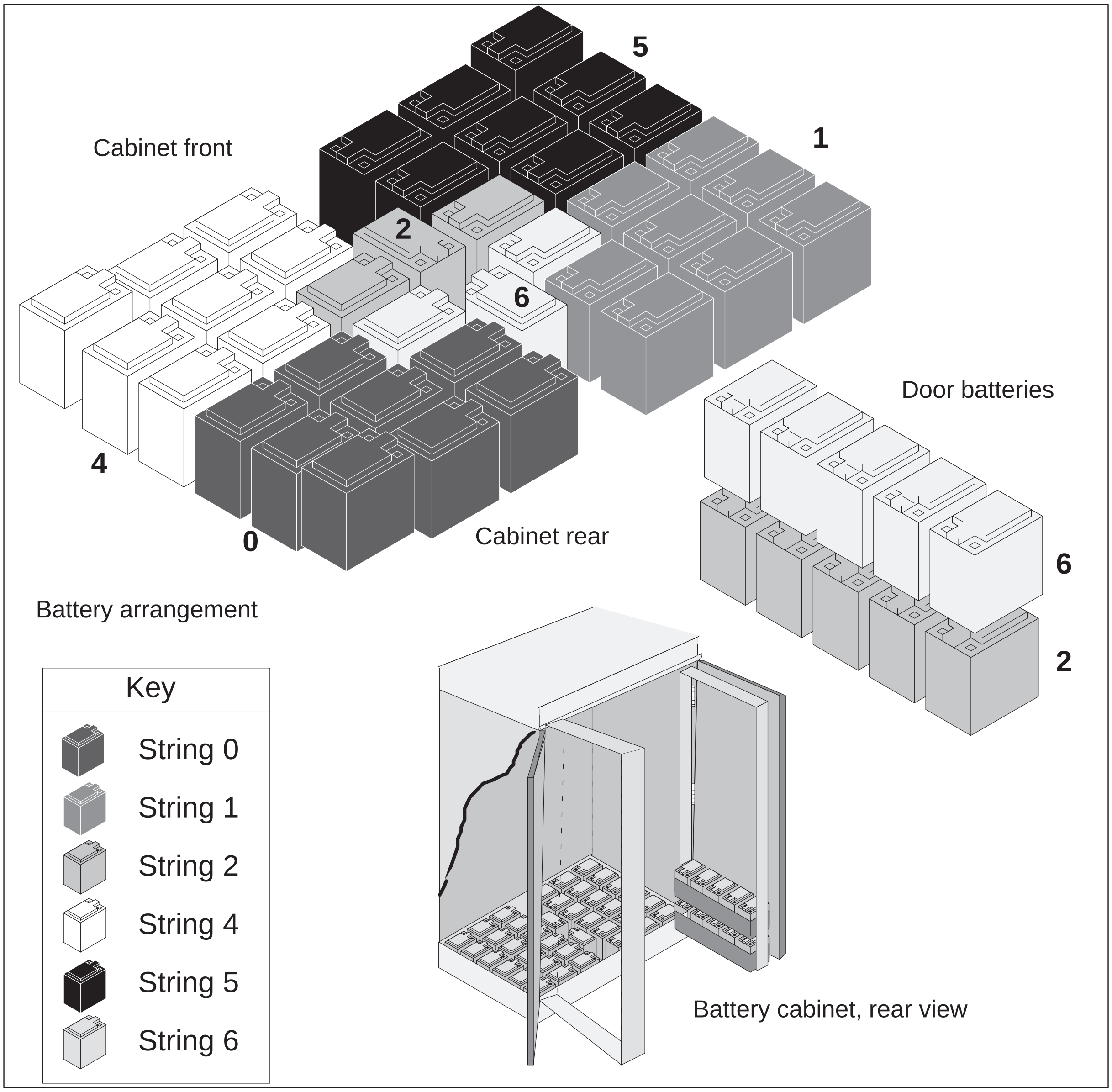
DANGER
Hazardous chemicals
Battery chemicals can be hazardous and explosive. Use caution.

Turn the correct BCC NT8X02 power switch to the OFF position.

6 Disconnect and remove matched battery string.

Battery replacement
OPAC (continued)

7 Install and interconnect the battery strings. Refer to the following figure for battery arrangement.



8 Connect the battery string installed in step 7 to the connector cable assembly.

9 Turn the BCC NT8X02 power switch to the ON position.

Battery replacement
OPAC (end)

At the MAP terminal

10 To return the battery strings to the load bus, type

>LOADB n
and press the Enter key.

where

n is the string pair 0–2, as follows:
0 is pair 0,4
1 is pair 1,5
2 is pair 2,6

Example of a MAP display:

```
 CM    MS     IOD    NET    PM    CCS    LNS    Trks   Ext    Appl
 .     .      .      .      .     .      .      .      .      .

 OPMPES                   SysB   ManB   OffL   CBSY   ISTB   InSV
 0 Quit     PM              0      0      0      0      0     30
 2 Post_
 3                         RED      AMBER    GREEN    OFFL
 4          OPMPES          0         0         7        0
 5
 6 Tst_     OPMPES    2 Cond:  GREEN  REM2     2   1   RMM   2
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_      Common     Rectifiers                  .      2    .
 9 OffL_      AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM   ECU FSP
10             .      .   .   .   .   .   M        M        .   .
11 Disp_     BCC    0    1    2    3    Temp      Door    BCCFUSES
12 Next     0= W    .    .    .    –   EHT ELT  FRNT SIDE    0   1
13          1= W    .    .    .    –    .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

Indicates the string pair is no longer in the open-circuit state.

11 To activate the automatic battery rotation and testing, type

>AUDIT ENABLE
and press the Enter key.

12 This procedure is complete.

Ground check
OPAC

Application

Check outside plant access cabinet (OPAC) system ground connections and measure ground resistance.

Interval

Perform this procedure according to local policy.

Common procedures

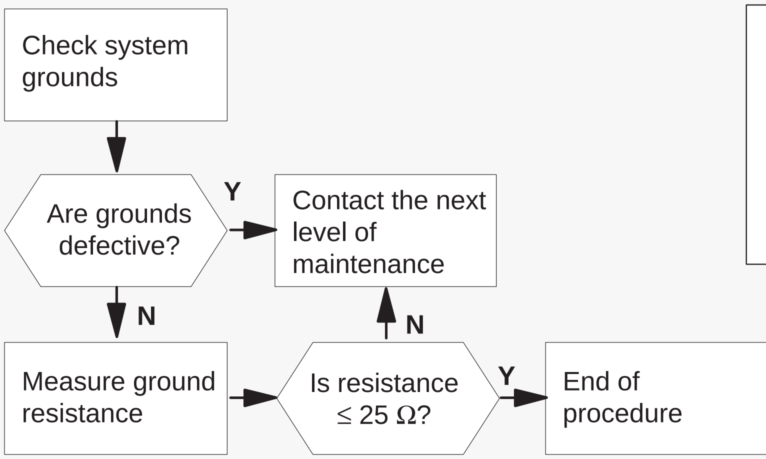
There are no common procedures.

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.

Ground check
OPAC (continued)

Summary of ground check



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Ground check
OPAC (end)

Ground check

At your Current Location

1 Check system grounds.

If grounds	Do
are in good condition	step 2
are damaged	step 3

2 Use local approved methods to measure ground resistance. The resistance for each ground must be ≤ 25 Ω.

If the resistance is	Do
≤ 25 Ω	step 4
not ≤ 25 Ω	step 3

3 For additional help, contact the next level of support.

4 The procedure is complete.

Discharge test failure
OPAC

Application

Use this procedure after a discharge test failure to determine if you must replace outside plant access cabinet (OPAC) batteries.

Interval

Perform this procedure after each discharge test failure.

Common procedures

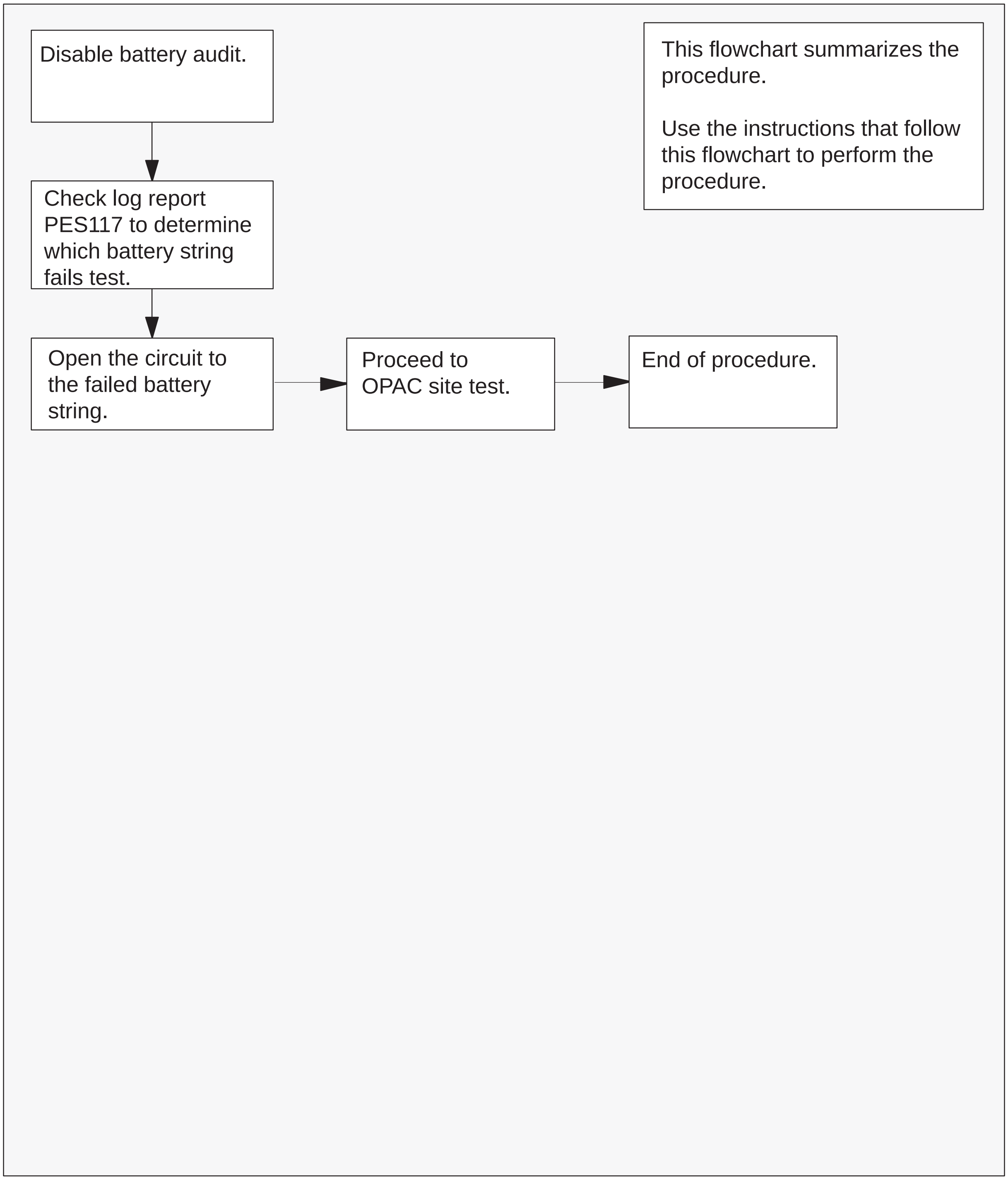
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps.

Discharge test failure
OPAC (continued)

Summary of discharge test failure



Discharge test failure
OPAC (end)

Discharge test failure

At the MAP terminal

1 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES
and press the Enter key.

2 To post the appropriate alarm state, type

>POST alarm_state
and press the Enter key.

where

alarm_state is RED, AMBER, GREEN, or OFFL

Note: This command posts the peripheral modules (PM) in the named alarm state and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the MAP terminal displays the appropriate OPAC.

3 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE
and press the Enter key.

4 From log report PES117, determine which battery string voltage tests below OPM_VOLT_TST_DIS. If strings 1 and 5 are marked as failures, determine if string 1, 5, or both, cause the alarm.

The OPACs with multiline test units (MTU): Default OPM_VOLT_TST_DIS = –495 or –49.5 Vdc.

5 To open the circuit to the failed battery string pair, type

>OPENCKT n
and press the Enter key.

where

n is the number of the string pair (0–3)

Note: The string pairs consist of the following groups:

- Pair 0 consists of strings 0 and 4.
- Pair 1 consists of strings 1 and 5.
- Pair 2 consists of strings 2 and 6.
- Pair 3 is not used.

6 Perform the site test procedure.

7 The procedure is complete.

Door alarm test
OPAC

Application

Use this procedure to test the door alarm in an outside plant access cabinet (OPAC).

Interval

Perform this procedure every time you visit the cabinet.

Common procedures

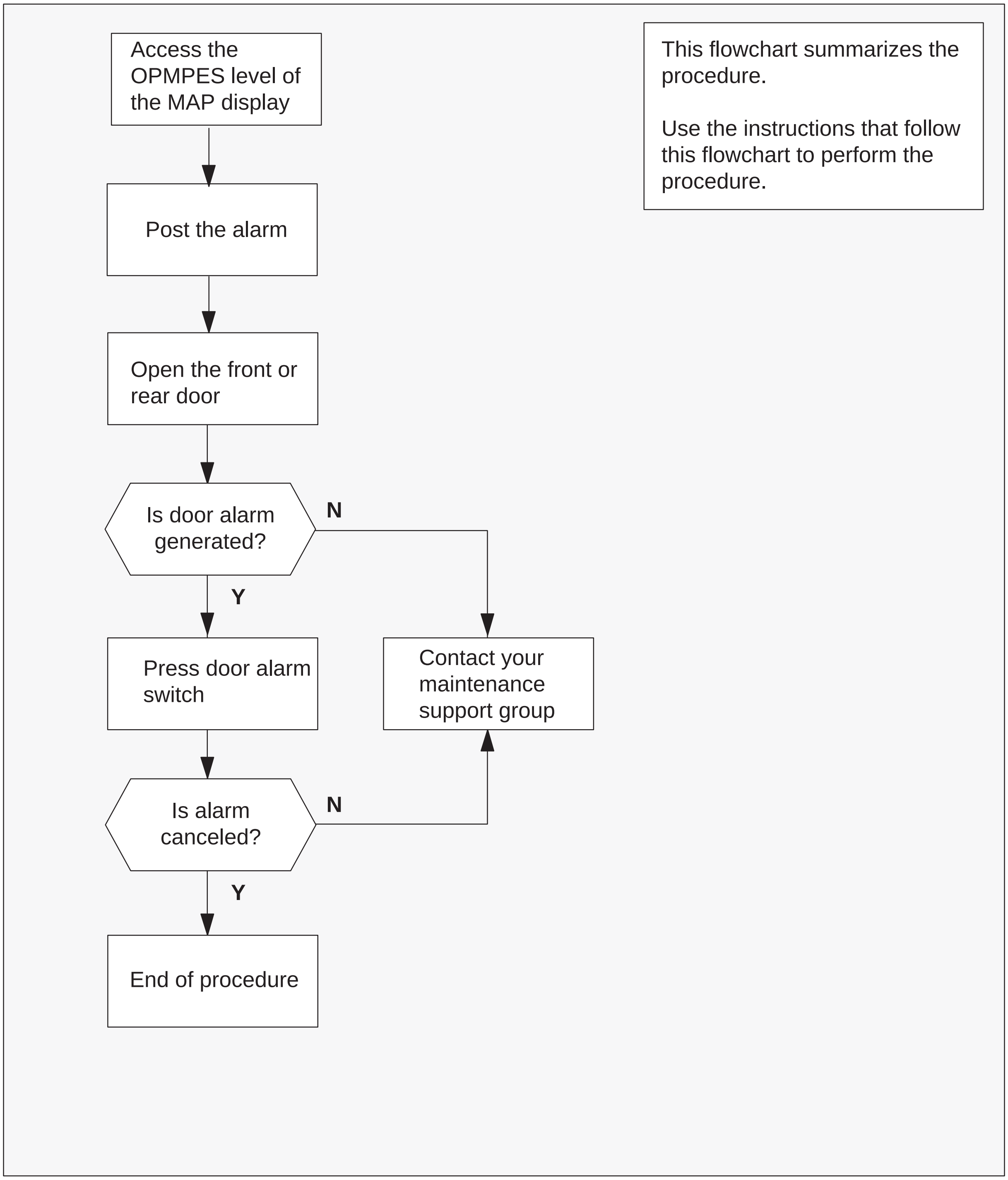
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of terms. Use the flowchart to review the procedure. Follow the steps to perform this procedure.

Door alarm test
OPAC (continued)

Summary of door alarm test



Door alarm test
OPAC (continued)

Door alarm test

At the MAP terminal

1 To access the OPMPES level of the MAP terminal, type

>MAPCI;MTC;PM;PES
and press the Enter key.

2 To post the correct alarm state, type

>POST alarm_state
and press the Enter key.

At the OPAC site

3 Open the door.

Door alarm test
OPAC (continued)

At the MAP terminal

4 Make sure that the system generates a door alarm at the MAP terminal.

Example of a MAP display:

```
 CM     MS     IOD     NET     PM     CCS     LNS     Trks    Ext     Appl
  .      .      .       .       .      .       .       .       .       .

OPMPES                SysB    ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM           0       3       4       0       4      30
 2 Post_
 3                      RED       AMBER      GREEN      OFFL
 4              OPMPES  0          1          3         1
 5
 6 Tst_        OPMPES     2 Cond:  RED     REM1      01   0   RMM   3
 7 Bsy_                                              Audit  Week  HBT
 8 Rts_             Common     Rectifiers       .          2     .
 9 OffL_             AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10                       F    F   F   .   .   .   .       .       .  .
11 Disp_           BCC      0     1   2   3  Temp  Door   BCCFUSES
12 Next             0=      .     .   .   -  EHT ELT  FRNT SIDE    0   1
13                  1=      .     .   .   -   .   .    O    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

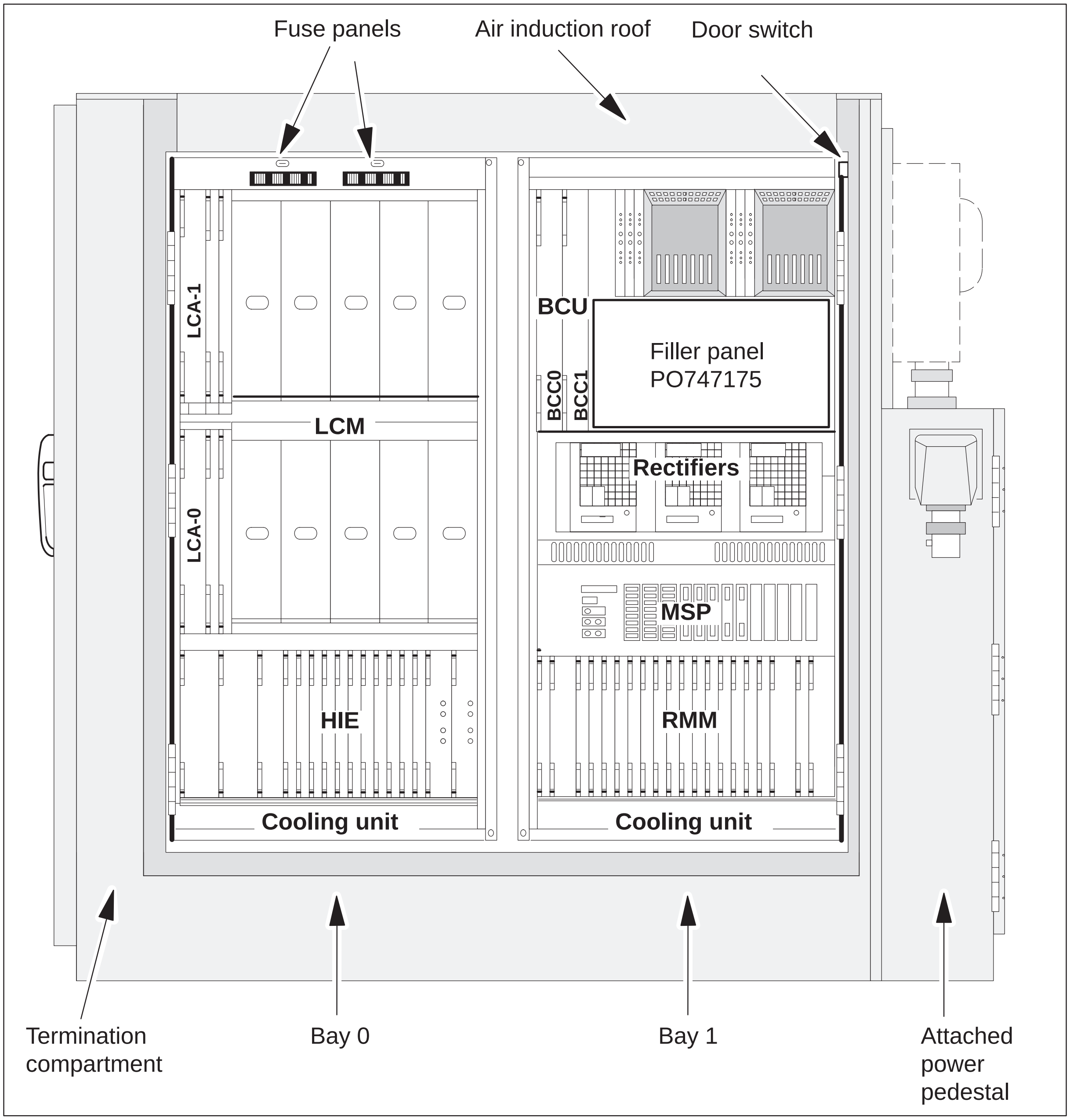
Indicates open front or rear door. The side door alarm is always a . (dot) condition and is not used.

If the door alarm	Do
generates	step 5
does not generate	step 6

Door alarm test
OPAC (continued)

At the OPAC site

5 Press the door switch and check the cancelation of the door alarm.



Door alarm test
OPAC (end)

If the alarm	Do
clears	step 7
does not clear	step 6

6 Contact your maintenance support group.

7 This procedure is complete.

Dust removal
OPAC

Application

Use this procedure to remove dust in an outside plant access cabinet (OPAC).

Interval

Perform this procedure every six months.

Common procedures

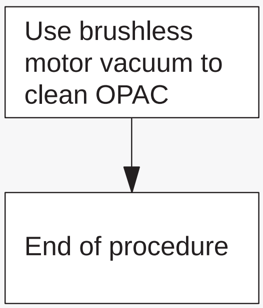
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform this procedure.

Dust removal
OPAC (continued)

Summary of dust removal



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Dust removal

At the OPAC site

1

> **CAUTION**
> **Possible service degradation due to electrical interference**
> Series-wound motors cause electromagnetic interference.

Vacuum OPAC frames to prevent the increase of electrostatic discharges that dust causes. Use a vacuum cleaner with an induction-wound brushless motor and plastic or rubber attachments. You can use battery-operated vacuum cleaners. Vacuum inside and around the frames at each inspection of the the OPAC filters. Do not bump any part of the frame. Avoid metal-to-metal contact.

2 This procedure is complete.

Fan cleaning and testing OPAC

Application

Use this procedure to test the fan functioning in an Outside Plant Access Cabinet (OPAC).

Interval

Perform this procedure when local policy directs.

Common procedures

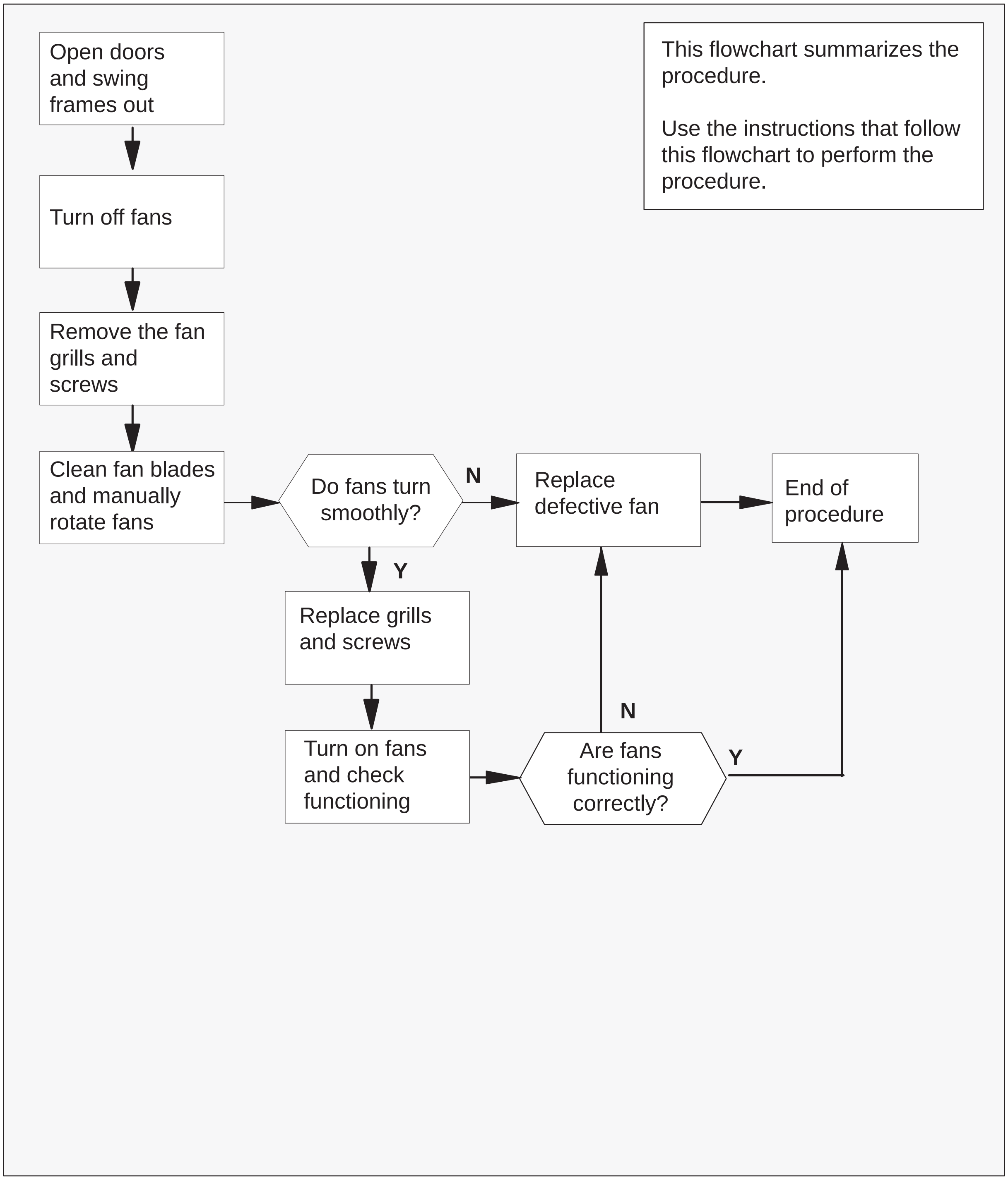
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the appropriate steps to perform this procedure.

Fan cleaning and testing
OPAC (continued)

Summary of fan cleaning and testing



Fan cleaning and testing
OPAC (end)

Fan cleaning and testing

At the OPAC site

1 To turn off the fans, remove fan fuses F1 – F4 in slot 8 and F1 – F6 in slot 9 of the MSP.

2 Remove the grills from the fans.

3 Clean the blades of the fans.

4 Manually rotate the fans to see if fan blades turn smoothly.

If fan blades	Do
turn smoothly	step 5
do not turn smoothly	step 9

5 Replace the fan grills.

6 To turn on the fans, replace fan fuses F1 – F4 in slot 8 and F1 – F6 in slot 9 of the MSP.

7 If necessary, use a heat gun or blow dryer on the fan thermostat sensor to turn on the fans. Take this step if the temperature is too cold for the roof exhaust fans to operate, .

8 Observe the fans to see that they operate correctly. Listen for any roughness in fan operation.

For each fan that is	Do
operating correctly	step 10
not running, running roughly, or, not operating correctly	step 9

9 Replace defective fan. If you can access the defective fan from inside the OPAC cabinet, use the *Fan replacement internal fans procedure.*

10 The procedure is complete.

Fan alarm test
OPAC

Application

Use this procedure to test the fan alarms in an outside plant access cabinet (OPAC).

Interval

Perform this procedure when local policy directs you to.

Common procedures

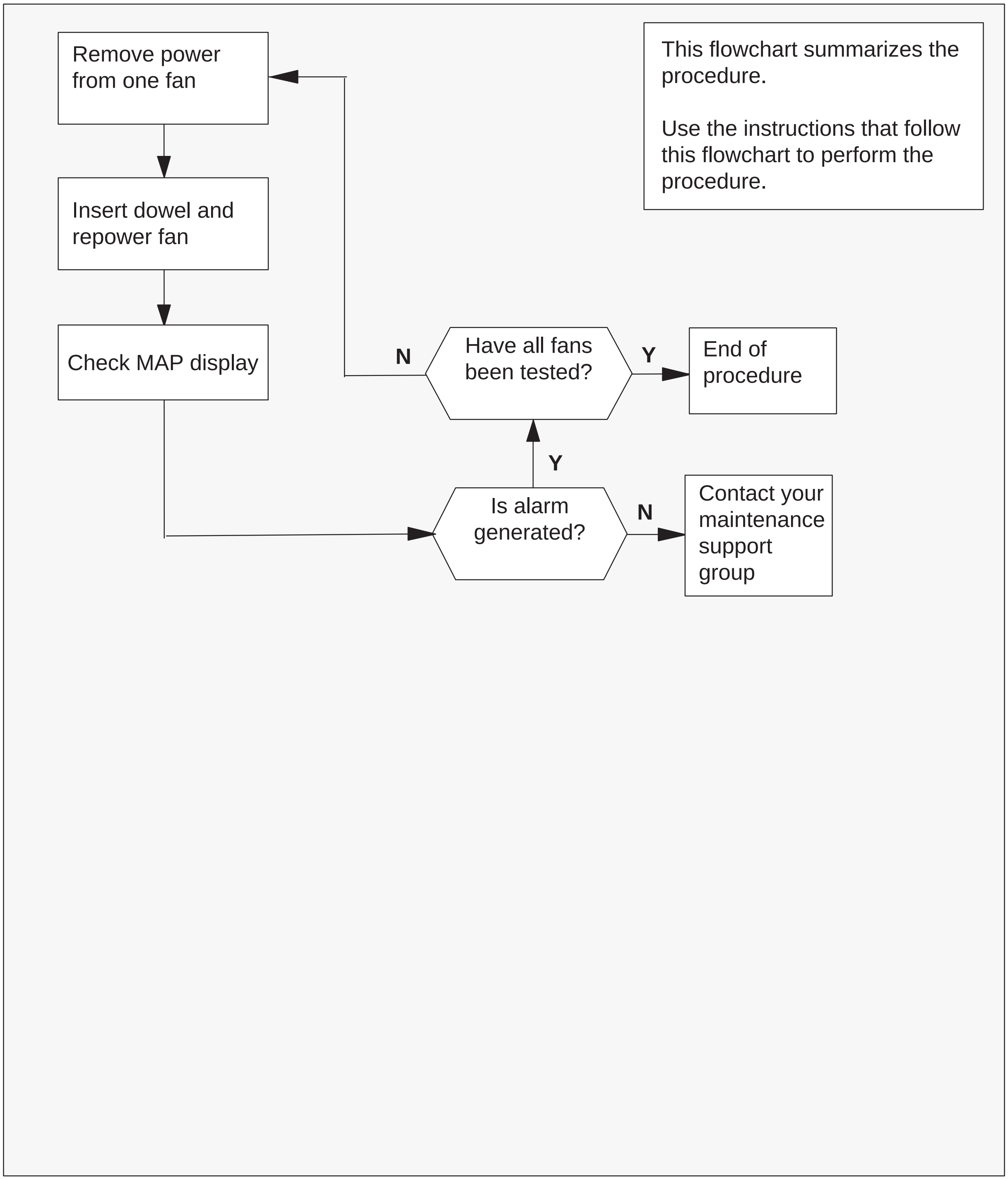
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the appropriate steps to perform this procedure.

Fan alarm test
OPAC (continued)

Summary of fan alarm test



Fan alarm test
OPAC (continued)

Fan alarm test

At the OPAC site

1 To turn off one of the fans, remove a fan fuse, F1 – F4 in slot 8 and F1 – F6 in slot 9 of the MSP.

Note: The air pressure that other fans create can start the fan to spin backwards.

2 Insert a wooden dowel into the stopped blades of the fan with no power.

3 Replace the fan fuse removed in step 1.

At the MAP terminal

4 Verify that the OPMPES MAP display produces a fan alarm (ECU).

At the OPAC site

5 Verify that the fan fail and frame fail lights on the MSP are lit.

6 Remove the fuse that you replace in step 3.

7 Remove the wooden dowel from the blades of the fan with no power.

8 Replace the fuse that you remove in step 6.

At the MAP terminal

9 Verify that the alarm generated in step 4 is cleared.

If an alarm	Do
clears	step 10
does not clear	step 11
did not generate	step 11

At the OPAC site

10 Verify that all fans have been checked.

If both sets of fans are	Do
not checked	step 1 for other fans
checked	step 12

11 Contact your maintenance support group.

Fan alarm test
OPAC (end)

12 The procedure is complete.

Fan filter replacement, air induction roof OPAC

Application

Use this procedure to replace Outside Plant Access Cabinet (OPAC) fan filters in the air induction roof.

Interval

Perform this procedure as often as every two months, but at least every six months. The frequency of this procedure depends on cabinet location and conditions.

> ***Note:*** Monitor the filters at each OPAC site to determine the rate particles charge filters. You can create a filter maintenance schedule from this study. Turn the fans off before you remove the filters.

The following table contains an example of a filter replacement schedule.

Filter replacement schedule

Ambient temperature °C	.0003 average residential (see note)	.0008 average industrial (see note)	.003 g/m heavy industrial (see note)
Cool (under 10°)	4 months	1.5 months	2 weeks
Warm (over 10° avg)	2 months	1 month	1 week
Note: Columns 2, 3, and 4 represent dust density of environment.			

Common procedures

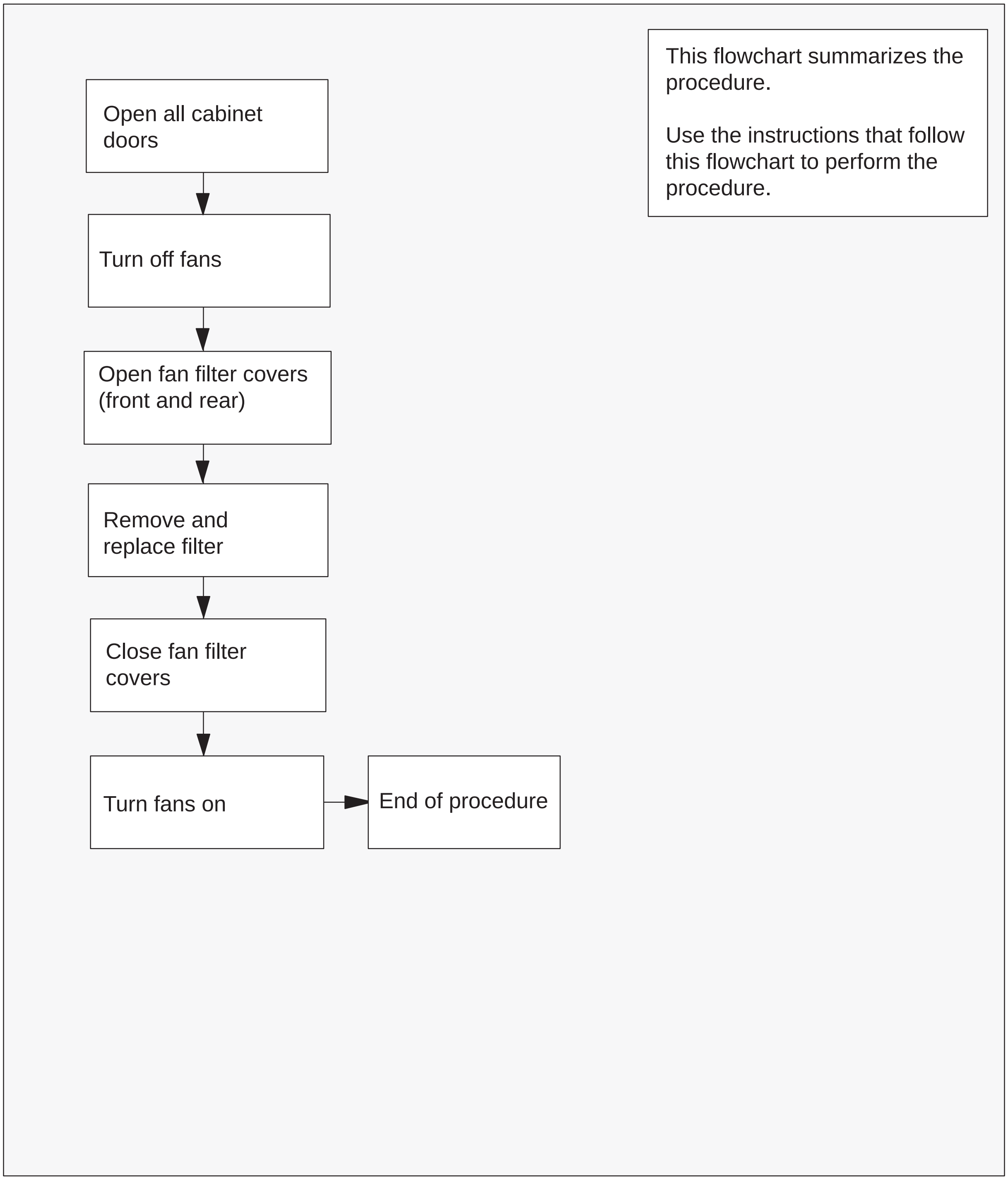
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Fan filter replacement, air induction roof OPAC (continued)

Summary of fan filter replacement, air induction roof



Fan filter replacement, air induction roof OPAC (end)

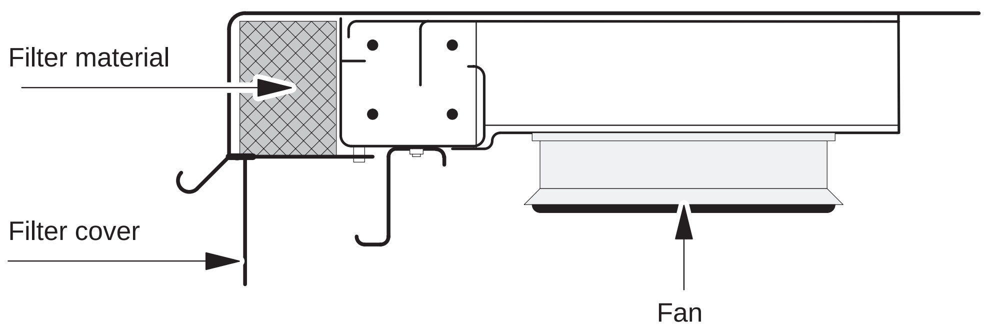
Fan filter replacement, air induction roof

At the OPAC site

1 Open all four cabinet doors.

2 To turn off the fans, remove fan fuses F1 – F4 in slot 8 and F1 – F6 in slot 9 of the MSP.

3 Open both filter covers.



Cross-section of air induction roof with filter

4 Remove and discard both old fan filters.

5

> **ATTENTION**
> Use only Nortel replacement filters to ensure the environmental properties of the OPAC cabinet system. Order and use the correct air filter kit, part number A0391171.

Install new fan filters and close hinged filter covers. Make sure both filters sit against the complete length of the grate. Wrong installation allows air to bypass the filter.

6 To turn on the fans, replace fan fuses F1 – F4 in slot 8 and F1 – F6 in slot 9 of the MSP.

7 Make sure air flows into the cabinet through the rain louver intake and out of the cabinet through the rain louver exhaust.

8 The procedure is complete.

Fuse replacement
OPAC

Application

Use this procedure to replace fuses in the outside plant access cabinet (OPAC).

Interval

Perform this procedure as needed. When one of the OPAC fuses has blown and needs replacement, a modular supervisory panel (MSP) alarm displays. This alarm displays on the MAP terminal under the FSP header.

Common procedures

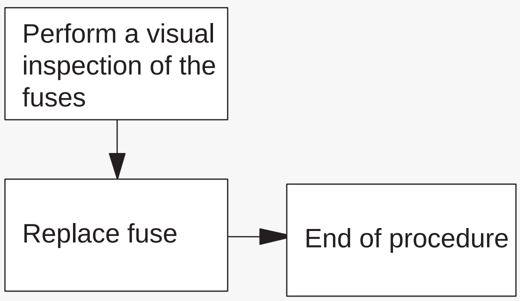
There are no common procedures.

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.

Fuse replacement
OPAC (continued)

Summary of fuse replacement



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Fuse replacement
OPAC (end)

Fuse replacement

At the OPAC site

1 Perform a visual inspection of the fuses at the top of bay 0. Perform a visual inspection of the MSP of the OPAC. Failed fuses have a colored button extended out of the fuse.

2 Replace the fuse with a fuse of the same color.

3 This procedure is complete.

GFCI check
OPAC

Application

Use this procedure to make sure the ground fault circuit interrupt (GFCI) for outside plant access cabinet (OPAC) operates correctly.

Interval

Perform this procedure before you use the outlets that have GFCI in the OPAC.

Common procedures

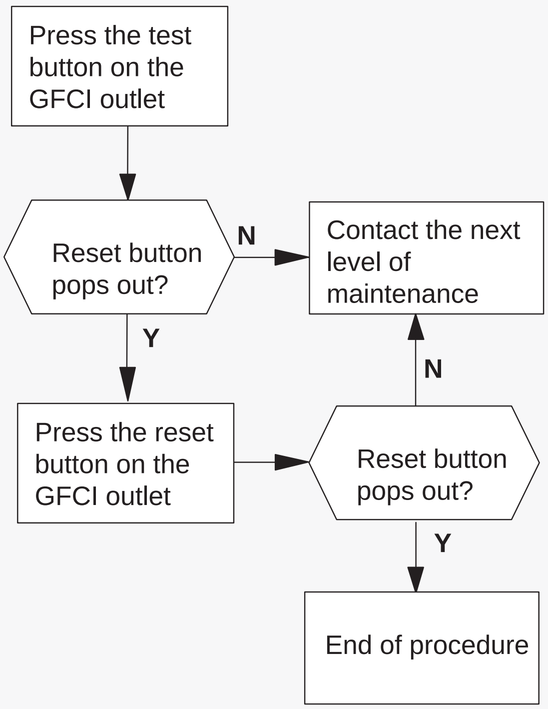
There are no common procedures.

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.

GFCI check
OPAC (continued)

Summary of GFCI check



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

GFCI check
OPAC (end)

GFCI check

At the OPAC site

1 Press the test button on the GFCI outlet.

2 Check if the reset button pops out.

If the reset button	Do
pops out	step 3
does not pop out	step 4

3 Press the reset button.

Note: If the outlet encounters a strong power change while in use, the reset button pops out. Press the reset button to reset the outlet.

If the reset button	Do
does not stay pressed	step 4
stays pressed	step 5

4 For additional help, contact the next level of maintenance.

5 The procedure is complete.

High temperature alarm test
OPAC

Application

Use this procedure to test the high temperature alarm in an OPAC.

Interval

Perform this procedure when local policy directs you to this procedure.

Common procedures

There are no common procedures.

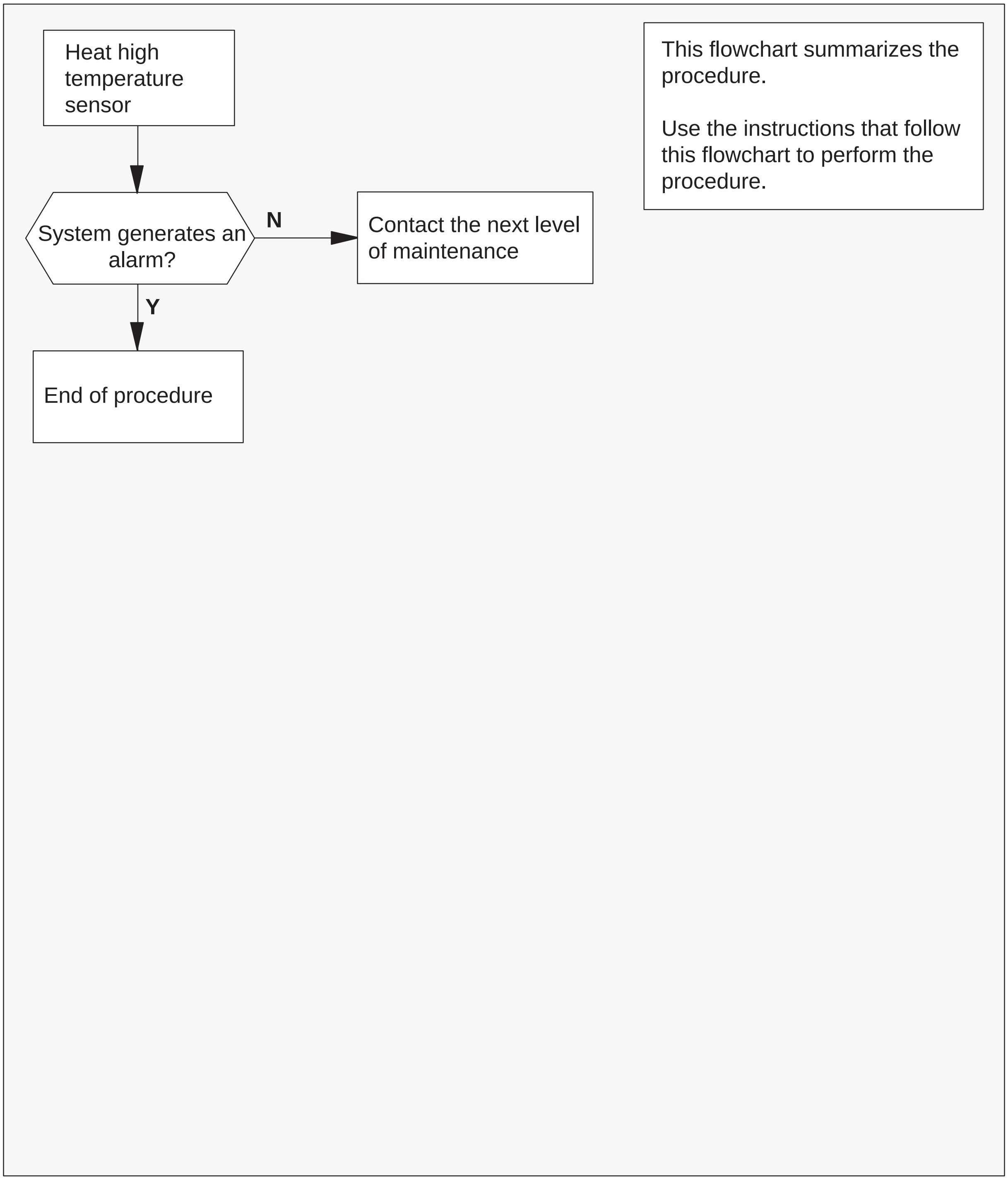
Action

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.

High temperature alarm test

OPAC (continued)

Summary of high temperature alarm test



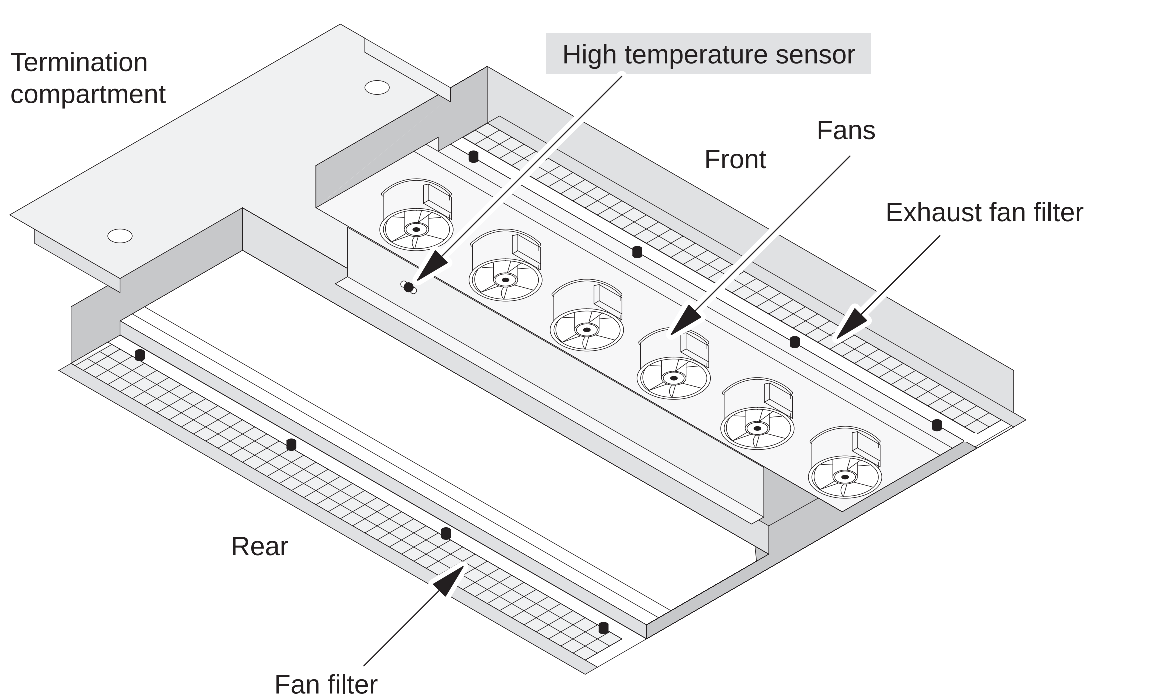
High temperature alarm test
OPAC (continued)

High temperature alarm test

At the OPAC site

1 To activate the high temperature alarm, blow hot air from a heat gun or a blow-dryer at the high temperature sensor. Refer to the following figures for the locations of the high temperature alarm sensors in the air induction roof.

Inside cabinet view from below, air induction roof



At the MAP terminal

2 Verify that the system generates an alarm.

If	Do
the system generates an alarm	step 4
the system does not generate an alarm	step 3

3 Contact the next level of maintenance.

High temperature alarm test
OPAC (end)

4 The procedure is complete.

Heaters test
OPAC

Application

Use this procedure to test the heaters in an outside plant access cabinet (OPAC).

Interval

Perform this procedure every 12 months.

Common procedures

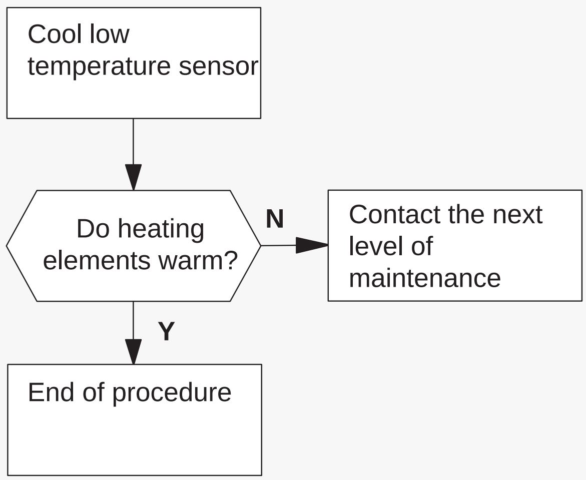
There are no common procedures.

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.

Heaters test
OPAC (continued)

Summary of heaters test



This flowchart summarizes the procedure.

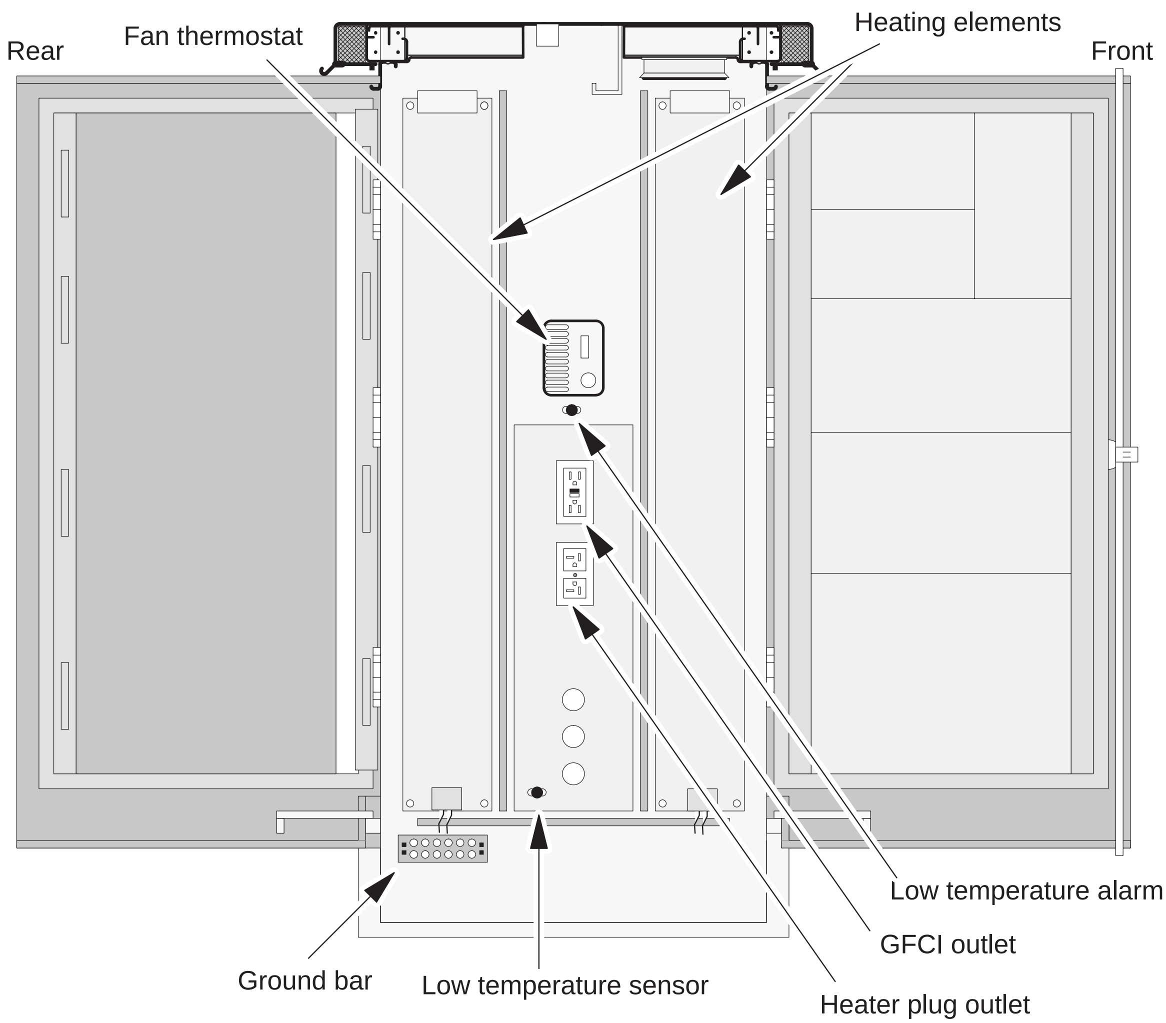
Use the instructions that follow this flowchart to perform the procedure.

Heaters test
OPAC (continued)

Heaters test

At the OPAC

1 Use a cooling spray to cool the low temperature sensor. Refer to the following figure for sensor location.



Right side view of the electronics compartment

2 To determine if the heating elements function, check the two heating elements on each wall of the compartment.

Heaters test
OPAC (end)

Refer to the previous figure for the location of the heating elements on the backplane of the electrical compartment. The heaters must be warm.

If the heating elements	Do
warm	step 4
do not warm	step 3

3 Contact the next level of maintenance.

4 The procedure is complete.

Low temperature alarm test
OPAC

Application

Use this procedure to test the low temperature alarm in an outside plant access cabinet (OPAC).

Interval

Perform this procedure every 12 months.

Common procedures

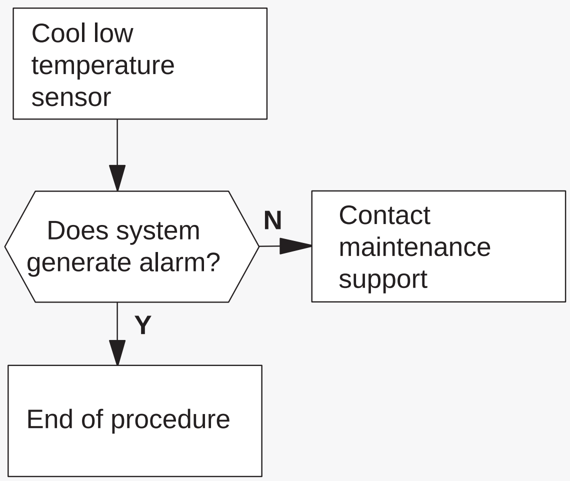
There are no common procedures.

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.

Low temperature alarm test
OPAC (continued)

Summary of low temperature alarm test



This flowchart summarizes the procedure.

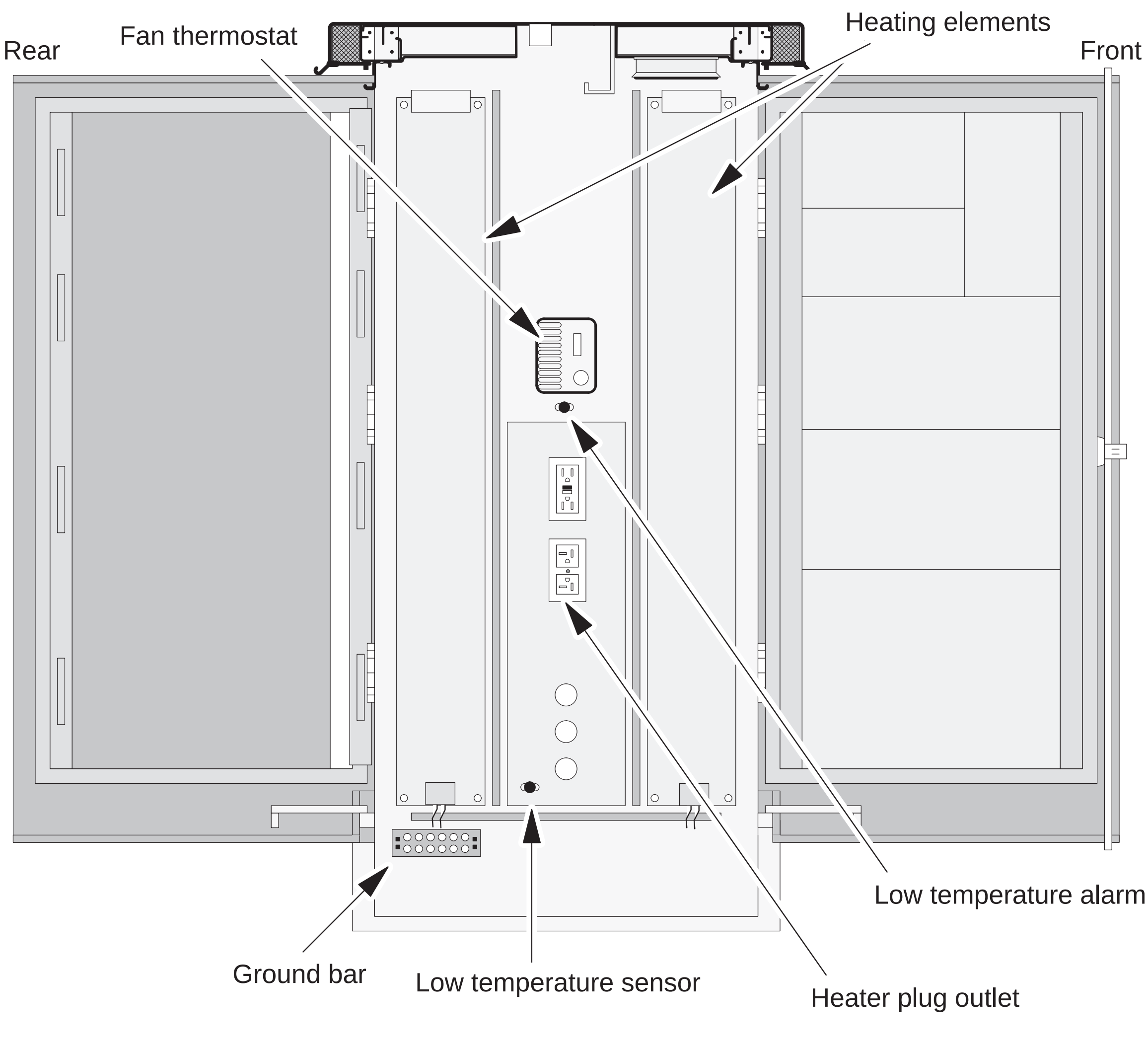
Use the instructions that follow this flowchart to perform the procedure.

Low temperature alarm test
OPAC (continued)

Low temperature alarm test

At the OPAC site

1 To select and activate the low temperature alarm, blow cooling liquid on the low temperature alarm. See the following figure for the location of the low temperature alarm.



Cutaway view of wall facing ac compartment

Low temperature alarm test
OPAC (end)

At the MAP terminal

2 Verify that the system generates the alarm.

If the system	Do
generates the alarm	step 4
does not generate the alarm	step 3

3 Contact your maintenance support group.

4 This procedure is complete.

Lubricate door hinges OPAC

Application

Use this procedure to lubricate the door hinges of an outside plant access cabinet (OPAC).

Interval

Perform this procedure every 4 months or according to local policy.

Common procedures

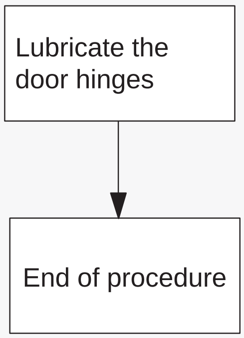
There are no common procedures.

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.

Lubricate door hinges
OPAC (continued)

Summary of lubricate door hinges



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Lubricate door hinges
OPAC (end)

Lubricate door hinges

At the OPAC site

1 Use the lubricant that local policy dictates to lubricate the door hinges.

2 The procedure is complete.

Open-circuit test failure
OPAC

Application

Use this procedure after an open-circuit test failure to determine if outside plant access cabinet (OPAC) batteries need replacement.

Interval

Perform this procedure after every open-circuit test failure.

Common procedures

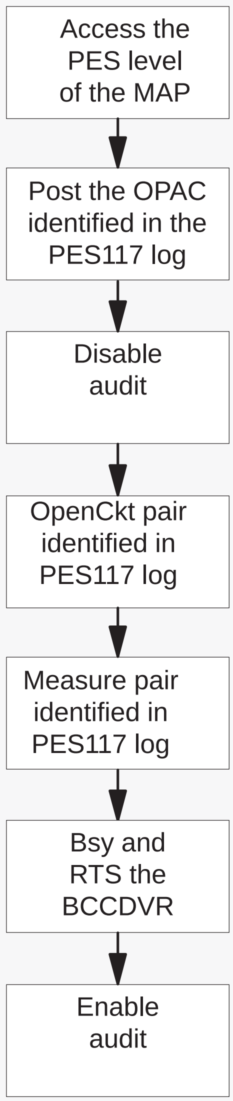
There are no common procedures.

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.

Open-circuit test failure
OPAC (continued)

Summary of open–circuit test failure



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Open-circuit test failure
OPAC (continued)

Open circuit test failure

At the MAP terminal

1 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES
and press the Enter key.

2 To post the appropriate alarm, type

>POST alarm_state
and press the Enter key.

where

alarm_state is RED, AMBER, GREEN, or OFFL

Note: This command posts all PMs in the named alarm state, and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the MAP terminal displays the correct OPAC.

3 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE
and press the Enter key.

4 From the PES117 log, determine which battery string voltage tested below OPM_VOLT_TST_DIS. If the system marked strings 1 and 5 failed, determine if string 1, 5, or both, caused the alarm.

Note: OPACs with MTU: Default OPM_VOLT_TST_DIS = –495 or –49.5 Vdc

5 To open the circuit to the failed battery string pair, type

>OPENCKT n
and press the Enter key.

where

n is the number of the string pair (0–2)

Leave the string pair in the open-circuit state for at least 6 hours before you proceed to the next step.

Open-circuit test failure
OPAC (end)

6 To measure the failed battery string pair voltage, type

>MEASURE PAIR n
and press the Enter key.

where

n is the number of the string pair (0–2)

If voltage compared to OPM_VOLT_TST_CHG	Do
is less negative	step 7
is equal to or more negative	step 8

Note: OPACs with MTU: default OPM_VOLT_TST_CHG = –509 or –50.9 V dc

7 If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair open-circuit and proceed with the *Site test procedure*.

8 If the voltage is equal to or more negative than OPM_VOLT_TST_CHG, the string can accept a charge. To return the battery string pair to service, type

>BSY BCCDVR
and press the Enter key.

>RTS BCCDVR
and press the Enter key.

Note: If the open-circuit test marks the same string within the next 2 months, proceed directly to the *Site test procedure*.

9 To enable the automatic battery rotation and testing, type

>AUDIT ENABLE
and press the Enter key.

10 This procedure is complete.

Paint touch–up
OPAC

Application

Use this procedure to touch-up the paint finish on the outside plant access cabinet (OPAC).

Interval

Perform this procedure as needed.

Common procedures

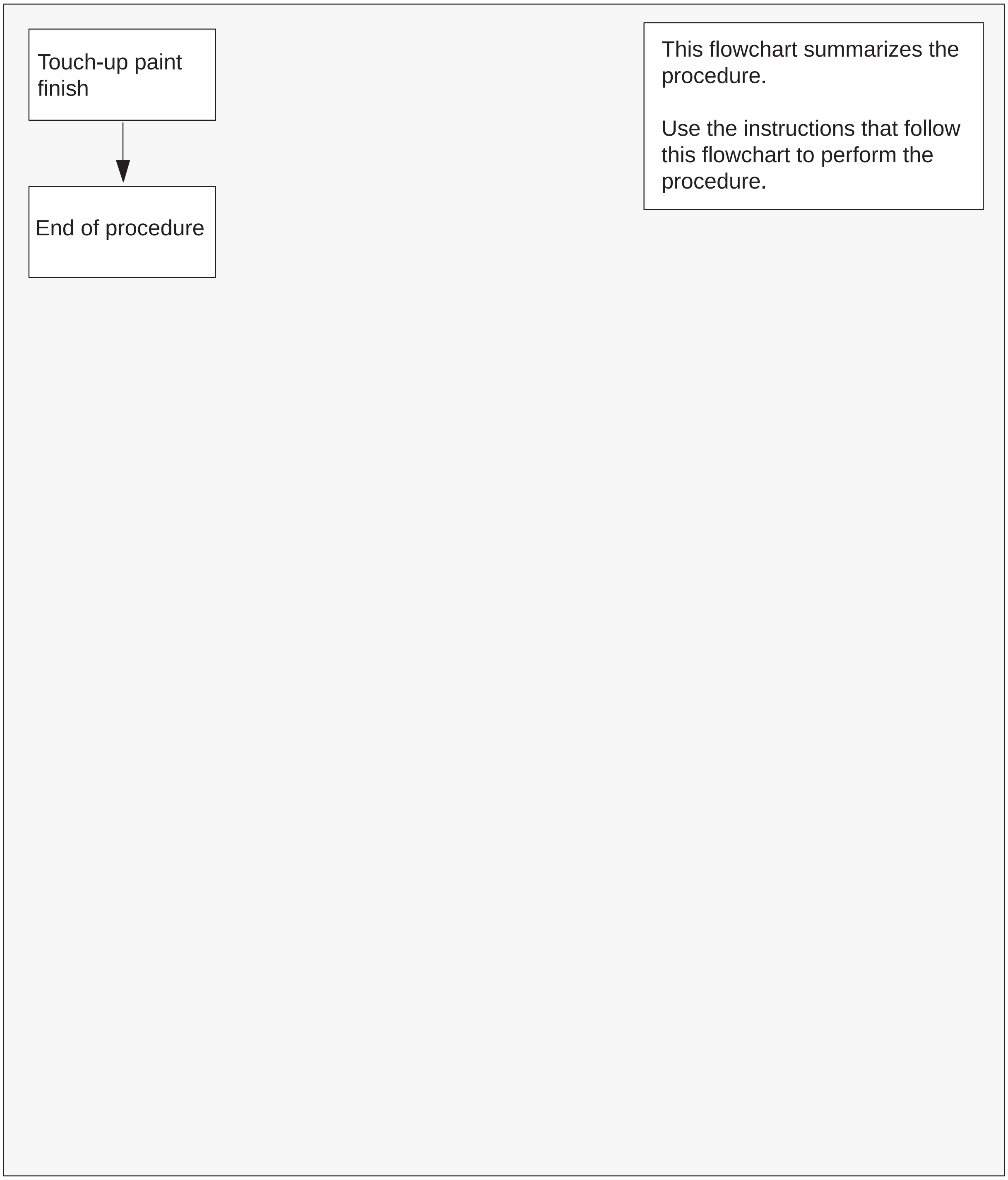
There are no common procedures.

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.

Paint touch–up
OPAC (continued)

Summary of paint touch-up



Paint touch–up
OPAC (end)

Paint touch–up

At the OPAC site

1 Use the correct touch-up paint for the OPAC.

If the OPAC	Do
is maple brown	Use paint kit R0115917.
is ivory	Use paint kit R0115497.
is light green	Use paint kit R0115496.

2 Use the bottle with brush to paint small areas, or the spray can to paint larger areas.

3 This procedure is complete.

Post charge test failure
OPAC

Application

Use this procedure following an outside plant access cabinet (OPAC) post charge test failure to determine if batteries should be replaced.

Interval

Perform this procedure after every post charge test failure.

Common procedures

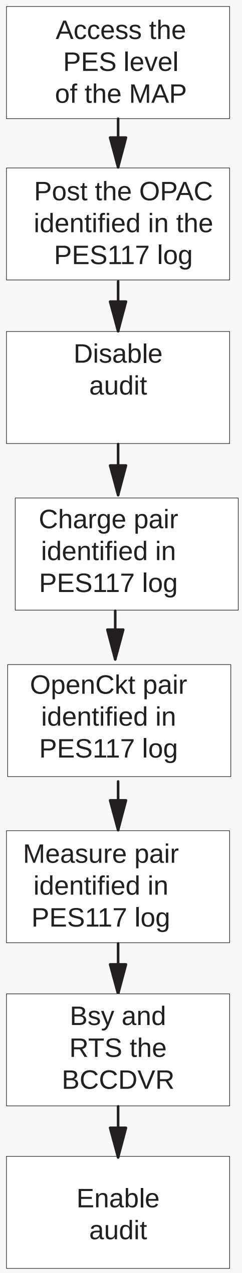
None

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Post charge test failure
OPAC (continued)

Summary of post charge test failure



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Post charge test failure
OPAC (continued)

Post charge test failure

At the MAP terminal

1 Access the OPMPES MAP display level by typing

>MAPCI;MTC;PM;PES
and pressing the Enter key.

2 Post the appropriate alarm by typing

>POST alarm_state
and pressing the Enter key.

where

alarm_state is RED, AMBER, GREEN, or OFFL

Note: This command posts all the PMs in the named alarm state, and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the MAP terminal displays the appropriate OPAC.

3 Disable the automatic battery rotation and testing by typing

>AUDIT DISABLE
and pressing the Enter key.

4 From the PES117 log, determine which battery string voltage tested below OPM_VOLT_TST_DIS. If strings 1 and 5 were marked failed, determine if string 1, 5, or both caused the alarm.

Note: OPACs with MTU: Default OPM_VOLT_TST_DIS = –495 or –49.5

5 Place the failed battery string pair on the charge bus by typing

>CHARGE n
and pressing the Enter key.

where

n is the number of the string pair (0–2)

Leave the string pair on the charge bus for at least 6 hours before proceeding to the next step.

6 Open the circuit to the failed battery string pair by typing

>OPENCKT n
and pressing the Enter key.

where

n is the number of the string pair (0–2)

Leave the string pair in the open-circuit state for at least 6 hours before proceeding to the next step.

Post charge test failure
OPAC (end)

7 Measure the failed battery string pair voltage by typing

>MEASURE PAIR n
and pressing the Enter key.

where

n is the number of the string pair (0–2)

If voltage compared to OPM_VOLT_TST_CHG is	Do
less negative	step 8
equal to or more negative	step 9

Note: OPACs with MTU: default OPM_VOLT_TST_CHG = –509 or –50.9 V dc

8 If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair open-circuit and proceed with the *Site test procedure*.

9 If the voltage is equal to or more negative than OPM_VOLT_TST_CHG, the string can accept a charge. Return the battery string pair to service by typing

>BSY BCCDVR
and pressing the Enter key.

>RTS BCCDVR
and pressing the Enter key.

Note: If the same string is marked failed by the open-circuit test within the next 2 months, proceed directly to the *Site test procedure*.

10 Enable the automatic battery rotation and testing by typing

>AUDIT ENABLE
and pressing the Enter key.

11 You have successfully completed this procedure.

Rectifier voltage check
OPAC

Application

Use this procedure to check the rectifier voltage in an outside plant access cabinet (OPAC) that has an MTU.

Interval

Perform this procedure during each visit to the cabinet.

Common procedures

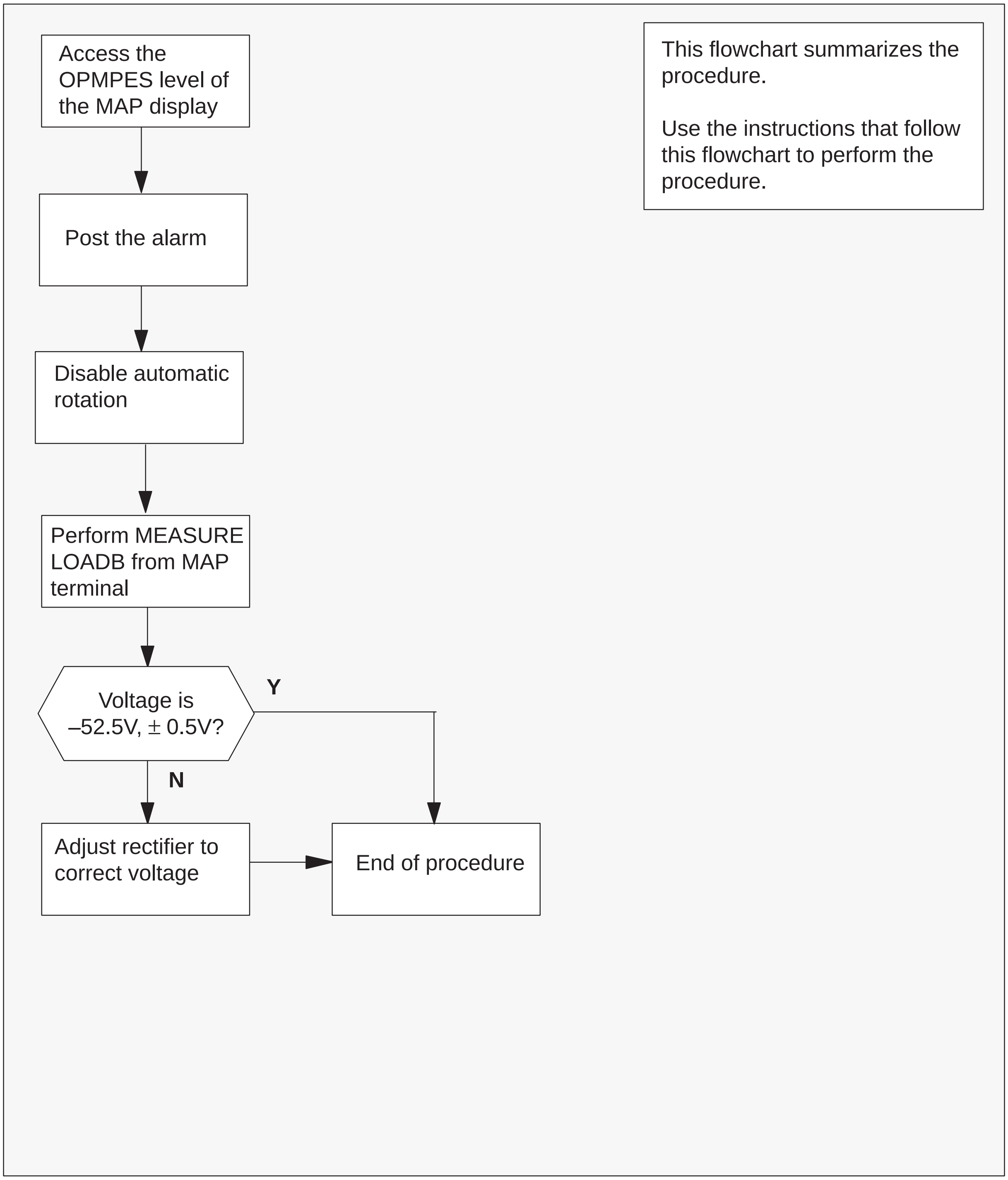
There are no common procedures.

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.

Rectifier voltage check
OPAC (continued)

Summary of rectifier voltage check



Rectifier voltage check
OPAC (continued)

Rectifier voltage check

At the MAP terminal

1 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES
and press the Enter key.

2 To post the correct alarm, type

>POST alarm_state
and press the Enter key.

where

alarm_state is RED, AMBER, GREEN, or OFFL

Note: This command posts all the PMs in the specified alarm state and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the MAP terminal displays the correct OPAC.

3 To disable the automatic battery rotation, type

>AUDIT DISABLE
and press the Enter key

4 To measure the voltage of the load bus, type

>MEASURE LOADB
and press the Enter key.

If voltage	Do
is OK	step 9
is not OK	step 5

At the OPAC site

5 Use the *Rectifier voltage adjustment procedure* to adjust the rectifier voltage until the rectifier voltage is in specification (–52.5Vdc, ± 0.5V). Make sure the currents from the rectifiers balance. If the rectifier voltage was low before adjustment, wait 24 h before you proceed with the battery capacity tests.

At the MAP terminal

6 To busy the BCC driver when the rectifier voltage is in specification, type

>BSY BCCDVR
and press the Enter key.

Rectifier voltage check
OPAC (end)

7 To return the BCC driver to service, type

>RTS BCCDVR
and press the Enter key.

8 To enable the automatic battery rotation, type

>AUDIT ENABLE
and press the Enter key.

9 This procedure is complete.

Rectifier replacement
OPAC

Application

Use this procedure to replace a rectifier in an outside plant access cabinet (OPAC).

Interval

Perform this procedure as required.

Common procedures

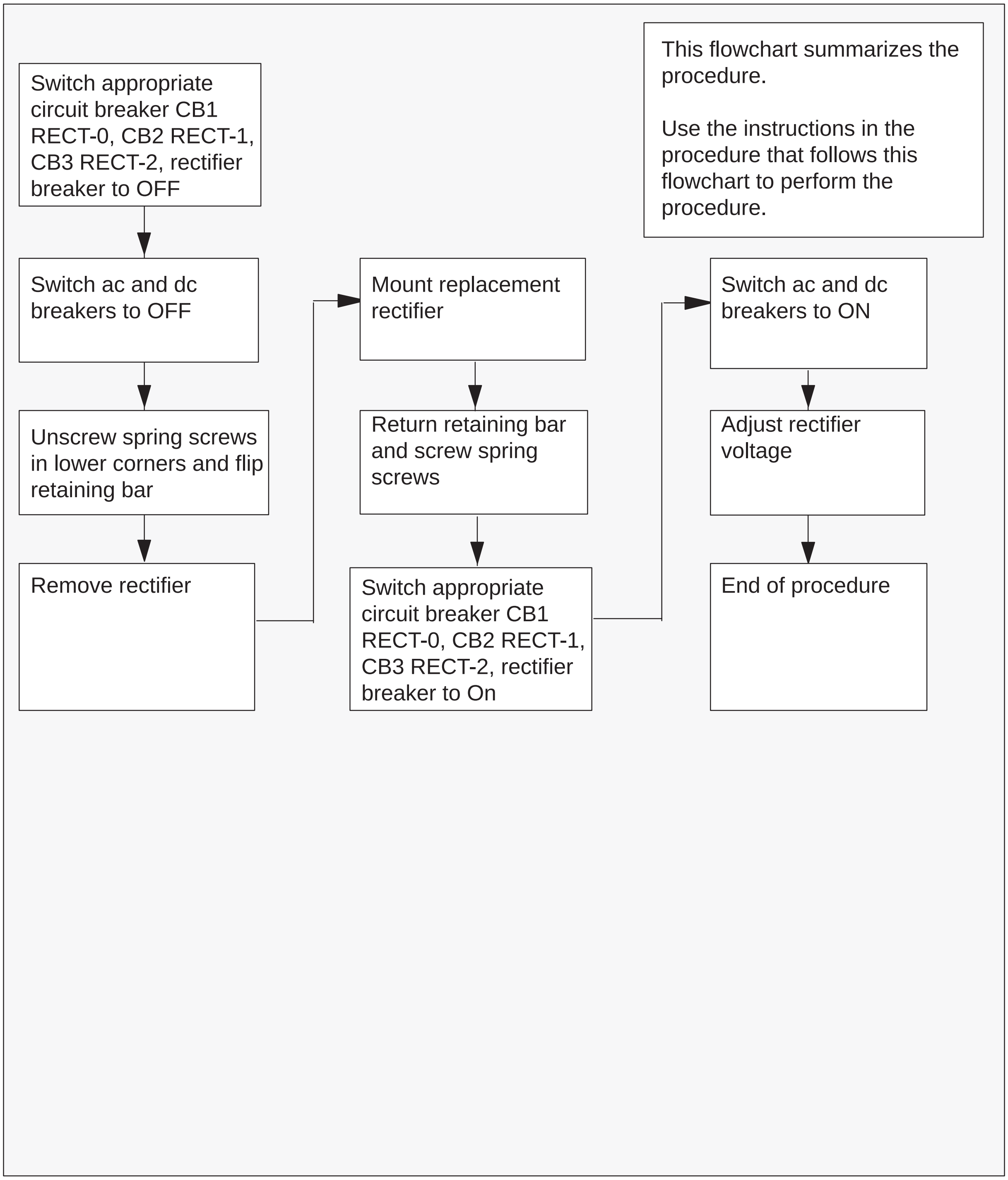
There are no common procedures.

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.

Rectifier replacement
OPAC (continued)

Summary of rectifier replacement



Rectifier replacement
OPAC (end)

Rectifier replacement

At the OPAC site

1 Switch the appropriate circuit breaker, CB1 RECT-1, CB2 RECT-2, or CB3 RECT-3 circuit breaker in the electrical compartment with attached power pedestal to OFF.

2 Set the ac and dc breakers on the front face of the rectifier to OFF.

3 Unscrew the large spring screws in the lower left and right corners of the rectifier shelf.

4 Flip back the hinged retaining bar and remove the rectifier.

5 Mount the replacement rectifier, flip the retaining bar back into place, and screw the retaining screws.

6 Switch the appropriate circuit breaker, CB1 RECT-1, CB2 RECT-2, or CB3 RECT-3 rectifier breakers to ON, and reconnect the load to the rectifier.

7 Set the dc breaker switch on the front of the rectifier to ON.

8 Set the ac breaker to ON.

9 Use the *Rectifier voltage adjustment procedure* to adjust the voltage.

10 The procedure is complete.

Wrist strap grounding cords test
OPAC

Application

Use this procedure to test the resistance of the wrist strap grounding cords. Check that the resistance is low enough to allow static electricity to discharge from the body of the user. Resistance must be high enough to prevent electrocution of the user if the equipment develops a short-circuit.

Interval

Perform this procedure one time each month.

Common procedures

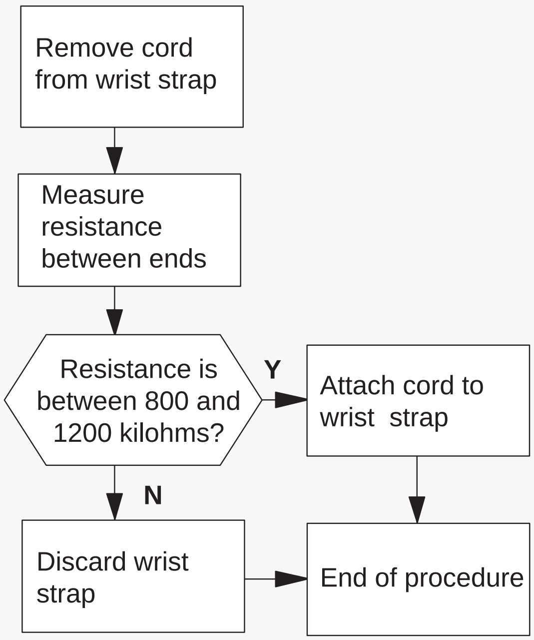
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform this procedure.

Wrist strap grounding cords test
OPAC (continued)

Summary of testing wrist strap grounding cords



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Wrist strap grounding cords test
OPAC (end)

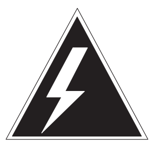
Wrist strap grounding cords test

At the OPAC site

1 Remove the grounding cord from the wrist strap.

2

DANGER
Risk of electrocution
The grounding cord is safe to use only if the resistance of the cord measures higher than 800 kilohms. A lower resistance can cause electrocution if equipment short-circuits while the user wears the wrist strap.



WARNING
Damage to electronic equipment
A grounding cord that has a resistance higher than 1200 kilohms cannot conduct static charges to ground correctly. This cord does not protect sensitive electronic equipment against build-ups of charges that can damage the equipment.

Measure the resistance between opposite ends of the grounding cord with the ohmmeter.

If resistance	Do
is between 800 kΩ and 1200 kΩ	step 5
is not between 800 kΩ and 1200 kΩ	step 3

3 Remove the whole assembly. Do not attempt to use the assembly.

4 Replace assembly as soon as possible.

Go to step 1 for new assembly.

5 You can use the grounding cord and wrist strap assembly. Assemble the wrist strap to the grounding cord.

6 This procedure is complete.

Fan replacement, internal fans
OPAC

Application

Use this procedure to replace defective fans in the air induction roof or the heat exchanger roof. You can access from inside the Outside Plant Access Cabinet (OPAC).

Interval

Perform this procedure when local policy directs you to.

Common procedures

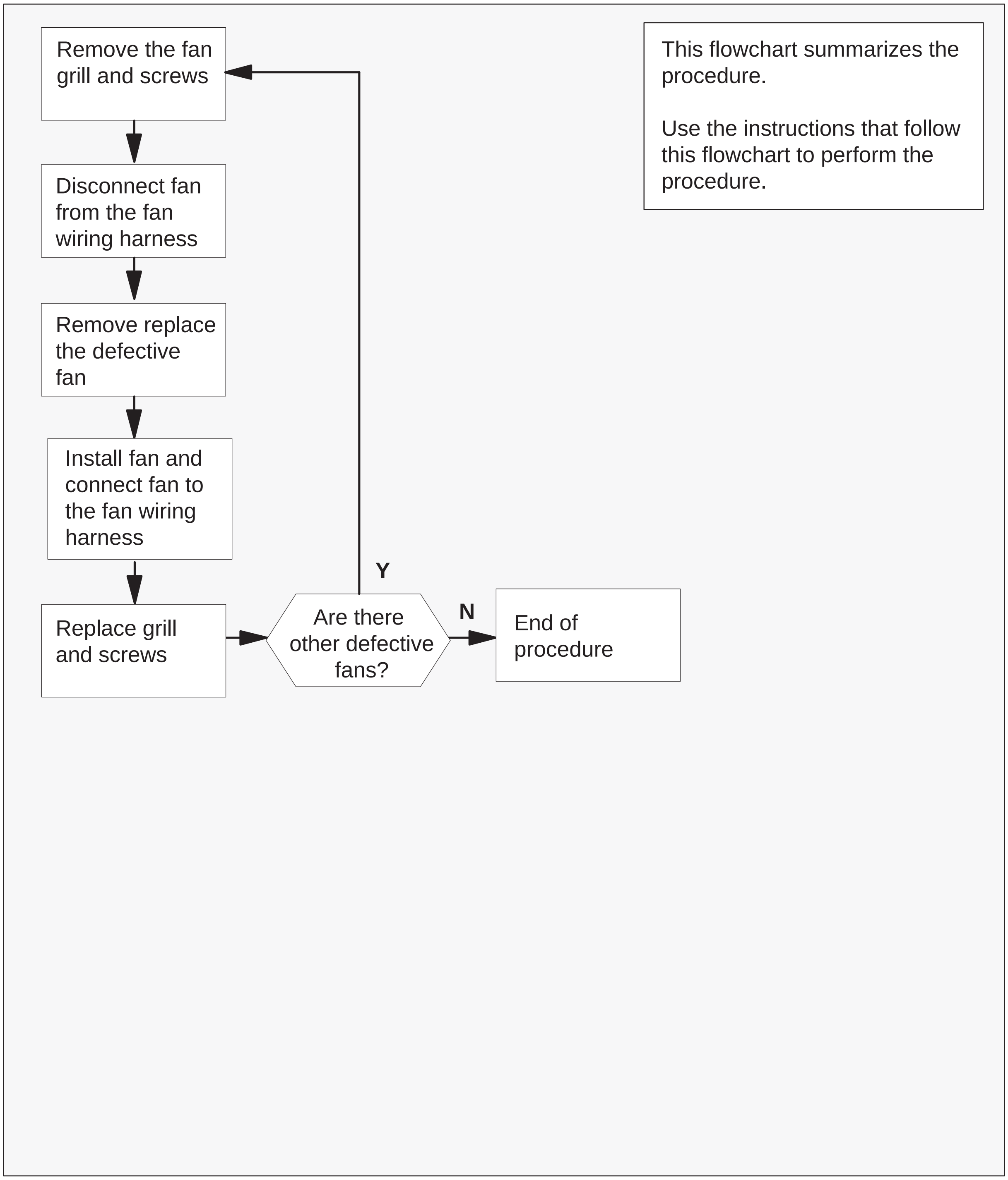
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the appropriate steps to perform this procedure.

Fan replacement, internal fans
OPAC (continued)

Summary of fan replacement, internal fans



Fan replacement, internal fans
OPAC (end)

Summary of fan replacement, internal fans

At your Current Location

1 Proceed only if a step in a maintenance procedure directs you to this procedure. This procedure can cause equipment damage or service interruption if you use the procedure alone.

2 Make sure that the frames are open to allow access to the exhaust fans in the roof, if necessary. Make sure you remove the correct fan fuse, F1 – F4 in slot 8 or F1 – F6 in slot 9 of the MSP, has been removed.

3 Remove the fan grill over the defective fan, if necessary. Put the two screws and the fan grill in a safe place.

4 Disconnect the fan connector from the fan wiring harness and remove the defective fan unit.

5 Install and connect the new fan unit to the fan wiring harness.

6 Replace the grill and the two screws.

7 Return power to the fans and check for additional defective fans.

If there are	Do
other defective fans	step 2 for the next fan
no other defective fans	step 8

8 The procedure is complete. Return to the main procedure that sent you to this procedure and continue as directed.

Rectifier voltage adjustment
OPAC

Application

Use this procedure to adjust the rectifier voltage in an OPAC equipped with a multiline test unit (MTU).

Interval

Perform this procedure according to local policy.

Common procedures

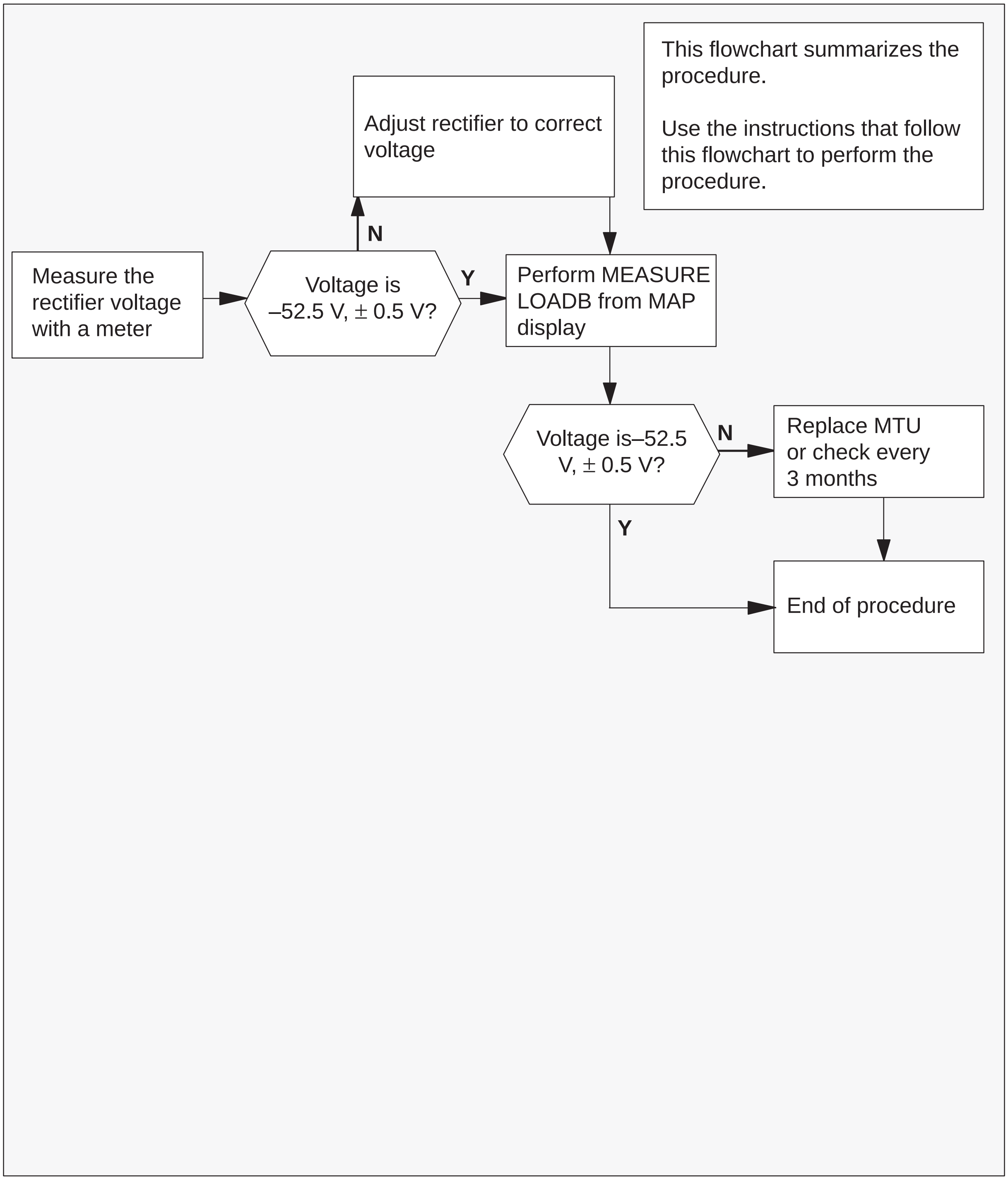
There are no common procedures.

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.

Rectifier voltage adjustment
OPAC (continued)

Summary of rectifier voltage adjustment



Rectifier voltage adjustment
OPAC (continued)

Rectifier voltage adjustment

At your Current Location

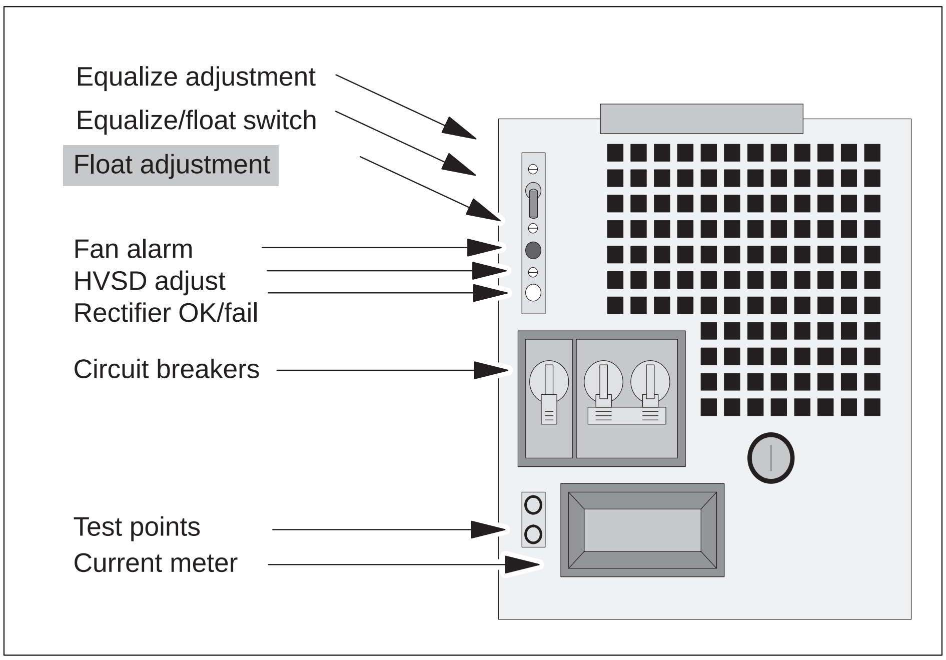
1 Proceed if a step in a maintenance procedure directs you to this procedure . Separate use of this procedure can cause equipment damage or service interruption.

At the OPAC site

2 Use a voltmeter with a minimum 2% accuracy to measure the rectifier output voltage.

If voltage	Do
is not equal to –52.5 Vdc, ± 0.5 V	step 3
is equal to –52.5 Vdc, ± 0.5 V	step 4

3 Turn the float adjustment screw to adjust the rectifier voltage. Adjust the voltage with specification (–52.0 Vdc, ± 0.5 V). Make sure that the currents from the rectifiers are balanced. If the rectifier voltage is low before adjustment, wait 24 h before you proceed with battery capacity tests. Refer to the following figure for location of the float adjustment screw on the rectifier face.



Rectifier voltage adjustment
OPAC (end)

At the MAP terminal

4 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES
and press the Enter key.

5 To post the appropriate alarm, type

>POST alarm_state
and press the Enter key.

where

alarm_state   is RED, AMBER, GREEN, or OFFL

Note: This command posts the PMs in the named alarm state and displays the first PM in the set. Use the NEXT command to scroll through the posted PMs until the MAP terminal displays the appropriate OPAC.

6 To measure the voltage of the load bus, type

>MEASURE LOADB
and press the Enter key.

7 Repeat step 6 two more times. Make sure voltage measurement is consistent.

If voltage	Do
is not –52.0 V dc , ±0.5 V	step 8
is –51.2 V dc, ±0.5 V	step 9

8 To replace the MTU, use the procedure for the NT2X10 or NT2X11 in the *Card Replacement Procedures*.

9 The procedure is complete. Return to the maintenance procedure that directs you to this procedure. Continue as directed.

Site test
OPAC

Application

Use this procedure to perform outside plant access cabinet (OPAC) site tests for battery strings that failed automatic tests.

Interval

Perform this procedure as local policy directs.

Common procedures

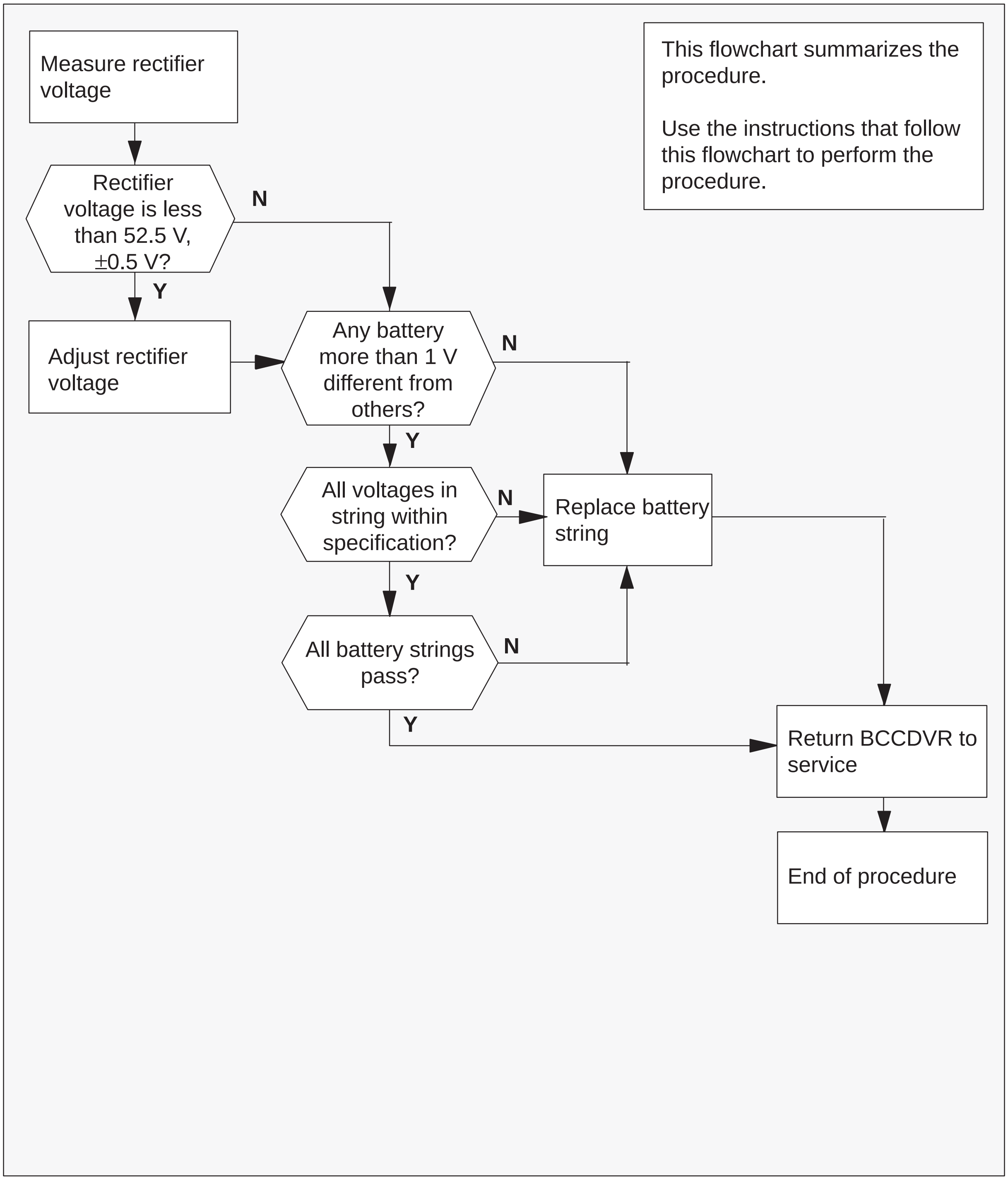
There are no common procedures.

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.

Site test
OPAC (continued)

Summary of site test



Site test
OPAC (continued)

Site test

At your Current Location

1 Only proceed when the maintenance procedure directed you to this procedure. Independent use of this procedure can damage equipment or interrupt service.

At the MAP terminal

2 Make sure that the previous procedure has the correct OPAC posted. Also make sure that the automatic battery is disabled and the correct circuit is open.

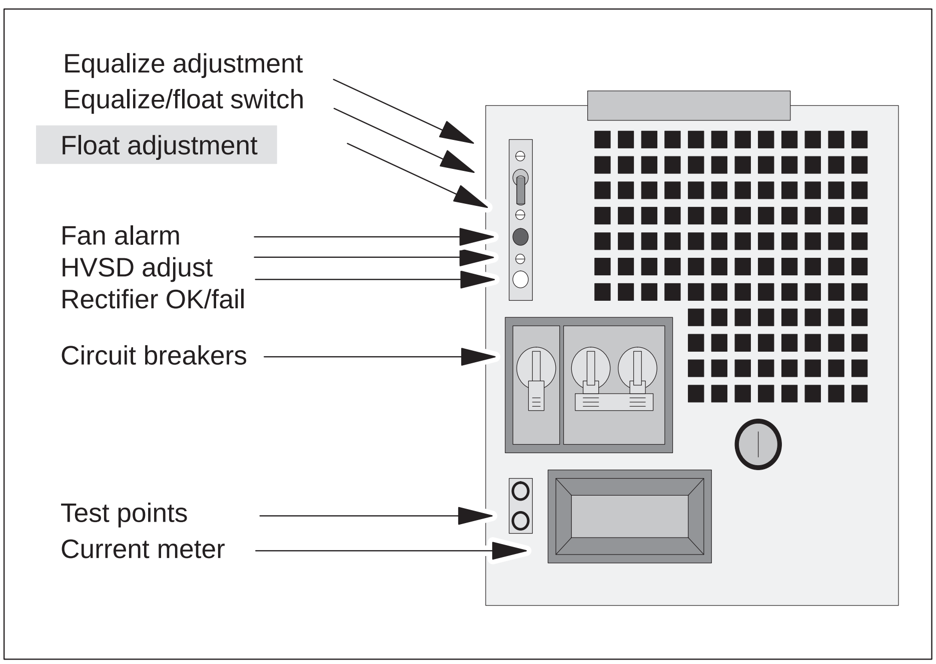
At the OPAC site

3 Measure the voltage of the rectifiers with the test jacks on the face of each rectifier. Use a voltmeter with at least 0.2% accuracy.

The voltage should be –52.5 V dc, ± 0.5 V. Low rectifier voltage can cause a battery string to fail other tests.

If the voltage	Do
is within specification	step 9
is not within specification	step 4

4 Adjust the rectifier float adjustment screw until the voltage is within specification and you balance the current from each rectifier. Refer to the following figure for the location of the float adjustment screw.



Site test
OPAC (continued)

At the MAP terminal

5 Measure the voltage of each battery in the failed battery string. If the voltage of any battery is more than 1 V less than the voltage of the other batteries in the string, replace the complete string.

If voltage for	Do
any battery is greater than 1 V different from any other	step 8
all batteries in string are within 1 V difference	step 6

6 Measure the voltage of the battery string.

If	Do
the battery string voltage is less than OPM_VOLT_TST_OCC (–50.4 Vdc)	step 8
the battery string voltage is less than OPM_VOLT_TST_DIS (–49.5 Vdc)	step 8
all voltages measure OK	step 7

7 Measure the voltage of each battery string.

If	Do
all strings appear OK	step 9
any string continues to fail the audit test, and other strings pass	step 8

At the OPAC site

8 Replace the battery string.

Site test
OPAC (end)

At the MAP terminal

9 To busy and return to service the BCCDVR, type

>BSY BCCDVR
and press the Enter key.

>RTS BCCDVR
and press the Enter key.

10 To enable the automatic battery rotation and testing, type

>AUDIT ENABLE
and press the Enter key.

11 This procedure is complete. Return to the main procedure and continue as directed.

Index

D

DMS-100 Family

Outside Plant Access Cabinet (OPAC)

Maintenance Manual

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