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DMS-100 Family

Remote Switching Center

Remote Switching Center Maintenance Manual

Volume 2 of 2

XPM11 and up   Standard   09.05   November 2000

NORTEL NETWORKS™

DMS-100 Family

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1 Maintenance overview

RCE to RSCE Conversion

The remote controller equipment (RCE) to Remote Switching Center-Equipment (RSCE) conversion allows operating company personnel to convert from remote cluster controller (RCC) to remote cluster controller 2 (RCC2) functionality. Operating company personnel use an RCE frame with the RSCE frame to apply the conversion. Operating company personnel remove the RCCs in the RCE frame from service. Cabling routes the remote maintenance modules (RMM) to a common peripheral module (CPM) controller shelf in the RSCE. An RMM reuse method supports RSC sites that have RCEs. The RCEs are equipped with one or two RMM shelves. When the RCE converts, the frame offers all of the functions of a remote switching center SONET (RSC-S). Additional sites that do not have space for two RMM shelves must use RSC-S products that are in cabinets.

Restrictions

Restrictions limit, the conversion of an RCC to an RCC2 platform.

- The conversion applies only to current RCE cabinets. The conversion does not provide equipment to use as a new installed RSC-S.
- The only applications supported for conversion are DS-1.
- Current line concentrating module (LCM) bays do not support integrated services digital network (ISDN).

RCC and RCC2 differences

The RSC-S is an enhanced RSC. The RSC-S is based on the RCC2. The RCC2 has more peripheral side (P-side) ports than the RCC. The RSC-S has all the same functionality as the RSC and the following additional features:

- increased capacity
- extended distance capability
- The RCC is based on the expanded peripheral module (XMS). The RCC2 is based on a CPM.
- The RCC2 replaces the RCC module.

- The host for the RCC handles channel supervision messaging. The NTMX76 message and channel supervision message card allows the RCC2 to handle CSM functions.
- In the RSC-S, the time switch card is enhanced and is referred to as a matrix pack.
- The RSC-S allows P-side to P-side connections to DCH cards.
- There is no restriction on the number of intra-switched calls with the introduction of the matrix card to the RCC2. The system can use more central-side (C-side) links in different ways.
- The RCC2 includes pulse code modulation (PCM) signaling in one pack with the introduction of the new signaling processor (SP).
- Handling of PCM signaling is altered in the RSC-S.
- The RCC formatter pack is no longer available. The new matrix and SP cards handle the functions of the RCC formatter pack.
- The RSC-S is provisioned in cabinets, not in frames.

When an RSC converts to an RSC-S, the RSC uses the same methods as the RSC-S to handle problems. The RSC offers the same automatic maintenance capabilities as the RSC-S. The RSC requires manual maintenance for the same conditions as the RSC-S.

The functional description describes the components of the RSCE configuration. The description highlights the voice and message flows. The description shows how software processes affect the components.

Problems can occur in the following areas:

- components, like a card or power supply
- the links that connect the components
- the software that controls the voice and message flow.

The RSC-S, the RSC, the Digital Multiplex System (DMS), and the Data Packet Network (DPN) have the same problem solving design. When problems occur, system actions like audits try to locate the problem. The system actions can correct the problem so that the system does not require manual interruption. If the system requires manual interruption, the system describes the correct problem indicators.

With the RSC-S, automatic maintenance includes the output problem indicators. The Automatic Maintenance section of this document includes output problem indicator information.

Functional description

The RSC-S uses common peripheral module (CPM) architecture instead of XMS-based peripheral module (XPM) architecture. When the RSC-S uses the CPM instead of an XPM, the system implements the following:

- change in channel supervision message (CSM) connections in the CPM
- direct channel connection to the D-channel handler (DCH) NTBX02, DS30A interface (I/F) NTMX74, and dual DS-1 I/F NTMX81 cards
- enhancement of the matrix
- creation of the PCM card to concentrate all signaling functions into one card
- slight modification of handling of digital signal 1 (DS-1) signaling bits A, B, C, D
- addition of downloadable firmware to the unified processor (UP) NTMX77 and PCM signaling processor NTMX73 cards. The NTMX77 is equipped with two FLASH EEPROMS. The FLASH EEPROMS or banks, are two 256 kbyte chips that you can program. The chips load the firmware separately of the RAM load on a manually busy (ManB) RCC2 or RCC2 unit. The chips load the firmware when the user enters the following commands:

  >LOADPM PM CC FIRMWARE

  >LOADPM UNIT unit_no CC FIRMWARE

In this architecture, primary components are the RCC2 or dual RCC2 (DRCC2). The user can install the RCC2 with or without the services of the ISDN or emergency stand-alone (ESA). The following sections describe the RCC2 and DRCC2 according to operating areas. In each operating area, the section highlights the functions of cards and presents the other RSC-S components.

Remote cluster controller 2

The RCC2 is the primary operations device for the RSC-S. Functional areas of the RCC2 include the following:

- cards
- speech and message paths in the RCC2
- routine exercise (REx) test
- Switch of Activity (SWACT)

- updating static data (SD), non-ESA
- returning the RCC2 to service.

> ***Note:*** Figure Functional block diagram of RCC2 relates to the functional description of the RCC2 that follows.

Cards

The RCC2 uses the following cards:

- host communication
- processor
- speech bus
- peripheral communication.

Host communication cards

These cards translate between the 16 host DS-1 ports and the parallel speech bus. The RCC2 host communication cards include the Quad Frame Carrier NTMX87 and the Enhanced Matrix NTMX75.

The Quad Frame Carrier NTMX87 provides an I/F between RSC-S peripherals. The RSC-S peripherals include remote line concentrating modules (RLCM), outside plant modules (OPM) and collocated transmission equipment like channel banks. The user can equip a Quad Frame Carrier with up to four packlets. The packlets can be a dual DS-1 NTMX81AA or a filler plate NTMX83AA. Dual DS-1 packlets support all the features, performance counters, and maintenance functions that a NT6X50AB provides.

The enhanced matrix NTMX75 card combines the functions of the formatter card NT6X41/NT6X72 and the time switch NT6X44. The NT6X41/NT6X72 and the NT6X44 are used on the RCC2 for RSC applications. The NTMX75 card does not block. The NTMX75 card performs the switching functions required by the RCC2 shelf and the extension shelf. The NTMX75 is a single-stage time switch with 2528 input and output channels. The NTMX75 can switch a channel to a free channel. Input and output channels are divided into two groups, C-side and P-side. The C-side group has 640 channels with 128 channels for service cards. The P-side has 1888 channels.

Processor cards

The NTMX77 and the 68020 central processing unit (CPU) control RCC2 activities. The memory cards associated with these processor cards, are consolidated in the UP card. Memory is on a single processor card, not on separate memory cards.

Speech bus cards

The speech bus contains two speech busses. The two speech busses are send and receive. The speech bus cards include the following:

NTMX76 or NT6X69 The new NTMX76 circuit card provides an I/F and processes signaling and control messages between the RCC2 and the central control (CC). The NTMX76 uses International Telegraph and Telephone Consultative Committee (CCITT) level 2 Signaling System No 7 Q.703 over its data channels.

The Q.703 protocol allows for enhanced distance capacity (EDC), up to 804.5 km (500 mi), between the RSC-S and the host. The Custom Local Area Signaling Service (CLASS) feature Deluxe Call Waiting with Disposition and EDC are fully compatible and supported. The Q.703 protocol provides for:

- complete duplexing
- windowing
- equal treatment and performance in both messaging directions.

The NTMX76 messaging is optional. If you use the NTMX76, the NTMX76 circuit card replaces the NT6X69 messaging card. The NTMX76 card is the I/F between the UP and up to 32 data links.

The message and CSM card processes signaling and controls messages between the RCC2 and the computing module (CM). The NTMX76AB card performs the following actions.

- Channel supervision messaging (CSM) for call processing and diagnostics. The system passes CSM messages between two peripherals at the same time with the PCM. Use the messages to setup, maintain, and terminate calls and to check the accuracy of the parity and PCM path.
- The read-only memory (ROM) and random access memory (RAM) tones generation
- Receives and sends DS30 control messages to the CM.

The NTMX76AB version of the message and CSM card contains upgraded firmware. The firmware supports the Analog Display Services I/F (ADSI).

The NTMX76AB contains deluxe spontaneous call waiting identification (DSCWID).

> **ATTENTION**
> Make sure you do not install the universal tone receiver (UTR) and the global tone receiver (GTR) on the same RCC/RCC2. There is no way of knowing which receiver interprets tone samples. Some call processing tones can degrade if designed for use with a GTR.

NT6X92

Universal tone receiver (UTR) The UTR NT6X92BB, BC identifies and processes dual tone multifrequency (DTMF), MF, MF-socotel, CMF-forward and backward tones. The UTR identifies and processes in 32 channels on the parallel speech bus.

Global tone receiver (GTR) The GTR, NT6X92EA identifies and processes DTMF, MF, MF-socotel, CMF-forward and backward tones. The GTR identifies and processes in 64 channels on the parallel speech bus.

NTMX75 The formatter NT6X41/NT6X72 and time switch NT6X44 functions are combined in one card, the enhanced matrix NTMX75.

NTMX73 NTMX73 supports all low-level signaling tasks and provides the system clock. This card replaces XPM circuit cards NT6X86, NT6X80, and NT6X28. Software that maintains synchronization with the network resides on this card.

NT6X78 The NT6X78 CLASS modem resource (CMR) card supports Calling Number Delivery (CND) and other CLASS services. The CMR card provides the ADSI protocol to transmit CLASS data between the CC and ADSI-compliant customer premises equipment (CPE).

The NT6X78AB, NT6X69AD, and NT6X92BB cards, are required for compliance with ADSI protocol. The ADSI protocol supports CLASS features that provide display-based information, like DSCWID, to subscribers with ADSI-compatible CPE.

DSCWID The proprietary DSCWID feature is revised to comply with Bellcore TR-416. Bellcore TR416 describes the requirements for DSCWID and specifies how this feature I/Fs with an:

- ADSI set

  A screen-based ADSI CPE that can illustrate options.
- SCWID set

A non-ADSI CPE that can deliver caller identification (CID) data.

- 2500 set

  A non-ADSI CPE that can signal DTMF but cannot deliver off-hook CID data.

The CC sends tones that alert the DSCWID subscriber of a pending call and the CPE of pending caller data. The CC provides alerting signals that when a DSCWID line has a call and a second call attempts to terminate to that line. There are two types of alerting signals, subscriber alerting signal (SAS) and SAS followed by a CPE alerting signal (CAS). The subscriber recognizes the SAS as the call waiting tone (CWT). The CAS alerts the CPE of data if the subscriber line has the Caller Identification (CID) feature.

In response to alerting tones the DSCWID CPE generates an acknowledgement (ACK) tone. The ACK indicates that the DSCWID CPE is ready to receive DSCWID data. The GTR/UTR card in the RCC2 collects the ACK tone. If the CPE is ADSI compatible, the system sends a DTMF A ACK signal in response to the CAS. If the CPE is a SCWID CPE, the CPE sends a DTMF D ACK signal in response to the CAS. When the system sends alerting tones, the subscriber can control the transfer of the incoming call. The subscriber can respond with the CPE softkeys or the hard-coded keys. The subscriber responds with the CPE softkeys if the CPE is ADSI. The subscriber responds with the hard-coded keys if the CPE is a SCWID or a 2500 set. If the CPE does not respond with an acknowledgment tone, the CPE is treated as a 2500 set. The following three figures show examples of responses from the three set types.

Figure 1-1 Example of a DSCWID call on an ADSI set

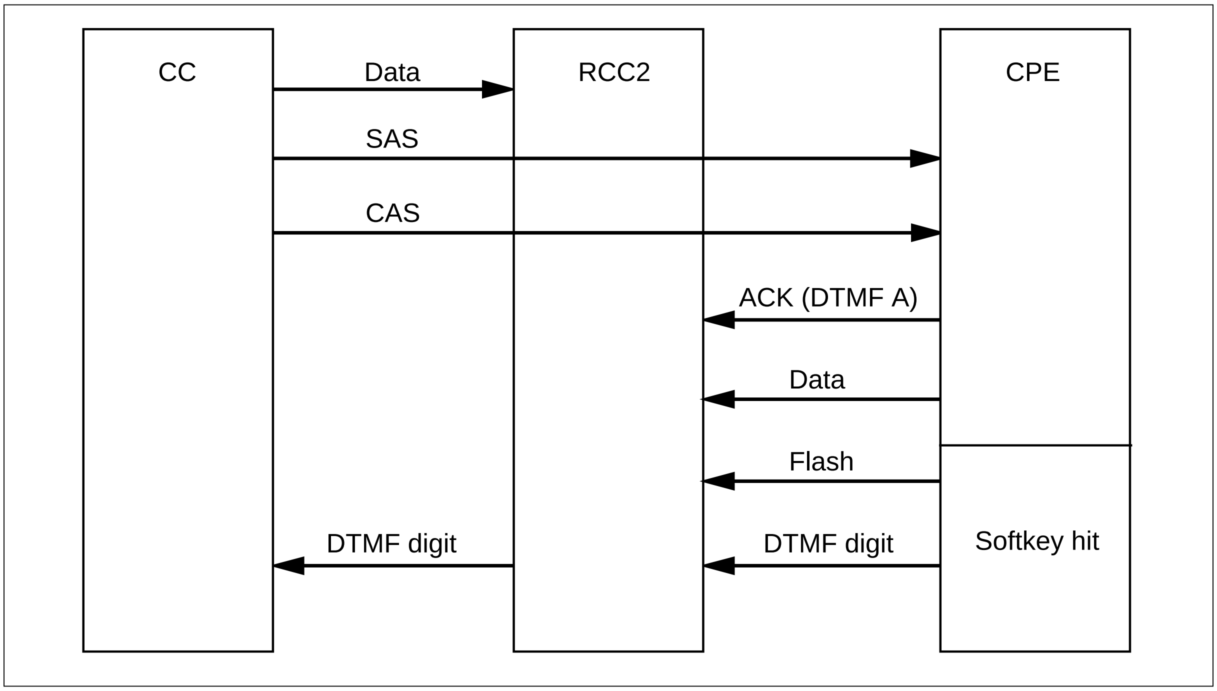


Figure 1-2 Example of a DSCWID call on a SCWID set

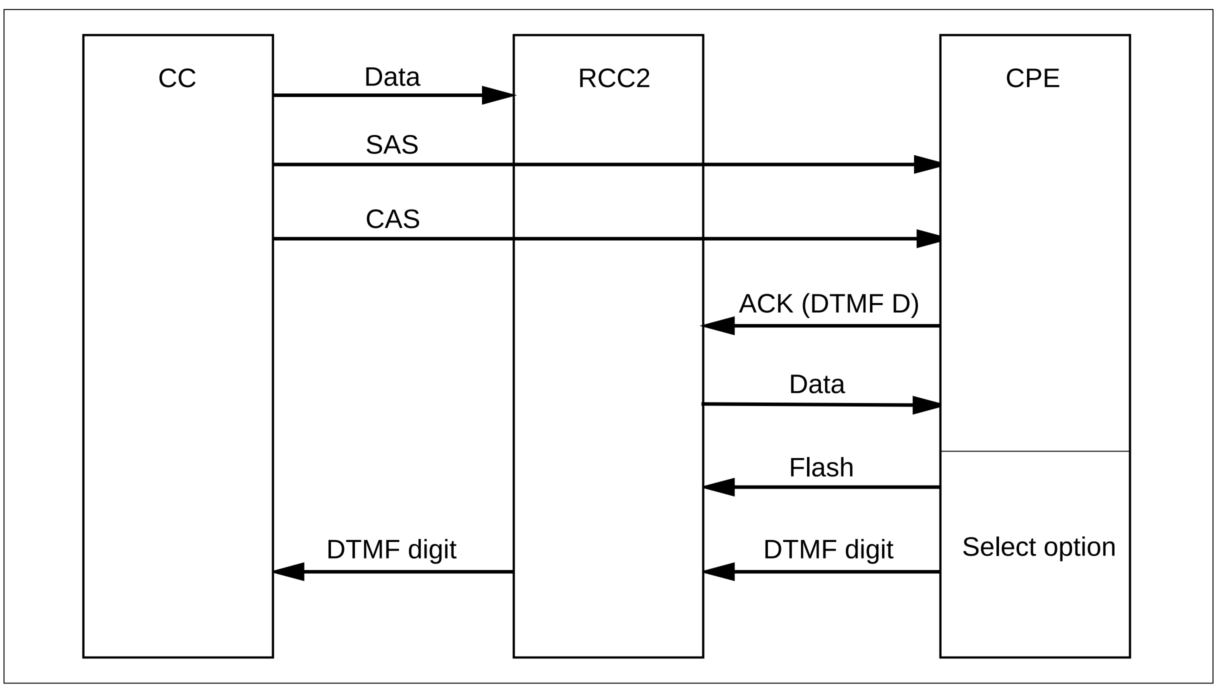
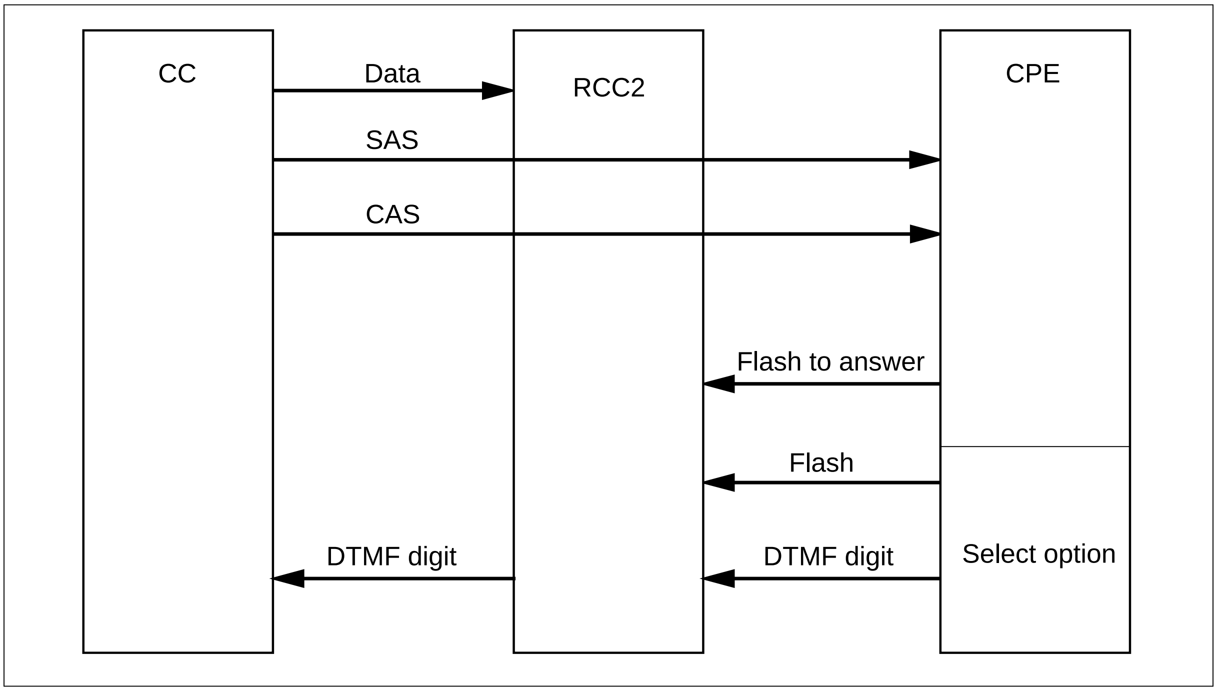


Figure 1-3 Example of a DSCWID call on a 2500 set



The CC sends alerting signals to the CPE, even when a GTR/UTR channel is not available. If no GTR/UTR channels are available, the CC does not send any data to the CPE. In the proprietary DSCWID, when RCC2 did not attach a GTR/UTR, the flash was ignored. For Bellcore compliance, the switch must provide options if a flash is detected and if the flash cannot attach a GTR/UTR. The RCC2 sends a flash to the CC if the RCC2 cannot attach a GTR/UTR in 400 ms, to comply with the requirement. If the first notification of a pending call is not acknowledged in 10 s, the CC sends a second alerting signal. If the CC does not send display data to the CPE because of GTR/UTR channels that are not available, the CC holds the data. The CC sends the data again, if re-alerting occurs.

When the RCC2 receives a flash signal from the analog display services interface (ADSI) compatible CPE of the customer, the RCC2 starts a T-tone timer. The T-tone times the maximum time allowed between sending a flash and the DTMF digit on an ADSI set. The speech path is muted during the 600 ms timeout. The T-tone timer starts for the first option selection during a DSCWID call. ADSI DSCWID option selections that follow the previous selections, start the T-tone timer.

DSCWID option selections on a SCWID or 2500 set use a new timer (T-flash). The subscriber uses the T-flash timer after a call is answered with SCWID and 2500 sets. This provides the customer with time to select an option after a flash. This new timer allows a subscriber time to flash and dial a DTMF digit in 600 ms.

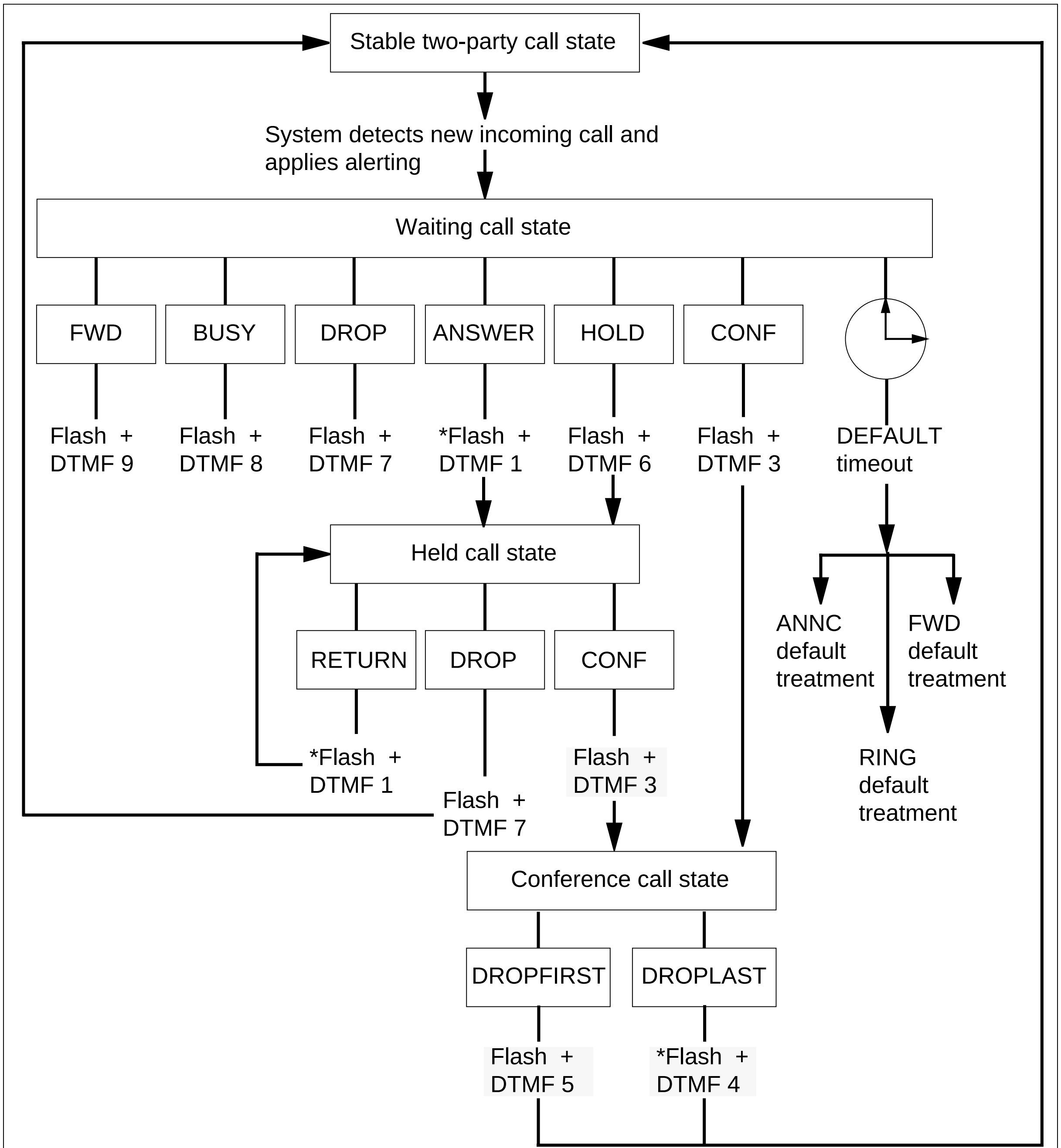
The operating company can set the T-flash timer from 1 to 8 s, default = seconds. The RCC2 starts the T-flash timer if the operating company sets the NONADSI field in table DSCWDTYP to Y (yes) and the RCC2 receives a flash signal from the SCWID or 2500 set of a customer during the held or conference call state. The RCC2 monitors the DSCWID call state and the type of CPE because the timer depends on this information. If the RCC2 cannot attach a GTR/UTR before 400 ms, the system applies the RETURN option.

The CC attempts to stay synchronized with the CPE at all times. The supervision prevents problems. For example, when the CPE appears to have performed a function, but the switch does not process the option based on the call state. DSCWID call waiting transfer options are:

- answer the new call and put the current call on hold
- disconnect the current call and answer the new call
- forward the new call
- connect the new call to a busy (BSY) announcement
- put the new call on hold after you connect to a hold announcement
- conference the new call with the current call.

The following figure shows DSCWID with ADSI set transfers:

Figure 1-4 DSCWID with ADSI set dispostions



Note 1: An asterisk (*) indicates that a flash can be performed to accomplish the same function as sending the DTMF code for that digit.

Note 2: Positions can be available if: a non-ADSI set is configured for hard-coded keys to perform DSCWID positions or the subscriber is able to provide a DTMF-digit within 600 ms. NONADSI must = Y in table DSCWDTYP for the exact DSCWID type.

NT7X05 The NT7X05 card provides local storage of XPM loads and images in a memory card that is not volatile or mechanical.

Peripheral/Remote Loader-16 (PRL) reduces XPM simplex time. The PRL allows XPM software loads to transfer to the XPM and store in a local in-service (INSV) XPM unit. The PRL allows the system to replace a current load file with a new load file. During load file replacement, the last image is available for recovery actions. The local storage mechanism is the NT7X05 circuit card. The software transfer occurs when the user instructs a ManB XPM unit to load from the NT7X05 card. The operating company personnel instructs the ManB XPM unit to load from the NT7X05 card. Use the LOADPM command with the following parameters:

> **DANGER**
> **Possible service interruption**
> The LOCAL LOADFILE option of the LOADPM command has a parameter of [<file> string}]. If you use this file_name parameter, the system will use the loadfile named in the parameter. The loadfile named in the the parameter is not patched. Do not use this parameter unless the NOPATCH option of the loadfile is requested.

```
>LOADPM [PM]

                    [ACTIVE]

                    [INACTIVE]

                    [UNIT] LOCAL LOADFILE
```

The PRL uses imaging technology to accomplish peripheral loading improvements. A high level in the CM provides imaging control. The CM provides imaging control by monitoring changes to restart survivable objects in the XPM. Restart survivable objects are SD and code, in the form of patches. The PRL dumps an image, makes a copy, of the RAM of the MX77. The MX77 is in an INSV active or inactive, XPM unit. The PRL copies the image to the NT7X05. If the XPM must be reloaded, the system restores the image from the NT7X05 to the UP RAM.

> ***Note:*** The PRL cannot dump an image of an embedded processor. The user must load the CMR processor from the CM. To load the CMR processor

from the CM: use the LOADPM command with a source of CC and a parameter of CMR .

You can dump an image of the Unified Processor RAM to the NT7X05 card when the XPM is InSV. Use the IMAGE command with the following parameters:

```
IMAGE

    [<DEVICE {PM,

                        ACTIVE,

                        INACTIVE}]

    [<ALL>{ALL}]
```

When the operating company installs the NT7X05 card, the load file is not correct and must be loaded with parameter XPMSTOR. To view the status of NT7X05 files, enter the following command:

>QUERYPM FILES
Example of a MAP response:

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

Note: The example MAP response reflects RSC-S with ISDN. The NT7X05 image file name appears for non-ISDN configurations only.

When loading is required, the CM verifies the NT7X05. If NT7X05 is present, the CM transfers the following information to the UP:

- a software load referred to as the recovery software loader (RSL)
- the name of the requested load file
- indicates if the image or load file must be loaded.

The RSL checks the NT7X05 load file name. If the load name test passes, the RSL restores the image or load to the UP. When the RSL stores a good file, the RSL verifies the image/load file integrity. The RSL verifies the image/load file integrity as part of the restore/loading process to avoid loading delays. To view the status of the NT7X05 files, enter the following command again.

>QUERYPM FILES
Example of a MAP response:

```
Unit 0:
   NT7X05 load File: CRI05AW
   NT7X05 Image File:CRI05AW
   CMR Load:  CMR03A
Unit 1:
   NT7X05 load File: CRI05AW
   NT7X05 Image File:CRI05AW
   CMR Load:  CMR03A
```

Peripheral communication cards

The following cards translate between the 54 P-side ports and the parallel speech bus:

NTMX75 The NTMX75 card, described earlier in the host communication section, applies here.

NTMX87 The Quad Frame Carrier NTMX87 card provides an I/F between RSC-S peripherals and collocated transmission equipment like channel banks. The octal DS-1 circuit card contains four dual DS-1 packlets NTMX81 or fillers NTMX83. The dual DS-1 packlets provide and support all features, maintenance functions and performance counters provided by NT6X50AB.

NTMX74 The DS30A NTMX74 card provides 32-DS30A links for the following:

- terminating LCMs
- RMM
- Subscriber Carrier Module-100S Remotes (SMS-R) located at the RSC-S.

Each I/F chip on the NTMX74 serves four DS30A links. Separate the message (MS) links by a minimum of four when you enter table LCMIN to prevent a single chip failure. A single chip failure causes a T1 outage. The following table shows link-to-chip relationships.

Table 1-1 DS30A link relationship

Chip number	DS30A link numbers
1	22, 23, 24, 25
2	26, 27, 28, 29
3	30, 31, 32, 33
4	34, 35, 36, 37
5	38, 39, 40, 41
6	42, 43, 44, 45
7	46, 47, 48, 49
8	50, 51, 52, 53

NTMX72AB (power converter)

The NTMX72AB power converters, are located in slots 1 and 2 (unit 0) and 26 and 27 (unit 1) of the RCC2 shelf. The power converters receive -48 V from office battery and have output voltages of +5 V, +12 V and -12 V.

The NTMX72AB provides

- active and fail indicators
- automatic recovery from low battery (ARLB) circuit. The ARLB monitors the input voltage. When the voltage falls below the minimum specified operating level, the ARLB signals the auxiliary power supply to shut down the converter. When the input voltage rises above the minimum startup level, the ARLB circuit enables the auxiliary supply
- protection against overvoltage, undervoltage, and overcurrent
- detection of the condition of the DCH power fuse
- a +5 V monitoring circuit to check that the mate converter is in operation
- support for -48 V and -60 V input voltages

Speech and message paths in the remote cluster controller 2

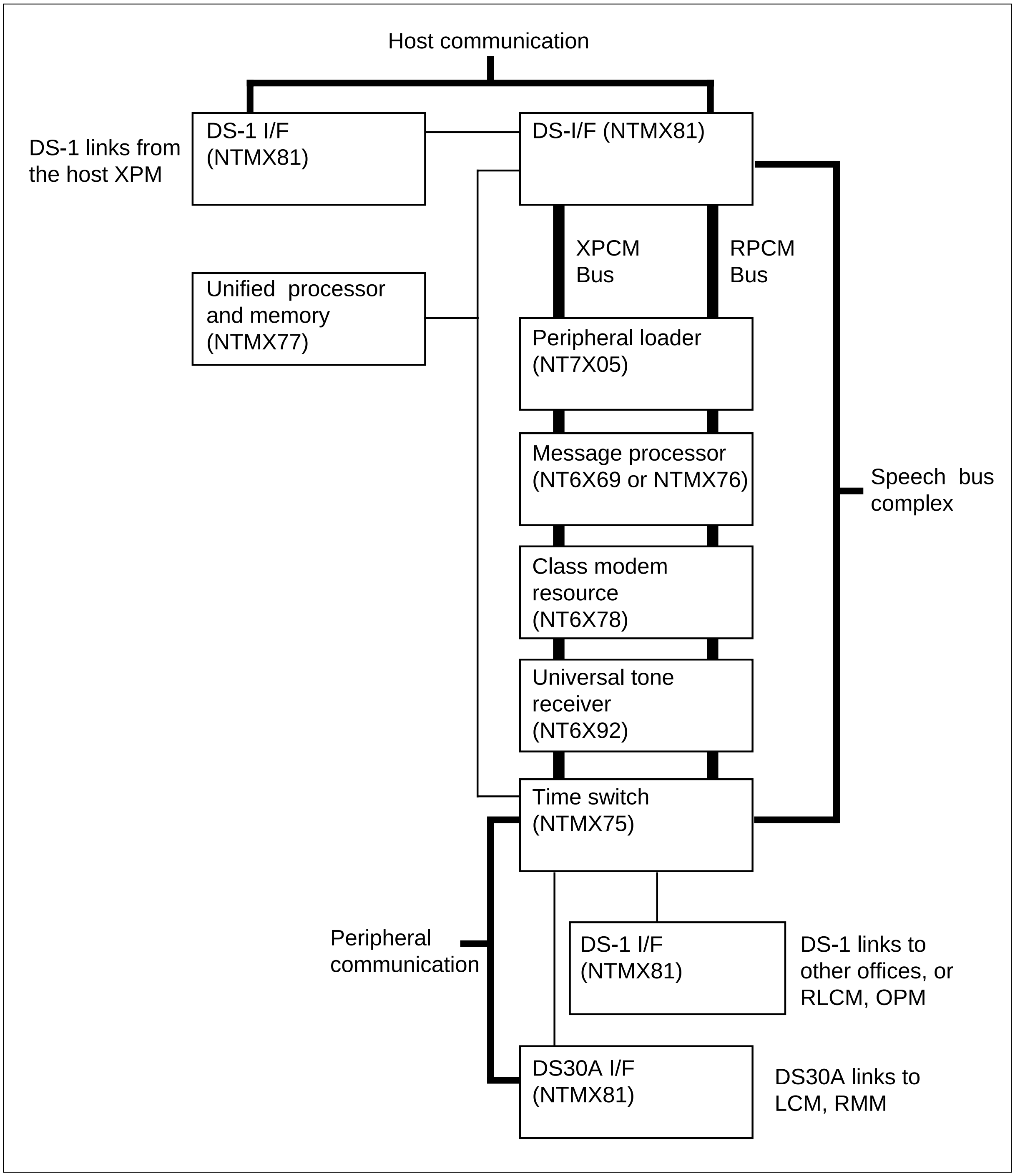
The parallel speech bus includes a transmit bus and a receive bus. Voice and message paths go between the two RCC2 units. The paths go in a DRCC2 from the RCC2 to the host.

For an RCC2 to work, communication between the RCC2 units must be present. For example, the inactive unit can take over call processing. The RCC2 units communicate over the intermodule communication (IMC) links.

An RCC2 communicates with the host over message links 0 and 2. If both message links fail, the RCC2 cannot communicate with the host, and ESA is enabled.

The following figure shows a working block diagram of the RCC2.

Figure 1-5 Functional block diagram of the RCC2



Routine exercise (REx) test

The REx test, tests the RCC2 to make sure that either unit can take over call processing if the other unit fails. The REx test schedules are controlled through table OFCVAR, parameter NODERExCONTROL. When the user enters the table, the user can control REx test scheduling for a peripheral module (PM). This action occurs when the user posts the PM from the PM level of the MAP display. Following are examples:

>TST REx ON
```
XPM n is included in the REx test
schedule
```
>TST REx OFF
```
XPM n is removed from the REx test
schedule
```
>TST REx NOW
```
REx test in progress
(REx test messages)
```

The REx test combines many of the diagnostic and operating routines of the RCC to improve fault coverage and reliability. The system generates logs during the test. The system generates operational measurements (OM) pegs and alarms. The system suppresses the OM if the OM is intentionally activated because of the REx test.

Switch of activity

A Switch of Activity (SWACT) occurs when the two units of an RCC2 switch activity. The active unit becomes the inactive unit. The inactive unit takes over call processing and becomes the active unit.

A peripheral that supports a subscriber line with an active DSCWID session undergoes a SWACT. The peripheral undergoes the SWACT between the alert tones. The timer default seconds after re-alert and before the incoming call is acknowledged. All parties to the call are dropped.

An RCC2 with DS-1 links that operates in high-level data link control (HDLC) mode. If all HDLC links lose synchronization to the active unit, the unit attempts a SWACT. If the SWACT fails, the RCC2 enters ESA. If synchronization fails in the inactive unit, the unit works in the DMS-X mode.

The system handles errors on the RCC2 that undergoes the SWACT in a different way. The system handles errors based on when the error occurs during the SWACT. When the error occurs:

- before the activity switch. The SWACT cancels and the node is in the ISTb state. The system makes the inactive unit SysB, and maintenance personnel can recover the unit. If maintenance personnel do not recover the unit, the system recovers the SysB unit.
- after the activity switch, but before the full post-SWACT cleaning is complete. The system makes the complete node SysB. Maintenance personnel must determine the cause of the failure and bring the node back

in service. If maintenance personnel does not bring the node back in service, the system recovers the SysB unit.

- after the current activity switch and, after the full post-SWACT cleaning. The new inactive unit remains out-of-service (OOS). Maintenance personnel must bring the inactive unit back in service. If maintenance personnel does not bring the unit back in service, the system recovers the SysB unit.

When a data synchronization failure occurs for any of the P-side nodes the system makes that P-side node BSY and returns the P-side node to service. A P-side node data synchronization failure of a single P-side node does not impact the node that is undergoing the SWACT. The data synchronization failure also does not impact any other P-side nodes.

Controlled and uncontrolled switch of activity (SWACT)

There are two types of SWACT, controlled and uncontrolled. The user implements controlled SWACTs by

- enter the SWACT command
- planned system requests, like the REx test schedule
- busy (BSY) the active unit while the inactive unit is INSV.

Controlled SWACTs occur when both units, are INSV or, if the RCC2 is in the in-service trouble (ISTb) state. The RCC2 is in the ISTb state because of a previous REx test failure.

> ***Note:*** Feature AF2987 makes sure that the unit does not return-to-service (RTS) by a system audit.

The system implements uncontrolled SWACTs when either a hardware fault or a trap is present in the active unit. Examples of failures that initiate uncontrolled SWACTs are:

- power
- clock
- extension shelf
- power converter.

Updating SD non-ESA

To execute call processing and maintenance on the RCC2 and the subtending nodes of the RCC2, the RCC2 must know which of the following are present:

- cards
- ports

- execs
- terminals.

This information, called SD, is in tables. You refer to this information as SD, because the RCC2 does not change the data separately. The RCC2 changes data separately for dynamic data, like call-processing connections. Call-processing connections are established when a call is set up.

Data entered through the different inventory tables in the CM determines the node data in the RCC2 and subtending XPMs. Examples of inventory tables in the CM are LTCINV, LCMINV and IPMLINV. These tables identify the nodes that must communicate with each other. You can enter a node, like an LCM on an RCC2. When you enter the node, you must place an entry for the LCM in the RCC2 Node table. The entry allows the RCC2 to route messages to and from the LCM.

The CM can check that the head or messaging XPM has the resources available for the new node. The CM checks the resources as you enter the data through the inventory tables. If the CM determines that the XPM does not have the resource required, the CM rejects the Data Modification Order (DMO). If the CM accepts the DMO, the CM writes the data into a copy of the XPM node table. The CM determines the internal index for the new node.

The system transfers the data to the XPM. The CM reads the data from the CM version of the Node table of the XPM. The transferred data includes the internal index for each tuple. You write the internal index in the Node table of the XPM. The CM sends the index to the XPM. The XPM uses the index to determine the location of the tuples in the Node table of the XPM.

The transfer of the index to both units from the CM assures that the XPM receives the same tuple indexes for both units. The transfer maintains the synchronization in the Node table required for the XPM to support warm SWACTs and inter-unit messaging.

Before, the CM transferred the Port table information for a node in the same message as the node data. The Node and Port tables are separate tables in the XPM. The CM now transfers the node and port data in separate messages. The CM uses separate configuration table identifiers for each table.

CM data sync

The XPMs must follow requirements to maintain system sanity. As a requirement, the XPM must make sure that node and port tables in both units remain synchronized. You must reference common tuples to both units, by the same internal indexes and contain the same data. Maintaining identical indexes in both units allows processes to communicate between units. Active processes continue functioning after a warm SWACT. This synchronization was not difficult to maintain in the original design of the XPMs. The synchronization of the mate unit node and port tables is more difficult to maintain ,with the introduction of new functionalities.

Node table sync improvements

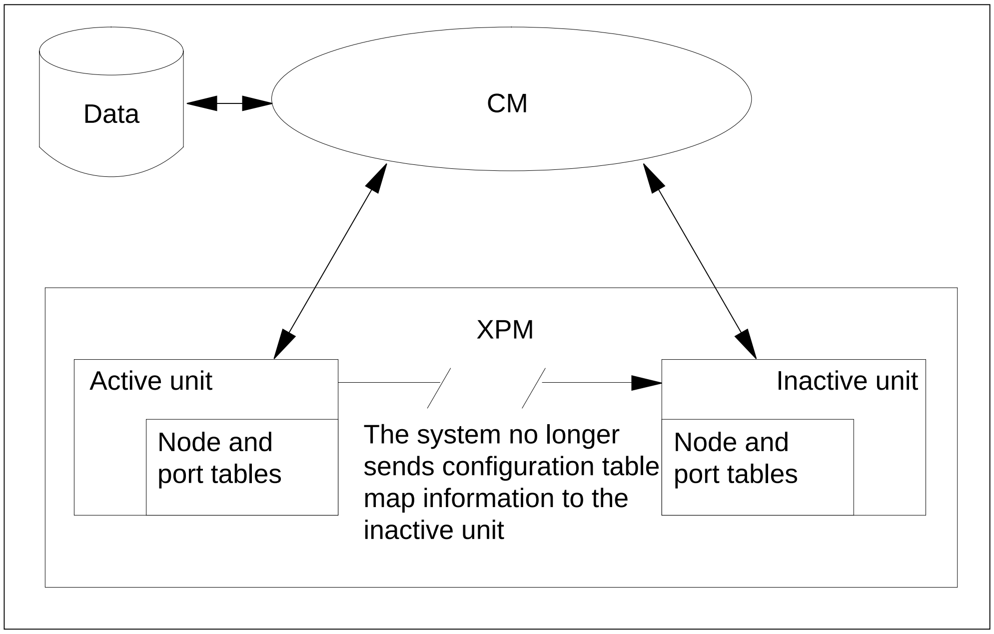
Feature AF5678, XPM Node Table Synchronization Design created table PMNODES. Table PMNODES contains a list of all nodes in each XPM. This table transfers XPM node information to the new CM load during a software upgrade. This transfer ensures the new CM software contains the correct node order for each active XPM. The CM controls the sequence and entry of node and port tables in both XPM units. Synchronization is maintained between the CM and the tables in both active and inactive XPM units. The XPMs no longer synchronize using mapping information sent from the active unit to the inactive unit.

Table PMNODES is a read-only table. The system adds and deletes tuples as the user enters related inventory tables, like RCCINV and LCMINV. The system rejects attempts by a user to update this table directly. The system checks XPM resources when the user adds or changes a tuple for a subtending node in an inventory table. The system displays warnings when an XPM does not have the:

- table space
- port
- terminal resources

to support the new requirements. For a complete description of the entries for table PMNODES, refer to the *XPM Translations Reference Manual*.

Figure 1-6 Improved XPM node table synchronization



Configuration data table (CDT) management is a new software component added by feature AF5678. The CDT bind I/F allows XPM applications to bind an aspect to a CDT during initial program load (IPL). An XPM with a software load that is bound with the new CDT management system notifies the CM during an XPM node data audit. The CM starts a CDT audit at each 5 min interval. The CDT audit initiates the XPM node data audit in the XPMs.

The CDT / XPM node does the following:

- audits
- converts XPMs that have compatible software loads into the new node table management control
- verifies the sanity of XPMs that the CDT/XPM converted.

To maintain backward compatibility of XPMs with software loads, without CDT management capability, continue to maintain mate unit synchronization as described earlier.

The CM has control of both units of an XPM node under the following conditions:

- The CDT / XPM node data audits updated the tuple(s) of that node in table PMNODES. The tuples match the data and indices sequence of the tuples in the XPM node and port tables.
- The CM had control in a previous software load.
- A new XPM is added other than during a one night process (ONP) conversion. Nodes added during ONP are not new. The nodes are now INSV.

Note: The CM can gain control of compatible XPM node and terminal tables. The CM gains control when an office receives a software load with the new node table management system. The CM gains control during the next scheduled CDT/XPM node data audits. When an XPM is OOS, the CM assumes control when CDT/XPM audits convert an XPM and align the CM tables. The CDT/XPM audits convert an XPM to the CDT management system and align the CM tables with the node tables.

The CM initiates the audit request to an XPM with a VERTUPLE message. The VERTUPLE has a parameter that initiates the XPM to respond. The XPM can respond with a message with current tuples of data or with a checksum of the table. The data of the tuples, supplies the CM with information to convert an XPM to CDT management control. The CM aligns to the table of the active unit when there are differences between the active and inactive unit tables. The CM sets the XPM in-service trouble (ISTb). After an XPM converts to CDT, a request for a checksum of the table occurs when the CDT audit runs.

Checksums of the node and port table data, check synchronization of XPM nodes under the CDT management system. To calculate checksums, the system regenerates each tuple in the XPM table. After a tuple is formatted, the system calculates the checksum for that tuple. The system adds the tuple to the table checksum for that XPM. The system verifies the XPM checksums against corresponding checksums in the CM. A wrong checksum indicates an out-of-synchronization condition. A wrong checksum causes the system to set that unit to ISTb. During the next audit cycle, if the unit checksum matches the CM checksum, the system clears the ISTb condition.

When the CM takes a more action in maintaining the accuracy of the node tables in XPMs, the XPMs become less active. The XPM must accept the CM data as the CM sends the data. The XPM cannot make corrections or adjustments to the data.

- The XPM no longer derives node table data from a part of data sent from the CM. The CM specifies all the data contained in the node and port tables. The XPM stores the data as it is received.
- The CM notifies operating company personnel if resources are not available on an XPM when inventory tables are changed. This includes if the XPM is ManB or OOS at the time the inventory tables are changed.
- The XPM no longer compares node tables between units. The CM makes sure that the node tables in each unit agree because the CM controls the content of each table. Configuration download occurs when both units, are taken OOS and returned to service at the same time.
- Node and port table aspect and access routines allow applications to access the data. Read-only access is provided to applications. Tuples in XPM tables are continuously updated from the CM while the XPM is INSV.
- A new external node number to internal node number look-up table in the XPM provides fast conversion from external to internal node numbers. The new look-up table also eliminates collisions.
- An enhanced messaging I/F includes status information between the CM and XPM. The new I/F contains:
  - the ability to detect lost messages with the addition of a sequence number from 1 to 255 in the header.
  - a byte of data transfer status information that informs the XPM if more messages follow.
  - a count of tuples affected by the message.
  - table design identification to identify the version of XPM table software. To maintain backward compatibility, leave the current node table management software in the XPM until XPM06.

Enhanced Dynamic Data Sync (EDDS)

Dynamic data describes the link and node states that support call processing in the XPM. These states are normally set in the active unit of an XPM. The states are set through the node and link RTS, or state changes triggered by external factors. These states propagate to the inactive XPM unit through the main part and separate messages of the XPM data sync mechanism.

The EDDS is a necessary component of warm SWACT. A warm SWACT preserves processing of ISDN and plain old telephone service (POTS) calls. Warm SWACTs occur when the active unit of an XPM drops activity. An XPM drops activity because of an XPM trap, REx test or other causes . The warm SWACT preserves call and unit states so that calls continue without interruption. For a warm SWACT to succeed the inactive unit must be INSV.

If the inactive unit was OOS, ManB, SysB or central-side busy (CBsy) before, the following events occur during a RTS:

- The inactive unit initializes.
- The OOS tests run on the inactive unit.
- If the inactive unit SD checksum is wrong, the CM sends new SD and marks the inactive unit ISTb.
- The active unit sends dynamic data to the inactive unit (bulk sync).
- The CM marks the inactive unit INSV.

Feature AF6436 provides EDDS and warm SWACT capabilities for ISDN basic rate interface (BRI) calls on the RCC2.

Reset non-remote carriers and trunk call cleanup

In addition to the CM dynamic data, all carriers that are not remote are cycled if present. Cycling is the activity of performing a BSY and RTS sequence on a terminal. This activity makes sure all trunk data are initialized in the RCC2. This activity releases all trunk calls and attempts to RTS any system busy trunk carriers.

Line call cleanup

On line concentrating XPMs, calls on all subtending P-side nodes become idle. To idle the nodes, takes into account intra- and inter-switched calls on subtending RCC2s. The cleanup impacts the order in which P-side nodes become idle. The calls in local P-side nodes become idle first, followed by calls in subtending RCC2s. During the line call cleanup, the RCC2 can encounter messaging overload. The system inhibits call terminations and originations to prevent messaging overload.

Special occurrences

An LTC+ with subtending RCC2s can have subtending SMSRs. In the event of an LTC+ with subtending RCC2s, not all of the RCC2s can have loads compatible with this feature. In that event, the INSV SWACT busies and RTSs the subtending P-side nodes. The node initiating the SWACT and all P-side nodes that contain correct, supported loads remain INSV.

ESA entry

The ESA mode is entered as a result of the following faults:

- alarms/rebounded messages on all message links of the RCC2 node
- no communication with the CC
- forced by mate unit if in dual configuration

The RCC2 enters the ESA mode when the RSC_ESAENTRY_BADLINK reaches the time-out parameter defined in OFCENG table. The RCC2 enters the ESA mode when the time-out parameter, RSC_ESAENTRY_BADCSIDE defined in table OFCENG is reached. The RCC2 enters the ESA immediately, when the mate RCC2, forced ESA entry receives a message.

ESA exit

The CC is responsible to the RCC2 for ESA exit. The CC sends a message, esa_call_query, to the remotes that are in ESA mode. When the CC receives a response from the remote, the CC starts the ESA exit process. The CC sends an esa_exit_msg when the RSC_XPMESAEXIT reaches the time-out parameter defined in OFCENG table.

The CC receives the response message and the remote stays in the ESA mode when the remote is in a dual configuration. The user sets the FORCE ESA option to Y and the CC receives the response from both RCC2s. When the user sets the RSC_XPMESAEXIT time-out parameter defined in table OFCENG to zero, a manual ESA exit is required.

RSC_XPMESAEXIT parameter

The Remote Cluster Controller XMS-based Peripheral Module Emergency Stand Alone Exit (RSC_XPMESAEXIT) parameter is required. The RSC_XPMESAEXIT appears in a switching unit with the RCC and the ESA feature.

The RSC_XPMESAEXIT parameter determines if the system initiates ESA exit or, if manual intervention is required to exit ESA. The RSC_XPMESAEXIT determines how long the system waits to initiate the ESA exit.

Provisioning rules

Set the value of this parameter to the required delay between links being restored, or communication with C-side peripheral recovered, and the remote service center that comes out of ESA mode.

The time is in 10 s intervals. For example, a value of 2 indicates a delay of 20 s. The default setting of 6 indicates that after a 60 s delay, the system initiates an ESA exit. Refer to Range information. A value of N (no) indicates that in order to exit ESA, the system requires a manual RTS.

The range of values type is RSC_ESA_EXIT_TYPE with the following multiple values:

Table 1-2

SYSTEM_ESA_EXIT	{N, Y}
EXIT_DELAY	{0 to 100}

The SYSTEM_ESA_EXIT field is a boolean that determines the type of ESA exit. The system can initiate an ESA exit Y or the user can initiate a manual ESA exit N. The EXIT_DELAY field determines how long the system waits to initiate the ESA exit. The value is not zero if the system initiates the ESA exit. The delay increases by 10 s increments. The range has a minimum of zero, a maximum of 100, and a default of six. The activation is immediate.

Verification

Verification of the SYSTEM_ESA_EXIT field is Y; verification of the XPM_EXIT_DELAY field is 6.

To check:

1. Set the parameter to the default value of the parameter in table OFCENG as follows:

Table 1-3

RSC_XPMESAEXIT	Y	6

2. From the MAP display, post an INSV RCC.
3. Break RCC C-side message links at DSX.
4. From the MAP display, observe RCC change from INSV to CBsy, to SysB.
5. From the MAP display, observe the ESA decreasing count, start at 60.
6. From the MAP display, observe the system warm exit RCC.

Memory requirements

This parameter value requires one word of memory.

Dump and restore rules

Copy the current value of this parameter when you perform a dump and restore.

If the current software release has the parameter RSC_XMPESAEXIT delay set to zero, set the new parameter as follows:

Table 1-4

RSC_XPMESAEXIT	N	0

If the previous software release had the parameter RSC_XMPESAEXIT delay set to a setting that is not zero, set the new parameter as follows:

Table 1-5

RSC_XPMESAEXIT	Y	<dt>

where <dt> is the ESA exit delay time of the previous software release.

Returning the remote cluster controller 2 to service

An RCC2 is returned to service if manual maintenance has been performed or if a system audit detects a faulty component.

If manual maintenance has been performed and a fault has resulted in either the RCC2 unit or PM going system busy (SysB), the unit is usually busied and tested. Once the faulty component is found and repaired or replaced, an RTS is performed on the unit or PM.

If a system audit detects a faulty component, an audit tries to return the component to service.

Performing an RTS without running diagnostics

If you use the FORCE parameter with the RTS command, the system does not perform ROM diagnostics.

WARNING
Use the FORCE parameter only if the system directs you to use the FORCE parameter.
Operating company personnel must not use the FORCE because diagnostics that are normally part of the RTS command can find an additional fault.

The system displays the following message sequence when you use the RTS command with the FORCE parameter:

```
>TST UNIT 0 FORCE
ROM/RAM query
/Clear data
Initializing
/Static Data
Loading:Execs
Initializing
ESA Data Load
```

After the message sequence a dynamic data synchronization occurs. When the synchronization completes, the system RTSs the unit.

Dual RCC2

In a converted RSC-S, a single EXT shelf can extend to two RCC2 shelves. As a result, a completely equipped RSCE provides the controller functions of a completely extended Dual RSC-S.

An RCC2 that is part of a dual configuration is functionally the same as a single RCC2. The main difference is that the two peripherals, are connected by P-side DS-1 links.

The following sections describe the DRCC2 in terms of the following operating areas:

- speech and message paths
- ESA and dual ESA (DESA)
- maintenance messaging

Speech and message paths

The DRCC2 allows calls that originate on one RCC2 and terminate on the interconnected RCC2 to route directly over interlinks when the call is setup. The minimum configuration for a DRCC2 requires four messaging links.

For this type of call to occur, the two peripherals must be able to communicate with the host and with each other.

C-side connections to the host

The host communication cards, are made up of the NTMX81 and NTMX75 cards. In the DRCC2, these cards, handle communication between the two peripherals. The C-side ports 0 and 2 handle the messaging links to the network.

Sending messages between RCC2s

The system receives a message over a messaging link from the interconnected RCC2. The system routes the message to the NTMX76 of the active unit. The message card examines the message and determines if the message is for the active or inactive unit. The P-side ports 0 and 8 handle the messaging links between the two peripherals.

Inter-RCC2 link dynamic SD update

Feature AF6046 is dynamic download of SD for table IRLNKINV. Before feature AF6046, the system did not dynamically download interlinks information in table IRLNKIN to both RCC2s of a DRCC2. To download interlinks information, the system required a manual busy and return-to-service of the two RCC2s. The manual busy and return-to-service of the two RCC2s caused an E1 outage. The system downloaded table IRLNKINV information to the master RCC2 and the mate RCC2. The system downloaded the table IRLNKINV information as part of the SD bulk download.

Feature AF6046 provides a process that continuously reconfigures interlinks between two INSV RCC2 nodes in a dual configuration. When feature AF6046 performs this action, AF6046 preserves the interswitched calls that have stability. This feature provides the following functions:

- adds a new command, INTERSW, to the IRLINK MAP level. The new command allows you to enable and disable interswitched calls for the posted RCC2.
- improves the BSY interlink MAP command. The command allows you to display the number of interswitched calls being reverted to the network using available C-side channels.
- enhances the QUERYIR interlink MAP command. The command allows you to display the status of IRLINKS. You can refer to the status of interswitching, enabled and disabled, capability of the posted RCC2 of a DRCC2.
- allows dynamic downloading of IRLINKS SD to both RCC2s interconnected in a dual configuration.
- provides dynamic downloading of ForceESA SD.

Before you add, remove or move interlinks of a posted RCC2 of a DRCC2, disable interswitching capability. To disable interswitching capability, enter the following command from the IRLINK MAP level:

>**INTERSW DISABLE**

To confirm that the system disabled interswitching, enter the QUERYIR command. The QUERYIR command displays the status of interswitching capability for the posted RCC2:

>**QUERYIR**

Example of a MAP display

```
Interswitching is DISABLED
IR   FROM        TO             C  ALRM SLIP FRME BER STATE
 0   RCC2  0, 0   RCC2  1, 0      .        0    0         OK
 1   RCC2  0, 8   RCC2  1, 8      .        0    0         OK
 2   RCC2  0, 4   RCC2  1, 7      .        0    0         OK
 3   RCC2  0, 9   RCC2  1, 12     .        0    0         OK
```

When the interswitching capability is disabled, reconfigure the IRLINKS. To reconfigure the IRLINKS, enter the BSY command with the IRLINK numbers to reconfigure. The AF6046 improves the BSY command. Use the command to display the number of interswitched calls that revert to the network on available C-side channels. The following example describes the BSY command:

>BSY 3

Example of a MAP response

```
67 interswitched calls will be reverted to the network.
Potential loss of calls on the interlink if there are no
available C-side channels.
```

The C-side channels of the RCC2 are a limited resource. You must reconfigure IRLINKS during periods of low traffic only. You can lose some interswitched calls if not enough C-side channels are available.

Before you perform a ManB on a specified IRLINK, you must enter the INTERSW command. If you do not enter the INTERSW command the following response appears in the MAP terminal:

>BSY 3

Example of a MAP response

```
interswitched calls should be disabled before an
interlink is busied.
```

When you complete the ManB on the IRLINKS enter table IRLNKINV and change the links for the desired IRLINK configuration. If the units, are INSV, the system immediately downloads SD to both units of both RCC2s of the DRCC2.

After DRCC2 IRLINKS are reconfigured, enter the improved RTS command to RTS the IRLINKS. The MAP terminal displays the following response to indicate interswitching is disabled:

>RTS 3

Example of a MAP response

```
Be aware that Interswitching is Disabled.
```

To enable interswitching, enter the following command from the IRLINK MAP level

:>**INTERSW ENABLE**

To confirm that the system enabled interswitching for the posted RCC2, enter the QUERYIR command from the IRLINK MAP level:>**QUERYIR**

Example of a MAP display

```
Interswitching is ENABLED
IR   FROM        TO            C  ALRM SLIP FRME BER STATE
 0   RCC2  0, 0   RCC2  1, 0      .        0    0         OK
 1   RCC2  0, 8   RCC2  1, 8      .        0    0         OK
 2   RCC2  0, 4   RCC2  1, 7      .        0    0         OK
 3   RCC2  0, 6   RCC2  1, 6      .        0    0         OK
```

The system continuously downloads IRLINKS and Forced ESA SD to both RCC2s of the DRCC2. The system must download the following:

- ESA lines
- ESA trunks
- ESA table control data
- components of the ESA SD for both RCC2s

For this reason, the system sets the units of both RCC2s to ISTb with the reason `ESA STATIC DATA MISMATCH`.

You can perform a manual download on the ESA SD at the PM MAP with the RCC2s posted. To perform this action enter the LOADPM command with the source of `CC`. and file of `ESADATA`. You can update the ESA SD the data at the automatic SD updates that occur each night. Table OFCENG tuples RSC_XPMESASDUPD_BOOL and RSC_XPMESASDUPD_HOUR define the updates.

ESA and DESA

The following sections describe how the design of the system makes sure that the RCC2 can communicate with the host. The sections describe how the DRCC2 enters and exits ESA and DESA.

Synchronization in DESA

When the DRCC2 enters DESA, the NTMX81, NTMX75, and NTMX76 cards allow both peripherals to synchronize and send messages to each other.

In order to interswitch calls, both peripherals must be synchronized to the same source. In normal operation, each RCC2 in the DRCC2 follows the timing of the host line group controller (LGC) or line trunk controller (LTC). The system sends the timing element out to all nodes in the network so that both peripherals synchronize to the same source.

The RCC2 uses the NTMX75 card to generate the frame pulse. An internal XPM clock controls the pulse. The clock for the active unit continuously adjusts to the network clock pulse so that the RCC2 synchronizes with the host.

When communication to the host is lost, the internal XPM clock for the active unit has no frame pulse to follow. The XPM clock enters free-run mode. The NTX380AA package allows the RCC2 to synchronize with the interconnected RCC2. The DRCC2 software determines the RCC2 that will be the source of the frame pulse. This RCC2 sends frame pulses to the other RCC2, over links 0 and 8.

Forced ESA

When RCC2 A and RCC2 B are in ESA, the system implements DESA and the system allows interswitched calls.

> ***Note:*** The RCC2 B is not completely in ESA. The RCC2 B can exit ESA under fixed conditions. For example, if the RCC2s cannot exchange messages over the interlinks, the RCC2 B starts a timer. The timer is the same as the timer in parameter RSC_ESAENTRY_BADLINK in table OFCENG. This timer stops links from bouncing.

When the timer begins, the following results can occur:

- If the interlinks cannot resume messaging before the timer expires, RCC2 B stops simulating faults and exits ESA.
- If the interlinks resume messaging before the timer expires, the system cancels the timer and DESA is established again.
- The timer expires and RCC2 B exits ESA, but the interlinks resume messaging. The system forces RCC2 B back into ESA.

Maintenance messaging

For the messaging channels, RCC2 software performs the following tasks:

- uses DMS-X protocol to send and receive messages across the interlinks
- handles inter-messaging link faults that the messaging system detects
- provides support when maintenance is performed on the messaging links.

The RCC2 software can send a message from one RCC2 to the other RCC2. The RCC2 software sends the message to the firmware of the NTMX76 card to be transmitted. If the system cannot send the message, the system returns the message to the messaging software. For example, the link can be closed, or there can be a time-out in the DMS-X protocol. These messages are rebounded.

When a message rebounds, the message link is closed and software attempts to send the message over the other messaging link. The software informs the XPM maintenance in the RCC2 of the message. The XPM maintenance attempts to RTS the defective link, and the system generates a PM181 log.

ESA warm exit

The RCC2 warm exit is based on the RCC warm exit. The RCC warm exit software makes adjustments to operate warm exit for the RCC2.

The warm exit for the RCC2 was developed to address problems that occur when an RCC2 exits ESA. The RCC2 warm exit handles service outage of up to 20 min, and the drop of all calls that have stability.

The warm exit occurs for the same reasons as the cold exit. The warm exit has messaging between the RCC2 and the CC. The messaging informs the CC of active calls.

The ESA warm exit has support for the DRCC2. ESA warm exit does not have support for ISDN.

RSC ESA firewall

An RCC enters ESA when communication to the C-side node is lost. When this happens, the RCC node is marked CBsy. CBsy indicates that either the C-side node or C-side links are OOS. DMS system actions are not permitted on a CBsy node. This effectively provides a firewall and protects the RCC from any detrimental system actions. When communication with the C-side node is restored, the RCC is marked SysB, so that the system can restore the node fully to an InSv state, (usually through an ESA warm exit).

When a DS-1 link on the C-side of an RCC is broken, the link goes SysB and the unit goes CBsy. If no other message supporting links are available, the node also goes CBsy. This status remains until one or more message supporting links are restored. At that time, the link goes InSv and the RCC node or unit goes SysB with a SysB reason of “CSLink RTS". The node or unit is then RTSed or exits ESA by the DMS system.

Feature AF6240 prevents a CBsy node from going SysB when the C-side links are SysB and futher to prevent a SysB link from going to a state of “OK" without first verifying C-side communications. This feature alters the way in which system maintenance recovers a CBsy RCC. Instead of the CM forcing a CBsy node to SysB, the system waits for carrier maintenance to recover the DS-1 link(s) and then recovers the RCC node or unit.

Feature AF6142 enhances ESA service by the following actions:

- enhancements to the commands at the RCC level of the MAP display to prevent detrimental human machine interface (HMI) request to an RCC in ESA
- The ESA condition is displayed at the MAP terminal when an RCC is found in ESA
- new and modified log reports.

The following enhanced MAP display commands perform an ESA query prior to executing a command to an RCC that may be in ESA.

- BSY
- TST
- RTS
- LOADPM
- QUERYPM
- PMRESET
- XPMRESET
- RECOVER

The DMS system response to the above commands provide the operating company personnel better information of the RCC ESA status, thus improving RCC maintenance and preventing accidential outages through unnecessary maintenance actions.

BSY command

An RCC in ESA may still be busied however, the operating company personnel must respond to a new warning such as:

Example of a MAP response:

```
>BSY PM
WARNING – The RCC is in ESA.
A manual ESA exit is required if the RCC is
busied.

Please confirm (“YES”, “Y”, or “NO”, “N”):
>Y

A manual ESA exit is now required.
To attempt ESA exit, type RTS WARMEXIT
```

Command syntax

```
Parms: <DEVICE> {UNIT <UNIT_NO> {0 TO 1}
                      [<CMR> {CMR}],
                 PM [<CMR> {CMR}],
                 LINK <PSIDE_LINK> {0 TO 63},
                 INACTIVE}
       [<FORCE> {FORCE}]
       [<NOWAIT> {NOWAIT}]
       [<ALL> {ALL}]
```

TST command

If an RCC is in an ESA mode, enhancements to the TST command prevents the actions, such as below, from being implemented:

Example of a MAP response:

```
>TST PM
RCC 0 Unit 1    Request Invalid
                RCC is in ESA
RCC 0 Unit 1    Request Invalid
                RCC is in ESA

            or

>TST UNIT 1
RCC 0 Unit 1    Request Invalid
                RCC is in ESA

            or

>TST UNIT 0
RCC 0 Unit 0    Request Invalid
                RCC is in ESA
```

The CM rejects the test request because this HMI command is detrimental to the service of the RCC operating in the ESA mode.

Command syntax

```
Parms: <DEVICE> {UNIT <UNIT_NO> {0 TO 1}
                      [<ROM> {ROM}]
                      [<CMR> {CMR}]
                      [<ALL> {ALL}],
                 PM [<ROM> {ROM}]
                    [<CMR> {CMR}]
                    [<ALL> {ALL}],
                 LINK <PSIDE_LINK> {0 TO 63},
                 REX <REX_ACTION> {ON,
```

RTS command

The enhancements replace the system driven ESA exit with a manual ESA exit driver. It halts processing when an error condition is encountered and better informs the operating company personnel regarding failures and alternative actions. The command syntax and responses are:

Example of a MAP response:

```
>RTS PM COLDEXIT
WARNING
COLDEXIT causes all stable calls to be lost
WARMEXIT allows stable calls to survive ESA exit

            or

>RTS PM EXITBYPASS
WARNING
EXITBYPASS bypasses ESA exit
All stable calls and ESA OM data will be lost
WARMEXIT allows stable calls to survive ESA exit.
```

Command syntax

```
Parms: <DEVICE> {UNIT <UNIT_NO> (0 TO 1)
                    [ <NODATASYNC> (NODATASYNC)]
                    [ <CMR> (CMR)],
                PM  [ <CMR> {CMR}],
                LINK <PSIDE_LINK> (0 TO 63),
                    ACTIVE
                    INACTIVE  [ <NODATASYNC> {NODATASYNC}],
                       SYSB)
        [<FORCE>    {FORCE}]
        [<EXIT>     {WARMEXIT,
                    COLDEXIT,
                    EXITBYPASS}]
        [<NOWAIT>  {NOWAIT}]
        [<ALL>  {ALL}]
```

Three new parameters are added to the RTS command they are:

- WARMEXIT
- COLDEXIT
- EXITBYPASS

Examples of responses to the WARMEXIT parameter include:

Example response to WARMEXIT parameter:

```
>RTS PM WARMEXIT

ESA warm exit passed

            or

Request Invalid
PM not in ESA

            or

Request Invalid
PM does not support warm exit
COLDEXIT option must be used

            or

ESA warm exit failed
No response from PM.
Check MSG LINKS at TRKS;CARRIER level.
Attempt WARMEXIT after links are verified.

            or

ESA warm exit failed
Execs are invalid
COLDEXIT option must be used.

            or

ESA warm exit failed.
Static data was changed.
COLDEXIT option must be used.
```

Examples of responses to the COLDEXIT parameter include:

Example response to COLDEXIT parameter:

```
>RTS PM COLDEXIT
WARNING
COLDEXIT causes all stable calls to be lost
WARMEXIT allows stable calls to survive ESA exit.

Please confirm (“YES”, “Y”, “NO”, or “N”):
>Y

ESA COLD exit passed

            or

Request Invalid
PM not in ESA

            or

ESA COLD exit failed
No response from PM
Check MSG links at TRKS;CARRIER level
Attempt EXIT after links are verified
```

Examples of responses to the EXITBYPASS parameter include:

Example response to EXITBYPASS parameter:

```
>RTS PM EXITBYPASS
WARNING
EXITBYPASS bypasses ESA exit
All stable calls and ESA OM data will be lost
WARMEXIT allows stable calls to survive ESA exit.

Please confirm (“YES”, “Y”, “NO”, or “N”):
>Y

RTS passed

            or

Request Invalid
PM not in ESA

            or

RTS failed
No response from PM
Check MSG links at TRKS;CARRIER level
Attempt EXIT after links are verified
```

LOADPM command

The enhancements prevent a LOADPM command execution on an RCC that is known to be in ESA. It also prevents ESA static data from being loaded into an RCC operating in simplex mode with valid ESA static sata in the active unit. The command syntax and responses are:

Example of a MAP response:

```
>LOADPM PM
RCC 0 Unit 1    Request Invalid
                RCC is in ESA
RCC 0 Unit 0    Request Invalid
                RCC is in ESA

Try LOADPM INACTIVE to load inactive unit or Try
RTS WARMEXIT tp force PM out of ESA then LOADPM

            or

>LOADPM UNIT 0 CC ESADATA
RCC Unit 0      Request Invalid
                Node is ISTb

ESA Data download aborted due to lack of node
redundancy.
Existing ESA static data is valid
```

Command syntax

```
Parms: <DEVICE> {UNIT <UNIT_NO> {0 TO 1},
                 PM,
                 INACTIVE,
                 ACTIVE}
       [<SOURCE> {CC [<MODE> {FULL,
                              DATA,
                              EXEC,
                              ESADATA,
                              CMR,
                              FIRMWARE,
                              XPMSTOR}]
                     [<FILE> STRING],
                  LOCAL [<MODE> {IMAGE,
                                 LOADFILE}]
                        [<FILE> STRING]}]
       [<FORCE> {FORCE}]
       [<NOWAIT> {NOWAIT}]
       [<ALL> {ALL [<RFILE> STRING]}]
```

QUERYPM command

The enhancement adds a new parameter to the QUERYPM command of ESA. The enhancement also denies QUERYPM CNTRS request when the RCC is in ESA. This prevents the reset sent down to query the counters if the RCC is SysB. The enhancement also display the current ESA status information and office parameters configuration from the office engineering table, OFCENG.

Example of a MAP response:

```
>QUERYPM CNTRS
RCC 0 Unit 1    Request Invalid
                RCC is in ESA
RCC 0 Unit 0    Request Invalid
                RCC is in ESA
```

or

```
>QUERYPM ESA
RCC ESA Subsystem Status

ESA static data is valid
Expected ESA exit is Warm
Dual ESA entry force down is Enabled
RCC 0 is in ESA

OFCENG RSC_ESA Office Parm Configuration

Nightly ESA static data downloading is Enabled
Nightly ESA static data download at 1 am
ESA exit requires manual intervention
ESA exit will be performed by the system
ESA exit timer set at 60 seconds
ESA dial tone notification is Enabled
```

Command syntax

```
Parms: [<OPTION>    {ESA,
                    FLT,
                    CNTRS,
                    FILES,
                    DIAGHIST [<OPTHIST>     {DIAG,
                                            CARD,
                                            RESET}]}]
```

PMRESET command

The enhancement allows the PMRESET command to bypass the ESA firewall on the RCC that is known to be in ESA. Resetting an RCC in ESA drops all stable calls for the ESA exit procedure.

Example of a MAP response:

```
>PMRESET PM
RCC 0 Unit 1    Request Invalid
                RCC is in ESA
RCC 0 Unit 0    Request Invalid
                RCC is in ESA

Use EXITBYPASS option to force reset PM in ESA.

            or

>PMRESET PM EXITBYPASS
WARNING
EXITBYPASS allows the RCC in ESA to be reset.
The PMRESET will drop the RCC out of ESA.
All stable calls and ESA OM data will be lost.

Please confirm (“YES”, “Y”, “NO”, or “N”):
>Y
```

Command syntax

```
Parms: <DEVICE> {UNIT <unit_no> {0 TO 1},
                    PM}
        [<OPTION>   {NORUN,
                     NODATA,
                     EXITBYPASS}]
```

XPMRESET command

The enhancement allows the XPMRESET command to bypass the ESA firewall on the RCC that is known to be in ESA. Resetting an RCC in ESA drops all stable calls and discards all ESA operational measurements data for the ESA exit procedure.

Example of a MAP response:

```
>XPMRESET PM
RCC 0 Unit 1    Request Invalid
                RCC is in ESA
RCC 0 Unit 0    Request Invalid
                RCC is in ESA

Use EXITBYPASS option to force reset PM in ESA.

            or

>XPMRESET PM EXITBYPASS
WARNING
EXITBYPASS allows the RCC in ESA to be reset.
The XPMRESET will drop the RCC out of ESA.
All stable calls and ESA OM data will be lost.

Please confirm (“YES”, “Y”, “NO”, or “N”):
>Y
```

Command syntax

```
Parms: <DEVICE> {UNIT <unit_no> {0 TO 1},
                    PM}
        [<OPTION>   {NORUN,
                     NODATA,
                     EXITBYPASS}]
```

RECOVER command

The enhancement allows the RECOVER command to bypass the ESA firewall on the RCC that is known to be in ESA. Recovering an RCC in ESA drops all stable calls and discards all ESA OM data for the recover procedure. If the RCC has NT6X45BA hardware or later this command can determine if the RCC has been loaded since power up. If the RCC has not been loaded since power up, it will be loaded and returned to service. If the RCC is in ESA and the EXITBYPASS option is not specified, an ESA exit is attempted. Otherwise an RTS is executed.

Example of a MAP response:

```
>RECOVER
RCC 0 Unit 1    Request Invalid
                RCC is in ESA
RCC 0 Unit 0    Request Invalid
                RCC is in ESA

Use EXITBYPASS option to force reset PM in ESA.
```

or

```
>RECOVER PM EXITBYPASS
WARNING
EXITBYPASS allows the RCC in ESA to be reset.
The RECOVER will drop the RCC out of ESA.
All stable calls and ESA OM data will be lost.

Please confirm (“YES”, “Y”, “NO”, or “N”):
>Y
```

Command syntax

```
Parms: [<NOWAIT> {NOWAIT}]
        [<ALL> {ALL}]
        [<EXITBYPASS> {EXITBYPASS}]
```

Enhanced PM log reports

Some enhancements are made to the logs generated by the ESA exit process, refer to the *DMS-100 Logs Reference Manual* and the *Extended Peripheral Module Logs Reference Manual (DS-1)* for detailed information on these log enhancements.

RSC ESA Exit simplification and recovery of the inactive unit

Feature AF6244 improves the reliability and reduses down time of single and dual RCCs by:

- Restructuring and simplifying the RSC ESA exit procedures.
- Providing a new interface to the ESA exit procedures for the RSC ESA HMI.
- Giving the single RSC ESA exit drivers the ability to recover an inactive unit prior to an ESA exit.

The ESA exit procedure and the ESA exit drivers are restructured such that the manual ESA exit driver, the system ESA exit driver and the dual ESA exit driver use the same ESA exit procedures.

A manual ESA exit driver, which uses the restructured common RSC ESA exit procedures, is provided to support the improvements to the RSC ESA exit HMI. This manual driver also returns additional error information so the RSC ESA HMI can determine what has occurred when the ESA exit fails so the operating company personnel can be advised as to what should be done next.

The ability to recover an at task inactive unit of the RCC prior to an ESA exit, permits a system warm ESA exit to proceed. When communication has not been restored to the active unit, an ESA warm SwAct is not possible. After the inactive unit is recovered an ESA warm SwAct to warm exit is possible. The RCC can be returned to service without an outage and without waiting for the message link to the active unit to be restored.

This feature also RTSes the inactive unit of the RCC when, the only unit of the RCC that the CM can communicate with, is at ROM level. After being RTSed, the ESA state of the RCC should be determinate. If the RCC is found in ESA it performs a warm exit from ESA and return the RCC to service without an outage. Previously the RCC would remain in ESA until manual actions recovered the RCC.

When the single or dual RCC is in ESA, it is queried every ten seconds as long as it remains in ESA. After it has been queried for the amount of time specified in the Office Parm RSC_XPMESAEXIT, the exit is initiated. For cold ESA exit, this is simply requesting that the ESA exit message be sent and the ESA OMs collected. The single RCC is then turned over to Base XPM Maintenance to be RTSed.

For a warm ESA exit, the instant RTS of the single or dual RCC and its subtending nodes is initiated. Once the single or dual RCC and subtending nodes are in service, the procedure to setup the ESA calls is run. The ESA OMs are then requested and the RCC is turned over to Base XPM Maintenance to be RTSed if required.

RCC2 with ISDN

The RCC2 can configure with ISDN services for RSC-S. The operating areas of the RCC2 with ISDN include:

- cards
- speech and message paths
- host ISDN peripherals
- enhanced LCM (LCME)
- operation, administration, and maintenance (OAM) processor.

> ***Note:*** The figure Functional block diagram of the RCC2 with ISDN relates to the following functional description of the RCC2 with ISDN.

Cards

The RCC2 with ISDN is based on RCC2. The RCC2 with ISDN consists if two additional cards. The two new cards are the enhanced ISDN signaling preprocessor (EISP) and the DCH. The RCC2 uses the NTXM81 card when the RCC2 requires clear DS-1 channels.

The DCH card is an ISDN line group controller (LGCI) or ISDN line trunk controller (LTCI). The DCH card provides the primary I/F to all D-channels and performs Q.921 link access procedure on D-channel (LAPD) layer 2 processing. The DCH connects to an ISDN loop and receives or sends messages on the signaling and packet data channel.

The EISP card provides a communication channel between the UP and the DCH cards.

The DS-1 cards NTMX81 provide the 64 kb/s clear channels necessary to process D-channels.

Speech and message paths

Speech and message paths of the RCC2 with ISDN are like the RCC2 without ISDN. The addition of the DCH, EISP, and DS-1, NTMX81, cards allows the RCC2 to process calls from ISDN terminals.

The DCH cards provide the Q.921 function and the processing for the D-channels from the ISDN loops that terminate on ISDN line cards. The DCH interprets the service access point identifier (SAPI) data with SAPI 16, packet data. The DCH cards send the data over Bd links to the packet handler (PH). The DCH cards route the SAPI 0, call control messages, data to the EISP for additional processing. The DCH return the SAPI 17 messages back on the same loop.

A DCH resides in a P-side port and terminates a single port. The single port contains 32 64 kb/s time slots. The zero time slot supports messages to the EISP. The remaining slots, support BRI D-channels to ISDN terminals or Bd channels to the PH.

Host ISDN peripherals

The RCC2 can connect to either an LGCI or an LTCI.

The host XPM terminates the DS-1 links from the RCC2 and passes the circuit-switched traffic on to the network. As with the RCC2 without ISDN, the XPM nails the traffic up through the RCC2. The traffic is non-concentrating. Many of the other capabilities of the host XPM depend on the configuration of the RSC-S with ISDN.

The following list of host XPM capabilities show how to handle data-switched traffic:

- provides P-side DS-1 links to the PH if the PH is at the host
- terminates LCMs directly

 Note: A host XPM that does not have to directly support an ISDN line concentrating module (LCME) can be an LGC or LTC.

- terminates LCMEs directly, if the host XPM is an LGCI or LTCI
- enables the RCC2 to support trunks if the host XPM is an LTC or LTCI.

LCME

The LCME provides the subscriber with BRI, using the two binary one quaternary (2B1Q) U-loop I/F. Northern Telecom uses 2B + D channels and six maintenance channels. These channels are located throughout the 2B1Q superframe to provide North American Standard 2B1Q U-loop I/F.

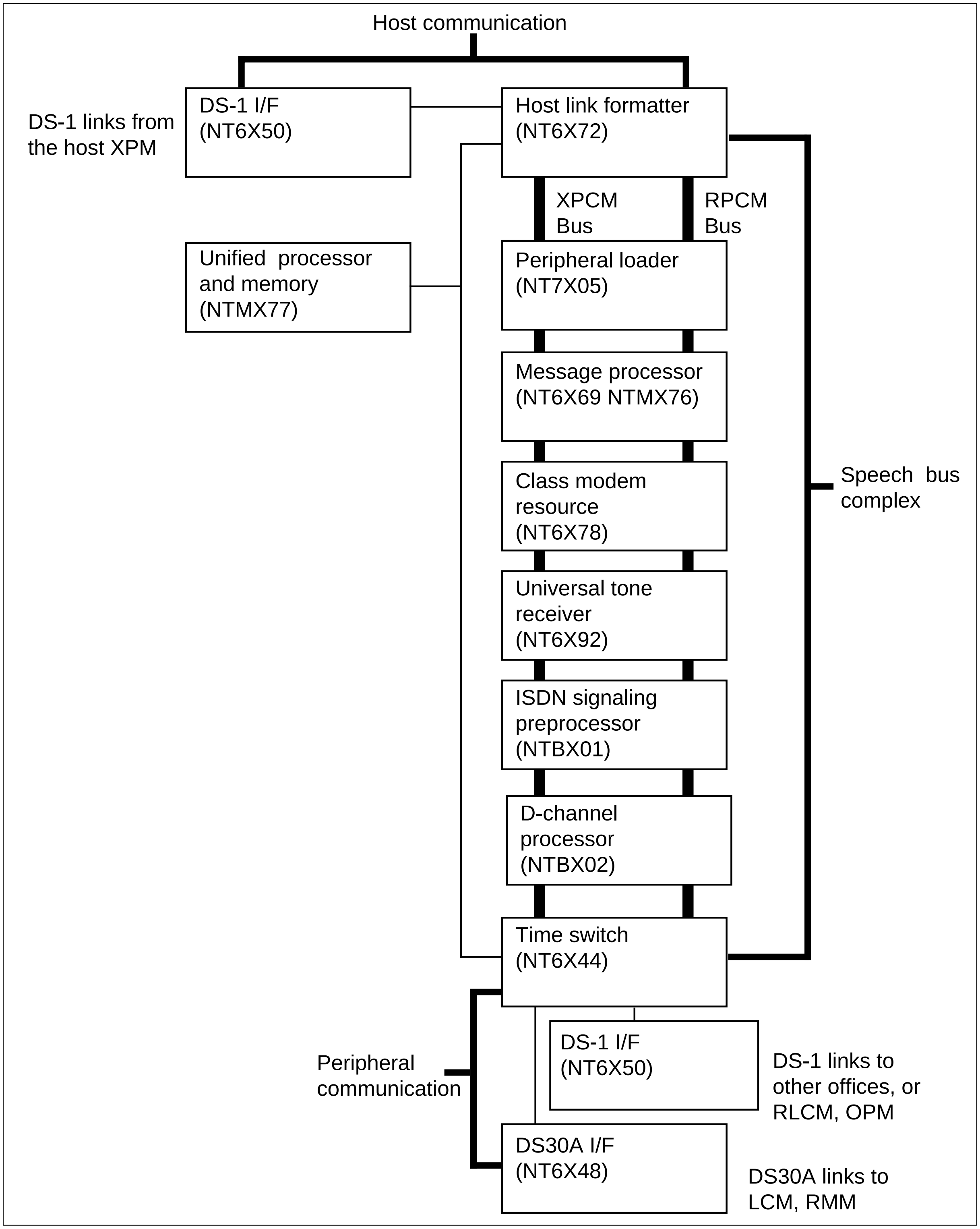
LCM

The RSC-S can be provisioned with an LCM. The RSC-S provisioned with an LCM does not support ISDN. The RSC-S with LCM offers two features: coin and automatic number identification (ANI) support, and increased line density, 640 compared to 480.

The LCM has six internal DS30A ports that contain two message ports and four speech links. 30 external ports are available for connection to LCMs or LCMEs.

The following figure is a functional block diagram of the RCC2 with ISDN:

Figure 1-7 RCC2 with ISDN



Fault conditions

The RSC-S contains monitoring systems that detect and indicate fault conditions. The following section describes fault conditions that automatic maintenance monitors. The next main section describes Automatic maintenance features. The section describes fault conditions for the RSC-S according to the configurations.

RCC2

RCC2 fault conditions include errors that occur in processor cards and errors that do not occur in processor cards.

Errors specific to processor cards

The following errors can occur in RCC2 processor cards:

Traps

Traps are interrupts that hardware or software errors (SWERR) generate. Traps, occur when the CC receives a gain message from the new active unit that was not requested.

SWERR

A SWERR is an error attributed to software.

Intermittent, soft, and hard, parity faults

The three types of parity faults are as follows:

- intermittent

  Intermittent parity faults occur when the subsystem detects a fault but does not find an error during the reread of the location.

- soft

  Soft parity faults occur when the subsystem detects a parity error and finds an error when the RCC2 rereads the location. The subsystem does not find an error when the RCC2 tries to write to the location. The error can occur in either the program store (PS) or memory store.

- hard

  Hard parity faults occur when the RCC2 detects a fault and the RCC2 cannot reread or write to the memory location. The hardware has faults and you must replace the associated memory card to correct the fault.

Exception faults

An exception is a special condition at the ROM or task level that preempts normal processing. Exception handling includes exception detection, data capture, and recovery. Exception services include exception administration, reporting, and data access and display.

Both internal and external conditions can cause exceptions. Internal conditions include:

- instructions without authorization
- address errors
- tracing
- breakpoints
- co-processor protocol violations.

External conditions include:

- interrupts from external devices
- bus errors
- co-processor, detected errors
- resets.

Fault condition exceptions that you must service, appear in the following table:

Table 1-6 XPM error type and description (Sheet 1 of 2)

Type	Fatal	Description
1	No	Indicates value range error
2	No	Indicates segment not present
3	No	Indicates exit from uncalled procedure
4	No	Indicates stack overflow
5	No	Indicates floating point
6	No	Indicates division by zero
7	No	Indicates nil pointer reference
8	No	Indicates not used
9	No	Indicates not used
10	No	Indicates I/O error—result of system procedure IOCHECK
11	No	Indicates string
12	No	Indicates string indexing
13	No	Indicates set error

Table 1-6 XPM error type and description (Sheet 2 of 2)

Type	Fatal	Description
14	No	Indicates bad coin semipostpay (CSP), standard procedure not implemented
15	Yes	Indicates bad P-code instruction
16	No	Indicates task error
17	Yes	Indicates request for reset—Trap 7
18	No	Indicates not used
19	Yes	Indicates parity error
20	No	Indicates addressing error
21	No	Indicates illegal instruction
22	Yes	Indicates spurious interrupt
23	No	Indicates bus error
24	No	Indicates MMU error
25	No	Indicates not used
26	No	Indicates privilege violation
27	Yes	Indicates sanity time-out

Errors not specific to processor cards

The following errors do not occur in RCC2 processor cards:

- SD mismatch faults

  SD defines the RSC-S configuration and does not change as calls connect and disconnect. When SD in the host and the RCC2 do not match, data corruption can result. When a mismatch occurs, the host knows that there is a line. The RCC2 does not know that there is a line. As a result, calls are lost.

- unit node table mismatch faults

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

- Mate unit matching compares the inactive unit tables with the active unit and sets the XPM ISTb in the event of mismatch. The active unit sends table mapping information to the inactive unit during updates.
- Node table audits determine if the information corresponds to data in the CM table PMNODES. To prevent differences in entries for the XPM units, the CM maintains all node information. Refer to the *XPM Translations Reference Manual*. for a complete description of the entries for table PMNODES, introduced in feature AF567.

Feature AF5678, Node Table Synchronization Design, introduces the following error handling changes:

- Table Control applications change inventory tables. Table control applications reject tuples that cannot have support when a peripheral does not have the required resources available.
- The node table audit raises an ISTb condition on an XPM that has a node table mismatch with the CM. You must clear the ISTb condition. To clear the ISTb condition BSY and RTS the complete XPM.
- Negative acknowledgment can occur from the XPM, during the download of the CDT node or port information. This event can occur during a bulk download. This condition causes the system to cancel the loading or RTS process.
- A negative acknowledgment from the XPM, can raise an ISTb condition on the XPM. This event occurs during the download of the node CDT or port CDT data during a dynamic configuration update.

Additional faults that do not occur in a card:

- intermodule communication faults

  An intermodule communication fault occurs when two RCC2 units cannot communicate. A warm SWACT is not possible because one unit does not know what the other unit is processing.
- messaging overload on speech bus cards

  Messaging overload conditions can prevent the CMR and GTR/UTR cards from transmitting data. For example, messages sent to the RCC2 to support ADSI protocol for display-based features are forwarded to the CMR card. The CMR card forwards the data to the CPE. If the CMR receives the request to transmit data, and no modem resources are available display data is not sent to the CPE. Modem resources are not available if the CMR is overloaded,

The CPM must receive an acknowledgment (ACK) tone from the GTR/UTR card to transmit data. If there are no channels on the GTR/UTR card to transmit the ACK tone, the CPM does not send the display data to the CPE.

DRCC2

The main fault that can occur with the DRCC2 involves damage to the interlinks. When damage occurs over the messaging interlinks, 0 and 8, the peripherals cannot communicate. Interswitched calls cannot take place.

RCC2 with ISDN

An RCC2 with ISDN can have the same faults as an RCC2 without ISDN. The RCC2 with ISDN can have problems with sending and receiving data packets and call control messages. Most of the problems involve the DCH card.

Automatic maintenance

This section shows how audits and system actions identify the fault conditions. The system can adjust the fault, or the system can produce a log that identifies the problem.

Exception processing system

Feature AF5680, Exception Processing System Enhancements, provides improvements in exception handling. This feature provides exception services that improve the strength of the RCC2. The exception processing system improvements support the following functions:

- removal of trap data loss when multiple traps occur within a 10 s period
- accurate capture of trap-specific data
- guaranteed survival of trap data over restarts and reloads
- capture of both supervisor and user stacks at exception time
- circular buffer management at exception time
- enhanced trap administration
- expanded trap-specific error information to accommodate parity fault requirements. The exception processing system reports parity faults to the parity audit, not to the CC
- storage of the trap system version for each trap
- traceback support on patched procedures.

ROM-level exception processing

On initialization, the firmware maps all vectors to local exception handlers. The ROM-level exception processing performs the following:

- minimizes error recording and reporting
- establishes a bootstrap environment
- provides debug utilities
- allows for abstraction of memory management hardware.

Task-level exception processing

Task-level exception processing reports critical information on hardware and software states. Task-level exception processing reports the information when hardware or software faults prevent normal operation of the CPM unit. The process restores the task to a known point of execution and allows the task to perform recovery actions. If the process cannot recover the task, the task-level exception processing initiates local maintenance to restart or reset the CPM unit.

Exception processing system trap recovery

The exception processing system interacts with the CC, PMDEBUG, and local maintenance in the CPM. The subsystem interacts with the components to recover from error exceptions and to report and display information about error exceptions.

Exception recovery consists of three different operations:

- determine level of the trap, fatal or can recover
- process fatal trap
- recover task, non-fatal trap

When the exception processing system detects a fatal error, the subsystem initiates local maintenance action to drop activity on the active unit. The local maintenance resets or restarts the CPM unit. When the CPM is INSV, the unit reports exception errors to the CC. The exception errors are in the form of messages that are not requested. The exception errors generate a report for each exception that is not reported in the trap buffer. The CC receives the report and acknowledges the message. The CC logs into PMDEBUG to extract the exception information. The CC generates a PM185 log report for each trap.

The PMDEBUG allows you to view and delete exception data from the trap buffer, at the task level. Changes are made in the display routines to reflect data capture differences for required improvements. An example of the PMDEBUG debug, TRAPINFO level display appears in the following figure. At the ROM level, the system can display exception data as a hex dump.

Figure 1-8 Example exception display with improvements

```
Run Load name = NLT02WY
MP ron name = XPMRKA03, SP rom name = XPMRKA03
trap in MP : Div by 0
Trap was Recoverable. Unit was Active/Busy
Task: BASEMON 0009 0009 Trap Sequence #: 1 Current load
PP Time : 00:00:22:04.70
Occurred at : 001951DF DEBUG 21 DOZERRODI 115 Offset: #21
Called from : 000D8A80 BASEMON 18 TDRIVBOD 30 Offset: #228
 000D8B8C BASEMON 18 TERMDRIV 11 Offset: #18
PC:000010AA SR=2100 US=0001FEB2 SS=001ABFF6 TCB=0001F00C
DO =0000FFFF D1 =00090000 D2 =FFFF0101 D3 =0000FF00
D4 =000100FF D5 =FFFF0009 D6 =00000B0D D7 =001A0000
A0 =0001F924 A1 =0001F92C A2 =0001FEB2 A3 =001951DF
A4 =000A6F6E A5 =0001FEC2 A6 =000F9BC2 A7 =001ABFF6
System Stack:
0017ABFF6: 0004 0000 0006 0001 F00C 000A 000A 0998
0017AC006: 0004 0000 0006 0001 F00C 000A 000A 0998
User Stack:
0001FEB2: 0004 0000 0006 0001 F00C 000A 000A 0998
0001FEC2: 0004 0000 0006 0001 F00C 000A 000A 0998
0001FED2: 0004 0000 0006 0001 F00C 000A 000A 0998
```

The recovery process is complete. The system notifies the exception reporting system that new trap data is available and exception handling is complete. The recovery process either sets up the trapped task for recovery and allows recovery to resume, or initiates a maintenance action. The maintenance action restarts or resets the unit.

If the trap is not fatal, the subsystem restores the convicted task to a point of execution. The point of execution allows the task to be restored to a known state. The process of recovery does not restart the task. The process of recovery forces the task to perform a multi-level exit back to the task mainline.

The task recovery model specifies that a task must provide a mainline. A mainline is a continuous loop. The mainline must repeatedly call the main body of the steady state code. The mainline must follow with a call to a recovery procedure. After a recoverable trap the subsystem resumes the task. The subsystem forces the task to return to the next instruction after the call to the main body of code. The next instruction is a call to a recovery procedure or a branch back to the start of the loop.

Memory management unit error recovery

The enhanced exception processing system feature provides an enhancement to exception recovery. The enhancement deals with the direct memory access memory management unit (DMA MMU). Before this feature, the exception processing system convicted the interrupted task when a DMA MMU error occurred. The subsystem convicted the task, even if the software on the NTMX77 was not a part of the error. The convicted task determined if the error was fatal because an MMU error is not fatal. The processor that caused the fault did not know that a problem had occurred.

In the enhanced feature, the external processor receives wrong data if the access is for a read from NTMX77 memory. If the access is to write to NTMX77 memory, no data is written. The processor determines the trap to be fatal and initiates maintenance action to restart or reset the unit.

EDC protection for babbling links

Feature AF4915 is EDC Protection for Babbling Links. Feature AF4915 provides software support for outgoing message channels on the NTMX76AA circuit card. Outgoing message channel management reduces the number of lost messages.

The NTMX76AA circuit card uses CCITT level 2 signaling (Q.703) over the NTMX76AA data channels. The NTMX76AA circuit card provides message I/F to the UP. The NTMX76AA channel provides up to 32 HDLC message channels for interface to the UP. To enable HDLC messaging, both the host and remote offices must be equipped with the NTMX76AA circuit card.

The NTMX76AA sends HDLC messages through message buffers allocated in the common RAM. The NTMX76AA checks the message to make sure that the message is correct. The NTMX76AA copies the message to the R8071 Rockwell memory buffer. The NTMX76AA copies the message from the R8071 memory to the message buffer to receive a message in the R8071 data link. The NTMX76AA queues the outgoing buffer in the R8071 transmit queue if the number of buffers already queued is less than the maximum allowed. If the queue is full, the NTMX76AA rebounds the message.

Loop Recognition for HDLC links

Feature AN1523, Loop Recognition for HDLC EDC links, supports loop recognition in the HDLC protocol on the NTMX76AA. This feature detects loop conditions that are not needed on the messaging channels in both the LTC+ and the RCC2. When AN1523 detects an unwanted loop, the feature increments relevant protocol operational measurements (POM). The EDC shelves respond by alerting the CC of protocol problems, like negative acknowledgements (NACKS), through the operational fault (OPF) system. After the CC receives the alert, the CC begins appropriate maintenance like setting the RCC2 SysB. This action causes a SWACT, or causes the RCC2 to enter ESA.

> ***Note:*** For this feature, loop refers to, recovering the current transmitted data on the side of the same link that receives. Loop does not refer to connection of the P-side output of a link to the input of another P-side link.

The following section describes two messaging concerns: channel management and overload.

Channel management

When the RCC2 or LGC plus sends a message on an HDLC link, the message is copied to a buffer. The buffer is in the NTMX76AA circuit card. The NTMX76AA circuit card sends the message on the correct destination link as determined from the message. The NTMX76AA circuit card has a limited number of buffers used for messaging. The R8071 has limited transmit queues for an exact link. As a result, the NTMX76AA does not have an available buffer for message transmission. This feature controls the rate at which the NTMX76AA sends outgoing messages so that buffers remain available.

Overload

An overload condition occurs when too many messages within a specified time are received on a messaging link. An overload condition can occur if the link increases output to a destination. If a link overloads, the channel management system does not permit a transfer of messages to the NTMX76AA circuit card. The channel management system stores the messages in a holding queue until the link is cleared.

The following section describes the REx test and SWACT process. The section describes the audits and system actions that identify fault conditions in terms of RSC-S components.

SWACT

During a SWACT, the two units of an XPM exchange activity status. The unit that handles call processing becomes the inactive unit. The inactive unit becomes the active unit and takes over call processing. All processing of active POTS or ISDN BRI calls are maintained during a warm SWACT.

A SWACT can be either controlled or uncontrolled. You implement a controlled SWACT by:

- inputting the SWACT command
- planned system requests, like the REx test schedule
- BSY the active unit while the inactive unit is INSV.

A controlled SWACT occurs when both units are INSV, or the RCC2 is ISTb because of a previous REx test failure.

The system implements an uncontrolled SWACT when there is either a hardware fault or a trap in the active unit. The PM181 log messages provide the operating company personnel with the reason the active unit dropped activity.

In a controlled SWACT, the following message interchange occurs:

- The CC messages the active unit of the RCC2 to start an audit of the inactive unit.
- The active unit messages the inactive unit to start a pre-SWACT audit.
- The inactive unit messages the pre-SWACT audit results back to the active unit. The unit initiates a warm SWACT is based on the audit results.
- The original active unit stays INSV and clears data that does not have stability.
- The new active unit sends five gain messages to the CC.
- The CC sends five, gain-acknowledge messages to the RCC2.
- The RCC2 sends three, gain-acknowledge received messages to the CC.
- The CC tells the original active unit to drop activity.
- The original active unit sends the CC a drop message, and the CC expects to receive this message.

If a controlled warm SWACT fails, the following message interchange occurs:

- The CC messages the active unit of the RCC2 to start an audit of the inactive unit.
- The pre-SWACT audit is implemented.
- A warm SWACT is initiated based on the audit results.
- The original active unit stays INSV and clears data that does not have stability.
- The new active unit does not send messages to the CC.
- The 5 s wait time of the original active unit expires and a SWACT-back occurs.
- The original active unit sends a SWACT-failed message to the CC.
- The CC SysB and RTS the inactive RCC2 unit.
- If the CC does not receive messages, the CC forces a SWACT, SysB, and RTS of both units of the RCC2.

In an uncontrolled SWACT, the RCC2 initiates the pre-SWACT audit. The sequence of messages is as follows:

- The active RCC2 unit messages the inactive RCC2 unit to start a pre-SWACT audit.
- The system implements the pre-SWACT audit.
- The system initiates a warm SWACT based on the audit results.
- The new active unit messages the CC that a gain, not requested occurred.
- The original active unit stays INSV and clears data that does not have stability.
- The new active unit sends five gain messages to the CC.
- The CC sends five gain-acknowledged messages to the RCC2.
- The RCC2 sends three, acknowledge-received messages to the CC.
- The CC tells the originally active unit to drop activity.
- If the CC does not receive messages, the CC forces a SWACT, SysB, and RTS of both RCC2 units.

The CC receives a gain message from the new active unit. The CC acknowledges the gain to the original active unit and the SWACT is complete. This action marks the completion of a SWACT for both controlled and uncontrolled SWACTs. When a SWACT occurs, the CC and the RCC2 exchange a series of drop and gain messages that clarify an activity. The following table describes common phrases found in the drop and gain messages:

Table 1-7 Message phrases that describe CC to RCC2 SWACT communication (Sheet 1 of 2)

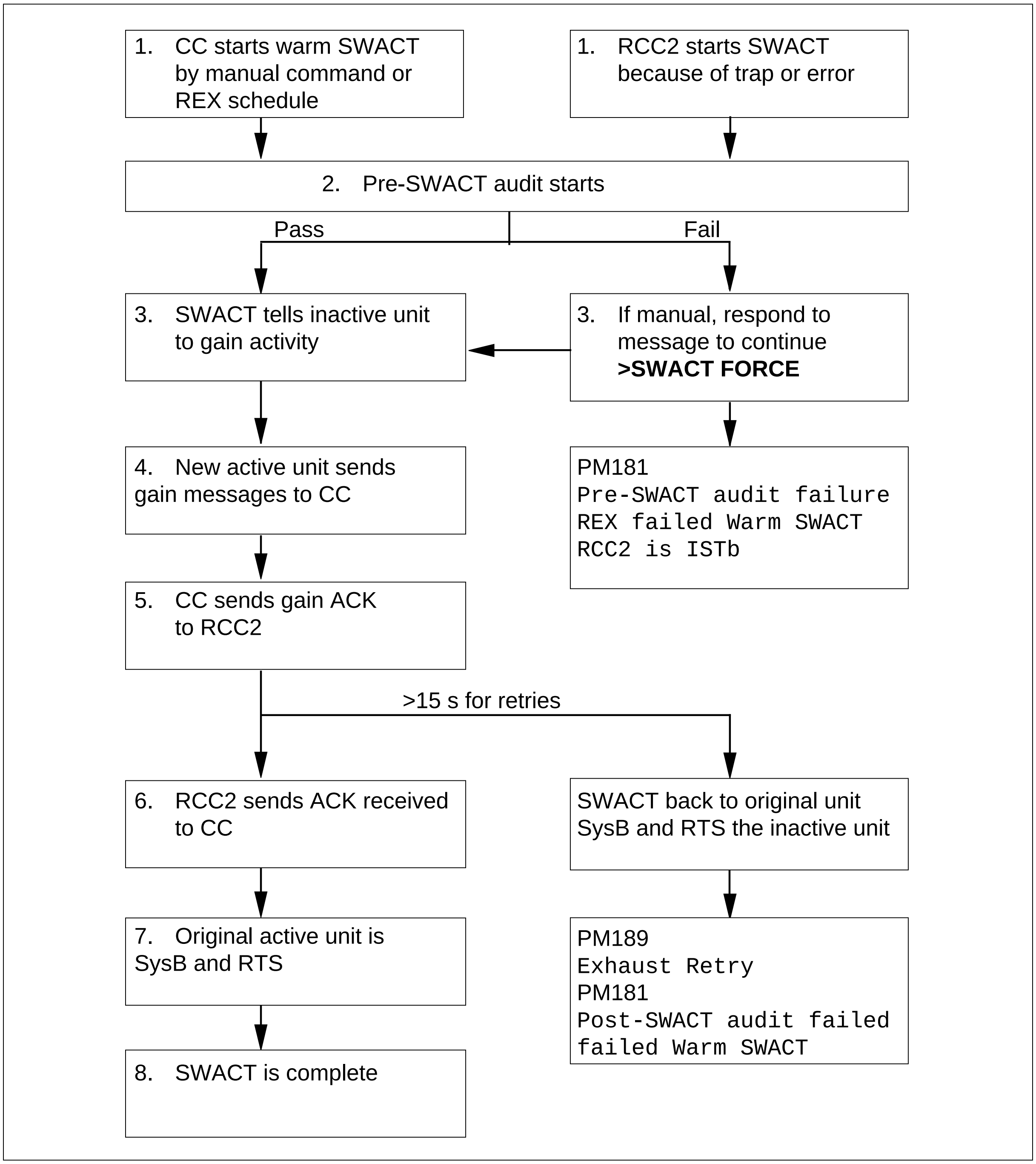
Message phrase	Description
Original active unit	Indicates active unit before the SWACT, unit 0
Original inactive unit	Indicates inactive unit before the SWACT, unit 1
new active unit	Indicates active unit after the SWACT, unit 1
new inactive unit	Indicates inactive unit after the SWACT, unit 0
Gain message	Indicates the message the new active unit 1 sends to the CC informing the CC that the unit has gained activity
Gain acknowledge message	Indicates the message the CC sends to original active unit to confirm the new active unit is sending messages

Table 1-7 Message phrases that describe CC to RCC2 SWACT communication (Sheet 2 of 2)

Message phrase	Description
Gain acknowledge received	Indicates message original active unit sends to CC to confirm the new active unit passed the post-SWACT audit
Drop message	Indicates message the original active unit 0 sends to the CC informing the CC that the unit has dropped activity

The following figure illustrates the sequence for a controlled and uncontrolled SWACT and the SWACT-back operation of feature AN0538. The following sections discuss this feature:

Figure 1-9 SWACT sequence



Pre- and post-SWACT audits

Feature AN0538, RCC2 Pre-SWACT/Post-SWACT Audit, improves the warm SWACT operation. The feature denies the SWACT if the inactive unit cannot maintain activity or communication with the CC. Under these conditions, feature AN0538 provides the capability to SWACT-back to the originally active unit. The SWACT controller in the CC and an autonomous capability added to the RCC2 software drives this feature.

SWACT controller

All manual requests and selected system requests for warm SWACTs are routed to the SWACT controller in the CC. The SWACT controller polls PM diagnostic history data located in the CC and RCC2 status data. The SWACT controller uses the poll information to determine if the SWACT controller allows the SWACT to proceed. The SWACT controller can deny the request for a warm SWACT or allow the warm SWACT to proceed. During the SWACT the new inactive unit stays in service. The new inactive unit initiates a process to clean up data structures left in states that do not have stability.

Pre-SWACT audit

Before the RCC2 executes a SWACT, the active RCC2 unit queries the mate RCC2 unit over the intermodule communication (IMC) links. The RCC2 messages the SWACT controller in the CC. Feature AN0538 improves the pre-SWACT audit of the inactive unit. With AN0538, the inactive unit includes the state of the unit during diagnostics. The inactive unit assigns a weighted value to the results of the diagnostics. The result of the pre-SWACT audit query is a boolean pass or fail.

When the SWACT controller denies a manual request for a warm SWACT, a message appears at the MAP terminal. The message indicates that the SWACT controller denies the request and provides a detailed reason for the denial. The system informs you that you can override the SWACT controller. To override the controller, enter the SWACT FORCE command. If you override the SWACT controller the system attempts a warm SWACT. The system does not consult diagnostic history or status.

Post-SWACT audit

After a SWACT, two-way communication is available with the CC and the new active unit can maintain activity. The inactive unit becomes SysB and RTSs. The system keeps the unit that was active INSV until the new active unit can check two-way communication with the CC. The new active checks the capability to maintain activity. The RCC2 executes a SWACT-back to the original active unit: if communication fails or the new active unit cannot maintain activity.

SWACT-back

If an RCC2 does not receive a gain-acknowledged message from the CC, the original active RCC2 unit initiates a SWACT-back. During a SWACT-back, the original active RCC2 unit attempts to regain activity. If the unit regains activity, the system sets the inactive unit to SysB and RTSs the unit. The active unit remains INSV. ISDN that have stability and POTS calls from the original active unit are preserved over the SWACT-back. All new calls made after the

SWACT and before the SWACT-back are dropped. If a SWACT-back is not complete, the system sets both RCC2 units to SysB and RTSs the units.

> ***Note 1:*** The system does not initialize OM and peg counts again, after a SWACT-back.
>
> ***Note 2:*** This feature is not supported during RCC2 or CC overload.

SWACT-back is provided for the following manual SWACT commands:

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

  where

  unit_no
  is the number of the active unit
- BSY ACTIVE.

> ***Note:*** A REx test initiated by the REx scheduler includes a SWACT-back. For more information on how this feature interacts with REx testing, refer to REx test.

Manual SWACT

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

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

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

Uncontrolled SWACT

An uncontrolled SWACT can occur when:

- both units are INSV
- the active unit is INSV and the inactive unit is ISTb
- the active unit is INSV and the inactive unit is SysB.

Each of these states results in a different SWACT design. The state of the units and the reason for the activity drop determine sequence of events during an uncontrolled SWACT.

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

- activity time-out
- no CC links

  Message links to the CC or host XPM are broken. Messaging cannot occur.
- duplicate fault

  A critical hardware fault has occurred.
- jammed

  The unit is jammed, meaning that it cannot change status active/inactive.
- DRCC2 sync

  This message deals with the RCC2 when it is part of a DRCC2 configuration. The original active unit of a DRCC2 cannot continue to process calls. The original active unit must SWACT to allow RCC2 and mate RCC2 synchronization.
- ready for ESA

  This message deals with the RCC2. In this event, all CC messaging is lost. If the original inactive unit does not send a drop message within a time period, the RCC2 enters ESA.
- SD damage
- The original active unit sends a drop message to the CC.
- The new active unit must send a gain message.

As with controlled SWACTs, the XPM continues to resend the gain message up to 15 s.

An uncontrolled SWACT can occur if the original active unit is INSV and the original inactive unit is ISTb. The event that causes the inactive unit to be ISTb determines the system response to the ISTb. If data synchronization causes the

IStb, the description is the same as if the active and inactive units are INSV. If data synchronization causes the ISTb, the original active unit drops synchronization and the XPM starts again. When the original active unit is ISTb, the system drops all calls.

If the original active unit is INSV less than 3 min, the unit returns to service without OOS diagnostics. The system does not run OOS diagnostics because a previous SWACT occurred less than 3 min before. The system ran OOS diagnostics on the active unit at that time. If the original unit is active more than 3 min, the active unit returns to service with OOS diagnostics.

The active unit attempts to gain activity again. If the active unit cannot gain activity again, the system sets both units and the complete XPM to SysB.

REx test

A REx test is a series of tests performed on an XPM unit. The system scheduler can begin the REx test one time each 24 h interval or operating company personnel can start the REx test manually. The REx test combines the diagnostic and functional routines available on XPMs. Results of the REx test include four classes:

- not performed
- passed
- failed
- aborted by manual action.

All four classes of REx test generate a log or display a message at the MAP terminal. The maintenance record stores REx tests that pass or fail. Failure reasons are available for REx tests that fail.

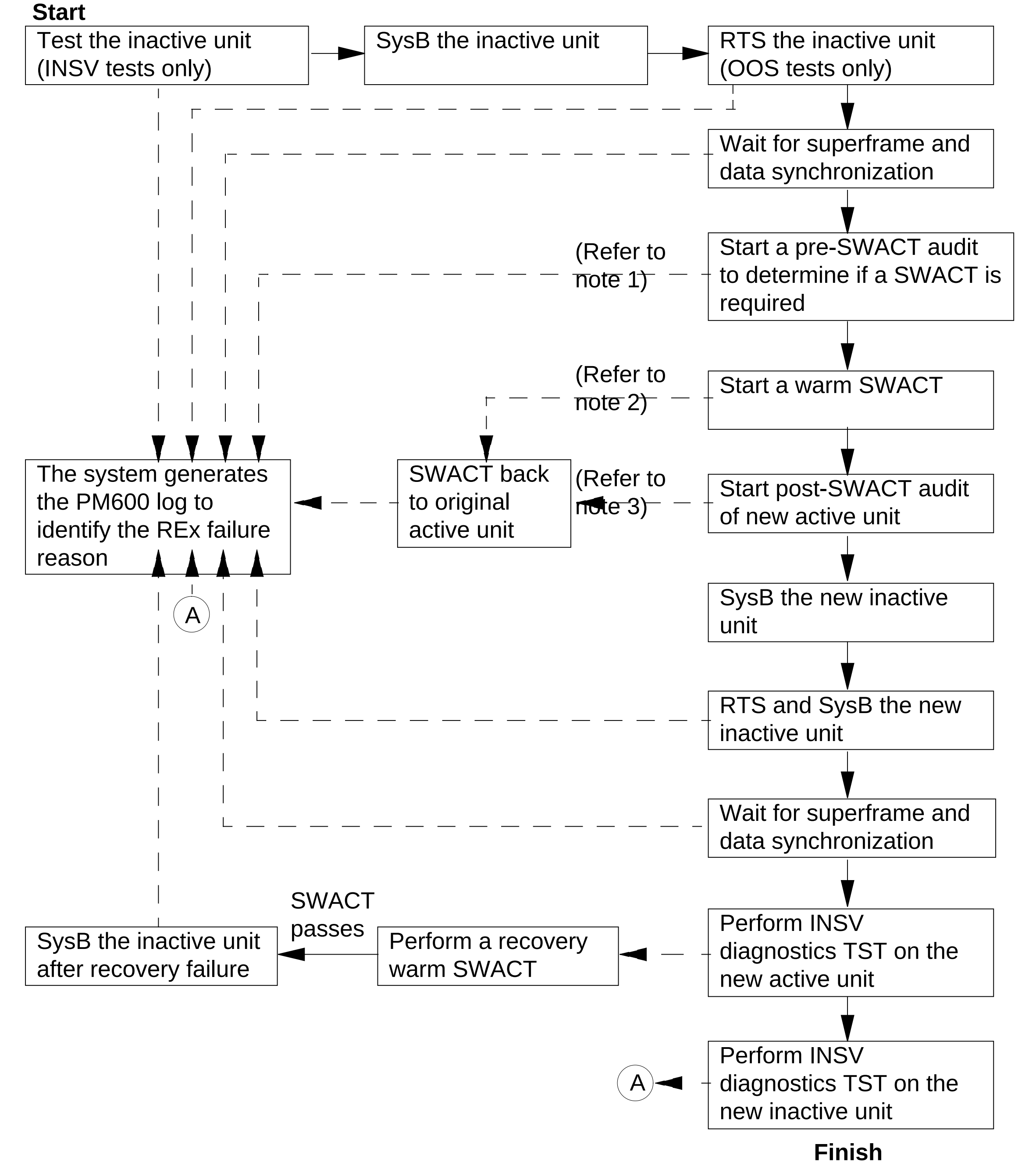
The REx test state machine, or controller, performs tests in the following order:

1. Test the inactive unit. This includes INSV tests only.
2. SysB the inactive unit.
3. RTS the inactive unit. This includes OOS tests only.
4. Wait for superframe and data synchronization.
5. Perform a pre-SWACT audit.
6. Perform a warm SWACT.
7. Maintain call processing capability on the original active unit.
8. Perform a post-SWACT audit.
9. SWACT back to original active unit if necessary.

10. SysB the new inactive unit.
11. RTS the inactive unit.
12. Wait for superframe and data synchronization.
13. Run INSV diagnostics test (TST) on the new active unit.
14. Run INSV diagnostics TST on the inactive unit.

The REx test state machine controller actions appear in the following figure:

Figure 1-10 REx test state machine actions



Note 1: Pre-SWACT audit failed.
Note 2: SWACT failed.
Note 3: Post-SWACT audit failed.

If a REx test fails, the system generates a PM600 log. The PM600 log initiates a major alarm for the XPM that fails 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 REx test completes.

If an INSV or OOS diagnostic test fails, the system provides a reason for the test failure. The REx test failure reason includes the mnemonic of the diagnostic that failed and the unit that fails. The mnemonic is an easy-to-remember abbreviation. The unit that fails is either 0 or 1.

The PM600 log details the following:

- the start time of each step the REx test executes
- the unit that the REx test step affects
- the failure reason.

The REx test steps appear in the log after the step that fails are recovery actions. The REx test starts recovery actions after the failure. The log includes the unit when the REx test action is unit-specific like:

- BSY unit
- RTS unit
- TST unit
- synchronization.

The QUERYPM, QUERYPM FLT, TST REx QUERY, and TST REXCOV QUERY commands contain information about the last REx test. Manual and system REx tests store and display a new date, time, and status in the REx test maintenance record. The status of an REx test can be either passed or failed. *Passed* means the REx test completed with no errors. *Failed* means the REx test did not complete because of an error. The status information is available through the QUERY PM and TST REX QUERY commands. When the REx test fails, you can RTS the XPM from ISTb. You can perform a manual RTS, a manual REx test or an automated REx test to RTS the XPM.

The system stores a REx test maintenance record for each XPM. The maintenance record contains the following information:

- REx test scheduler, if the XPM is in the system
- date, time and result of the last REx test
- failure reason, diagnostics failures, and a list of defective cards if the last REx test failed
- date and time of the REx test that failed before
- date and time of first passed REx test after the earlier failure.

The following restrictions apply to REx tests:

- If the office uses the NT-40 processor the system REx test controller runs a REx test on one XPM at a time. The SuperNode supports REx testing for a maximum of ten XPMs with the same REx test class, at the same time.
- A maximum of four LCM_REx_TESTs can run at the same time. The tests can run at the same time if the HOST XPM that the LCM_REX_TESTs subtend to is not being REx tested
- The S/DMS system REx test (SREx) scheduler, schedules the LCM_REXCOV tests for converter and ringing voltages in LCM.
- For a REx test to run, the node must be INSV or ISTb because of a REx test failure. A REx test can run if the node is ISTb because P-side DS-1 links are OOS.
- If a warm SWACT is not possible, a REx test will terminate.
- After successful completion of a REx test, the XPM has a new active unit (because of the SWACT).
- If a restart occurs while a REx test is in progress, the system does not generate the PM600 log. The system does not generate the log because the restart deallocates the temporary data store used to build the PM600 log.
- A manual REx test does not have a SWACT controller override.

REx test state machine I/F to the pre-SWACT and post-SWACT audits

The REx test state machine or controller:

- calls the pre-SWACT audit, messages the other unit, and initiates the warm SWACT if the audit passes
- accounts for SWACT denial and failure reasons
- terminates a REx test if a SWACT is denied
- terminates a REx test if a SWACT back occurs. The active unit of the XPM does not change from the time the REx test began. A REx test performs recovery and consists of a busy (BSY) and an RTS of the inactive unit.
- displays the failure reason for a SWACT denial or failure performed during a manual REx test at the MAP terminal as REx failed. To obtain a detailed reason for the failure, use the TST REX QUERY or TST REXCOV QUERY command for the posted XPM. In addition, the system generates a PM600 log report. The PM600 details the reason for the REx test failure.

System REx controller: XPM maintenance

Feature AF3771, System REx Controller: XPM Maintenance. Feature AF3771 provides the SuperNode switch with an SREx controller. The SREx controller coordinates all system REx tests under a common REx test scheduler. This feature allows LCM REx tests to be scheduled while other REx tests are in progress. The SREx test allows a REx test on the whole switch including all peripherals like the RSC-S in less time. REx tests provide early indication of faults that can affect service and allows operating company personnel to take action. The NT 40 systems will continue to use IOREXP for LGC node types.

Feature AF3771 allows operating company personnel to find and resolve REx test failures earlier and reduce outages in the field. The SREx test controller allows operating company personnel to:

- change the order in which the REx test, tests peripherals
- coordinate between manual- and system-initiated REx tests
- receive alarms for the RSC-S not being REx tested in a time limit set using table REXSCHED.

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

- SUSPEND suspends REx testing 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 testing after suspending REx testing.
- QUERY returns the status of the REx test as active or suspended.
- HELP returns a short description of the REx test.

The REx test order for feature AF3771 is critical nodes first, like the communications module and message switch (MS). Secondly, the number of days from the last system or manual REx test. Third, the order of internal PM, RSC-S number.

Table REXSCHED must contain data to establish the REx test schedule for the RSC-S. This table contains the information that the REx test coordinator requires to schedule the tests according to operating company specifications. To disable the test enter data in table REXSCHED. For more information about table REXCHED, refer to the data schema section of the *Translations Guide*.

The system generates the IOAU112 log report for LCMs if:

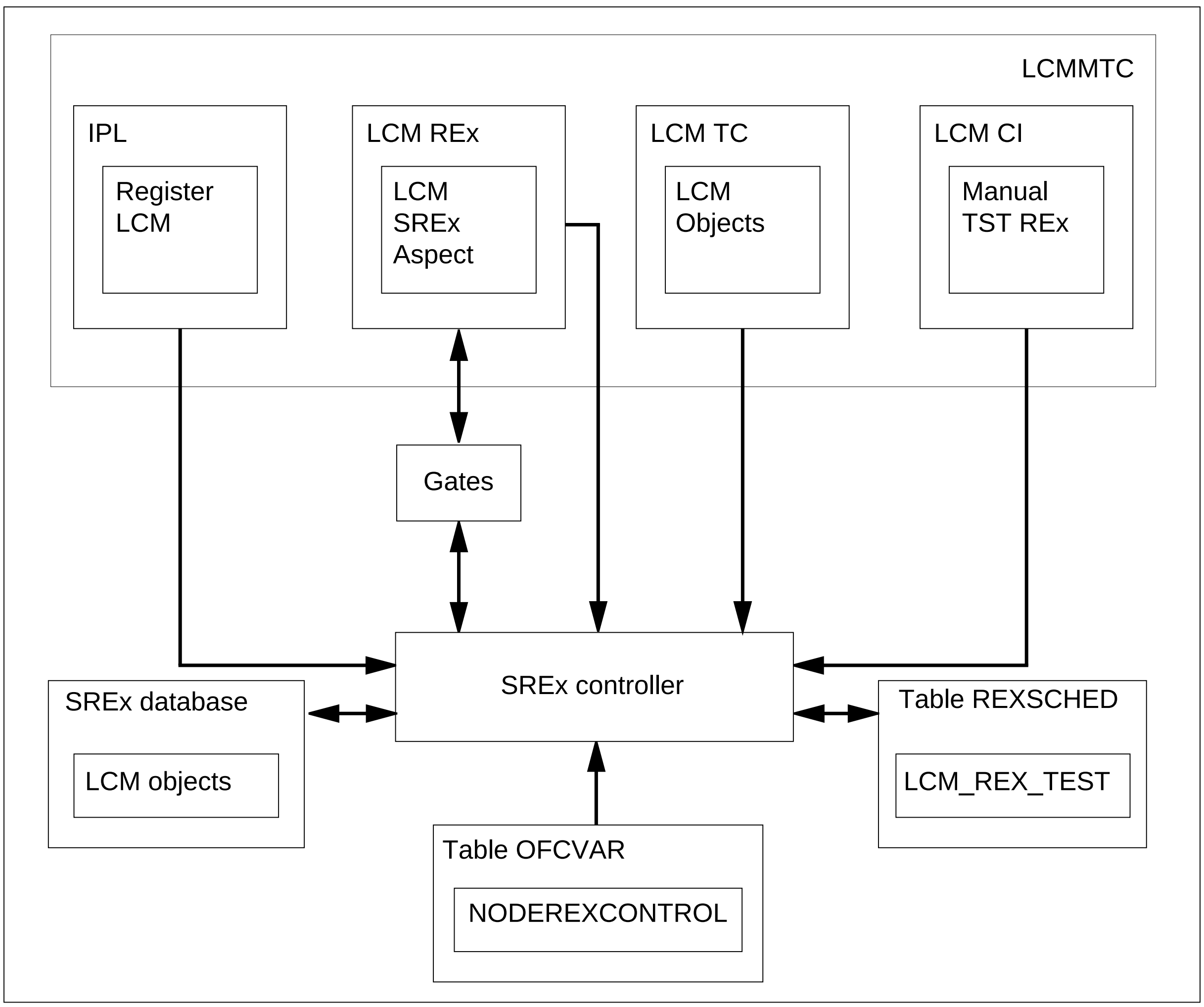
- a REx test has not run on the LCM for more than seven days
- the REx test takes longer than specified
- the REx test does not start after a defined number of attempts.

Extended line concentrating module (XLCM) REx test results

Table REXSCHED controls the scheduling of SREX tests for LCMs. The LCM_REX_TEST task SREx can run together in multiples of four and at the same time with REx tests of XPMs. The LGC, LTC and the RCC XPMs can be hosts to LCMs. Conflicts occur when an XPM scheduled for REx testing is the host of an LCM scheduled for REx testing.

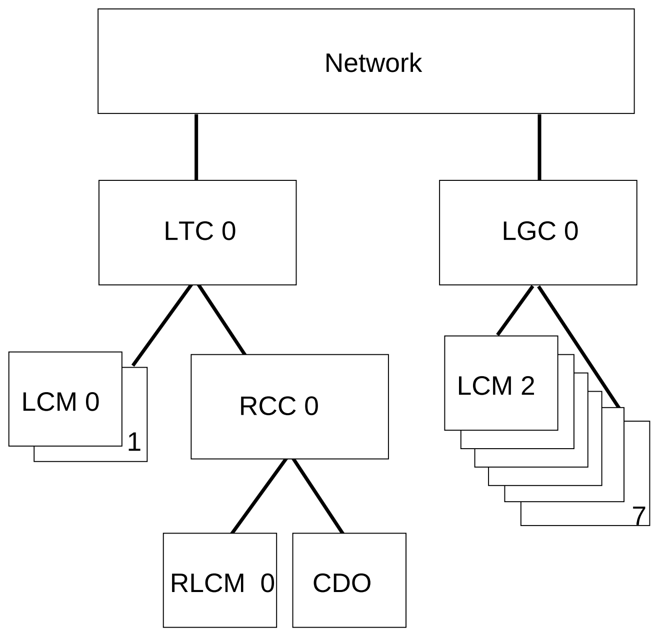
To avoid conflicts, the SREx controller schedules all REx tests of XPMs and LCMs that run together. The LCM SREx subsystem registers the LCM_REX_TEST class and identifies when the test depends on other REX_TEST types during IPL. As LCM nodes are added to the SREx database, the controller automatically enters entries with defaults in table REXSCHED.

Figure 1-11 SREx system dependencies



The converter voltage and ring test parts of LCM_REX_TEST require wait states and different test resources. The wait states and test resources cause delays in SREx main task execution. The LCMCOV_REX_TEST runs at a lower priority and starts the tests separately from the LCM_REX_TEST. The 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 execution. The entry of the PARALLEL execution field for LCMCOV_REX_TEST, in table REXSCHED, allows a maximum of one.

Figure 1-12 SREx scheduling



Note: The REx tests can run on LCM 0 and LCM 1 at the same time with REx tests that run on RCC 0 and LGC 0.
Note: The REx tests cannot run on LCM 2 through LCM 7 if a REx test runs on LGC 0.

If the LCM_REX_TEST and the LCMCOV_REX_TEST run at separate times, the site REX_TEST coverage, completes faster. Without limits of the converter voltage and ring tests, the LCM_REX_TESTs can run at the same time. The LCM_REX_TESTs can be scheduled separately for best execution periods.

> ***Note:*** The LCMCOV_REX_TEST runs on LCMs, XLCMs, OPMs and RLCMs.

Feature AF3234 provides the following REx test improvements for LCM peripherals and different peripherals, for example LCME:

- ESA REx test
- LCM and ESA-independent REx test
- MAP command for manual REx test
- fault indicators
- REx test maintenance record
- MAP commands to access REx test failures.

ESA REx

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

MAP commands for manual REx tests

The XLCM diagnostics allow a manual LCM REx test. To run the manual REx test add a REx or REXCOV parameter to the TST command. Add the parameter at the PM level of the MAP display. The following are examples of the TST command:

>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.

When you post the LCM, set manual control of scheduled LCM or LCMCOV REx tests, type:

>TST REX [ON] [OFF]

> ***Note:*** The TST command enables or disables the REx test of the posted LCM.

or

>TST COVREX [ON] [OFF]

> ***Note:*** The TST command enables or disables the COVREX test of the posted LCM.

To set LCM REx tests for immediate execution, 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 TSTOVREX NOW command:

```
LCM HOST 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”)
```

LCM and ESA-independent REx test

The scheduler starts REx tests on an LCM. When the REx tests complete, the scheduler initiates the ESA REx test. A manual LCM REx test does not start an ESA REx test. When a REx test does not complete, the system sets the LCM ISTb. The system sets the LCM ISTb if INSV diagnostics fail or SysB if OOS diagnostics fail.

Fault indicators

A REx test that does not complete causes the system to set the LCM unit ISTb or SysB. The system provides a reason for the REx failure. Audits on LCMs occur every 10 min and run INSV tests. The ISTb flag remains, with a reason for the REx failure. If the audit is not complete and the REx test detects additional failure conditions, the audit contributes to the ISTb list. When the LCM is SysB and a successful system RTS completes, the system returns the unit to ISTb. The system does not return the unit to INSV with the reason for the REx failure. To remove the ISTb, 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) one time each hour. The system generates NAG400 in response to the NAG command. The NAG400 lists all nodes not INSV. Field REX_INFO in log NAG400 displays the results of the last REx test. For LCMs, the system log lists the LCM_REX_TEST result first, separated by a colon from the LCMCOV_REX_TEST result.

NAG

The CI level NAG command displays all OOS nodes. The MAP terminal response to the NAG command is like the response in the NAG400 log report. The command and log report are part of the NAG feature. The NAG feature provides a snapshot of nodes in the system that are OOS or have a REx issue. To include offline (OFFL) nodes in the output, enter the command NAG ALL. The log report runs one time each hour. To turn the log report on and off, enter the command string NAG ON or NAG OFF.

The system includes a node in the output or log report when the node is in one of the following states:

- SysB
- CBsy
- ISTb
- ManB.

The system includes a node in the report if the node fails, aborts or does not complete the last REx test. When a node does not have a REx problem, the string ATP appears in the REx column. The string ATP appears in the REx column to indicate that all tests passed.

The following figure is an example of an abbreviated report in response to the NAG command:

```
NAG400 JUN20  11:09:08 5800 INFO Node Assessment Graph
Front End Load: FSL37AO
Level     Node      Status        REX INFO    COUNT   UNIT 0       UNIT 1
    CPU        1      ACT
CM                  NORMAL
MS                  NORMAL
MS                  NORMAL
IOD                 NORMAL
NET                 NORMAL
PM  LTC        3     ISTB          FAILED         1         ISTB      ISTB
    DTC        0     ISTB        NO_REX_RUN       4         ISTB      ISTB
    SMS        0     ISTB        NO_REX_RUN       4           .         .
    TMS        1     ISTB          FAILED         1         ISTB      ISTB
    LTC        0     ISTB           OFF           9           .         .
    LTC        2     ISTB           ATP           1           .         .
    TMS        0     ISTB        NO_REX_RUN       4         ISTB      ISTB
    SMA        0     ISTB        NO_REX_RUN       4         ISTB      MANB
    SMA        1     ISTB           ATP           2         ISTB      ISTB
    TMS        2     ISTB        NO_REX_RUN       4         ISTB      ISTB
    MSB7       0     ISTB           ATP           1         ISTB      ISTB
    LCM HOST   00 0  ISTB         FAIL:PASS       2         ISTB      ISTB
    LCM HOST   00 1  ISTB         FAIL:PASS       2         ISTB      ISTB
    LCME HOST  01 0  ISTB         Pass:N/A        4         ISTB      ISTB
    IDT        0     MANB          ----           2          --        --
    LIM        0      .          NO_REX_RUN       2           .         .
    LIM        1      .          NO_REX_RUN       2           .         .
Offline Node count: 1
```

REx maintenance records

The system generates a maintenance record to indicate results of recent REx tests for each LCM entered. This information is available at the PM level of the MAP display for a posted LCM.

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

Components

The following section identifies fault conditions in the RCC2, the RCC2 with ISDN, and the DRCC2. The section includes new diagnostics and REx test results for the XLCM.

XLCM diagnostics

The XLCM diagnostics provide the CC and the XLCM software required to test the tip/ring reversal relay on each LCM bus interface card (BIC), NT6X54. The software performs the test on each logical-drawer. You can start the test manually from the MAP display level or the system can start the test automatically. The XLCM diagnostics apply to the LCM and do not operate on the LCME.

The XLCM diagnostics provide the following:

- BIC test schedules
- test activation and deactivation
  - — BICRELAY command
- test operation
  - — system test, run according to user-defined schedule
  - — manual test, initiated from the LCM MAP display level over a single drawer of an LCM
- test results
  - — new LCM node ISTb reason
  - — PM132 log report
  - — PM181 log report.

The BIC is an I/F between the 64 line cards in a drawer and the digroup control card (DCC), NT6X52, in the LCM. Each BIC contains two identical halves that connect a maximum of 32 line cards from 0-31. The halves form a drawer pair. Each drawer of the pair is a logical drawer or digroups 0 or 1. Each LCM has ten BICs in ten drawers. Each LCM contains 20 logical drawers.

The BIC uses two relays on each half of the BIC for ringing distribution. The first relay selects between the ringing voltage and the ANI and coin voltages. The ringing voltage consists of ac ringing voltages to a telephone. The ANI and coin consist of dc voltages that perform coin-activated functions. The second relay is the tip and ring reversal relay. The tip and ring reversal relay switches ringing voltages from tip to ring and ring to tip. The BIC uses the tip and ring reversal relay for multiparty ringing.

The XLCM diagnostics tests the reversal relay only. The XLCM diagnostics allow you to schedule the system BIC relay test (BRT). You can schedule the BRT over a set of LCMs and the associated drawers of the LCMs. This procedure is known as the scheduled BRT. You can run a manual BRT on each logical drawer.

To schedule the BRT, use the information from the following two office parameters in table OFCVAR:

- BICRELAY_XLCM_TEST_SCHEDULE
- BICRELAY_MUM_SIMUL_TESTS

The parameters allow operating company personnel to perform the following:

- schedule the BRT from one to seven days a week
- define the window size
- define how many tests at the LCM-level that the system can run together.

The XLCM diagnostics provide testing at the office level, LCM, and drawer levels. The office level test loops over each LCM in the schedule. A single BRT runs on each drawer of the LCM. Test results appear in an XLCM report that combines the results of each drawer test.

The scheduled BRT runs the LCM-level test. The test selects an LCM that has not had drawers tested during the BRT window defined by office parameters. The test runs a BRT on each drawer of the LCM. The test is a single LCM drawer test. The system runs the test from the LCM-level. Operating company personnel can run the test manually from the LCM MAP display level.

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. The drawer-level test constitutes a BRT.

A new command interpreter enables, disables, resets, or queries the BRT for the complete office. The BICRELAY command has one parameter that can be ON, OFF, RESET or QUERY:

- ON

  enables the test to begin at the scheduled window
- OFF

  disables any current scheduled drawer-level tests, and does not allow the office-level test to resume
- RESET

  enables you to start the office-level tests again, if no LCMs have been tested
- QUERY

displays the following:

- the current on or off status of the office-level test
- the number of LCM-level tests now in progress
- the next LCM to be tested in the scheduled BRT.

The following is an example of the BICRELAY command:>**BICRELAY ON**

The system BRT displays results of each LCM-level test in the form of a new PM132 log report. The PM132 displays a combined report of each drawer-level test in a given LCM. The following limits apply:

- The system test sets the logical drawer ManB before the relay test runs. If any lines are in a call-processing BSY state, the system test skips the drawer for the test cycle.
- Maintenance personnel must set the drawer to ManB before the manual BRT on a single drawer runs.
- If each logical drawer does not contain one or more NT6X17 line card, the XLCM does not test the drawer.
- This test does not run on an LCM together with automatic line tests (ALT) or REx tests.
- The BRTST_START_TIME and BRTST_STOP_TIME fields of the BICRELAY_XLCM_TEST_SCHEDULE office parameter cannot be entered with the same value. There must be at least a 10 min time span between each parameter.

The XLCM diagnostics use the test access bus, metallic test equipment, and a single NT6X17 card in each drawer to complete the test. If you run the ALT at the same time as the BRT this can cause delays to both tests. If REx test starts on an LCM, the system does not run the BRT on that LCM. The LCM remains the same state, and the system generates the PM181. The log indicates that the BRT did not run because of a REx test in progress.

XLCM REx test results

The REx tests provide an early indication of faults that can affect service. The tests allow operating company personnel to take action. An office parameter controls REx tests that the system starts for LCMs. The office parameter determines the time interval to perform REx test on the LCM. The LCMs are REx tested one at a time, in the order in which the tests are entered. A REx test involves OOS and INSV tests run on both LCM units.

> ***Note:*** Before this feature, only the system scheduler was able to initiate a REx tests on an LCM. No manual REx test was available.

Changes that this feature generates to the system REx test do not change the functionality of the current diagnostic subtests.

Feature AF3234 provides the following REx test improvements for LCM peripherals and variants of the LCM peripherals like LCME:

- ESA REx test
- LCM and ESA-independent REx test
- MAP command for manual REx test

- fault indicators
- REx test maintenance record
- MAP commands to access REx test failures.

ESA REx The ESA REx test is performed on ESAs that are subtended for RLCMs. The ESA REx tests the ability of RLCM units to enter and exit ESA. The ESA REx tests the ability of RLCM to message to the ESA processor while in ESA. Before this feature, the ESA REx test started by a system or manual request. This functionality does not change. The XLCM diagnostics change the order of the system REx test. The system implements the ESA REx test after the system LCM REx test is complete. The ESA REx is not as a subtest.

LCM REx Before this feature, the system scheduler started an ESA REx test as part of the LCM REx subtests. The scheduler now starts REx tests on an LCM. When the REx test is complete the scheduler starts the ESA REx test. LCM REx test that manual action implements does not implement an ESA REx test. When a REx test does not complete, the system puts the LCM in an ISTb state if INSV diagnostics fail. The system puts the LCM in a SysB state if OOS diagnostics fail.

MAP command for manual REx test The XLCM diagnostics allow you to implement a manual LCM REx test. The addition of a REx test parameter to the TST command at the PM level of the MAP display accomplishes the manual REx test. The following is an example of this command:>**TST REX QUERY**

Note: Perform all subcommands on one posted LCM.

Fault indicators A REx test that is not complete sets the LCM unit to an ISTb or SysB state. The reason for the change in state is that the REx failed. Audits on LCMs occur in 10 min intervals. These audits run INSV tests. Before this feature a successful audit cleared the ISTb flag. This feature affects only a successful audit. The ISTb flag remains with a REx failed reason. If the audit is not successful and the audit detects additional failure conditions, the audit contributes to the ISTb list. If the LCM is in a SysB state and a successful system RTS occurs, the unit returns to an ISTb state. The unit returns to an ISTb state instead of an INSV state with the REx failed reason. Operating company personnel receive notification of a REx test failure. To remove the ISTb state, the LCM must complete a manual RTS or a manual or scheduled REx test.

REx test maintenance record A REx test generates a maintenance record. An internal database stores the maintenance record to indicate the results of REx tests for each LCM entered. Each time REx test activity occurs the system updates the maintenance record. This information is available at the PM level of the MAP display for a posted LCM.

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

MAP commands to access REx test failures The QUERYPM FLT command indicates that an LCM unit is ISTb or SysB because REx failed is the REx test failure reason. Use the TST REx QUERY command to provide the test ID of the subtest. The card list that is the cause of the REx test failure also provides test ID for each unit.

RCC2

The most common way to test the RCC2 is to issue the TST command. The type of tests depends on the RCC2 state and the TST command parameters. The following determine fault conditions for the RCC2:

- overload indicators like PM128 and QUERYPM
- REx tests
- audits of the intermodule communication links
- RCC2 parity errors.

Overload resources

An overload occurs when the amount of call processing on an LCM is greater than the LCM processor cards can handle. When an overload occurs the RLCM accepts calls at a slower rate until the overload clears. Normally, the LCM queues call requests and assigns priorities to the call requests in the data store of the LCM. As the data store reaches capacity, RLCM overload controls, slow the rate of load acceptance. The RCLM can stop the call process until data store is available. The LCM overload control occurs for:

- Central-side (C-side) communication

  The LCM processor cards can slow or stop C-side communication. When this process occurs the LCM processor cards decrease the rate at which the cards scan for messages on the C-side. When the LCM processor cards slow the incoming workload, the need for data store decreases. This process shows the MAP display queries of LCM status slow, and the C-side responses to terminals that the LCM supports.

- line scanning

  During overload, LCM processor cards terminate the scan of the BIC until data store is available. When the LCM processor cards stop the scan of the BIC, the LCM prevents incoming work from the P-side. The LCM queues the work in the BIC output buffers. When the buffers are complete, the LCM does not accept any more work. This action results in partial dials or ignored keys on business sets.

Display of overload state

When the LCM becomes overloaded, the LCM status display changes to ISTb while both units display INSV. When you enter the QUERYPM FLT command at the LCM level, the MAP response includes the following message: `LCM Overloaded`.

Overload indicators (PM128, QUERYPM

When the RCC2 enters overload, the system generates a PM128 log, RCC2 is ISTb. The PM128 log contains the message: `PM Overloaded`. To receive the same message, post the RCC2 at the PM level of the MAP display and enter QUERYPM FLT.

When the RCC2 overloads, immediately start to collect all important OMs that track the amount and types of traffic. The reason that the RCC2 enters overload can relate to a maintenance area, like network faults. The reasons can relate to under engineering of the RCC2 configuration. Forward the OM reports to both maintenance and engineering personnel for analysis.

Log reports PM128 and PM181 indicate the LCM overload condition. When call processing resumes, the system generates log PM128. Log PM128 contains the following message: `LCM out of Overload`.

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 CPU. Flow control regulation begins when the CP level tasks use a percentage threshold of the real time available to the CP level. When CP level tasks use a smaller percentage of real time, flow tasks send a message that indicates the overload condition has passed.

XLCM overload control

The XLCM has a number of small, medium, and large memory blocks (LMB). All of the memory blocks are of a fixed size. Domestic LCMs and XLCMs use small and LMB to receive external messages and to send messages. The XLCM uses small memory blocks (SMB) for utility purposes like timer control blocks. The XLCM uses medium memory blocks (MMB) for call data blocks (CDB). The CDBs hold data associated with active lines.

The XLCM reports overload when the XLCM cannot receive an external message because not enough small or LMB are present. An external message is a DMSX or interunit communication (IUC). Service degradation can occur before the XLCM enters overload.

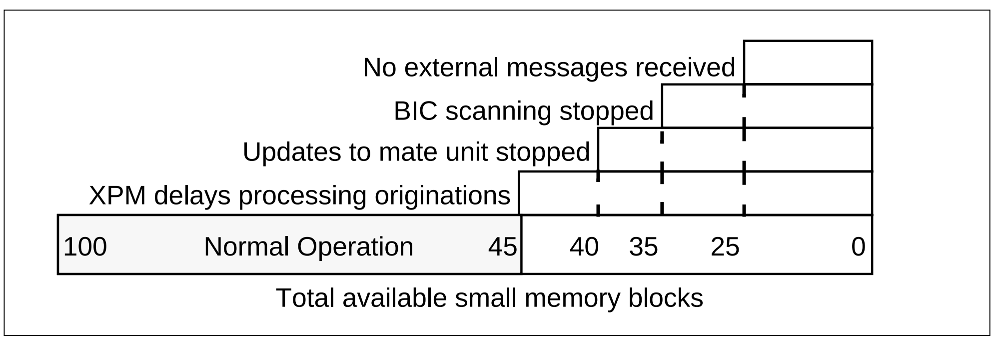
An XLCM has four throttle levels to prevent overload. Three of the levels are based on the number of available SMB. The levels conserve SMB and are weighted to give terminating calls priority over originating calls. The four levels of throttle are as follows:

1. An XPM throttles two messages to an XLCM each 50 ms. The throttle controls small peaks of heavy traffic. Sustained messaging at this rate can drive the XLCM far into overload.
2. An XLCM appends the number of available SMB. The XLCM appends the available SMB for external messages to each POTS origination message and all messages that originate from P-phones. The number = the total available SMB - the number of SMB reserve. When the number is less than 20, the XPM delays processing the origination until the number returns to 20 or greater.
3. The total number of SMB available for external messages is less than 15; total available SMB - number of SMB reserve < 15. An XLCM stops sending call processing updates to the mate of the XLCM.
4. The total number of SMB available for external messages is less than 10; total available SMB - number of SMB reserve < 10. An XLCM stops scanning the bus interface cards (BIC) for line scan changes.

An XLCM has a reserve of SMB that do not receive external messages. The XLCM has the reserve of memory blocks to protect the XLCM during overload. When the XLCM enters overload, internal processes have enough SMB to finish the tasks. The total number of SMB available can be less than or equal to the size of the SMB reserve. In this event, the XLCM rejects external messages that require SMB except the maintenance or monitor messages. The XLCM sends an overload report to the CM.

The overload protection system is static. Throttle levels are constant, nonreactive, and distributed because there is no one place where overload is monitored. There is no place where protective measures are initiated and controlled.

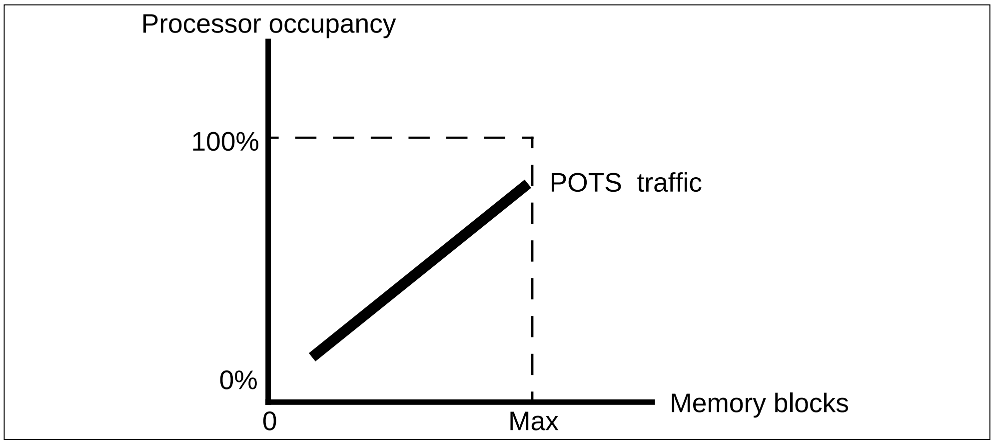
Figure 1-13 XLCM overload protection system



Early POTS models of the small memory LCM 64 k, have limits to the memory block capacity. The LCM would run out of SMB before the LCM would run out of real-time use. The design of the LCM depends on the memory block capacity. Memory block limited is an LCM characteristic that carries over to XLCMs.

The XLCM overload system works with POTS traffic. The present number of SMB is 100 and the size of the SMB reserve is 25. The processor continues to be memory block limited. The processor runs out of SMB before the processor runs out of real-time use. The following graph shows processor occupancy or real-time use compared to memory block use.

Figure 1-14 Processor occupancy (real-time use) versus memory blocks



The XLCMs have more memory blocks than small-memory LCMs. There are extra messaging requirements for the XLCMs like P-phones provisioned with features like displays and Multiple Appearance Directory Number (MADN). The XLCM can run out of real time before the XLCM runs out of memory blocks. This action causes a real-time overload condition. The following charts are examples of real-time overload conditions:

Figure 1-15 Processor occupancy—real-time overload

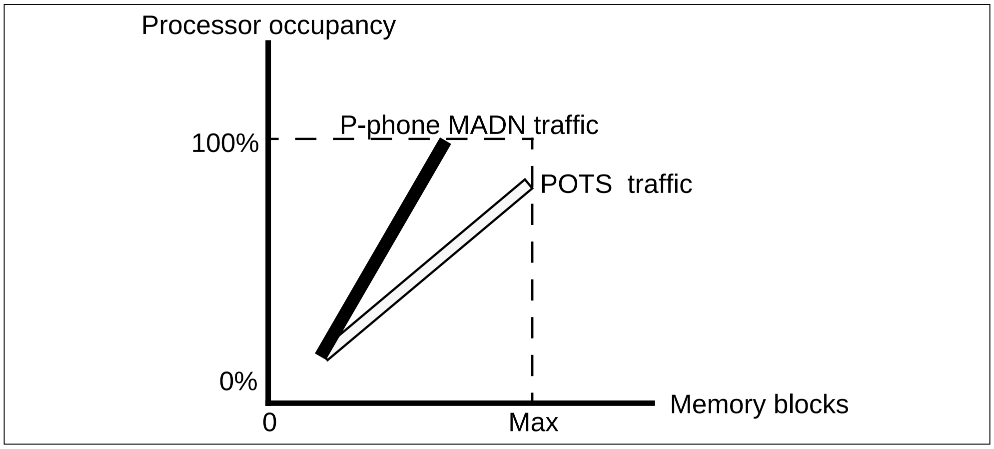
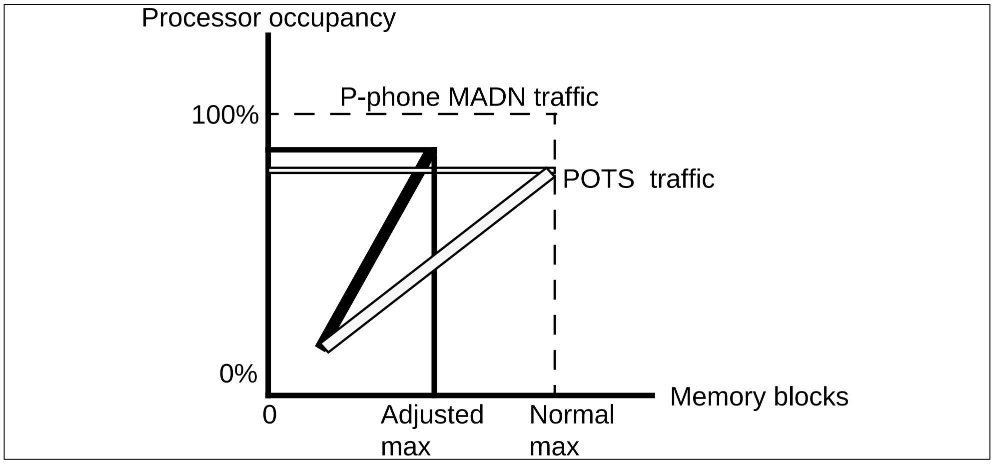


Figure 1-16 Processor occupancy—memory block reduction after real-time overload detection



The XLCM is memory block limited. Outages can occur because the XLCM cannot handle real-time overload. Outages can occur under the following conditions:

1. no overload report is sent because the XLCMs do not detect real-time overload. The CM does not suspend functions that require a response from the XLCM. The CM does suspend functions when the system reports an overload. If the XLCM does not respond in time, the CM sets the XLCM SysB.
2. the XLCM cannot handle starvation when lower priority tasks do not run. This can lead to traps or important software errors that cause the CM to set the XLCM SysB.

Enhancements to the overload protection system

The enhanced XLCM overload protection system detects when an XLCM is in real-time overload. The XLCM reports the overload to the CM. The XLCM takes protective measures to maintain XLCM sanity. The protective measures are active for a short time to retain the XLCM call processing capacity.

This enhancement adds three new components to the current overload protection system. The current overload system modifies to accommodate the three new components:

1. processor occupancy data collection

   This component is distributed over areas of XLCM code. This component collects the data that is not formatted but detects real-time overload. The component leaves the data that is not formatted in a depository for the data analysis component. The data analysis component matches the priority of the segment of the system in which the component resides.

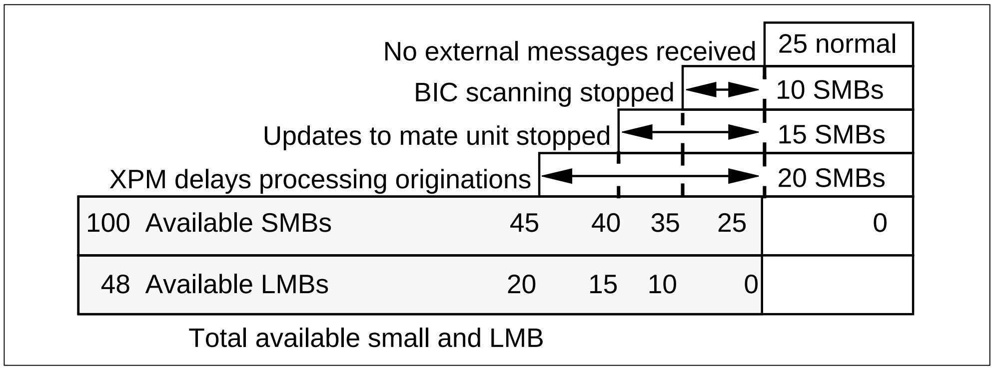
2. real-time data analysis

   This component analyzes data in the depository, and indicates processor occupancy status. The status is not a percentage. The status is a distress rating. The component does not use a percentages because percentages are difficult to work with, when real time is not available. Percentages do not supply all of the information that the control component requires. When an XLCM reports overload, the control component uses the distress rating and reports the data to the CM. The data analysis component indicates the activity of the component and, if the component runs at normal intervals. This component runs at a high priority.

3. real-time overload control

   This component scans the distress rating that the data analysis component generates. If the rating indicates real-time overload, the control component adjusts parameters in the overload protection system. The component adjusts the parameters to recover some real-time. The adjustments keep memory block limits ahead of the real-time limits of the XLCM. If the data indicates no trouble, the control component restores the overload protection system parameters to allow maximum call processing. This component runs at a very high priority. An example of real-time overload control appears in the following figure:

Figure 1-17 Overload protection system variable thresholds



Changes to the real-time subsystem

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

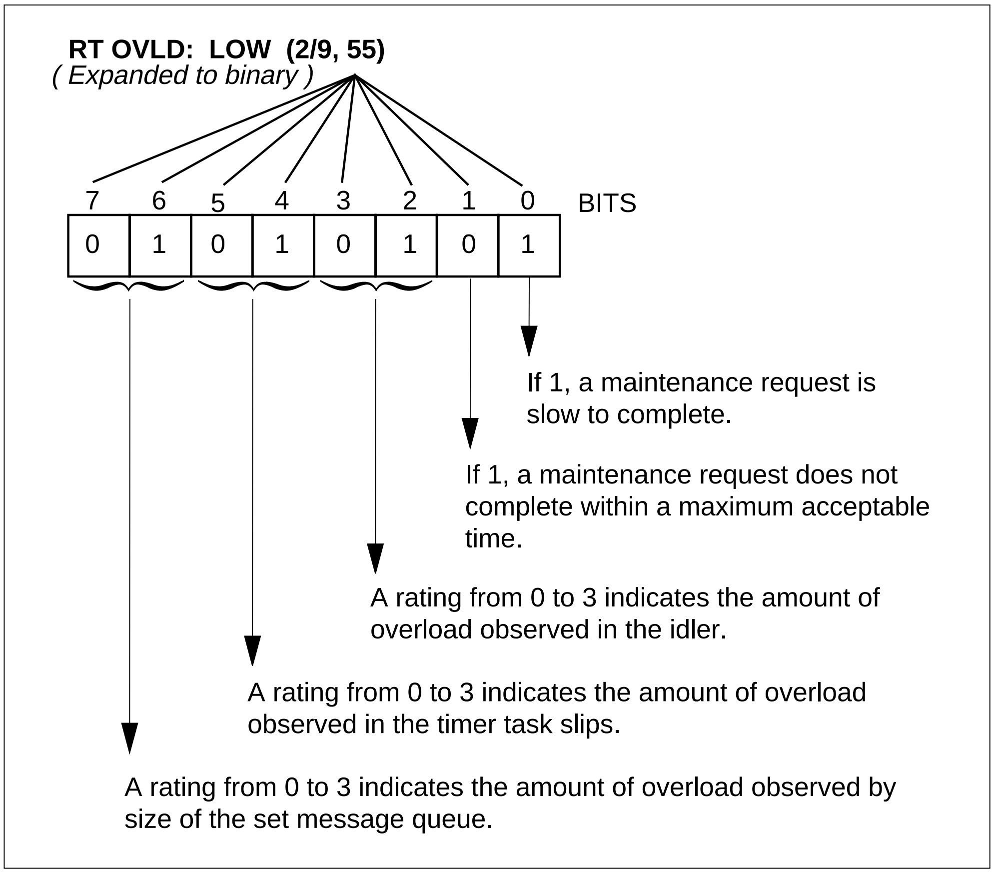
The following are enhancements to the real-time subsystem:

1. To preserve real-time, work shedding reduces the number of memory blocks available for external messages. Work shedding reduces the number of memory blocks for all associated throttles, until the XLCM recovers some real-time use.
2. Real-time overload is a processor occupancy rate of 75% or higher for a minimum amount of time. The calculation of percentages is real-time intensive. This is not a flexible method of calculation. This method of calculation can cause a premature reaction if the XLCM is not in severe real-time trouble.
3. The subsystem monitors the amount of time required to process key maintenance requests at high levels, but not 100% of occupancy. The subsystem makes sure that the XLCM responds to the requests before the CM times out or enters overload. The average time to process these key requests is benchmarked. If processing time takes longer than the benchmarked average, assume real-time overload.
4. The subsystem monitors idle task activity. The XLCM enters real-time overload if an idle task does not run for a specified period of time.
5. The timer task slip counter has a high occupancy, but not at 100%. If the timer task slips at more than the normal high occupancy rate, the XLCM enters real-time overload.
6. The subsystem monitors the size of the set message queue. If the queue gets too high, 40 or above, the XLCM is near real-time overload.
7. The subsystem has LMB in the work shedding component. The LMBs can recover real-time.

XLCM log report appendages

An XLCM adds a new field to current overload messages sent to the CM. The new field indicates the level of real-time overload. When the CM is at CCM04 or later, the new information appears in two logs. The information appears in the modified PM180 LCM Enters Overload log and modified PM180 LCM Overloaded log. The field contains a ratio of the maximum real-time distress level reached. The distress level is reached before the system generates the overload report, values 0—9, to the maximum level of real-time distress, values 5—9. The log report provides a real-time overload indications summary byte in hexadecimal format. An example of the summary of real-time overload indications appears in the following chart:

Figure 1-18 Summary of real-time overload indications



The XLCM maintains overload data that allows the XLCM to provide a summary of the overload period. The XLCM adds the summary 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 includes the information.

This feature is active in XLCMs and international XLCMs with extended memory and XPM04 loads. The new logs automatically apply when CCM04 is installed in the CM.

This feature detects real-time overload to report overload status to the CM. The feature preserves enough real-time to make sure that the XLCM functions according to the memory block limited operating model.

The system integrates the real-time overload detection and protection subsystem into the current memory block overload system. When real-time trouble occurs, the system sheds work. To shed work the system changes the memory block overload system parameters. The system sheds work to reduce the amount of memory blocks available for new work. This feature makes the new overload system dynamic. The system can adjust to allow high processor occupancy in any traffic configuration.

LCM talk battery audit

Before the Talk Battery Alarm feature, the system did not report loss of talk battery unless the talk battery fuse did not work. The system did not alert maintenance personnel that LCM subscriber lines were not able to have dial tone.

The Talk Battery Alarm feature adds new CM and LCM maintenance software. The new software audits each LCM shelf for the presence of talk battery. If the audit fails to detect talk battery, the system generates critical alarm log report PM179.

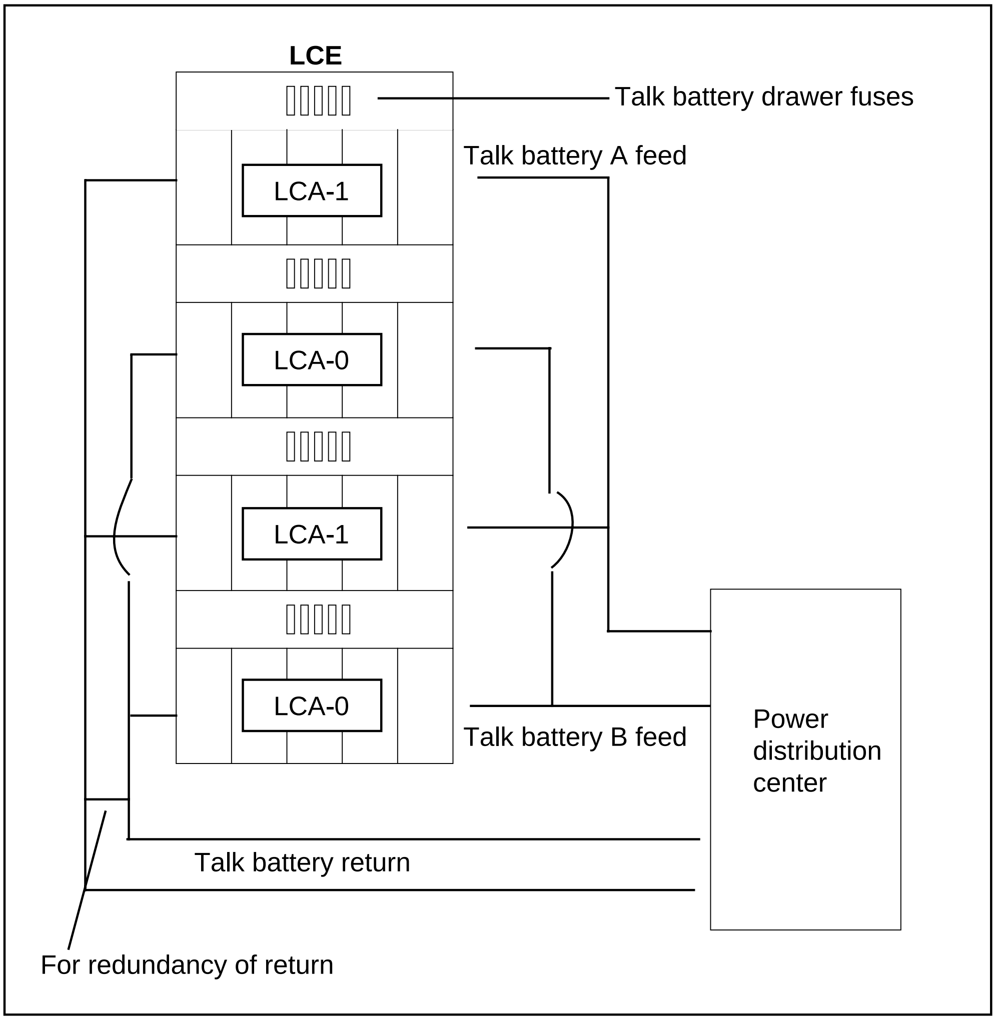
To support this feature, each LCM shelf must have a minimum of one world line card (WLC). A subscriber can use the WLC for the talk battery audit for call processing. With this feature, the system generates a minor alarm log report PM179 if WLCs are not available to perform the audit.

> ***Note:*** This feature supports all WLC types. The WLC can reside in the LCM shelf.

Loss of talk battery

The following figure is an example of how talk battery is distributed in a line concentrating equipment (LCE) frame with four shelves:

Figure 1-19 Talk battery distribution on LCE framexxx



The A feed provides talk battery for the second and fourth shelves of the LCE frame. The B feed provides talk battery for the first and third shelves. The feeds are not redundant. A single fault that loses a feed can affect two shelves that hold a maximum of 640 subscriber lines.

> ***Note:*** Talk battery returns have redundancy. A single fault cannot cause an outage.

Before this feature the system did not identify a loss of talk battery. The system did not identify a loss of talk battery unless the outage blew the talk battery fuse. If the fuse blows, the LCM indicates `INSV` on the MAP display. The LCM performs a line card audit. The audit cannot check for loss of talk battery. The loss of talk battery can affect one or two LCM shelves. The location of the fault determines if the loss affects one or two shelves.

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

Feature activation

Change the value of office parameter TALK_BATTERY_ALARM in table OFCENG to activate the Talk Battery Alarm feature. The Talk Battery Alarm feature is disabled by default. Each LCM shelf in the office must include a WLC before the LCM can activate this feature. A minor alarm occurs for each LCM shelf that does not contain a WLC.

While the Talk Battery Alarm feature is active, diagnostics and background audits perform talk battery testing.

When you disable the Talk Battery Alarm feature, talk battery alarms and ISTb reasons that this feature introduces automatically clear.

Background audit

Each LCM can audit the shelves for loss of talk battery. When you disable the Talk Battery Alarm feature, audits do not run. When you disable the alarm the LCMs in the office do not run a check for the loss of talk battery.

When you activate the Talk Battery Alarm feature, the system performs a search 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 an available WLC is not found, the system generates minor alarm log report PM179. Pm179 indicates that the system cannot test talk battery, and the LCM becomes ISTb. If an available WLC is found, a special audit checks for loss of talk battery feed. The audit occurs a minimum of one time each minute. All LCM shelves are tested at the same time so that each LCM shelf is checked. Audits do not run talk battery tests on an OOS LCM.

If the available WLC used for audit testing is not available, the audit searches for another available WLC. For example, if the WLC goes OOS. If another available WLC is found, audit testing continues with the new WLC. If an available WLC is not found, the system generates a PM179 minor alarm log report. The Pm179 indicates that the system cannot test for talk battery. The LCM shelf is set ISTb.

To test for loss of talk battery feed, the WLC checks the presence of talk battery feed to the WLC. The test passes if talk battery feed is present and fails if the feed is not present.

If an INSV WLC is occupied, the system does not perform a talk battery test but assumes that the test passed. This condition occurs by off-hook or call processing busy (CPB), or both. 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 LCM shelf becomes ISTb. The audit does not report the failure until diagnostics clear the alarm and ISTb state.

Diagnostics

The talk battery test is incorporated into INSV and OOS diagnostics for an LCM unit. The diagnostics affected 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, even if you repeat the test on the same LCM. If the talk battery test passes, diagnostics clear the alarm and ISTb reason. Manual and automatic versions of these commands are affected. Diagnostics operate talk battery tests when the talk battery alarm feature is activated.

To support the Talk Battery Alarm feature, each LCM shelf must have a WLC. There are no provisioning rules for the location of the WLC in the shelf. The maintenance line card in LSG 0 Card 0 for the LCM shelf can be assigned a WLC. If the card has a WLC the card can be used by the feature to test the ringing generators.

The MAP commands that BSY the last available WLC on an LCM shelf are modified to issue a warning message. The warning message indicates if this condition occurs. These commands are as follows:

- BSY

  Enter the BSY command at the LTP MAP level when the system posts a WLC.
- DIAG

Enter the DIAG command at the LTP MAP level when the system posts a WLC. The DIAG ManBs the WLC but not permanently.

- BSY DRWR

  Enter the BSY DRWR command at the PM MAP level when the system posts an LCM.

If one of these commands causes the last available WLC on the LCM shelf to be busied, a warning message appears:

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 1 min unless WLC becomes available.
```

The QUERYPM FLT command is modified to display new ISTb reasons by shelf and line equipment number (LEN) for both alarm conditions. The alarm conditions appear in the following MAP response:

Example of a MAP response:

```
Node inservice trouble is present:
    One or both units Inservice Trouble:
LCM UNIT 0 Inservice Trouble is present:
    Talk Battery failure detected on shelf <shelf #> by
<LEN>       LCM UNIT 1 No Faults are present

or

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

The MAP commands that RTS the first available WLC on an LCM shelf are modified to issue the following notification messages. The notification messages indicate that the minor alarm and ISTb reason for the LCM shelf is clear. The ISTb reason is clear now that a WLC is available to test for talk battery failures. The following commands can cause this condition are:

- RTS

  The following MAP response appears when you enter the RTS command at the LTP MAP level. This condition occurs when the system posts and RTSs a WLC.

  Example of a MAP response:

  ```
  RTSing the first available WLC on the LCM shelf.  The LCM
  shelf can detect a loss of talk battery.  The minor alarm and
  ISTb reason can be cleared for the LCM shelf in 10 min (unless
  the last WLC is not available again).
  ```

- RTS DRWR

  The following MAP response appears when you enter the RTS DRWR command at the PM level while the system posts an LCM:

  Example of a MAP response:

  ```
  RTSing DRWR of the first available WLC on the LCM shelf.  The
  LCM shelf can detect a loss of talk battery.  The minor alarm
  and ISTb reason can be cleared for the LCM shelf in 10 min
  (unless the last WLC is not available again).
  ```

This command does not affect ESA for RCC2. Talk battery alarm conditions are ignored. When the ESA exit procedure occurs, the CM diagnoses the LCM to determine if talk battery failures are present.

Limits

The following limits apply to the Talk Battery Alarm feature:

- The following LCM types support the Talk Battery Alarm feature:
  - XLCM 256 Kbyte capacity
  - LCME
  - cabinetized XLCM (ELCM or Meridian cabinetized LCM)
  - remote line concentrating module (RLCM)
  - OPM, cabinetized RLCM with 256 Kbyte capacity.
- You can use the same WLC for talk battery testing and as a subscriber line. If 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 a maximum delay of 90 ms before the subscriber receives dial tone. If the talk battery test is in progress the WLC can receive a call termination request. If the WLC receives this request an additional maximum delay of 90 ms can occur before ringing begins. For both originations and terminations, there is no call processing result other than this small delay.

- The Talk Battery Alarm feature can detect only the loss of talk battery *feed* to an LCM shelf. The WLC limit does not allow the detection of the loss of talk battery *return*. Talk battery returns are duplicated and return failures are less possible to occur. For additional support, refer to figure Talk battery distribution on LCE frame.
- The CM does not perform talk battery tests while the LCM or one of the C-side nodes is in the overload condition.
- The Talk Battery Alarm feature only isolates shelf-level failures of talk battery feed. The only talk battery feed failures always reported are failures that affect talk battery for all lines on the LCM shelf. Drawer-level failures can be detected. Detection depends on the drawer in which the WLC resides and the drawer in which the failure occurs.
- Faults that occur in the WLC or the drawer can prevent the WLC from correctly detecting talk battery failures. These include faults that cause the WLC to fail line card diagnostics. In this event, the WLC can report a talk battery failure that is not correct and cause a critical alarm. The WLC can report talk battery failure, even if talk battery is present for other lines on the shelf. The critical alarm log report PM179 details the location of the WLC to help troubleshoot these occurrences.
- The Talk Battery Alarm feature does not affect ESA operation on the following components:
  - — RCC
  - — RLCM
  - — OPM.

The system ignores talk battery alarm conditions or reports, during ESA. Talk battery failures are not reported while an LCM is in ESA mode. During the ESA exit procedure, the CM diagnoses the LCM to determine if talk battery failures are present.

- When the Talk Battery Alarm feature for an office, is active each LCM in the office can audit for talk battery failures. A maximum of 10 min can pass before each LCM in the office begins to audit for talk battery failures. The length of time the LCM audit takes to cycle through each LCM in the office determines the delay time. An office with heavy traffic and a large number of LCMs can take longer than 10 min before each LCM begins to audit.
- If the SERVORD OUT command deletes the directory number (DN) assigned to the last WLC on an LCM shelf, a minor `Cannot test Talk Battery` alarm occurs. The alarm message indicates the WLC for which the last assigned DN was deleted. In this condition, the WLC is HASU. the WLC is in a maintenance state that prevents the LCM use of

the WLC for detecting talk battery failures. Use one of the following solutions to resolve this condition:

- — BSY and RTS the LCM. This is not recommended because of service outage. The WLC can be in the correct HASU maintenance state so that 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 a DN assigned. This option requires additional hardware, like an additional WLC. The option provides redundancy for the Talk Battery Alarm feature.
- — Assign a DN to the WLC so that the LCM can use the WLC for talk battery testing. This option provides the easiest answer.

REx

For the REx test sequence to run, both units must be INSV. The REx test does not operate if the following conditions are present:

- a REx test is running on a HOST XPM where this node is subtending
- warm SWACT is not turned ON for the PM
- one unit is SysB, the PM is ISTb
- the units, are SysB, the PM is SysB
- the PM is in overload
- the PM is ISTb.

> ***Note:*** If the PM is ISTb because of a previous REx test, the REx test operates again.

When the TST REx NOW command terminates the the REx test, the terminal displays a message. This message indicates the reason the REx test was terminated. The system generates a PM181 log with the same type of message.

Audits of the intermodule communication links

An audit operates sanity tests on intermodule communication links to make sure the data on those links is not lost nor corrupted. The audit operates on the inactive and active units. If a fault is detected, only the active INSV unit reports the fault to CC. The following procedures occur when a fault is detected on the intermodule communication link or links:

- the link is closed
- the RCC2 status changes to ISTb
- the RCC2 units no longer communicate over the links; a warm SWACT cannot occur

- the system generates a PM128 log
- at the RCC2 level, the QUERYPM FLT command contains the message `NON-CRITICAL HARDWARE FAULT`.

Handling a parity error fault

If a parity fault is detected, the fault can be corrected without a loss of service. This section provides information on:

- the types of parity faults
- a summary of the actions the CM takes to deal with parity faults
- the actions that operating company personnel must take.

The three types of parity faults are:

- An intermittent fault, occurs when the system detects a fault, but no error is found during the reread of the location.
- A soft fault, occurs when the system detects a parity error. An error is found when the XPM tries to reread the location. An error is not found when the XPM tries to write to the location. The error can occur in the program store or memory store.
- A hard fault, which occurs when an XPM detects a fault and cannot reread or write to the memory location.

When a parity fault occurs, the CM determines the correct action to perform on the XPM unit. This action depends on the state of the unit that reports the active or inactive fault. All three types of faults are handled the same by the CM.

When the CM detects a parity fault in the active unit of the XPM, the CM sets the unit ISTb. The system sets the unit to ISTb with a reason of parity. The CM recovers the unit during a maintenance window. The maintenance window for recovering a parity fault on the active unit is the XPM REx test window. If the time for the XPM REx test window is identical to the current time of the switch, an audit checks if the active unit of the XPM has an ISTb of parity. If the audit finds an ISTb, the CM can SWACT and reload the XPM if there are no requirements. This action clears the ISTb parity fault and the short term failure (STF) parity fault peg and resolve the parity fault in the XPM.

When the active unit reports the parity fault, the system generates a PM181 log to notify operating company personnel of the problem. The CM recovery actions include an XPM SWACT. The actions include loading the new inactive unit with the XPM software load defined in the corresponding inventory table. The CM considers this loading action an autoload by the CM. The ISTb is cleared by a manual, CM, or mate reload of the XPM software to the affected unit.

The CM does not permit a REx test to occur

- on a P-side or C-side node of the XPM that recovers from a parity fault
- on the XPM if a P-side or C-side node recovers from a parity fault.

The CM cannot let two XPMs in the same configuration perform a parity reload that are in the same configuration. A P-side node cannot perform a parity reload at the same time as the C-side node. A C-side parity cannot reload occur at the same time as its P-side node. These restrictions makes sure that only one XPM in a configuration is in simplex at a time.

The CM informs operating company personnel of a parity fault through PM181 log reports. This log is the primary trouble indicator. Operating company personnel can check for associated logs, like the PM128, to understand what actions that the CM is takes. Examples of the messages associated with the PM181 and PM128 logs, are provided in this section.

The XPM unit can be set ISTB with multiple reasons at the same time. When you perform a QUERYPM FLT at the MAP level, all of the ISTb reasons appear that have occurred on the unit and that have not yet been cleared.

Hard parity fault When the XPM active unit reports a hard parity fault, the system generates a PM181 log. This log notifies operating company personnel that:

- a parity fault occurred on the active unit, and the unit has been set ISTb
- the CM can load the unit again, during the next XPM REx test window.

You can perform a manual SWACT and reload to clear the ISTb and the parity fault.

An example of a PM181 log report follows:

```
PM181 JUL23 23:29:16 7700 INFO RSCE 0 Unit 0
Node: Istb, Unit0 Inact: ISTb, Unit1 Act: ISTb
Parity audit has detected a hard parity fault.
The system can autoload the unit during the next
XPM REx test window.
Monitor the system for maintenance and recovery.
Site Flr  RPos  Bay_id  Shf Description Slot  EqPEC
RAL1 00   C05   CMVI 00  18  RSCE : 000   3    AX74
```

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

An example of a PM128 log follows:

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

Use the command string QUERYPM FLT to display the faults on a posted XPM. The following example MAP response displays a hard parity fault in unit 1 of the posted XPM:

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

Action by the CM: The CM can SWACT and reload the XPM during the next XPM REx test window. After the reload the XPM is clear of this ISTb fault.

User action: Action is not required by operating company personnel. You can start a manual SWACT and reload to clear the parity fault.

DRCC2

The maintenance functions for the DS-1 interlinks are the same as maintenance function for the DS-1 links that connect to the host PM. The maintenance functions include:

- detecting if the card is present
- monitoring the DS-1 circuits and reporting the following conditions slips, frame loss, bipolar violation (BpV), remote carrier group alarms (RCGA), and local carrier group alarms (LCG)
- reporting the state of the link.

RCC2 with ISDN

The RCC2 can be configured with a spare DCH. If a DCH card goes OOS, the spare DCH gains control of the current D-channel processing. The DCH gains control without temporary loss of D-channel service. Enter the SWITCH command to manually start this function. When the RCC2 performs a warm SWACT, the SWACT does not affect data communication.

Increase to manual maintenance

With the RSC-S, automatic maintenance includes the output of the correct problems indicators. For additional support, refer to the section Automatic maintenance.

2 RSCE Equipment Hardware

This chapter describes the hardware components of the Remote Switching Center Equipment (RSCE), Product Engineering Code, NTMX89GA.

Hardware components

The following sections describe the components in RSCE configuration.

Table 2-1 Hardware component deliverables (Sheet 1 of 2)

Hardware	PEC
Modular supervisory panel (MSP)	NTRX40
Power converter	NTMX72
PCM signaling	NTMX73
32-port DS30A	NTMX74
Enhanced matrix	NTMX75
HDLC/DMSX messaging interface card	NTMX76
Processor with 8-MB dynamic random access memory (DRAM)	NTMX77
DS60 extender and power supply	NTMX79
Dual DS-1 packlet	NTMX81AA
Compact dual DS-1 packlet	NTMX81BA
Filler packlet	NTMX83AA
Compact filler packlet	NTMX83BA
CPM shelf	NTZZ12XA
EXT shelf	NTMX8601
Quad frame carrier	NTMX87AA/AB

Table 2-1 Hardware component deliverables (Sheet 2 of 2)

Hardware	PEC
Penta DS-1 packlet carrier	NTMX87BA
Peripheral loader	NT7X05

RSCE

The RSCE allows for the conversion of an RCE frame to an RSCE frame, (RCC to RCC2). The RCC and the RCC2 have different controller shelves. The RSCE provides the space to mount up to two common peripheral modules (CPM) and one extension (EXT) shelf. The RSCE uses a version of the multi-vendor interface equipment (MVIE) cabinet that allows for provisioning at the shelf level. An MVIE cabinet with RCC2 packfill supports the functionality on the RCC2. Minimum configuration is a single RCC2 shelf, a modular supervisory panel (MSP), and a cooling unit. A single EXT shelf can extend to two RCC2 shelves. When fully equipped, an RSCE provides the controller functions of a fully extended dual RSC-S.

Figure 2-1 RCE frame configuration

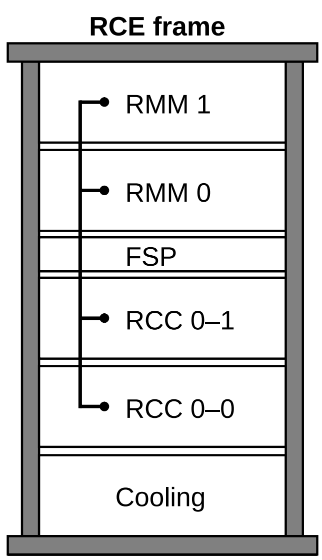
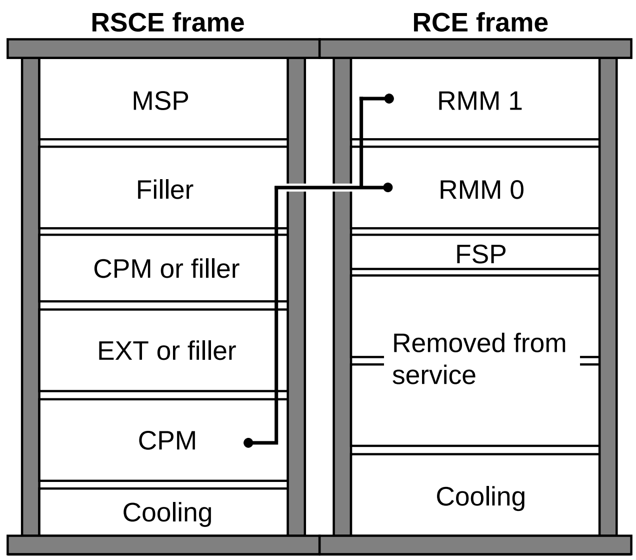


Figure 2-2 RCE frame configuration converted to RSCE



CPM
As a remote unit (RCC2), the CPM supports CDO trunks, digital loop carriers (DDL), DS30A links, D-channel handler (DCH) cards, and DS1 P-side links.

Remote cluster controller 2 (RCC2)

WARNING
RCC2 supports a maximum of ten P-side peripherals
The maximum number of peripheral nodes configured on an RCC2 cannot exceed ten. This limit includes LCM(E)s, RLCMs, SMSRs, RMMs and remote modules. The system rejects attempts to datafill more than ten P-side nodes in an inventory table.

Remote cluster controller 2 (RCC2)
During normal operations that do not have SONET interfaces, the host line group controller (LGC) or line trunk controller (LTC) controls the RCC2. The RCC2 P-side ports can be configured to support lines, trunks, outside plant modules (OPM), remote line concentrating modules (RLCM), and SMS-Rs off the RSC-S.

The RCC2 is the remote office unit of the common peripheral module (CPM). The RCC2 is a single-shelf, 68020-based module and contains units 0 and 1.

For reliability, RCC2 units 0 and 1 run in active and standby modes of operation.

The RCC2 shelf contains the following components:

- duplicated RCC2 processor cards that have a processor based on 68020 or 68040 (NTMX77 or NTAX74, in the order given). The NTAX74 cellular access processor (CAP) with a 68040 base is an optional upgrade replacement for the NTMX77 UP with the 68020 base. The CAP increases XPM capacity, real-time availability, and memory. An RCC2 with the CAP requires the components that follow to support NTAX74 functionality:
  - the NTBX01BA or NTBX01AC ISDN Signaling Preprocessor
  - the NTBX02BA Enhanced D-Channel Handler

  Note: An RCC2 with NTAX74 requires the NTBX01BA or NTBX01AC ISDN Signaling Preprocessor and the NTBX02BA Enhanced D-Channel Handler.

- duplicated expanded time switch, a high capacity switch matrix
- duplicated messaging interface circuit cards that contain the interface to both C-side and P-side message channels
- duplicated power converters to power circuit cards
- a pulse code modulation (PCM) signaling card that supports all low-level PCM signaling tasks
- DS-1 interface cards or eight DS-1 links for each card for host-directed DS-1 links for P-side link requirements
- a DS30A interface card that provides 32 DS30A links for interfacing to line concentrating modules (LCM), RMMs, and SMS-Rs at the RSC-S
- a selection of the following service circuit cards:
  - global tone receiver (GTR) or universal tone receiver (UTR)
  - custom local area signaling service (CLASS)
  - modem resource (CMR)
  - D-channel handler (DCH)
  - enhanced ISDN signaling preprocessor (EISP)

The RCC2 contains RSC-S processor and memory cards for the following:

- normal and emergency stand-alone (ESA) modes
- time switches

- tone generators
- power converters

The RCC2 also supports GTR/UTR for lines and trunks in normal and ESA modes, and provides local switching for the following:

- host-directed calls that connect LCM, DS-1 trunking, RLCM, OPM, and data line card (DLC) channels to host-directed DS-1 channels
- line and trunk calls internal to the RSC-S and associated remotes of the RSC-S that the intraswitching feature supports
- intraswitched calls during ESA supported when the ESA feature is in use

This process uses up to 20 C-side ports and 54 P-side ports. The ports support all features of the current RSC and RSC with ISDN with increased capacity. The RCC2 peripheral allows the following connections:

- C-side to P-side
- P-side to C-side
- P-side to P-side
- C-side to C-side

The C-side ports support host-to-remote capabilities

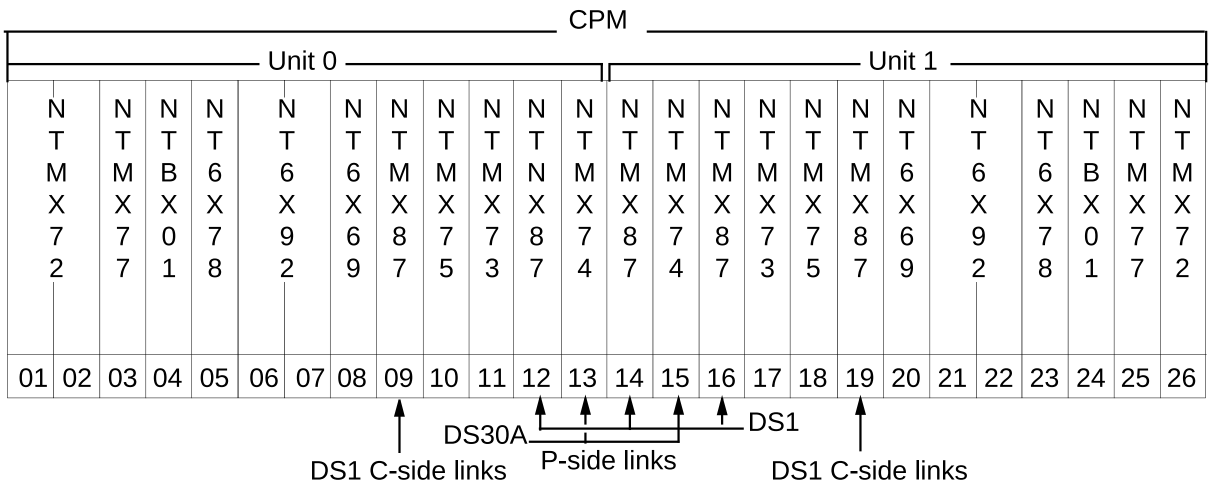
The RCC2 performs the termination functions that follow:

- the C-side links from the host LGC or LTC (for DS-1 electrical links), with a maximum of 20 DS-1 links. The links provide a maximum of 480 channels
- the DS-1 links from the mate RCC2 in a dual configuration
- the P-side DS-30A links from LCMs, RMMs, and SMS-Rs
- the P-side DS-1 links for digital connectivity to RLCMs and OPMs in the remote-off-remote configuration
- the P-side DS-1 links for digital trunking to community dial offices (CDO) and private branch exchanges (PBX)

The following diagram shows the circuit card layout for an RCC2 shelf.

> ***Note:*** Space limits mean that the following diagram that does not show slot 27. This slot contains an NTMX72 power converter.

Figure 2-3 RCC2 circuit card layout



In NA010 and lower, up to 16 C-side ports are available. This configuration requires the NTMX87AA/AB in slots 9 and 19. NA011 and higher supports these packs when an office needs only up to 16 C-side links.

In NA011 and higher, up to 20 C-side ports are available. This configuration requires the NTMX87BA in slots 9 and 19. This hardware is backward compatible from NA008 to NA010 for use in the 16 C-side link configuration.

When an RSC is converted to an RSCE, the first RCC2 shelf is always provided. This RCC2, combined with the RCE that mounts RMMs or RME/PDC for power, and LCEs for lines, supports a single RSC-S office.

A second RCC2 shelf that is provisioned allows for expansion to a dual RSC-S configuration. Provisioning an EXT shelf extends the capabilities of one or both RCC2 shelves. These equipment configurations allow for the support of any RSC-S configuration.

The current LCM bays do not support ISDN. Operating company personnel must order LCEI frames so the system supports ISDN cards after the conversion.

The following table describes circuit cards for RCC2 unit 0 (slots 01 through 13).

Table 2-2 RCC2 unit 0 circuit cards (Sheet 1 of 2)

Slot	Description	PEC
01-02	Power Converter	NTMX72
03	Unified Processor *or* Cellular Access Processor	NTMX77 *or* NTAX74
04	ISDN Signaling Preprocessor	NTBX01
05	CLASS Modem Resource *or* Peripheral Recovery Loader-16	NT6X78 *or* NT7X05
06	Global/Universal Tone Receiver	NT6X92
07	Global/Universal Tone Receiver *or* Peripheral Recovery Loader-16	NT6X92 *or* NT7X05
08	Enhanced Message and Tone Card *or* HDLC Message and Tone Card (for EDC)	NT6X69 *or* NTMX76
09	The following configurations are possible: (see notes below)	
	Penta DS-1 Packlet Carrier *with* Compact Dual DS-1 Packlet (1-5) *or* Filler Face Plate (0-4)	NTMX87BA *with* NTMX81BA *or* NTMX83BA
	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
10	Enhanced Matrix NTMX75AA *with* NTMX87AA/AB in slots 9 and 19 *or* Enhanced Matrix NTMX75DA *with* NTMX87BA in slots 9 and 19.	NTMX75AA *or* NTMX75DA
11	Pulse Code Modulation Signaling Processor	NTMX73

Note 1: Refer to “Maintenance overview" in this document for detailed descriptions of circuit cards for an RCC2 shelf.

Note 2: The functionality of the NT7X05 Peripheral/Remote Loader-16 requires the NTMX77AA for support .

Note 3: For NA011, a 20 C-side link configuration is available. This configuration requires the Penta DS-1 Packlet Carrier. For a 16 C-side link configuration, the Quad Frame Carrier is acceptable. The Penta DS-1 Packlet Carrier is hardware backward compatible to NA008, but only in a 16 C-side link configuration.

Table 2-2 RCC2 unit 0 circuit cards (Sheet 2 of 2)

Slot	Description	PEC
12	(Enhanced) D-Channel Handler *or* Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTBX02 *or* NTMX87AA/AB *with* NTMX81 AA *or* NTMX83AA
13	DS-30A Interface Card	NTMX74

Note 1: Refer to “Maintenance overview" in this document for detailed descriptions of circuit cards for an RCC2 shelf.

Note 2: The functionality of the NT7X05 Peripheral/Remote Loader-16 requires the NTMX77AA for support .

Note 3: For NA011, a 20 C-side link configuration is available. This configuration requires the Penta DS-1 Packlet Carrier. For a 16 C-side link configuration, the Quad Frame Carrier is acceptable. The Penta DS-1 Packlet Carrier is hardware backward compatible to NA008, but only in a 16 C-side link configuration.

The following table describes circuit cards for RCC2 unit 1 (slots 14 through 27).

Table 2-3 RCC2 unit 1 circuit cards (Sheet 1 of 2)

Slot	Description	PEC
14	(Enhanced) D-Channel Handler *or* Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTBX02 *or* NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
15	DS-30A Interface	NTMX74
16	(Enhanced) D-Channel Handler *or* Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTBX02 *or* NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
17	Pulse Code Modulation Signaling Processor	NTMX73

Note 1: Refer to “Maintenance overview" in this document for detailed descriptions of circuit cards for an RCC2 shelf.

Note 2: The functionality for the NT7X05 Peripheral/Remote Loader-16 requires the NTMX77AA for support.

Note 3: For NA011, a 20 C-side link configuration is available. This configuration requires the Penta DS-1 Packlet Carrier. For a 16 C-side link configuration, the Quad Frame Carrier is acceptable. The Penta DS-1 Packlet Carrier is hardware backward compatible to NA008, but only in a 16 C-side link configuration.

Table 2-3 RCC2 unit 1 circuit cards (Sheet 2 of 2)

Slot	Description	PEC
18	Enhanced Matrix NTMX75AA *with* NTMX87AA/AB in slots 9 and 19 *or* Enhanced Matrix NTMX75DA *with* NTMX87BA in slots 9 and 19.	NTMX75AA *or* NTMX75DA
19	The following configurations are possible: (see notes below)	
	Penta DS-1 Packlet Carrier *with* Compact Dual DS-1 Packlet (1-5) *or* Filler Face Plate (0-4)	NTMX87BA *with* NTMX81BA *or* NTMX83BA
	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
20	Enhanced Message and Tone Card *or* HDLC Message and Tone Card (for EDC)	NT6X69 *or* NTMX76
21	Global/Universal Tone Receiver *or* Peripheral Recovery Loader-16	NT6X92 *or* NT7X05
22	Global/Universal Tone Receiver	NT6X92
23	CLASS Modem Resource *or* Peripheral Recovery Loader-16	NT6X78 *or* NT7X05
24	ISDN Signaling Preprocessor	NTBX01
25	Unified Processor	NTMX77
26-27	Power Converter	NTMX72

Note 1: Refer to “Maintenance overview" in this document for detailed descriptions of circuit cards for an RCC2 shelf.

Note 2: The functionality for the NT7X05 Peripheral/Remote Loader-16 requires the NTMX77AA for support.

Note 3: For NA011, a 20 C-side link configuration is available. This configuration requires the Penta DS-1 Packlet Carrier. For a 16 C-side link configuration, the Quad Frame Carrier is acceptable. The Penta DS-1 Packlet Carrier is hardware backward compatible to NA008, but only in a 16 C-side link configuration.

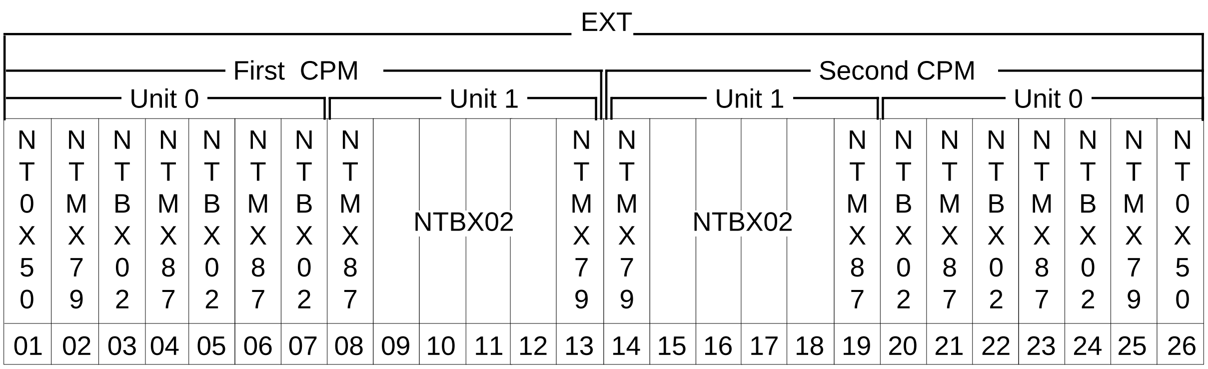
EXT

The DS60 EXT power pack connects the extension shelf (EXT) to the main shelf. The extension shelf has up to 12 Dual DS1/2MB packlets. The shelf also contains 1 to 4 octal DS-1 interface cards and DS60 extension cards.

The following diagram figure shows the circuit card layout for an RCC2 EXT shelf.

> ***Note:*** The figure that follows cannot show slot 27 as a result of space limits. This slot also can contain an NT0X50 filler face plate.

Figure 2-4 RCC2 EXT shelf circuit card layout



The following table describes the circuit cards for an RCC2 EXT shelf.

Table 2-4 RCC2 EXT shelf circuit cards (Sheet 1 of 2)

Slot	Description	PEC
01	Filler Face Plate	NT0X50
02	DS60 Extender	NTMX79
03	(Enhanced) D-Channel Handler	NTBX02
04	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
05	(Enhanced) D-Channel Handler	NTBX02
06	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
07	(Enhanced) D-Channel Handler	NTBX02
08	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA

Note 1: Refer to “Maintenance overview" in this document for detailed descriptions of circuit cards for an RCC2 EXT shelf.

Note 2: Do not use the NTMX87BA Penta DS-1 Packlet Carrier in the RCC2 extension shelf.

Table 2-4 RCC2 EXT shelf circuit cards (Sheet 2 of 2)

Slot	Description	PEC
09-12	(Enhanced) D-Channel Handler	NTBX02
13-14	DS60 Extender	NTMX79
15-18	(Enhanced) D-Channel Handler	NTBX02
19	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
20	(Enhanced) D-Channel Handler	NTBX02
21	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
22	(Enhanced) D-Channel Handler	NTBX02
23	Quad Frame Carrier *with* Dual DS-1 Packlet (1-4) *or* Filler Face Plate (0-3)	NTMX87AA/AB *with* NTMX81AA *or* NTMX83AA
24	(Enhanced) D-Channel Handler	NTBX02
25	DS60 Extender	NTMX79
26-27	Filler Face Plate	NT0X50

Note 1: Refer to “Maintenance overview" in this document for detailed descriptions of circuit cards for an RCC2 EXT shelf.

Note 2: Do not use the NTMX87BA Penta DS-1 Packlet Carrier in the RCC2 extension shelf.

RMM

Remote maintenance module The RMM is based on the DMS-100 switch maintenance trunk module (MTM). A minimum of one RMM is recommended at each RSC-S site. The RMMs perform diagnostic and line tests, and monitor alarm conditions. A maximum of two RMMs can be provisioned for each RCC2. One DS30A P-side port is dedicated to each RMM.

Capability is not available in the RSC to RSC-S conversion to mount RMM shelves or line modules in the new cabinet. The RMM and line module functions are started outside through the reuse of the RMMs or line modules mounted in a current RCE frame. Umbilical cables route an RMM, LCM, or LCME, to the CPM shelf.

An RMM can contain the following components:

- one RMM control card
- one group coder-decoder (CODEC) card
- two power converters
- a maximum of 14 service circuit cards. These cards includes scan, signal distribution (SD), metallic test access (MTA), test trunk, and line test unit

For more information on these components, refer to the *Translations Guide*.

3 RCC2 signaling

This section describes Remote Cluster Controller 2 (RCC2) signaling format and protocols and the features the RCCs support.

Signaling and communications protocols

The RCC2 uses the following protocols for communications and subscriber services:

- DMS-X

  DMS-X is a half-duplex, byte-oriented protocol. Use a full duplex message channel like the DS-1 or DS-30A links to implement the protocol. The RCC2 processor handles DMS-X message protocol on the message channels of the RCC2 to the host, remote or collocated equipment.

- HDLC

  HDLC is a full duplex message protocol based on the CCITT level 2 Signaling System 7 (Q.703). This protocol is supported between LTC+ and RCC2 peripherals.

- Q.921 CCITT link access procedure on the D-channel (LAPD)

  The Q.921 LAPD protocol establishes data link communications between a service access point identifier (SAPI) and a terminal end point identifier (TEI). The link communications allow the SAPI to transmit information sent from a higher layer protocol, or receive information for delivery to a higher layer protocol. The Q.921 protocol transmits common signal channel (CSC) messages and embedded operations channel (EOC) messages.

- Q.931 CCITT digital network access

  The Q.931 protocol communicates call setup, call monitoring, and call tear-down information between an RCC2 and the host. An RCC2 must translate Q.931 generic-based signaling messages to a DMS-X message format the host can read. Use Q.931 protocol for common signal channel messages.

- X.200

The X.200 protocol is the Open Systems Interconnect (OSI) defined 7-layer stack communications protocol.

- The ADSI tones and Compatible Voiceband Data that comply with Bellcore.

  Bellcore Customer Premises Equipment Compatibility for Voiceband data transmission, CLASS features, and ADSI tones.

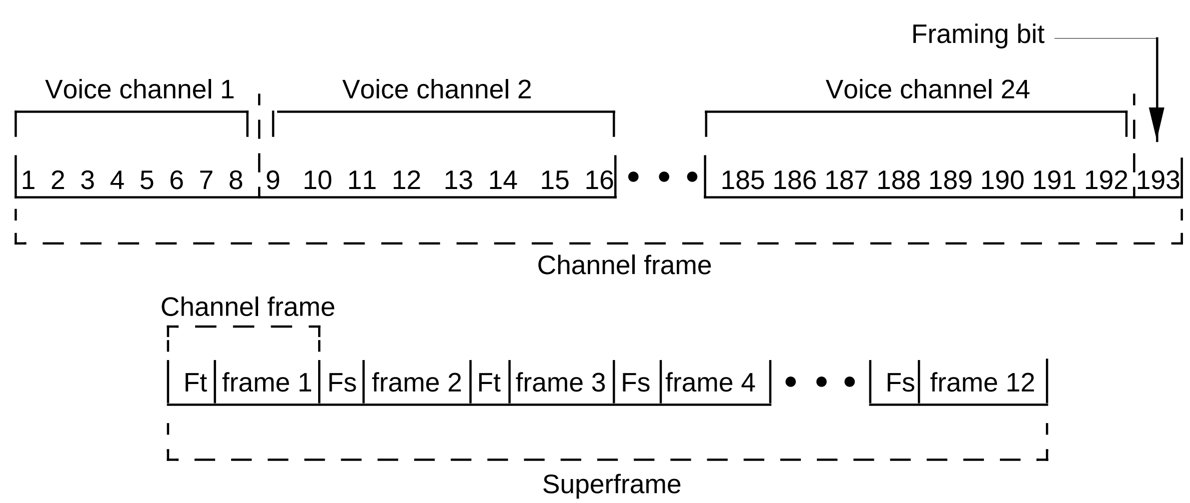
C-side links

The RCC2 and the host central controller (CC) exchange information over 2 to 16 DS-1 central-side (C-side) links. The information exchange uses an extended super frame format. The DS-1 links operate at a rate of 1.544 Mb/s, with a sampling frequency of 8000 frames every second.

A DS-1 link consists of 24 channels. Each channel contains 8 bits of pulse code modulation (PCM) data. The end of the sequence includes a framing bit, also referred to as stuffing or S-bit. The bit makes sure the RCC2 and the host recognize the beginning of each 24-channel sequence. the system sends 192 bits of information during each 24-channel sequence, plus a framing bit.

The DS-1 channel frames carry speech information, signaling information, or operations information. The design of a DS-1 frame and a super frame appears in the following figure. The super frame consists of 12 DS-1 frames.

Figure 3-1 DS-1 frame format



Fs = frame signaling bit
Ft = frame timing bit

Extended frame format

The DS-1 extended super frame format (ESF) consists of 24 frames. The 24 synchronized bits are used as follows:

- Framing pattern sequence (FPS) use 6 bits

  Every fourth framing bit, beginning at the fourth bit, carries an FPS bit. The FPS and the cyclic redundancy check (CRC) define an in-frame condition.

- Facility data link (FDL) use 12 bits

  The 4-kbit per second facility data link (FDL) bit begins with the first framing bit. An FDL messaged bit is carried every other frame.

- Cyclic redundancy check (CRC) use 6 bits

  The cyclic redundancy check (CRC) bit begins with the second bit and is carried every fourth bit. In an extended super frame, a block check field is checked six times. The CRC-6 check detects bits that emulate an FSP bit and determines if an out-of-frame condition is present.

The superframe alignment pattern appears in the following figure.

Table 3-1 Superframe alignment pattern (Sheet 1 of 2)

Frame number	Framing bit type	Framing bit value
1	FDL	m
2	CRC	CB1
3	FDL	m
4	FPS	0
5	FDL	m
6	CRC	CB2
7	FDL	m
8	FPS	0
9	FDL	m
10	CRC	CB3
11	FDL	m
12	FPS	1
CB = check bits m = message bite		

Table 3-1 Superframe alignment pattern (Sheet 2 of 2)

Frame number	Framing bit type	Framing bit value
13	FDL	m
14	CRC	CB4
15	FDL	m
16	FPS	0
17	FDL	m
18	CRC	CB5
19	FDL	m
20	FPS	1
21	FDL	m
22	CRC	CB6
23	FDL	m
24	FPS	1
CB = check bits m = message bite		

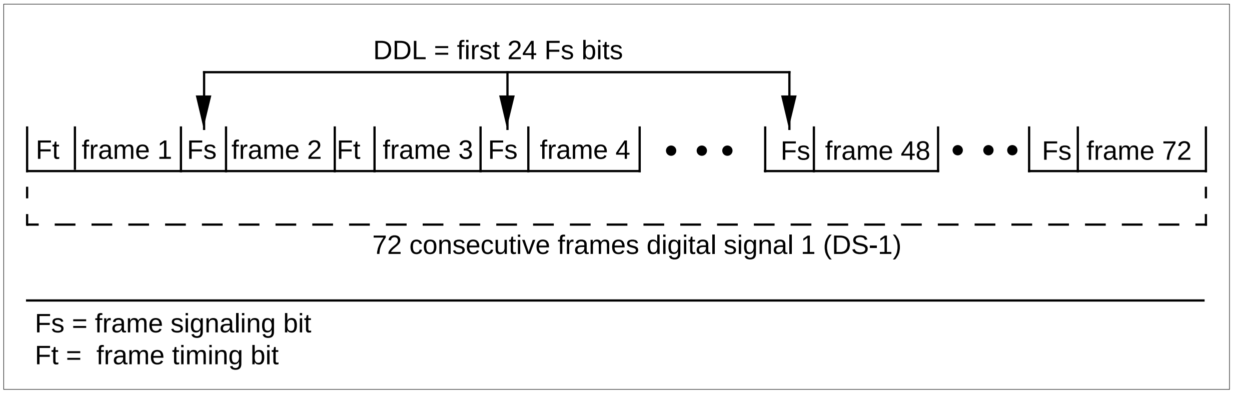
Signaling additions

As a part of the North America signaling, the Bellcore TR-303 protocol will add a facility data link.

DDL signaling to SLC-96

A derived data link (DDL) frame consists of six super frames or 72-channel frames. Use the derived data link (DDL) to virtually connect the CC to the SLC-96. The DDL message uses the first 24 of 36 frame-signaling (Fs) bits of 72 frames. The design of the synchronized bits of 72 consecutive frames appears in the following figure.

Figure 3-2 DDL signaling format



The 24-bit pattern conveys three types of information:

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

Incoming DDL

The DS-1 interface (IF) card has a string of six consecutive DDL bits received from the DS-1s, on the DS30 lines. The DS30 signaling protocol is like DS30A protocol.

Outgoing DDL

In transmission, the CPM places a 6-bit byte in every 12th frame that comes out of the matrix card. This process occurs four times in 72 frames for a total of 24 DDL bits.

DDL processing

The matrix card switches all frame output to one DS60 digroup (two DS-30s) connected to the SIGP card. The signaling processor (SP) takes control from that point.

Table 3-2 DDL message bits and field names

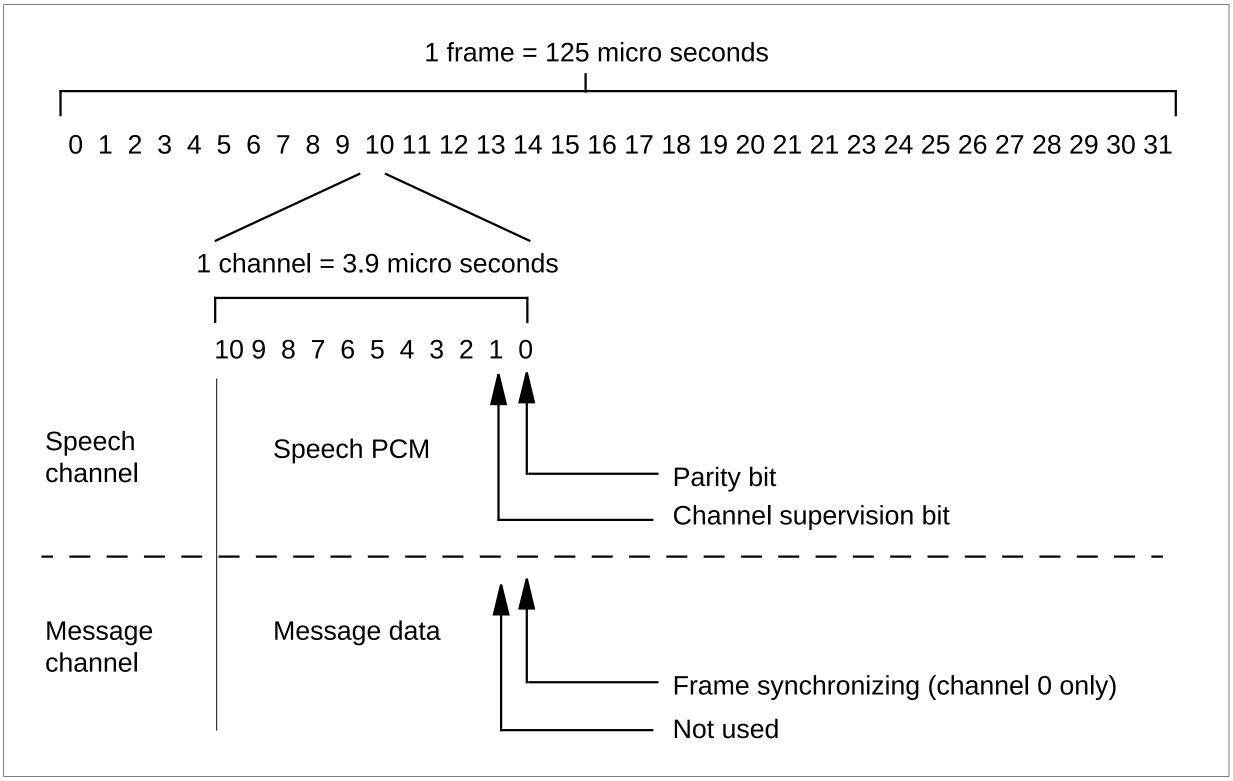
DDL bits	Field name	Explanation
1 -11	Concentrator field (C-field)	Shelf groups AB and CD use the C-field only when the shelf groups operate in Mode II. This field carries information for shelves A, B, C, and D. The information includes control of subscriber assignment and deassignment to DS-1 channels, hook changes, and activation of the PCM looping test. ***Note:*** When no C-field is available to send on the DDL link, the microprocessor sends an idle pattern on the DDL link. The RCC2 sends an idle pattern when no new C-field is present.
12-14	Spoiler bits (fixed pattern of 010)	Spoiler bits are inserted at assigned positions in the DDL. The bits make sure the DDL does not duplicate a signaling pattern .
15-17	Maintenance field (M-field)	The M-field on the A-link carries information for all shelves, and controls card and customer loop testing (refer to note).
18-19	Alarm data link field (A-field)	The A-field on the A-link carries alarm and system control information for all shelves (refer to note).
20-23	Protection line switch field (S-field)	The S-field on the A-link controls the switching of the DS-1 protection link (refer to note).
24	Spoiler bit field (fixed pattern of 1)	The spoiler bit is inserted at the assigned position in the DDL to make sure the DDL does not duplicate any signaling pattern.
Note: If fields M, A, or S do not change between messages, the microprocessor sends previous field patterns. The microprocessor only sends information to the SP when a DDL field changes. Idle patterns are not transmitted.		

P-side links

The RCC2 supports up to 54 P-side links that can be configured to different groups of DS-1 links and DS-30A links. P-side DS-1 links can attach to remote line concentrating modules (RLCM), outside plant modules (OPM), and PBX or CDO trunking. P-side DS-1 links have the same format as C-side DS-1 links. P-side DS-30A links can connect to collocated equipment, like enhanced line concentrating modules (LCME) or remote maintenance modules (RMM). The DS-1 links and DS30A links use the DMS-X protocol.

The DS30A channel frames carry speech information or message information. The design of a DS30A frame appears in the following figure. The DS30A links operate at a rate of 2.56 Mb/s with a sampling frequency of 8000 frames every second. The DS30A link frame consists of 32 channels. Each channel contains 10 bits of pulse code modulation (PCM) data.

Figure 3-3 DS-30A frame format



A frame synchronization bit occurs at channel 0 bit 0. This process makes sure the RCC2 and the LCME or RMM recognize the beginning of each frame sequence.

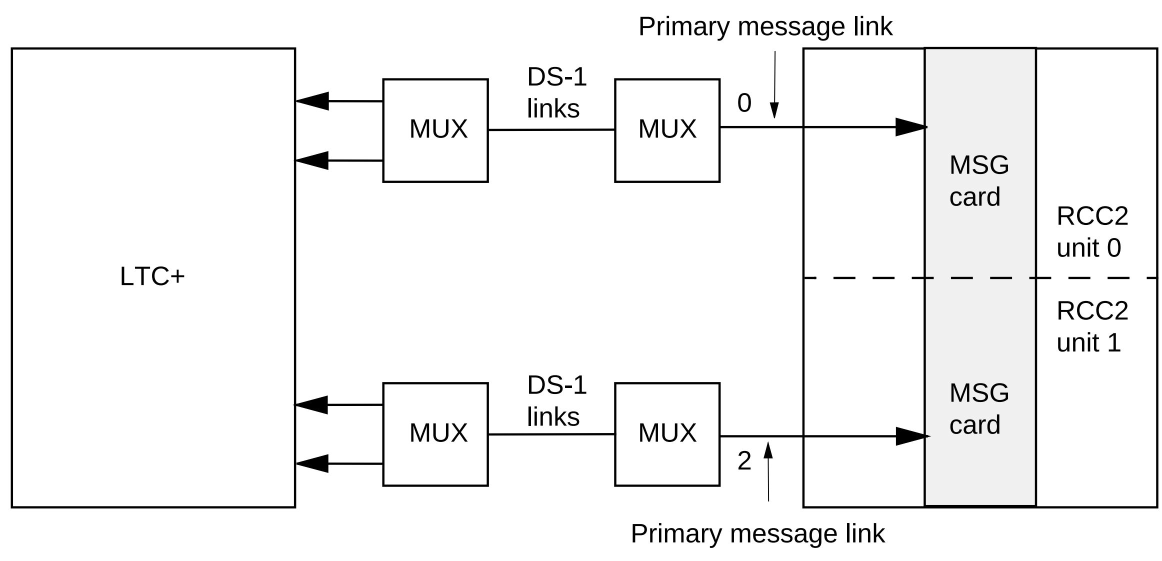
Message links

The RCC2 and host exchange system use dedicated message links to control information. The host uses system control messages to transfer call processing, initialization, and maintenance information to the RCC2. The RCC2 uses system control messages to inform the host of RCC2 activities. System control messages contain information like time slot assignments to off-hook subscriber lines, test requests, and alarm statuses.

One message channel time slot is the primary message link, and the other message channel is the secondary message link. The primary message link is active. The secondary message link is not active.

The host monitors both links for messages. The host only responds to messages on the primary link. When DS-1 links 0 and 2 are installed, the first channel on DS-1 link 0 is selected as the primary message channel.

Figure 3-4 RCC2 message links



Message channels

The following communication links use the DMS-X protocol:

- between the RCC2 and the host peripherals on the C-side
- between the RCC2 and peripherals on the P-side

Messages from the CC to the RCC2 are first sent to the host XPM, like a line trunk controller (LTC+). The host LTC recognizes the message is for the P-side node and sends the message through a channel between the two nodes. The XPM messaging software system sends the message through the channel until the message arrives at the P-side node.

The XPM messaging software system consists of the following functional layers:

- The physical link layer is level 1. This layer provides the mechanism required to transfer the data bits between nodes. The DS-1 link is a necessary mechanism. The link connects the host XPM P-side interface card and the RCC2 C-side interface card.
- The data link layer is level 2. This layer provides the mechanism required to transfer messages between directly connected nodes. The mechanism uses the route the network layer selects. This layer performs error detection and notification, and maintains sequential message order. This layer also allows activation and deactivation of links that support messages.
- The network layer is level 3. This layer provides the application software with the mechanism required to send a message between network nodes. The network layer selects a route used to send messages toward the destination node. This layer starts the required service from the message link layer.

Data link layer

The RCC2 converts two standard DS-1 frames into one internal DS60 frame. Timeslot 1 of links 0 and 2 is removed from the DS-1 interface. The timeslot has a direct connection to the first network message interface (NMIF) channel in the correct RCC2 message card. The speech bus interface (SBIF) directs messages along the speech bus until the messages reach the messaging card. Each timeslot on the speech bus can serve as a messaging channel, toward the shelf C-side or P-side. DMS-X protocol uses channel 1 on each link.

DMS-X and HDLC protocol applications

The DMS-X and high data link control (HDLC) data link protocols are used between:

- an LTC (DMS-X), or LTC+ (DMS-X and HDLC)
- and an RCC2

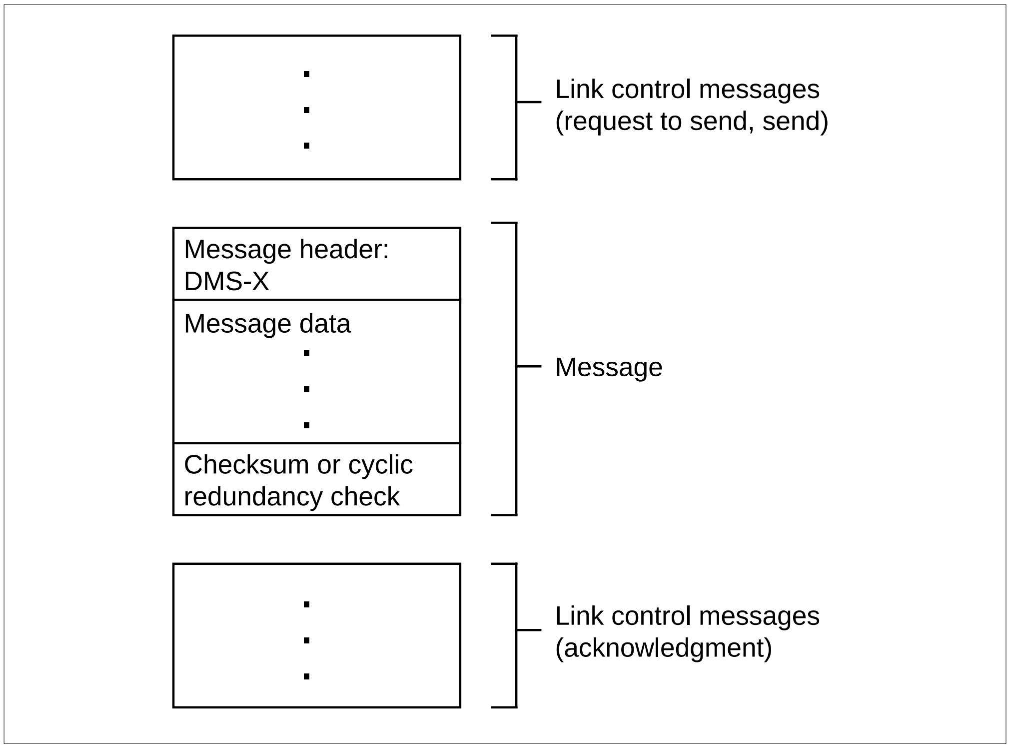
To apply a data link protocol on a specified timeslot, to the C-side of an RCC2 or P-side of an LTC or an LTC+ the specific channel is declared a data link. This data link is assigned to a specific node entity. The system creates more data links in the LTC+ and RCC2.

DMS-X protocol

DMS-X is a half-duplex, byte-oriented protocol, implemented with a full duplex message channel like the DS-1 links.

The DMS-X protocol is a state-driven code that requires handshake messaging between the RCC2 and host at each stage of data transfer. This process allows the communicating terminals to delay the message transfer if either terminal is not ready. The DMS-X handshaking protocol appears in the following figure.

Figure 3-5 DMS-X handshaking protocol



The following perform message error detection:

- message time-out
- message checksum
- CRC calculation

In the event of protocol, checksum, or CRC failure on an outgoing message, the sending node attempts the send sequence again.

On an incoming message failure, the sending node reroutes the message again over an alternate (C-side) link. Hardware redundancies provide at least one other path to and from a node.

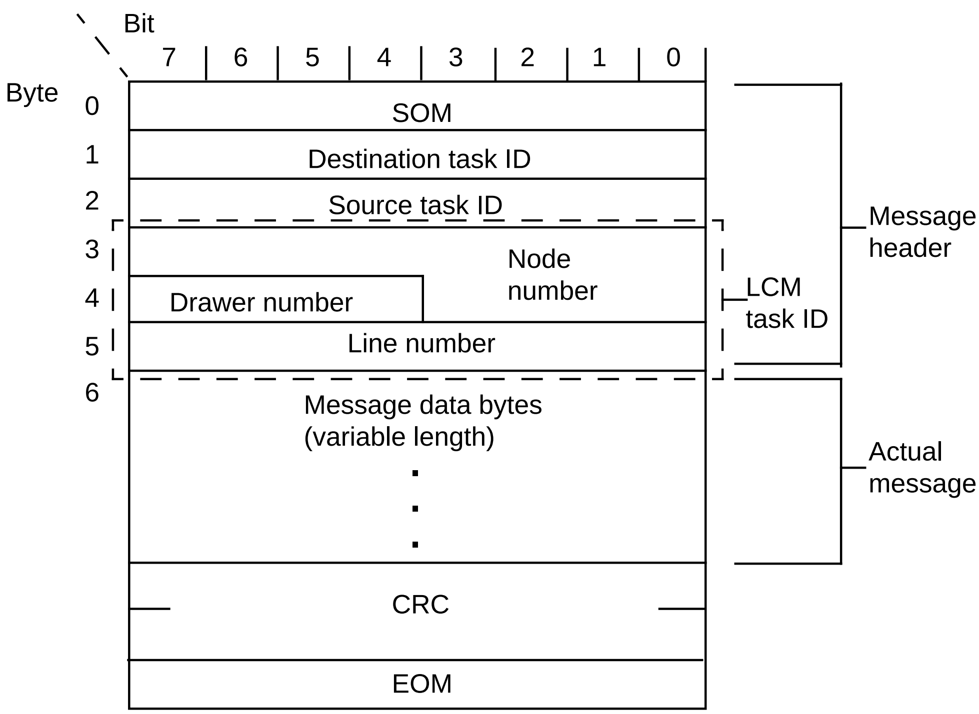
DMS-X message format

The DMS-X message applies to both DS-1 and DS30A. The DMS-X message header is the first 6 bytes as follows:

- The first byte is the start of a message.
- The second byte is the destination task identification (ID) of the message. An outgoing message uses this ID to identify the process to receive the message.
- The third byte is the source task ID. An incoming message uses this ID to identify the process that sent the message.
- The last three bytes are the task ID number.

The number of bytes in the message or data varies. The CRC that occupies 2 bytes, detects transmission errors. The end of message occupies 1 byte. The DS-1 message format appears in the following figure.

Figure 3-6 DMS-X message format



EOM = end of message
ID = identification
LCM = line concentrating module
SOM = start of message

HDLC protocol

High data link controller (HDLC) protocol is a LTC+ to RCC2 message protocol for the extended distance capability (EDC) application. The NTMX76AB messaging card implements this protocol. The host and the remote peripherals contain this card. The NTMX76AB messaging card replaces the NT6X69 card. The same links provide message links between the LTC+ and the RCC2, but timeslot 6 is used through the speech bus interface (SBIF).

Application of the HDLC protocol cannot occur with the use of the NMIF. The speech bus requires two additional timeslots. The timeslots cannot be used for speech.

Protocol change from DMS-X to HDLC

Feature AN 1548, with feature AN0979, In-service Upgrade DMS-X to HDLC, supports the upgrade of the DS-1 links between the LTC+ and the RCC2.

The remote can be in service when the messaging protocol changes. Static data downloaded from the CC is updated dynamically in the host and the remote peripherals.

When HDLC protocol is applied dynamically, the system scans for calls on channels dedicated to HDLC messaging. When established calls are on these channels, the system displays a warning. The warning indicates that the system can drop active calls. The system prompts the user to reject or confirm the possible call drops. The system reserves free channels (channels without calls) for HDLC. The channels remain reserved until a protocol change occurs or the user refuses the protocol change.

The following is an example MAP display of this process:

```
Enter Y to confirm, N to reject or E to edit
```

>**Y**

```
3 existing calls will be dropped

Please confirm (“Yes", “Y", “NO", or “N")
```

>**Y**

In the example three calls are established. The user allows the three calls to drop and continues the DMS-X to HDLC protocol change. As a result, the system sends static data from the CC to the LTC+ and the RCC2. The RCC2 nailed-up connections for HDLC message channels are established. Data and network links are created and bound into the messaging system. The PM is set ISTb until all HDLC links are synchronized.

The NTMX76 firmware (layer) handles HDLC synchronizations. Synchronization of the link occurs when the link host and remote sides communicate together. The NTMX76 audit process verifies if the new HDLC links are synchronized.

When at least one HDLC link (per unit) synchronizes, the audit activates the HDLC link for messaging. The system sends an unsolicited message to CC and generates a PM181 log for each synchronized HDLC link. A synchronization problem causes the ISTb state, clears when all the HDLC message links of an RCC2 unit are synchronized.

When a link does not synchronize or loses synchronization, each remote unit sends an unsolicited message to the CC. To prevent problems in one-night-process (ONP), the units send the message after the version registry check. The system generates a PM181 log that indicates the link that is not synchronized.

If all HDLC links lose synchronization to the active RCC2 unit, the RCC2 attempts to SWACT. If the SWACT fails, the RCC2 enters ESA. If all HDLC message links of a RCC2 unit do not synchronize after the dynamic upgrade, the RCC2 unit works in the DMS-X mode.

Restrictions and limits

Note the following limits when you apply the in-service upgrade from DMS-X to HDLC protocol.

- The HDLC protocol can be declared on a newly defined remote peripheral, or during the upgrade from DMS-X to HDLC. When this condition occurs, DS-1 carriers for messaging between the host and remote must use the B8ZC attribute. The carriers do not use ZCS. Table LTCPSINV defines DS-1. The corresponding tuple in table CARRMTC defines the B8ZC attribute.
- During dynamic upgrade, the system can drop up to six existing calls.
- Do not perform the dynamic upgrade during periods of heavy call traffic.

ISDN basic rate interface signaling

The ISDN basic rate interface (BRI), referred to as 2B+D, consists of the following:

- two 64-kbit B-channels for voice and data
- a 16-kbit D-channel for signaling and packet data

There are two types of ISDN BRI signaling: functional and stimulus.

Software in the physical set of the functional BRI terminal supports functional BRI signaling. The Q.931 protocol and the signaling control protocol (SCP) send call control messages between the functional BRI terminal and the network.

The system does not support stimulus BRI signaling for the RCC2 configuration.

Q.931 digital network access protocol

The Q.931 signaling protocol is used for call control. Protocol procedure is based on

- setup and takedown of calls and features between the network and terminals
- address displays and progress indicators at the terminal and the network
- B-channel control from the network

The Q.931 protocol supports basic error-handling procedures and re-initialization after errors that can be recovered occurred. The Q.931 protocol also determines the signaling methods used in host-switched calls.

Meridian business set signaling

Meridian Business Set (MBS) signaling allows call processing software to communicate directly with the MBS terminal. An above-voice frequency, low-speed data channel transports the MBS messaging over the loop. This data channel sends signaling information over a different D-channel between the RCC2 DCH card and the host.

The data channel is an 8-kHz signal with data communicated through the occurrence or absence of this signal. The system supports the following MBS features for the RCC2:

- Automatic Answer Back
- Automatic Dial
- Automatic Line
- Executive Busy Override
- Call Back Queueing
- Call Forward All Calls
- Call Park
- Call Pickup
- Call Waiting
- End-to-End signaling

- Group Intercom
- Individual Business Line
- Intercom
- Listen on Hold
- Make Set Busy
- Malicious Call Hold
- Multiple Appearance DN
- On-Hook Dialing
- Privacy Release
- Ring Again
- Speed Calling
- 3-Way Call/Call Transfer
- 6-Port Conference
- Feature Display
- Display Called Number
- Display Calling Number
- Query Time
- Business Set Inspect Key
- Automatic Inspect Mode
- Business Set Call Forward Universal Per Key
- Call-Request Enhancement
- Direct Station/Busy Lamp Field for MBS
- Station Camp-On for MBS
- Group Intercom All Call
- MADN Cut-Off on Disconnect (COD)
- MADN Bridging—Three-Way Call
- Multiple Executive Message Waiting Keys per DN

Universal tone receiver features

> **ATTENTION**
>
> For peak performance, do not install the UTR and GTR together on the same RCC/RCC2. You cannot know which receiver defines tone samples. Call processing tones can degrade if designed for use with a GT

Subscriber lines connected to an RCC2 can use the global tone receiver (GTR) or universal tone receiver (UTR) feature. This feature allows the part of the processing load removed from the host computing module (CM) to be used in the PM.

If the GTR/UTR feature is present on the RCC2, the RCC2 performs all digit collection functions where the subscriber terminal is.

The digital collection functions include the following:

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

With a GTR/UTR the RCC2 performs the following steps:

1. Request a GTR/UTR channel.
2. Instruct the GTR/UTR to start monitoring tones.
3. When monitoring starts, the RCC2 receives information on collected digits and normally performs translations functions on the digits.
4. When the receiver is not required any longer, the RCC2 frees the allocated GTR/UTR channel.

Note: A receiver request is necessary to start the sequence.

The RCC2 creates alerting tones to support the Deluxe Spontaneous Call Waiting Identification (DSCWID) feature. A line, with the DSCWID option, can have a established call. A second call can attempt to terminate to the line with the DSCWID option. When this condition occurs, the RCC2 provides one of two types of alerting signals. These signals are a subscriber alerting signal (SAS) or a SAS followed by a customer premises equipment (CPE) alerting signal (CAS). The tones alert the DSCWID subscriber of the pending call, and the DSCWID CPE of pending caller data.

The SAS is the tone that the subscriber recognizes as the call waiting tone. The CAS alerts the CPE of coming data. The SAS followed by a CAS triggers an Analog Display Services Interface (ADSI) compatible CPE that displays the DSCWID options. The CAS tone prepares the CPE to receive caller identification (CID) data.

The DSCWID CPE generates an acknowledge (ACK) tone. The tone indicates the system is ready to receive DSCWID data. If the CPE is ADSI compatible, the CPE sends a DTMF A ACK signal in response to the CAS. If the CPE is a SCWID CPE, the CPE sends a DTMF D ACK signal in response to the CAS.

When alerting tones are sent, the subscriber can control distribution to the incoming call with the following:

- the CPE softkeys if the CPE is ADSI
- the hard-coded keys if the CPE is a SCWID or a 2500 set

A T-tone timer sets the maximum amount of time allowed between a flash delivery and the DTMF digit on an ADSI set. When the RCC2 receives a flash signal from the ADSI compatible CPE of the customer, the RCC2 starts a T-tone timer. The value of T-tone is 600ms. The system mutes the speech path during the 600 ms T-tone. The T-tone timer is for the first option of DSCWID call. The CPE does not determine the use of the T-tone timer. DSCWID options that follow on an ADSI set also use the T-tone timer.

The DSCWID options that follow on a SCWID or 2500 use a new timer (T-flash). The T-flash is used after SCWID and 2500 sets answer a call. The T-flash provides the customer with time to select an option after a flash.

The introduction of a new timer occurred because a subscriber did not have enough time to flash and dial a DTMF digit in 600 ms. The T-flash is an operating company controlled timer that the company can set from one to eight seconds. The default value is 1.5 s. The RCC2 starts the T-flash timer if the following conditions occur:

- The user sets NON-ADSI field to Y
- the RCC2 receives a flash signal from the customer SCWID or 2500 set during the hold or conference call state

If the RCC2 cannot attach a GTR/UTR before 400 ms, application of the RETURN option occurs.

> ***Note:*** To comply with Bellcore TR-416, the RCC2 must provide options when the RCC2 detects a flash and cannot attach a GTR/UTR. The RCC2 complies with this requirement. The RCC2 sends a flash to the CC when the RCC2 cannot attach a GTR/UTR in 400 ms.

A- and B-bit signaling

The RCC2 basic call processing supports software for basic call processing, CLASS services, ISDN, and ESA. To support these activities, the RCC2 and host must exchange system control messages over the DS-1 message channel. Separate channel signaling messages use A- and B-bits from selected speech channels. A-bits are transported on bit eight of the sixth frame of every 12 frame sequence. B-bits are transported on bit eight of the twelfth frame in the sequence.

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

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

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

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

Call processing requires the following eight areas:

- origination and channel allocation
- tone generation with dial tone speed recording
- digit collection
- ringing
- automatic number identification
- loss padding
- messaging loss to host
- busy/return to service of lines

4 Locating and clearing trouble in the RSCE

The section Locating and clearing trouble in the Remote Switching Center-Synchronous Optical Network (RSCE) is for maintenance engineering and field maintenance personnel use. This section is for personnel that have a basic knowledge of the Digital Multiplex System-100 (DMS-100) Family of switches and the RSCE only.

5 Trouble isolation and correction

The Remote Switching Center Equipment (RSCE) consists of the following:

- the remote cluster controller 2 (RCC2) or the RCC2 with integrated services digital network (ISDN)
- line concentrating devices (LCD)
- trunks
- links that connect the components

This section describes the troubleshooting procedure for these components.

Description of troubleshooting procedures

The RCC2 is the primary component of the RSCE configuration. The state of the RCC2 normally determines the state of the other RSCE components.

Locating and clearing faults

This section describes fault location and clearance in terms of trouble condition indicators and trouble conditions.

Trouble condition indicators

The following items indicate trouble conditions:

- operational measurements (OM)
- log reports
- alarms

Operational measurements

Operational measurements (OM) monitor and count events in the system. The OMs are the best means to detect current and potential system troubles. The OM thresholding feature monitors and reports key RSCE with ISDN activity. These daily or weekly reports are routine and are the primary method of trouble detection.

Log reports

Logs are an analysis tool, and provide detailed information on call errors, diagnostic results and system status. Logs are also good indicators of trouble conditions when any of the following conditions occur:

- sudden increase in volume of logs
- message not printed reports
- large number of logs that are like

Alarms

Audible and visual alarms indicate that a problem requires corrective action. Correct performance of routine system maintenance and use of OMs and logs can minimize the occurrence of alarms.

The levels of the alarm are: minor, major, or critical. Each level of the alarm has an associated corrective action. The following table describes these alarm conditions.

Table 5-1 Alarm description

Alarms	MAP display	Description
Minor	(blank)	does not affect service
Major	(M)	indicates a condition condition that degrades or threatens service
Critical	(*C*)	indicates a service outage or potential service outage

Assessing alarms The MAP display subsystems produces alarms for the RSCE configuration. The following table lists the alarms and the alarm meanings. The table also lists log reports that normally accompany the alarm.

Table 5-2 Assessing PM alarms from the MAP display (Sheet 1 of 2)

MTC level	PM level	Possible examples
PM RCC2	**ISTb 1**	One (or both) units have minor problems. These problems do not normally involve the peripheral processor (PP). A static data mismatch occurs between an RCC2 unit and central control (CC). A non-messaging central-side (C-side) link is out-of-service (OOS). A peripheral-side (P-side) link is OOS.
PM RCC2 M	**ISTb 1**	One unit is system busy (SysB) usually because of a PP card failure. When the unit is the active unit, peripheral module (PM) software performs switch of activity (SWACT) on the units. Check for PM128 logs.
PM RCC2 *C*	**SysB 1**	Both units are SysB. When noncommunication with the host causes the SySb, the RCC2 enters emergency stand-alone (ESA). Refer to the following sequence of logs to enter ESA: • PM109 (The carrier is busy.) • PM128 (The RCC2 is in-service trouble [ISTb].) • PM107 (The RCC2 is C-side busy [CBsy].) • PM107 (The line controller modules [LCM] are CBsy.) • PM102 (The RCC2 is SysB.) • PM181 (The RCC2 is trying to restart the message links.) Another possible reason is that both PPs have faults, and both units are SysB.
PM RCC2	**ISTb 1**	One or both units have minor problems that normally do not involve the PP. For RCC2 with ISDN, the following problems can occur: The D-channel handler (DCH) card malfunctions. If the DCH is a spare, the DCH is in-service (InSv). When the DCH is not a spare, the DCH loses D-channel capability. The RCC2 is set ISTb. The ISDN signaling preprocessor (ISP) card malfunctions. The RCC2 cannot process ISDN calls, and the plain old telephone service (POTS) calls process continues.

Table 5-2 Assessing PM alarms from the MAP display (Sheet 2 of 2)

MTC level	PM level	Possible examples
PM RCC2 M	**ISTb 1**	One RCC2 unit is OOS. The RCC2 continues to process both voice and data calls.
PM RCC2 *C*	**SysB 1**	Both RCC2 units are OOS. Both voice and data services are lost. If the RCC2 enters ESA, the ability to process data calls depends on the location of the packet handler (PH).

How to clear alarms

Use the following guidelines to respond to alarms:

- When more than one alarm of the same level occurs on the MAP display, clear the alarms. Clear the alarms from the left of the screen to right of the screen.
- When the user fixes an alarm and an alarm of higher level occurs, respond to the new alarm. Do not continue attempts to clear the alarm with the lower level.

For procedures to clear an alarm, refer to *Alarm Clearing Procedures section in this document*.

Trouble conditions

As follows are possible RSCE trouble conditions:

- data mismatch
- lines
- DS30A
- digital signal 1 (DS-1) links
- dual remote cluster controller 2 (DRCC2)
- forced ESA
- RCC2 with ISDN
- ISDN lines

Lines

When a fault isolated to an LCD, maintenance procedures are like the procedures at the host office. Make sure faults in an LCM are not the result of a fault from another area.

DS30A

The DS30A links are on the P-side of the RCC2. Links are on the C-side of the enhanced line concentrating module (LCME), the LCM, and the remote maintenance module (RMM). When these links have faults, the faults affect the associated components.

DS-1 links

The DS-1 links are used on the C-side and P-side of the RCC2. Links on the C-side of the RCC2 send both voice and messages to the host. Some of the channels are used as trunks. Use two channels, links 0 and 2, only for messaging.

Links on the P-side of the RCC2 connect remote line concentrating modules (RLCM) or other offices. When this condition occurs, the links function as trunks. These trunks can be static or dynamic.

Dual remote cluster controller 2

Primary sources of trouble for the DRCC2 are the condition of the interlinks. The condition of the messaging links to the host office can cause the RCC2 to enter dual ESA (DESA).

The following table summarizes trouble indicators for faults that can occur on the interlinks. Indicators also appear when the problem is corrected.

Table 5-3 Indicators for interlink maintenance (Sheet 1 of 3)

Trouble indicator	Meaning	Indicators that cleared
PM110—MTCE LIMIT SET >QUERYIR shows ML under the BER heading.	Bipolar violation (BpV) at the maintenance limit (ML) BpV at the ML indicates a wear of the DS-1 link. This is normally set in table CARRMTC.	PM110—*Carrier BPV Limit Cleared* >QUERYIR shows the ML alarm is gone.
PM110—MTCE LIMIT SET PM222—Interlink is system busied. PM128—RCC2 goes ISTb. System drops calls on that link. >QUERYIR shows OS under the BER heading and the state as SysB.	BpV at the OOS limit BpV at the OOS limit are set in table CARRMTC.	PM110—*Carrier BPV Limit Cleared* PM106—RCC2 returns to service from ISTb. PM223—Interlink returns to service. >QUERYIR shows the ML alarm is gone, and the link is now OK.

Table 5-3 Indicators for interlink maintenance (Sheet 2 of 3)

Trouble indicator	Meaning	Indicators that cleared
PM109—Carrier Local Alarm Set PM222—Interlink is system busied. PM128—RCC2 goes ISTb. System drops calls on that link. >QUERYIR shows LCGA under the ALRM heading and the state as SysB. For the interconnected RCC2, >QUERYIR shows RCGA under ALRM.	Local alarm is set	PM106—RCC2 returns to service from ISTb. PM223—Interlink returns to service. >QUERYIR shows the ML alarm is gone, and the link is now OK.
PM109—Carrier Card Removed PM128—RCC2 goes ISTb. PM222—Interlink is system busied. System drops calls on that link. >QUERYIR shows (-) under the C heading and the state as SysB. For the interconnected RCC2, >QUERYIR shows LCGA under ALRM.	DS-1 card is missing	PM106—RCC2 returns to service from ISTb. PM223—Interlink returns to service. >QUERYIR shows the ML alarm is gone, and the link is now OK.
PM110—Carrier Slip Maintenance Limit Set >QUERYIR shows ML under the slip heading. For the interconnected RCC2, >QUERYIR shows RCGA under ALRM.	Slips at the ML	>QUERYIR shows the ML alarm is gone.

Table 5-3 Indicators for interlink maintenance (Sheet 3 of 3)

Trouble indicator	Meaning	Indicators that cleared
PM110—Carrier OSS Limit Set >QUERYIR shows OS under the SLIP heading. For the interconnected RCC2, >QUERYIR shows RCGA under ALRM.	Slips at the OOS limit	>QUERYIR shows the OS alarm is gone.
PM110—Carrier LOF Maintenance Limit Set >QUERYIR shows ML under the FRME heading. For the interconnected RCC2, >QUERYIR shows RCGA under ALRM.	Frame loss at the ML	>QUERYIR shows the ML alarm is gone.
PM110—Carrier LOF Maintenance Limit Set >QUERYIR shows OS under the FRME heading. For the interconnected RCC2, >QUERYIR shows RCGA under ALRM.	Frame loss at the OOS limit	>QUERYIR shows the OS alarm is gone.

Forced emergency stand-alone

When an RCC2 is in forced ESA, the system sends a PM189 log to the host with a FORCE DOWN message. The log simulates link faults on messaging links 0 and 2. If these links are posted at the CARRIER level of the MAP display, the alarm remote carrier group alarm (RCGA) appears. An example of this link is the POST LTC2.

The only way to know if the RCGA is a real alarm is to receive the PM189 log. If links 0 and 2 do break while the RCC2 is in forced ESA, the links have the local carrier group alarm (LCGA) alarm. This condition occurs at the CARRIER level.

> ***Note:*** Real faults at the RCC2 can be one-way. The alarm would continue as RCGA and operating company personnel would have only the PM189 log. This condition is not clear. In most occurrences, real faults on the messaging links are normally two-way and produce LCGA alarms.

RCC2 with ISDN

The following list shows procedures used for troubleshooting the RSCE with ISDN:

- B-channel packet service, ISDN line to Data Packet Network (DPN)
- provisioned B-channel data service, ISDN line to ISDN line
- D-channel packet service
- B-channel voice service
- B-channel circuit-switched data service

> ***Note:*** The main difference between an RCC2 without ISDN and an RCC2 with ISDN is the enhanced ISDN signaling preprocessor (EISP). If the EISP is at fault, the RCC2 with ISDN does not work. Enter the QUERY PM FAULT command to check for damaged cards. After the check is completed, take other maintenance action.

Integrated services digital network lines

The following table lists possible states for the ISDN line card, the equipment that is most likely OOS, and the suggested maintenance action.

Table 5-4 Restore service to the line (Sheet 1 of 2)

ISLC	Equipment OOS	Suggested maintenance action
CUT	Line	Post the ISDN line by the line equipment number (LEN) and enter the DIAG command to determine if the relay is stuck. Replace the line card if the relay is stuck.
LMB	RCC2, LCME, or message link between RCC2 and LCME	Post the ISDN line by the LEN. Enter the CKTLOC command to display the status of all PMs and links associated with the line. Access the MAP level associated with the item that does not have the correct status. Use MAP commands to test components.
DMB		Use the CKTLOC command in the line test position (LTP) level to identify where the fault lies. Take one of the following actions:
	DCH OOS	Access DCH and ISDN service group (ISG) levels of the MAP display. Post the correct DCH. Use MAP commands to locate damaged components.
DMB (continued)	Speech link OOS	Access the PM level of the MAP display. Identify the damaged speech link. Test the speech link and return the speech link to service to restore all LENs associated with that speech link.
	ISG channel	Busy and RTS the ISG channel at the ISG level of the MAP display.

Table 5-4 Restore service to the line (Sheet 2 of 2)

ISLC	Equipment OOS	Suggested maintenance action
	Path fault in RCC2	Perform a SWACT to see if the fault continues to exist.
	Path fault in LCME	Busy and return the LCME to service.
	I-flag is set	Use MAP commands to test for a damaged connection or a babbling terminal.
LO	Line	Loss of sync between the ISDN line card and the network termination 1 (NT1). The system detects this fault. The change out of this state occurs when the system detects a synchronization condition. Use commands available at the LTP level of the MAP display to locate damaged hardware.
INB	Line	Line that goes through office data modifications. An entry exists in table LNINV. If the line is not out of the installation busy state, use the CKTLOC command to verify the following: • a DCH channel associates with the ISDN line • the path between the DCH and the LEN is not broken
MB	Line	Line is ready for routine maintenance by input of commands at the LTP level of the MAP display. Remove the line from service for maintenance as a result of a customer complaint.
MB	Line	Line that goes through tests to find faults
CPD	Line	Line processes a circuit-switched call. The line is removed from service for possible maintenance activity when the call ends. The access to the line can take place from any MAP display for maintenance, after the state changes to manually busy. To cancel maintenance, post the deload queue at the LTP level of the MAP display.
NEQ	Line	Use the table editor (TE) to enter tables LNINV and DCHINV.

How to post ISDN lines using the POST DK command

The system activates the following POST command parameters if the customer purchases the SOC NI000050 2B-FIT/NIT feature:

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

The POST DK command displays a DN appearance on the specified key on an ISDN terminal, as shown in the following figure. If the DN appearance is active, the key number of the DN appearance and the bearer capability of the call appears. The far-end information also displays if the DN appearance is active.

Figure 5-1 LTP MAP level display with a posted ISDN line with key number and bearer capability displayed

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

After the POST DK command posts the ISDN line, the line below the control position appears. This line indicates the key number and bearer capability. In the previous example the CPE has DN 621-5986 assigned to key 33, and has a speech call active. The possible bearer capabilities appear in the following table:

Table 5-5 Bearer capability display codes (Sheet 1 of 2)

Bearer capability	Display
Speech	SP
3.1 kHz audio	3AU
Circuit mode data, rate adapted to 56 kHz	56C

Table 5-5 Bearer capability display codes (Sheet 2 of 2)

Bearer capability	Display
Circuit mode data 64 kHz	64C
Packet data	PMD

The system checks the DN state one time each second, and updates the display.

Responses to LTP level commands

The following table lists responses to commands initiated at the LTP level.

Table 5-6 Responses to LTP level command (Sheet 1 of 2)

POST		
Response	*Meaning*	*What to do*
`Option NI000050 is not enabled`	The user attempts to use the POST DK command and did not enable software option control (SOC) option NI000050.	Use a different POST command to post the DN.
`The DN is not an ISDN DN Posted circuits unchanged`	The POST DK command issues on a non-ISDN line. This command is only valid for ISDN lines.	Enter the command again on an ISDN line, or use a different POST command.
The system displays `NO EQUIPMENT` in the LEN field and `NEQ` in the status field.	The posted DN assigns to an LTID that is not mapped to a LEN in table LTMAP.	Use the SLT ATT command to Map the LTID to a LEN before posting the DN.

Table 5-6 Responses to LTP level command (Sheet 2 of 2)

POST		
`Incorrect DN Appearance.`	The specified DN does not appear on the specified Key.	Enter the POST DK command again with the correct key, or use the ALL option to list all keys for the DN.
`ACO/AFC DN:The key number shown may be different than the accurate key in use`	When you post a DN Appearance, the DN Appearance is a member of a group of Appearances for the DN. The posted DN appearance has a AFC or ACO provision. The key numbers for these DNs are not the same as the physical keys on the ISDN set. The Q.931 message protocol creates a different key. The Q.931 message protocol refers to the DN without reference to the key number used. The user or the ISDN set decide what physical key a call uses. The system never communicates the information to the CM or XPM.	This response is for information only.

Fault isolation tests

This section describes fault isolation tests for the following components:

- RCC2
- lines
- RCC2 with ISDN

RCC2

When you troubleshoot an RCC2, access the RCC2 MAP level and enter the QUERYPM FLT command. The following table lists possible reasons for a

SysB RCC2 alarm and the possible examples. In most occurrences, the log report mirrors the response to the QUERYPM FLT command.

Table 5-7 How to assess SysB alarms for the RCC2 (Sheet 1 of 2)

Message at RCC2 level	Possible examples
`All C-side Links are Down`	The C-side PM cannot talk with the RCC2.
`Audit Detected Different PM Activity`	As an example, the CC responds like unit 0 is active but unit 1 is active. The difference indicates CC does not respond like a SWACT occurred. The CC busies and returns both units to service. The units come back with the active and inactive original unit configuration of the CC.
`Audit Detected Different PM State`	The internal state of the active unit is not ready. The state is busy, restart, or synchronizing The state is normally a software error. CC busies and returns both the RCC2 and the C-side links to service.
`Autonomous Activity Drop`	A SWACT that the system generates occurred. A trap or facility audit normally causes the SWACT.
`Diagnostics Failed`	Unit failed test or RTS.
`Inact Unit Lost Data Synch`	Unit-to-unit communication failed and cannot perform a Warm SWACT.
`PM Audit Detect Fault`	One of the background hardware audits detected a fault.
`PM SWACT`	A Warm SWACT occurred.
`Require Data Load`	An error occurred on a DS-1 link to the unit. The unit waits for the maintenance system to perform a reset.
`Reset While InSv`	An error occurred on a DS-1 link to the unit. The unit waits for the maintenance system to perform a reset.
`REx Incomplete` (Terminated)	The routine exercise (REX) test cannot complete the series of tests because of a condition that is not normal. A minimum of one unit is ISTb. Inactive unit is BSY.
`REx Failed`	A failure occurred during a test. The messages are the result of the actions of the system to compensate for the failure. Achieves superframe and data synchronization. Inactive OOS Tests. Inactive RTS. Warm SWACT. Inactive OOS Tests after SWACT.
`Self Test Failed`	One of the background hardware audits detected a fault.

Table 5-7 How to assess SysB alarms for the RCC2 (Sheet 2 of 2)

Message at RCC2 level	Possible examples
`Trap Message Received From PM`	Unit sent a complete message to CC that follows an auto-restart.
`Unsolicited Message Limit Exceeded`	Unit sent more than 100 unsolicited messages to the CC in 1 min.

The following table lists possible reasons for an ISTb RCC2 alarm and possible examples. In most occurrences, the log report mirrors the QUERYPM FLT response.

Table 5-8 How to assess ISTb alarms for the RCC2 (Sheet 1 of 2)

Message at RCC2 level	Alarm	Possible examples
`One/Both Unit(s) ISTb`	minor	One or both units are ISTb.
`PM Overloaded`	minor	Traffic load is exceeding the ability of the PM to process calls.
`CSLinks Out of Service`	minor	C-side message links failed the periodic InSv C-side links test (one for each minute).
`PSLinks Out of Service`	minor	A P-side link (for example to the LCME or RMM) became SysB.
`Node Redundancy Lost`	major	A unit is OOS. The RCC2 cannot perform a necessary SWACT.
`Major CSLink Failure`	major	A C-side link failure caused a major alarm.
`Critical CSLink Failure`	critical	A C-side link failure caused a critical alarm.
`Interlinks out of service`	minor	One of the interlinks of the DRCC2 configuration is SysB.
`Bad MX77 IMC link`	minor	An intermodule communication link is bad.
`Bad 6X69 IMC link`	minor	An intermodule communication link is bad.
`PM node table mismatch`	minor	The node table data in the RCC2 and CC do not match.
`Dynamic data sync`	minor	The RCC2 has not achieved dynamic data sync.
`ESADATA`	minor	The RCC2 does not have an ESA load, or does not match the CC, or the current load is corrupted.

Table 5-8 How to assess ISTb alarms for the RCC2 (Sheet 2 of 2)

Message at RCC2 level	Alarm	Possible examples
`Static data mismatch with CC`	minor	The RCC2 static data does not match CC static data.
`Data mismatch with inventory table`	minor	The load in table RCCINV does not match the load name according to CC.

Lines

When the MAP screen displays an LCM alarm, enter the LCM MAP level and post the LCMs that match that state. Post the LCM according to site to ensure the LCM with the alarm is part of the RSCE configuration.

If the LCM is part of the RSCE configuration, post the C-side RCC2 and enter the QUERYPM FLT command. If a problem exists, perform an InSv test. If the test fails, perform normal RCC2 maintenance. When the maintenance is complete, LCM maintenance is the same as for the host office.

Remote cluster controller 2 with ISDN

When you troubleshoot an RCC2, access the RCC2 MAP level and enter the QUERYPM FLT command.

Diagnostic tests

The following section describes RSCE diagnostic tests.

NTMX76 pack diagnostics

Feature AF4342, NTMX76 Pack Diagnostics, provides message and high-level data link control diagnostics on the Channel Supervisory Messaging (NTMX76AA) memory and hardware.

The user implements tests from the CC or PMDEBUG level. The tests are classified as destructive or nondestructive. Destructive tests are performed on inactive and manually busied units. Tests are performed according to the message card in the inventory table of the RCC2 shelf, and the message card

NT6X69AC or NTMX76AA on the RCC2 shelf. The following tests are available:

- message tests—current tests for the NT6X69AC card and for the NTMX76AA card.
  - — tone diagnostic
  - — message
- high-level data link control tests—new hardware tests for NTMX76AA. These tests diagnose the Q.703 part of NTMX76AA.
  - — NTMX76 card existence
  - — memory
  - — receive connection memory
  - — data routing
  - — high-level data link control messaging system
  - — intermodule communication

Tone diagnostic test

Tone generation, explanation test, and tone checksum follow the current XMS-based peripheral module (XPM) message test design. The tone diagnostic test is a destructive test.

Message tests

The same tests used for the NT6X69AC circuit card are used for the NTMX76AA circuit card.

NTMX76AA card existence test

This test verifies that the system uses the NTMX76AA circuit card and not the NT6X69AC circuit card. This test is a nondestructive safe test.

Memory test

This test verifies the access and functionality of the receive and transmit data memory and the receive and transmit connection memory. This test is destructive.

Receive connection memory test

This test verifies the ability to route data from the receive data memory to the correct channel according to the receive connection memory. This test is destructive.

Data routing test

This test verifies the ability to route data from the transmit and receive data memories to the correct channels. The system routes data to the correct channels according to the receive and transmit connection memories. This test also verifies the transmit and receive data memories receive data from the designated channels. This test is destructive.

High-level data link control messaging system test

This test verifies the functionality of the high-level data link control messaging system. The test sends a high-level data link control message and loops the message back. This test is nondestructive.

Intermodule communication test

This test verifies that the bidirectional intermodule communication connection with the mate unit exists. This test uses two channels in each direction. Use of these channels cannot occur for other purposes. This test is nondestructive.

Enhanced line testing 1

Feature AF4838, RSCE Enhanced Line Testing 1, verifies the functionality provided in phases 1 and 2 of the DMS-100 switch translation language 1 project. The project provides ISDN 2B1Q loops that subtend LCMEs attached to an ISDN RCC2.

An operating system is the operating company system. The operating system supports operations, administration, and maintenance (OAM) of subscriber loops, trunks, POTS, and special services. The operating system supports all other services the DMS-100 switch provides. An operating system communicates with a DMS-100 switch with an X.25 data link. The interface between an operating system and DMS-100 switch is the translation language 1 command and response set.

The ISDN translation language 1 project provides the following capabilities:

- supports X.25 data links between operating systems and the DMS-100 switch
- decodes and encodes translation language 1 commands and responses
- executes maintenance that translation language 1 commands specifies. Generates responses that contain the results of maintenance.
- supports test equipment required to execute maintenance
- supports commands at the LTPISDN and LTPLTA levels of the MAP display to allow support of ISDN 2B1Q loop and line activities

The TEST command is a menu command available at the LTPISDN MAP level. To function, the test command requires a posted ISDN 2B1Q loop. The TEST command consists of many options. These options are also referred to as *unlisted menu* commands. Each option or *unlisted menu* of the TEST command is a test. The corresponding translation language 1 command provides a test. These tests implement ISDN loop and line maintenance activities.

Application of tests occur at the LTPISDN MAP level, except for the ac resistance test. The LTPLTA MAP display level implements the ac resistance test. The TEST command with an exact option implements each test at the LTPISDN MAP display level. The RES command with *ac* as an option implements the ac resistance test. The RES command is a menu command that requires a posted line in order to function.

The following table provides a description of the correct commands and activities.

Table 5-9 MAP commands, options, and activities (Sheet 1 of 3)

Command	Option and activity
CONN-DTAC-ISDN	Indicates the beginning of a test session. Tests and measurements that require digital test access can be performed. The line tested is seized and kept OOS for the duration of the test session.
CONN-MTAC-ISDN	Indicates the beginning of a test session. Tests and measurements that require metallic test access (MTA) can be performed. The line tested is seized and kept OOS for the duration of the test session.
DGN-DET-TOTS	Requests a complete set of tests on the ISDN 2B1Q line card, digital subscriber loop, and the 2B1Q NT1. This command determines if a fault exists in any 2B1Q loop component. This test is immediately ended when encountering a fault.
DISC-TACC	Indicates the end of a test session. Connections set up using the connect commands are released and the line returns in the previous state.
MEAS IMPNSE	Measures the impulse noise on the loop for a specified time.
MEAS-LOOP-LOSS	This command measures the 2B1Q signal level that the NT1 generates. This level identifies the existence of load coils on the loop, and verifies if the amount of loss is acceptable.
MEAS-NSE	Measures wideband noise interference on the digital subscriber loop.
MEAS-SCUR-DSL	Measures the sealing current the ISDN 2B1Q line card generates on the digital subscriber loop.
REPT-ALM	Generated by the DMS-100 switch when one or more test sessions encounters a failure.

Table 5-9 MAP commands, options, and activities (Sheet 2 of 3)

Command	Option and activity
REPT-INITZN	An autonomous command the operating system or the DMS-100 switch sends. The operating system uses this command to verify the DMS-100 switch is online and restart is complete. The DMS-100 switch uses this command to report the switch went through a restart
REPT-STAT	Checks the X.25 data link operation. The operating system sends this command to the DMS-100 switch if no additional messages are sent in the last 60 s.
RES AC	Implements the measurement of two-terminal ac resistance. this measurement is used to calculate three-terminal resistance to identify terminations and high resistance open circuits.
RMV-TOTS	Removes services from an ISDN 2B1Q line and places the line in a *manual* OOS state.
RST-TOTS	Restores service to an ISDN 2B1Q line and places the line in an *idle* InSv state.
RTRV-COND-ISDNL2	Instructs the DMS-100 switch to retrieve the current line state and standing condition (alarm or status) associated with one or more lines.
RTRV-DNCT	Retrieves the equipment associated with the directory number (DN) and call type of the line.
RTVR-PM-TOTS	Retrieves Retrieves the current set of performance monitoring data associated with an ISDN 2B1Q line. The data retrieved are block errors, errored seconds, and severely errored seconds in both directions of the transmission path.
RTRV-TRNSL	Retrieves the translation information associated with an ISDN line. This information is needed to determine if an ISDN 2B1Q line does not work because of datafill problems.
TEST ALM	Verifies the ability of the DMS-100 switch to detect and report loss of signal without an NT1 *Dying Gasp*.
TEST COLDST	Implements the cold start test. The cold start test checks the ability of the ISDN 2B1Q line card to train the echo cancellers and equalizers. The card trains the echo cancellers and equalizers to an NT1 over a maximum length in 15 s.
TEST DCSIG	Implements the NT1 signature test. This command measures the direct current metal termination characteristic of the NT1.

Table 5-9 MAP commands, options, and activities (Sheet 3 of 3)

Command	Option and activity
TEST DET	Implements the performance monitoring test. This command checks the ability of the ISDN 2B1Q line card. The line card detects bit block errors, errored seconds, and severely errored seconds for a specified direction of transmission.
TEST ILOSS	Implements the measurement of insertion loss test. This command implements the measurement of insertion loss on an ISDN 2B1Q digital subscriber loop.
TEST IMP	Implements the impulse noise measurement test. This command implements the measurement of impulse noise on an ISDN 2B1Q digital subscriber loop.
TEST NSE	Implements the measurement of wideband noise interference test. This command implements the measurement of wideband noise interference on an ISDN 2B1Q digital loop subscriber.
TEST SCUR	Implements the sealing current measurement test on an ISDN 2B1Q line card. During this test, continuous sealing current is given while the test equipment verifies the current is within the acceptable range.
TEST THR	Implements the performance monitoring threshold test. This command checks the ability of the ISDN 2B1Q line card to report threshold crossings for bit block errors. The card also reports errored seconds, and severely errored seconds for a specified direction of transmission.
TST-LPBK-ISDN	Performs bit error testing on an ISDN line card, and the digital subscriber loop to the NT1.
TST-PM	Checks the ability of the ISDN 2B1Q line card to detect bit block error, errored seconds, and severely errored seconds for a specified direction of transmission.
TST-QISDN	Performs loop measurements on the ISDN 2B1Q digital subscriber loop.
TST-THRS	Checks the ability of the ISDN 2B1Q line card to report threshold crossings for bit block errors, errored seconds, and severely errored seconds for a specified direction of transmission.

Digital test access

Feature AF4839, RSCE Digital Test Access, is a digital monitoring method for ISDN basic rate interface (BRI) loops and Bd connections.

Feature AF4839 provides the following services for the RSCE product:

- user-assigned terminal endpoint identifier (TEI)
- unsolicited message and link access procedure on the D-channel (LAPD) cleanup
- a digital monitoring method for ISDN BRI and Bd connections

User-assigned TEI

User-assigned TEI allows customers to specify an ISDN TEI. The range of TEIs is 0 to 63.

Link access procedure on the D-channel cleanup

The layer 2 state machine software in the DCH, and the EISP alters to comply with specifications. The specifications are found in *Bellcore Technical Reference*, ISDN D-Channel Exchange Access Signaling and Switching Requirements (Layer 2).

LAPD cleanup creates an audit of the resources important to correct messaging in the DCH and EISP.

Digital test access

Digital test access provides the ability to monitor circuit-switched B-channels, packet-switched B-channels, D-channels and Bd-channel. The test monitors traffic from an ISDN BRI loop. The external protocol analyzer performs the monitoring. The ISDN line card, or the two next channels on a digital trunk facility, accesses the external protocol analyzer.

The MTA allows test equipment to connect to subscriber lines with a test access bus in the LCM. Test equipment connects to any line card in the drawer. The subscriber line and the test equipment does not use a metal path in the MTA process. Broadcasts of the digital data streams to and from subscriber lines to a protocol analyzer establishes digital test access. Monitoring is done in the LCME for loop monitoring, and in the XPM that hosts the LCME for Bd connections. Digital test access does not affect service on the loop to which the test applies.

For the monitored loop channels or Bd connections, two streams of digital data are obtained. Upstream data, is the data flowing *toward* the DMS switch and *away* from the subscriber. The downstream data, is the data flowing *toward* the subscriber and *away* from the DMS switch.

Both the upstream and downstream data of the monitored loop or channel are 64-kb/s serial digital data streams to one of the following:

- two DS-0 channels of a DS-1 interface, entered for 64-kb/s transmission
- the B1 and B2 channels of an ISDN line card

The monitoring point for the upstream and downstream data of the loop channels (B or D) is the LCME time switch. This point occurs where the LCME connects to the line card. The monitoring point for the upstream data of Bd channels is the RCC2 time switch. This point is where the time switch connects to the DCH. The monitoring point of the downstream data of Bd channels is the time switch at the digital trunk. This time switch interfaces to the DPN PH.

Channels available for monitoring

Digital test access monitors the following:

- provisioned B-channels
- TDM D-channels
- circuit switched B-channels
- Bd channels the system routes to a DS-1 interface connected to a DPN switch

Each loop allows one digital test access Bd connection at a time. Multiple taps can be present on one Bd connection. Multiple taps allow different loops that use the same Bd connection to have simultaneous digital test access connections.

When a digital test access monitors a D-channel, the system delivers all four TDM channels are delivered to the protocol analyzer. The TDM group member number associated with a line is available from the LTP level of the MAP display with the CKTLOC command. The member number and line is also available at the LTPDATA level of the MAP display with the EQUIP DTA QUERY command.

Monitored equipment is for digital test access. Two commands at the MAP display connect to the monitored BRI channel or Bd connection. A nailed-up connection establishes the connection between the monitoring equipment and the monitored channel. The connection remains in place until operating company personnel use a MAP command to remove the connection.

The system maintains digital test access connections over CC restarts and XPM SWACTs, initiated manually or that the REX test causes. Digital test access connections also remain in place during DCH takeovers and LCME takeovers and takebacks.

Protocol analyzer requirements

The protocol analyzer must be able to interconnect with a DS-1 digital interface or an ISDN S/T loop interface. The protocol analyzer must be able to resolve separate D-channel members from the TDM group.

Preparation for digital test access monitoring

There are several steps to take before digital test access monitoring can begin. To make sure the data streams are preserved for data transmission, provision the DMS switch network. Failure to provision the DMS switch network results in corruption of digital data streams to the protocol analyzer.

The following list contains the requirements to prepare for digital test access monitoring:

- provision DS-1 monitoring equipment or provision ISDN line card monitoring equipment
- reserve equipment for use in digital test access monitoring
- establish digital test access connection
- monitor with digital trunk facilities or an ISDN line card

Provision DS-1 monitoring equipment

If a digital test access monitoring uses a DS-1 facility, provision of the facility to support 64 kbps clear data transmission must occur.

This requirement involves the following areas of the DMS switch:

- hardware that supports the DS-1 interface
- carrier datafill

The RCC2 DS-1 circuit card must be NTMX81AA.

Provision ISDN line card monitoring equipment

An ISDN line card monitors the digital data obtained from the digital test access on an ISDN line. The line card datafilled is in table LNINV as *hardware assigned software unassigned (HASU)*. This datafill of the line card as HASU prevents assignment of DCH resources. The B-channels of an ISDN line card cannot be nailed-up for provisioned B-channel service. The loop state must be installation busy.

Reserve equipment for digital test access monitoring

The equipment used to monitor the upstream and downstream data from the monitoring points that result from each digital test access application are two channels of a DS-1 digital trunk, or an ISDN line card.

An operating company personnel can monitor from a distance the upstream and downstream data using two channels of a digital trunk. The entry of the digital trunk is for RCC2 DS-1 digital test access.

When a digital trunk is used for digital test access monitoring, nail-up connections to the two DS-0 channels cannot occur. You cannot enter these channels in table TRKMEM. When channels are unequipped from digital test access usage the nail-up connections and entry can occur. Channels are made unequipped with the EQUIP DTA RESET command at the LTPDATA level of the MAP display.

A line card is equipped for digital test access use with the EQUIP command at the LTPDATA level of the MAP display. A LEN specifies the ISDN line card. The B1 channel receives the upstream data from the monitored line and the B2 channel receives the downstream data.

Establish digital test access connection

With the monitoring equipment provisioned, the digital test access connections are established and verified. Operating company personnel perform these actions from the LTPDATA MAP level. The CONNECT command makes the connection between the monitoring equipment and the BRI loop or Bd connection to monitor.

If the system supports the monitoring equipment and monitored loop or Bd connection on different peripherals, a network connection occurs. The network connection occurs between the two end-points. A monitored Bd-channel nailed-up to a digital trunk supported from a different peripheral requires a network connection. Connections in the network are nailed-up connections. The system retains the connections over CC restarts.

Details of monitoring in the enhanced line concentrating module

The LCME time switch where the line card resides obtains the upstream and downstream data for loop channels (B or D). A broadcast connection used at the time switch monitors the digital data for the upstream and downstream directions. The connection allows connections to remain not changed. For each data stream, connections occur to the RCC2 that hosts the LCME. The connections go to the monitoring equipment. If the monitoring equipment resides in an XPM other than the RCC2, bidirectional network connections are allocated. The following table summarizes this information.

Table 5-10 Time switch end-points (B or D channels)

Monitored channel	Channel connects to	Upstream monitor point	Downstream monitor point
Circuit switched (B1 or B2)	Any end-point supporting circuit switching	LCME hosting line card	LCME hosting line card
Provisioned B-channel, B1, and B2	Digital trunk or ISDN line card	LCME hosting line card	LCME hosting line card
D-channel	ISG or DCH	LCME hosting line card	LCME hosting line card

Details of monitoring in XPMs (Bd-channel)

Upstream and downstream data for the monitored Bd-channel derives from different points in the DMS switch. The upstream monitor point resides at the XPM that supports the LCME that serves the ISDN loop. The downstream monitor points for a Bd-channel are in the XPM hosting the digital trunk to the PH. A broadcast connection at the time switch monitors the digital data for the upstream and downstream directions. If the monitoring equipment resides on another XPM, bidirectional network connections are established. If the monitoring equipment does not reside on another XPM, connections remain within the XPM. The following table summarizes end-points for Bd-channels.

Table 5-11 Timeswitch end-points for Bd-channels

Monitored channel	Channel connects to	Upstream time switch end-point	Downstream time switch end-point
Bd-channel	Digital trunk	XPM hosting loop	XPM hosting digital trunk

Verification of digital trunk access connections

When a digital test access connection establishes, verify the accuracy of the connection. The CONNECT command at the LTPDATA MAP level verifies the accuracy. This command ensures delivery of connection information to XPMs that support the monitoring connection. This verification replaces the channel supervision message (CSM) used in circuit-switched connections. If a connection segment is bad, update the status information displayed at the MAP display.

Use the following procedure to use the digital test access feature correctly.

Steps for use of digital test access

1 Identify a loop to monitor.

Note: Only ISDN BRI loops are valid.

2 Identify the monitor equipment.

Note: This can be a digital trunk or an ISDN line card.

3 Provision the monitor equipment correctly.

Note: Check carrier or line datafill.

4 Connect protocol analyzer to the selected access point.

5 Enter the LTPDATA level of the MAP display.

Note: All digital test access commands are located at this level.

6 Post the monitored loop.

7 Reserve the monitoring equipment.

Note: Use the EQUIP command. Note the equip number that returns.

8 Connect the monitoring equipment.

Note: Use the following command syntax of the CONNECT command:

>CONNECT equip# chnl

9 Query all digital test access connections. This step is optional.

Note: Command syntax:

>EQUIP DTA QUERY ALL

10 Verify connection integrity. This step is optional.

Note: Command syntax:

>CONNECT equip# VERIFY

11 Release the digital test access connection.

Note: Command syntax:

>CONNECT equip# RLS

12 Release monitoring equipment.

Note: Command syntax:

>EQUIP DTA RESET equip#

Limits and feature interactions

The following is a list of digital test access limits and feature interactions:

- Bd connections that end at the DMS PH are not monitored.
- The office parameter MAX_DTA_ON_SWITCH limits the number of digital test access connections active in the office in table OFCENG.
- A maximum of six digital test access connections can be present at the same time in an XPM.
- Channels are allocated on links between the loop monitoring point and the monitoring equipment. Connections are made across peripheral and network modules between these channels. These channels are not available for call processing while the digital test access connection is active.
- If a unit of the RCC2 is OOS, act with caution when you add or remove digital test access connections. Digital test access connections download as part of the XPM static data. A change of the static data affects the RCC2 as follows.
  - — If the RCC2 is OOS, all static data for the RCC2 downloads as part of the RTS sequence. This can increase recovery time.
  - — If the RCC2 returns to service and static data is downloaded, a static data mismatch occurs between CC and the RCC2. This static data mismatch prevents a download of ESA static data to the RCC2.

- Link rearrangement of an LCME off of an RCC2 sometimes cannot occur. When digital test access connections are active on lines on that LCME link rearrangement cannot occur.
- The remove of a digital test access connection while an XPM is OOS can increase the time necessary to return that XPM to service. Digital test access connection information downloads as static data. The removal of a digital test access connection while the XPM is OOS requires a download of all static data to the XPM. This download must occur when the XPM returns to service.

  Note: The result of the addition and removal of digital test access connections on host XPMs is the same as the RCC2. The exception to this similarity applies to items that relate to ESA.

Layer 1 performance monitoring

Feature AF4842, RSCE Layer 1 Performance Monitoring provides the following layer 1 performance monitoring capabilities to the RCC2:

- Bd-channel logical loopback
- DCH performance OM. Refer to *Operational Measurements Reference Manual*
- layer 1 performance monitoring
- multipoint embedded operations channel (EOC)

Bd-channel logical loopback

Bd-channel logical loopback provides logical loopback between a DCH and the PH in the DPN. This loopback allows operating company personnel to place a logical terminals P-side link into loopback mode. This loopback assists in the identification of the existence of faults inside and outside the DCH.

The loopback is asserted at the DCH end of the connection. The loopback is not asserted at the PH end of the connection. After the application of the logical loopback for a logical terminal, the DCH loops back the test frame or test packet. The DCH loops back the test frame or test packet received from the PH. This process occurs through the use of the logical terminal identifier (LTID) for that logical terminal. An LTID identifies the logical terminal.

The command at the LTPISDN level of the MAP display places a logical terminals P-side link in the logical loopback mode. When a command places a logical terminal P-side link in a logical loopback mode, the P-side link is not available. The DCH makes sure the logical terminal cannot use that P-side link to establish new packet-switched virtual circuits (SVC). The DPN PH drops any active SVCs of the P-side link the P-side link is set to the loopback mode. Current permanent virtual circuits (PVC) on the P-side link are also dropped while the P-side link is in the loopback mode.

When the P-side link is not in a logical loopback mode and the DPN PH logically enables the P-side link, the logical terminal can send LAPD frames. When the loopback timer associated with the logical timer expires, the P-side link leaves the loopback mode. The implementation of the LTLOOPBK command at the LTPISDN level of the MAP display also causes the P-side link to leave loopback mode. If the PH send LAPD frames on this LTID, the frames are looped back to the PH.

> ***Note 1:*** The loopback timer is one of the parameters entered when the logical terminals P-side link is in the logical loopback mode.
>
> ***Note 2:*** This feature does not support an attempt to logically loop back a logical terminals P-side link that ends on a DMS PH.

Emergency stand-alone effects

In ESA, SWACT, and restart conditions, the result of loopback maintenance is not known. Remove all Bd-channel loopbacks before or immediately after these maintenance activities.

Layer 1 performance monitoring

Layer 1 performance monitoring provides layer 1 monitoring capabilities for a 2B1Q loop. Layer 1 monitoring comprises performance monitoring of cyclic redundancy checks (CRC), block error events, and the monitoring of loop conditions. The monitoring of loop conditions include synchronization, signal presence, and NT1 power status. Performance monitoring includes loop status monitoring for separate loops and offices. Performance monitoring also includes the ability to set one of 16 performance monitoring threshold sets for a 2B1Q loop. This section describes monitoring capabilities.

Monitoring capabilities

Monitoring capabilities include the ability to enable or disable the reporting of performance monitoring alerts and status alarms through the use of logs for separate loops and offices.

Loop status monitoring permits loops to report the following layer 1 conditions that are not normal:

- loss of synchronization word (LOSW)
- loss of signal with *no dying gasp* (LOS)
- loss of signal with *dying gasp* (LOSDG)
- change of NT1 test mode (NTM)
- S/T interface synchronization lost (TSYNC)
- performance monitor reporting (PERF)

The following capabilities handle performance monitoring data:

- Define up to 16 performance monitoring threshold sets to generate alerts by subscriber loops. Each set contains four thresholds:
  - — errored seconds—hourly (1 to 4095)
  - — errored seconds—daily (1 to 16383)
  - — severely errored seconds—hourly (1 to 4095)
  - — severely errored seconds—daily (1 to 16383)

  Note: An errored second is one or more CRC problems in a single direction of transmission during a 1-second interval. A severely errored second is three or more CRC violations in a single direction of transmission during a 1-second interval.

- Set one of 16 known threshold sets to any 2B1Q loop. Performance monitoring thresholding on a per-loop condition is provided but not limited to set values before thresholding. Threshold data is sent to line card hardware. A batch change supplement (BCS) application preserves threshold information for each loop.

  Note: A log generates when a threshold parameter for an error reaches the threshold level on an ISDN line card. This threshold parameter is for a far-end block error and a near-end block error. *Near end* refers to the parameters collected for NT1 to ISDN line card of data transmission on a U-loop. *Far end* refers to the parameters collected from the opposite direction of transmission.

- The time-of-day reference clock of each 2B1Q loop synchronizes with the master clock of the DMS-100 switch
- A periodic per-line audit detects and corrects threshold and time-of-day values on line cards
- The 2B1Q diagnostic functionality, implemented from the MAP display, which verifies threshold levels in the ISDN line card

Tables added or modified for layer 1 performance monitoring

Tables BLMTHRSH and LNTHRSH are added to support 2B1Q lines off an RCC2.

Table BLMTHRSH assists in the definition of threshold combinations for 2B1Q loops. Table LNTHRSH supports the preservation of threshold and alarm reporting data over a BCS application for 2B1Q and S/T loops. There is an entry for each 2B1Q loop with threshold combination or alarm reporting capability that are not default features.

Table Office Variable (OFCVAR) controls the default alarm reporting status of entered loops. The following table OFCVAR parameters support 2B1Q lines off an RCC2:

- ISDN_PERFORMANCE_MON_ALARM
  - — controls the reports of performance monitoring log LINE131 for separate offices
- ISDN_LOSS_OF_SYNC_WORD_ALARM
  - — controls the reports of layer 1 loss of synchronization
- ISDN_LOSS_OF_SIG_NO_DGASP_ALARM
  - — controls the 2B1Q loop reports of layer 1 loss of signal without *dying gasp* for separate offices
- ISDN_LOSS_OF_SIG_DGASP_ALARM
  - — controls the 2B1Q loop reports of layer 1 loss of signal with *dying gasp* for separate offices
- ISDN_NT1_TEST_MODE_ALARM
  - — controls the 2B1Q loop reports of NT1 test mode for separate offices
- ISDN_T_SYNC_LOST_ALARM
  - — controls the 2B1Q and S/T loop reports of T-SYNC for separate offices

Emergency stand-alone effects

Any data changes that occur while the RSCE is in ESA are not guaranteed in the subtending nodes of the remote after a warm ESA exit. When restoration of communications with the host office occurs, the state of the RSCE is only guaranteed to equal the state of the RSCE before the RSCE entered the ESA.

Table BLMTHRSH contains 16 PM threshold sets. These values do not change often, especially while the RSCE is in ESA. If an update of the LCME data does not occur with the data that changes, the lines on the LCME use old threshold values.

Table LNTHRSH contains lines that do not use default values. If changes occur on a line, the line continues to use the old value or default value. Performance of these changes on a line occur while the RSCE is in ESA. An audit corrects any mismatches between ISDN line cards and CC. The office parameters LCDI_SYNC_BURST and LCDI_SYNC_DELAY in table OFCENG determine the frequency of this audit. Set the office parameter LCDI_SYNC_BURST to zero to disable the audit. You should not disable this audit. If the audit detects and corrects mismatches, the system generates a LINE148 log.

The current procedure to restore all data in the RSCE and the subtending nodes is in the following steps. The restoration depends on the changed data during ESA. Use of this procedure to update the LCMEs data after warm exiting ESA does not always produce the correct results. The operating company personnel determine if the changed data requires an update in the LCME.

How to Update the LCME data after ESA warm exit

1 Wait for the inactive unit of the RSC-S to RTS. The active RSC-S unit does not get a copy of the current CCs static data. The inactive RSC-S unit that goes through a full RTS, which updates static data.

2 Perform a SWACT on the RSC-S. This SWACT switches activity between the active and inactive units. The previously active unit becomes inactive and goes through a complete initialization, and downloads static data.

3 For each LCME attached to the RSC-S, busy and RTS each unit in in sequence. This allows the other unit to takeover call processing during the busy and RTS procedure. This process downloads all new data to both units of the PM.

4 This procedure is complete.

Multipoint embedded operations channel

Multipoint EOC allows operating company personnel to determine the multipoint EOC configuration of a 2B1Q loop. Multipoint EOCallows operating company personnel to perform diagnostics on 2B1Q lines that have multipoint EOC. Multipoint EOC permits operating company personnel to set and release a B1, B2, or 2B+D loopback at any multipoint EOC nodes.

The EOC for the digital subscriber line provides access to necessary operations functionality in the NT1. Two EOC configurations are possible:

- standard EOC
- multipoint EOC

The standard EOC defines the operations interface used to send operation messages across the customer to network interface. Standard EOC is point-to-point EOC. Point-to-point EOC occurs when only two end nodes access the EOC. Through point-to-point capability, the NT1 connects to the ISDN line card. The point-to-point EOC channel is the channel associated between the ISDN line card and the NT1 used for OAM purposes. The EOC channel performs activities that are like the logical loopback on individual B-channels or all of the 2B+D loop.

Multipoint EOC occurs after placement of additional nodes on the 2B1Q loop between the ISDN line card and NT1. These additional nodes access the same EOC and allow the transport of basic rate 2B+D information over a T1 span line. The additional nodes pass the EOC signals from a digital subscriber line to a digital carrier facility. These processes do not change the EOC signals. Signals also pass from a digital carrier facility to a digital subscriber line.

The additional nodes can monitor information on an ISDN line card, and store errors of different types. Through the use of enhanced EOC messaging, data transfer occurs between these nodes and the ISDN line card. This messaging allows the DMS-100 switch to monitor the performance of an ISDN loop at a specific node. This messaging also allows the DMS-100 switch to instruct a node to set a loopback on a specified channel. The EOC specification for multipoint EOC is based on the point-to-point EOC specification. One to six multipoint EOCs can be present on a 2B1Q line.

> ***Note:*** The main difference between the point-to-point EOC and the multipoint EOC is that multipoint EOC loopback canoccur at different points in the loop.

Multipoint EOC provides the following capabilities:

- a table that provides operating company personnel with the ability to list all 2B1Q loops with multipoint EOC nodes. The term node also refers to line unit.
- the ability to determine the multipoint EOC configuration of the loop
- enhanced SUSTATE and QLEN commands to display multipoint EOC configurations and status information
- the ability to perform diagnostics on 2B1Q lines that have multipoint EOC line units
- the ability to set and release a B1, B2, or 2B+D loopback at a multipoint EOC node

A 2B1Q loop has multipoint capability when the LEN of the loop and the number of nodes in the loop are in table LNMPEOC. Table LNMPEOC supports 2B1Q lines off an RCC2. Multipoint EOC messages from the LCME automatically enters data in the table LNMPEOC. The user can read only table LNMPEOC. The LENs that support multipoint EOC are in sequential order. All 480 lines on an LCME can support multipoint EOC capability. Restarts and BCS applications maintain multipoint EOC data in table LNMPEOC.

After placement of multipoint hardware on a loop, the LCME detects this change and reports the change to the computing module (CM). An audit in the LCME reports the detection of hardware. The audit cycles through all 2B1Q loops on an LCME and checks for multipoint EOC nodes. When the CM receives this message, the module validates the data and adds a tuple to table LNMPEOC. The system generates a LINE149 log report and states that the loop contains multipoint EOC nodes.

When a change to the multipoint EOC configuration of a loop occurs, the LCME informs the computing module. The change is applied to table LNMPEOC. The system generates a LINE149 log. The LCME performs a second audit to make sure multipoint EOC accuracy between the LCME and the computing module occurs.

The time an audit requires to poll a multipoint EOC loop depends on the location of the loop in the LCME. With a logical drawer completely equipped with 2B1Q loops, the audit can require a maximum of 8 min to detect a change. The audit detects a change in the multipoint EOC configuration. Spread the 2B1Q loops evenly across all logical drawers. This action allows the audit to report any 2B1Q loops in the same time period.

> ***Note:*** Restarts cause the release of multipoint EOC loopbacks and restarts return the loop to the idle state.

Emergency stand-alone effects

An ESA does not affect any loopback set before ESA entry. The loop remains manually busy. The addition or deletion of multipoint EOC line units from a LEN while the RSCE is in ESA, affects line diagnostics. The addition or deletion of EOC line units affects the output from the SUSTATE command. The QLEN command obtains information from the CC The EC does not affect the QLEN command.

The following four figures contain examples of the MAP display response. Different MAP responses occur when different loopbacks are set and released at a multipoint EOC line unit.

The following figure is an example of the LTP data MAP display of an ISDN loop. A B1 loopback is set at multipoint EOC line unit 3. The following command sets the loopback:

`>LOOPBK mplu 3 b1`

Figure 5-2 Example of LOOPBK mplu 3 b1 MAP display

```
  CM    MS    IOD    NET    PM    CCS    LNS    Trks    Ext    APPL
   .    .      .      .      .     .      .     10 GC    .      .
                                                 *C*

 LTPDATA
  1 Quit_       POST      DELQ      BSYQ      PREFIX
  2 Post_
  3             LCC PTY RNG .....LEN..... DN   STA F S LTA TE RESULT
  4 Equip_      ISDN  LOOP  HOST 67 0 08 15 7226345 MB    .
  5 Connect_
  6 Sustate
  7 LoopBk_
  8 BERT
  9
 10 BPVO_
 11 Hold        Bl     Loopback activated at MPLU 3
 12 Next_
 13
 14
 15
 16
 17
 18
   MYMAP
 Time 10:25>
```

The following figure is an example LTPdata MAP display. This LTPdata MAP displays an ISDN loop. A B1 loopback is set at multipoint EOC line unit 3. A loopback query is issued. The following command queries the loopback:

>LOOPBK query

Figure 5-3 Example of LOOPBK query MAP display

```
  CM    MS    IOD    NET    PM    CCS    LNS    Trks    Ext    APPL
   .     .     .      .      .     .      .     10 GC    .      .
                                                 *C*

LTPDATA
 1 Quit_       POST      DELQ      BSYQ      PREFIX
 2 Post_
 3             LCC PTY RNG .....LEN..... DN   STA F S LTA TE RESULT
 4 Equip_      ISDN  LOOP  HOST 67 0 08 15 7226345 MB    .
 5 Connect_
 6 Sustate
 7 LoopBk_
 8 BERT
 9
10 BPVO_
11 Hold        Bl     Loopback on HOST 67 0 08 15  722 6345 at MPLU 3
12 Next_
13
14
15
16
17
18
  MYMAP
Time 10:25>
```

The following figure is an example LTPdata MAP display. This LTPdata MAP displays an ISDN loop where a B1 loopback is released from multipoint EOC line unit 3. The following command releases this loopback:

>LOOPBK rls

Figure 5-4 Example of LOOPBK rls MAP display

```
  CM    MS    IOD    NET    PM    CCS    LNS    Trks    Ext    APPL
   .     .     .      .      .     .      .     10 GC    .      .
                                                 *C*

 LTPDATA
  1 Quit_       POST      DELQ      BSYQ      PREFIX
  2 Post_
  3             LCC PTY RNG .....LEN..... DN   STA F S LTA TE RESULT
  4 Equip_      ISDN  LOOP  HOST 67 0 08 15 7226345 IDL
  5 Connect_
  6 Sustate
  7 LoopBk_
  8 BERT
  9
 10 BPVO_
 11 Hold        Bl     Loopback at MPLU 3 released
 12 Next_
 13
 14
 15
 16
 17
 18
   MYMAP
 Time 10:25>
```

The following figure is an example LTPdata MAP display of an ISDN loop. This loop is a 2B+D loopback set at multipoint EOC line unit 6. The following command sets this loopback:

>LOOPBK mplu 6 bbd

Figure 5-5 Example of LOOPBK mplu 6 bbd MAP display

```
 CM    MS    IOD    NET    PM    CCS    LNS    Trks    Ext    APPL
  .     .     .      .      .     .      .     10 GC    .      .
                                                 *C*

LTPDATA
 1 Quit_       POST      DELQ      BSYQ      PREFIX
 2 Post_
 3             LCC PTY RNG .....LEN..... DN   STA F S LTA TE RESULT
 4 Equip_      ISDN  LOOP  HOST 67 0 08 15 7226345 MB    .
 5 Connect_
 6 Sustate
 7 LoopBk_
 8 BERT
 9
10 BPVO_
11 Hold        2B+D     Loopback activated at MPLU 6
12 Next_
13
14
15
16
17
18
  MYMAP
Time 10:25>
```

Extended peripheral modules diagnostics history

Feature AF5006, Extended Peripheral Modules Diagnostics History, provides a resident database to record selected diagnostic results of XPMs. This feature captures diagnostic results that indicate the sanity of the XPM. The data in this database can control DMS switch maintenance. This database provides operating company personnel with MAP command access to data on the accumulated results of diagnostics. Warm, cold, and reload restarts do not affect the ability of the history database to retain data. This feature is not optional. This feature is part of software package New Peripheral Maintenance (NTX270AA).

An XPM can perform diagnostics to test the functionality of the hardware. Diagnostics can run as a result of CC or XPM requests. Diagnostics the XPM performs are a normal part of XPM audits. Operating company personnel use diagnostic results that feature AF5006 provides for system analysis.

Operating company personnel analysis

Feature AF5006 provides data on the failure history of diagnostics. This data identifies the number of failures that occur and the cards that are defective. The MAP commands display data for a specified XPM or for all XPMs that this feature supports. Two sets of data are available through the use of MAP commands: short-term failure counts and long-term failure counts.

Short-term failure counts

Short-term failure counts accumulate from the last time a unit correctly gains activity. Operating company personnel can use this data as a guide for maintenance activities and support organizations for outage analysis. If an outage occurs, include the XPM diagnostic history data for the peripheral with other important data.

Long-term failure counts

Long-term failure counts accumulate from the last time manual action or BCS application resets long-term failure counts. Long-term failure counts must last for the life of the BCS. Design personnel can use this data to make diagnostic system improvements.

The functionality of this feature applies to SuperNode and Bell-Northern Research (BNR) Reduced Instruction Set Computing platforms. For the NT-40 platform, the diagnostic results and suspect cards that the feature captures are smaller than the SuperNode or BNR Reduced Instruction Set Computing platforms. The NT-40 data store requirements cause this limit.

Description of diagnostics

Different diagnostics run on each type of PM because different PMs contain different hardware. There are approximately 75 diagnostics for XPMs. Only part of the 75 diagnostics runs on any specified PM. This feature captures failures for the following diagnostics:

- InSv
- OOS
- single diagnostic
- facility audit
- other audits

Each diagnostic indicates zero or more cards. The XPM determines the number of cards. The CC can generate card lists for display at the MAP terminal or in logs. A list of card failures includes any card which an XPM diagnostic or audit implicates and reports to the CC.

> ***Note:*** Feature AF5006 records only the cards that an XPM includes. This feature does not record cards that the CC generates.

Diagnostics can be grouped together and run as a set of diagnostics or run as a single test. Defined sets include:

- InSv tests
- OOS tests
- facility audit tests

- mate diagnostics
- read-only memory (ROM) diagnostics

In-service and out-of-service tests

InSv and OOS tests are solicited tests. These tests run as a result of CC requests. When the CC requests to test an XPM unit, the XPM runs a set of diagnostics. The CC uses the manual TST command, manual or system RTS, SWACT, BSY, or REX commands to request a test. The PM type of the XPM, the state of the XPM unit, and the activity of the XPM unit determine the diagnostics included in the set. If the unit is InSv, the XPM runs a set of InSv diagnostics. If the unit is OOS, the XPM runs a set of OOS diagnostics.

The results of each diagnostic are returned to the CC along with a final result for the complete set. If defective cards are present, the system generates a card list. The card list is transferred to the CC at the termination of the set of tests.

Facility audit

The facility audit, is a set of diagnostics which the XPM runs. The facility audit tests the XPM. If the facility audit detects problems, the audit sends a message to the CC. The message indicates the problem and a list of defective cards.

Mate diagnostics

If one unit loses communications, the mate unit can diagnose the unit. The mate unit sends results to the CC.

Read-only memory diagnostics

If the XPM is at the ROM level, the system can run a set of read-only memory (ROM) diagnostics.

This feature does not capture failures. This feature does not capture cards that mate and ROM diagnostics implicate. The MAP terminal generates a card list or log for each diagnostic. The diagnostic history does not record the card list or diagnostic failure.

The following table describes diagnostics that this feature supports. The diagnostic types are solicited, audited, or solicited and audited.

Table 5-12 Diagnostic supported (Sheet 1 of 3)

Diagnostic name	Description	Type (solicited, audit, or both)
AB DIAG	A/B Bits	solicited
AMUDIAG	NT6X50 External Loop	solicited

Table 5-12 Diagnostic supported (Sheet 2 of 3)

Diagnostic name	Description	Type (solicited, audit, or both)
CSD1 DG	C-Side DS-1	solicited
CMRDIAG	CLASS modem resource (CMR) card	both
CONT DG	Continuity Diag	solicited
CSMDIAG	CSM Diag	solicited
CS SPCH	Network Links	solicited
DCHIALB	DCH Inactive Loopback	solicited
DS1DIAG	P-Side DS-1	solicited
DS30A	NT6X48/NTMX74 Audit	audit
FAC AUD	Facility Audit	audit
FORMATR	Local Formatter	solicited
ISPHDLC	ISP HDLC Diag	solicited
ISPSPHI	ISP Speech Bus Internal	solicited
ISPSPHF	ISP Speech Bus Full	solicited
MSGDIAG	NT6X69 Messaging Card	solicited
MSG IMC	IMC Link	both
MX76 MSG	NTMX76 Messaging Card	solicited
PADRING	NT6X80 Pad and Ring	solicited
PARITY	Parity Audit	audit
PS LOOP	P-Side Loops	solicited
PS SPCH	P-Side Speech Links	solicited
RCC FMT	Remote Formatter	solicited
SCM AB	NT6X81 A/B Bits	solicited
SCM MSG	Subscriber carrier module (SCM) A/B DDL Message	solicited
SPCH DG	Speech Path	solicited

Table 5-12 Diagnostic supported (Sheet 3 of 3)

Diagnostic name	Description	Type (solicited, audit, or both)
STRDIAG	Special Tone Receiver	solicited
SYNC DG	Sync Diag	both
TONES DG	Tone Diag	both
TS DIAG	Time Switch Diag	solicited
UTRDIAG	UTR Card	solicited

The following table lists the cards that this feature supports.

Table 5-13 Supported cards (Sheet 1 of 2)

Card name	Description
NT6X40	Net Interface Link
NT6X41	Speech Bus Formatter and Clock
NT6X42	CSM
NT6X44	Timeswitch and A/B Bit Logic
NT6X45	Master Signaling File Processor
NT6X46	Signaling Processor (SP) Memory
NT6X47	Master Processor (MP) Memory
NT6X48	DS30A Interface
NT6X50	DS-1 Interface
NT6X55	DS-0 Interface
NT6X62	STR Card
NT6X69	Messaging Card
NT6X70	Continuity Card
NT6X72	Remote Cluster Controller (RCC) Host Link Formatter
NT6X78	CMR
NT6X79	Tone Generator
NT6X80	SCM Pad and Padring

Table 5-13 Supported cards (Sheet 2 of 2)

Card name	Description
NT6X81	SCM A-B Bit
NT6X85	SCM DS-1
NT6X86	SCM message
NT6X92	UTR
NT8X18	Subscriber Carrier Module-100S Remote (SMS-R) C-Side DS30A Interface
NTBX01	ISP
NTBX02	DCH
NTMX76	CSM and MSG Card
NTMX77	68020 Processor (Unified Processor [UP])

How diagnostics are stored

This feature stores diagnostic results as counters. Each unit of each peripheral that this feature supports has a set of counters. This feature provides counters for diagnostic failures and defective cards. This feature provides three types of counters:

- diag

  the number of times a diagnostic fails

- card

  the number of times a card is defective

- diag and card group

  the number of times a diagnostic and card group occurs

Each of the three counters has two subcounters. These subcounters are a short-term failure counter and a long-term failure counter. Short-term failure counters are reset often in the BCS cycle. Long-term failure counters record the diagnostic history of a peripheral or office over an extended period of time. The QUERYPM DIAGHIST RESET command or a BCS application resets the long-term failure counters.

A single test failure can report one or more diagnostic failures and zero or more defective cards. A diagnostic that runs in one unit can report cards in that unit and in the mate unit. Only certain diagnostics report failures on the mate unit. When a diagnostic failure occurs, each diagnostic sends the failure information to the history database.

Resets and time stamps

The history database stores the following five time stamps for every peripheral:

- for the node
  - the time when long-term failure counters are last reset
- for unit 0
  - the time when short-term failure counters for unit 0 are last reset
  - the time when the last diagnostic failure occurred on unit 0
- for unit 1
  - the time when short-term failure counters for unit 1 are last reset
  - the time of the last occurrence of a diagnostic failure on unit 1

The short-term counters of each unit are reset internally to zero when the unit gains activity. An RTS or SWACT command can cause this gain of activity. Long-term counters for each node are reset from an XPM posted at the MAP terminal. When long-term counters are reset, the system generates a log. This log includes a summary of the data collected for the node before the reset.

A BCS application resets all diagnostic history data. This data includes short- and long-term failure counts. The system does not generate a log with long-term failure counts.

Diagnostic tests for the RSCE and RSCE with ISDN run on the following components:

- RCC2
- lines
- DRCC2
- RCC2 with ISDN
- ISDN lines

Remote cluster controller 2

The TST command prompts the system to run the diagnostic test for the RCC2.

Lines

To perform a test on a subscriber line, enter the command several times. The repetition of the command makes sure the DS-1 links do not affect the results.

Dual remote cluster controller 2

The TST command at the IRLINK level, prompts the system to run the diagnostic tests for DRCC22.

Remote cluster controller 2 with ISDN

The TST command prompts the system to run the diagnostic tests for the RCC2.

ISDN lines

To make sure the DS-1 links do not affect the results, enter the command several times to test a subscriber line. This procedure is the same as the procedure to test lines that are not ISDN lines.

Product-specific test tools

Test tools provided for XPMs apply to RSCE components.

Real-time performance monitoring for NTMX73AA and NTMX76AA

Feature AF4903, Real-Time Time Performance Monitoring for NTMX73AA and NTMX76AA, supplies real-time performance information. This information includes data on the Pulse Code Modulation (PCM) Signaling circuit card (NTMX73AA). This information includes data on the optional Message Processor and Tone Generator circuit card (NTMX76AA). This information reflects real-time use of each circuit card.

The performance tool provides operating company personnel with performance and activity information for posted peripherals. The data appears at the performance level of the MAP display, sublevel PMact. The PMact sublevel provides information that indicates processor activity in the posted peripheral. The PMACT sublevel divides the real time use in two groups: call processing occupancy and low priority background. These two groups apply to the UP and EISP.

The PMact sublevel displays information for the NTMX73AA circuit card. The information for the NTMX76AA circuit card appears as the amount of time used to communicate with the HDLC protocol. The information on the amount of time appears in percent and only includes the time during the last minute.

The real time for the NTMX73AA and NTMX76AA processors is not classified in groups. This information is not like the information displayed for the UP and EISP. For both circuit cards, the feature provides the average time for the elapsed time from the start of the recording. The average time for the last 15 min appears if the elapsed time is greater than 15 min.

An example of the command to monitor the performance in RCC2 unit 1 follows:

>MAPCI;MTC;PM;POST RCC2 1;PERFORM;PMACT;START

The following figure is an example of the display for this command.

Figure 5-6 Example of an RCC2 MAP display

```
 CM    MS    IOD    NET    PM    CCS    Lns    Trks    Ext    APPL
  .     .     .      .      .     .      .      .       .      .



PMAct                     Sysb  Manb  Offl  Cbsy  ISTb  INSv
 1 Quit        PM            0     0     0     0     0     5
 2 Strt        RCC2          0     0     0     0     0     1
 3 Strtlog
 4 Stoplog     RCC2   1 InSv Links_OOS: CSide 0 PSide 0
 5 Stop        Unit 0: Act    InSv
 6             Unit 1: Inact  InSv
 7             LOAD NAME:
 8             STATUS:      REASON:      LOGS:      TIME:xx:xx:xx
 9                          UP AVG  ISP AVG  SIGP AVG  MX76 AVG
10
11             CALL PROCESSING  xxx xxx  xxx xxx  xxx xxx  xxx xxx
12             LOW PRIO BGND    xxx xxx  xxx xxx
13                              ORIG     ORIGAVG  TERM     TERMAVG
14                               xxx         xxx   xxx         xxx
15                              AVAIL    INUSE    HIGH
16             PS_CHNL            xxx      xxx     xxx
17             UTR                xxx      xxx     xxx
18
OPERATOR
Time 09:34
```

An example of the command to monitor performance in line trunk controller (LTC) unit 1 follows:

>MAPCI;MTC;PM;POST LTC 1;PERFORM;PMACT;START

The following figure is an example of the display for this command.

Figure 5-7 Example of an LTC MAP display

```
 CM    MS    IOD    NET    PM    CCS    Lns    Trks    Ext    APPL
  .    .      .      .     .      .      .      .       .      .



PMAct                     Sysb  Manb  Offl  Cbsy  ISTb  INSv
 1 Quit         PM           0     0     0     0     0     5
 2 Strt         LTC          0     0     0     0     0     1
 3 Strtlog
 4 Stoplog      LTC    1 InSv Links_OOS: CSide 0 PSide 0
 5 Stop         Unit 0: Act    InSv
 6              Unit 1: Inact  InSv
 7              LOAD NAME:
 8              STATUS:      REASON:      LOGS:      TIME:xx:xx:xx
 9                           UP AVG    ISP AVG    MX76 AVG
10
11              CALL PROCESSING  xxx xxx  xxx xxx  xxx xxx  xxx xxx
12              LOW PRIO BGND    xxx xxx  xxx xxx
13                               ORIG     ORIGAVG  TERM     TERMAVG
14                                xxx         xxx   xxx         xxx
15                               AVAIL    INUSE    HIGH
16              PS_CHNL            xxx      xxx     xxx
17              UTR                xxx      xxx     xxx
18
OPERATOR
Time 09:34
```

6 Troubleshooting chart

This chapter includes tables for troubleshooting conditions that generate alarms in the Remote Switching Center Equipment (RSCE). This chapter includes separate tables for each RSCE component. These components include:

- the remote cluster controller 2 (RCC2) or RCC2 with integrated services digital network (ISDN)
- line concentrating modules (LCM) or enhanced line concentrating modules (LCME)
- remote maintenance module (RMM)

The following table lists possible causes and actions to correct and clear LCM or LCME alarms.

Table 6-1 RSCE alarm clearing for an LCM or an LCME (Sheet 1 of 2)

Alarm condition	Possible cause	Action
Critical	The indicated number of LCM (or LCME) units is system busy (SysB) or central-side busy (CBsy).	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an LCM or LCME critical alarm. 2. Check for peripheral module (PM), ISDN, or LINE logs that indicate other problems in the LCM or LCME. 3. Check operational measurements (OM) that indicate problems in the LCM or LCME.

Table 6-1 RSCE alarm clearing for an LCM or an LCME (Sheet 2 of 2)

Alarm condition	Possible cause	Action
	Both LCM or LCME ringing generators (RG) are in-service trouble (ISTb).	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an LCM or LCME critical alarm. 2. Check for PM, ISDN, or LINE logs that indicate other problems in the LCM or LCME. 3. Check for OMs that indicate problems in the LCM or LCME.
Major	The indicated number of LCM (or LCME) units is ISTb or SysB.	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an LCM or LCME major alarm. 2. Check for PM, ISDN, or LINE logs that indicate other problems in the LCM or LCME. 3. Check for OMs that indicate problems in the LCM or LCME.
Major (continued)	One of the two RGs in an LCM (or LCME) is ISTb.	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an LCM or LCME RG major alarm. 2. Check for PM, ISDN, or LINE logs that indicate other problems in the LCM or LCME. 3. Check for OMs that indicate problems in the LCM or LCME.
Minor	The indicated number of LCM or LCME units is ISTb.	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an LCM or LCME minor alarm. 2. Check for PM, ISDN, or LINE logs that indicate other problems in the LCM or LCME. 3. Check for OMs that indicate problems in the LCM or LCME.

The following table describes possible causes and actions to correct and clear RCC2 or RCC2 with ISDN alarms.

Table 6-2 RSCE alarm clearing for an RCC2 or an RCC2 with ISDN (Sheet 1 of 2)

Alarm condition	Possible cause	Action
Critical	The RCC2 (or RCC2 with ISDN) units are SysB or CBsy. A loss of subscriber service occurred.	Proceed as follows: 1. Refer to *Recovery Procedures*. Follow the procedures to recover an RCC2. 2. Check for emergency stand-alone (ESA) and PM logs that indicate other problems in the RCC2. Check logs ESA101-ESA109, PM181, and PM171. For dual RCC2 (DRCC2), check for PM logs associated with dual ESA (DESA). Check logs PM221-PM223, and PM189 3. If ISDN is present, check for ISDN or LINE logs that indicate other problems in the RCC2. Check logs ISDN100-ISDN109, and LINE131. 4. Check for OMs that indicate problems in the RCC2.
	The RCC2 is in ESA. There is no communication to the CC in the host switch.	Proceed as follows: 1. Refer to *Recovery Procedures*. Follow the procedures to recover an RCC2 in ESA. 2. Check for ESA or PM logs that indicates other problems in the RCC2. Check logs ESA101-ESA109, PM181, and PM171. For DRCC2, check for PM logs associated with DESA. Check logs PM221-PM223, and PM189. 3. Check for OMs that indicate problems in the RCC2.

Table 6-2 RSCE alarm clearing for an RCC2 or an RCC2 with ISDN (Sheet 2 of 2)

Alarm condition	Possible cause	Action
Major	The indicated number of RCC2 units is CBsy or SysB. Subscriber service is not affected. When both RCC2s or units fail, a loss of subscriber service occurs.	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an RCC2 major alarm. 2. Check for PM logs that indicate other problems in the RCC2. 3. Check for OMs that indicate problems in the RCC2.
Minor	The indicated number of RCC2 units is ISTb. Subscriber service does not change.	Proceed as follows: 1. Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an RCC2 minor alarm. 2. Check for PM181 and PM128 logs that indicate other problems in the RCC2. 3. Check for OMs that indicate problems in the RCC2.

The following table describes possible causes and actions to correct and clear RMM alarms.

Table 6-3 RSCE alarm clearing for an RMM

Alarm condition	Possible cause	Action
Major	The indicated number of RMM units is SysB.	Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an RMM major alarm.
Minor	The indicated number of RMM units is CBsy.	Refer to *Alarm Clearing Procedures*. Follow the procedure to clear an RMM minor alarm.

7 Advanced troubleshooting procedures

This chapter describes advanced troubleshooting procedures for the RSCE.

Advanced trouble locating procedures

Use advanced troubleshooting procedures when normal troubleshooting procedures do not clear a problem. For the remote cluster controller 2 (RCC2), there is a common reason to use advanced troubleshooting. When the operating company personnel performs a PMRESET procedure more than one time, an error message occurs after each PMRESET attempt. When this condition occurs, use the advanced troubleshooting tool PMDEBUG. Refer to the *PMDEBUG User Guide* for additional information.

Bigfoot utility

The Bigfoot utility stores information on passed and failed diagnostics. Feature AF5008, XMS-based Peripheral Module (XPM) Routine Exercise (REX) Control and Trouble Notification Improvements allows the Bigfoot utility to maintain information only on failed diagnostics. Failed diagnostics or error log information improves debugging efforts. The diagnostics code maintains a results graph for each set of diagnostics that runs. The results graph contains data on each diagnostic test in a diagnostics run. The results graph identifies a diagnostic as passed, failed, not run, or test undefined.

Diagnostics results graph output

An example of the diagnostics results graph display output follows:

```
<001>       CLASS         EVENT      CC TIME OF EVENT
    DIAG GRAPH (#0F)    #00      00:00:06:34:58

Diag_id =did_cmr_diag(#7) – CMR Card Diagnostics.
res_num=FF(P=Pass,F=Fail,N=Not Run|Test Undefined,O=Other)
Diag Results Graph: PFNNNNNNNNNNNNNNNNN
```

Powering up the RSCE

Use this procedure when the RSCE components are put out-of-service (OOS) and power is cut to these components. The following steps are the reverse of a power-down procedure. In this procedure, start with the central side (C-side) and work toward the peripheral side (P-side) of the RCC2.

Powering up the RSCE

At the RSCE frame

1 To begin the first portion of the RSCE power-up procedure, post the C-side peripheral of the RCC2. The message links RTS to the RCC2. These links are busied when the RSCE is powered down.

2 Set the power switch to ON for one of the RCC2 units.

3 Set the reset button of this RCC2 unit and flip the associated circuit breaker up at the same time. Release the circuit breaker. The circuit breaker must remain up. If the circuit breaker trips down, a problem with the power circuits is present.

4 Repeat steps 2 and 3 for the other RCC2 unit.

5 Post the appropriate RCC2. This RCC2 must be offline (OFFL).

6 Busy both units of the RCC2.

7 Load one of the RCC2 units. List the correct device, like S01DPMLOADS. To load the unit, type

`>LOADPM UNIT unit_no LOADFILE IMAGE`

8 Return the unit to service. You must not use parameters. This method makes sure the RTS sequence includes diagnostics.

9 Repeat steps 7 and 8 for the other RCC2 unit.

10 Begin the second portion of the RSCE power-up procedure. Set the frame supervisory panel (FSP) circuit breaker (CB) of one of the LCME or LCM units to the ON position. The circuit breaker must remain up. If the circuit breaker trips down, a problem with the power circuits is present.

11 Repeat step 10 for the other LCME or LCM unit.

12 Post the first LCME or LCM.

13 Load one of the LCME or LCM units. List the correct device, like S01DPMLOADS. To load the unit, type

`>LOADPM UNIT unit_no CC`

14 RTS the unit. You must not use parameters. This method makes sure the RTS sequence includes diagnostics.

15 Repeat steps 13 and 14 for the other LCME or LCM unit.

16 Continue to repeat steps 13 and 14 until you return all LCME and LCM units to service. This action completes the second portion of the RSCE power-up procedure.

17 To begin the third portion of the RSCE power-up procedure, set the power switch of the RMM to ON.

18 Set the reset button on the NT2X09 power converter of this RMM unit and flip the associated circuit breaker (CB) up at the same time. Release the CB.

The CB must remain up. If the CB trips down, a problem with the power circuits is present.

19 Load the RMM unit. List the appropriate device, like S01DPMLOADS. To load the RMM unit, type

>LOADPM

20 RTS the unit. You must not use parameters. This method makes sure the RTS sequence includes diagnostics.

21 Repeat steps 18 through 20 if the RSCE uses two RMMs.

22 Post the RCC2 and RTS all P-side DS-1 links. The normal procedure is to post the P-side DS-1 links when the RSCE powered down.

23 This procedure is complete.

Powering down the RSCE

An RSCE is a separate switching system and it is not recommended that the RSCE be powered down. Communication with other offices is lost when the RCC2 is powered down. If a power down procedure is necessary, perform the steps in the following procedure.

Powering down the RSCE

At the RSCE frame

1 Notify the appropriate personnel that the RSCE will power down. Notify personnel both at the host office and at offices that connect to the RCC2 over P-side trunks.

2 Busy all P-side peripheral module (PM) off the RCC2. These PMs include RMMs and line concentrating devices (LCD).

3 Offline (OFFL) All P-side PMs off the RCC2. These PMs include RMMs and the LCD.

4 Busy all P-side links off of the RCC2. These P-side links include DS-1 links to other offices and the packet handler (PH).

5 To power down P-side PMs, set the switch to the associated power converter units to OFF.

6 Busy the inactive unit of the RCC2.

7 Post the associated line trunk controller (LTC) and busy the message link that connects to the busied RCC2 unit.

8 To power down the inactive unit of the RCC2, set the power converter of the unit to OFF.

9 Busy the active unit of the RCC2. Override any warning.

10 Post the associated LTC. Busy the message link that connects to the now busied RCC2 unit.

11 To power down the unit of the RCC2 that was active, set the power converter of the unit to OFF.

12 Post the RCC2 and OFFL the whole PM.

13 This procedure is complete.

8 RSCE routine maintenance procedures

This chapter contains the routine maintenance procedures for the remote switching center equipment (RSCE) and related cabinets. These procedures describe preventive maintenance tasks. These procedures are for maintenance engineering and field maintenance personnel. Maintenance engineering and field maintenance personnel perform these procedures at scheduled intervals. The RSCE project allows several configurations of shelves and cabinet types. Routine maintenance procedures appear for every cabinet type.

Checking torque on grounding bolts

Application

Use this procedure to check the correct torque of all grounding bolts.

Interval

Perform this procedure every month.

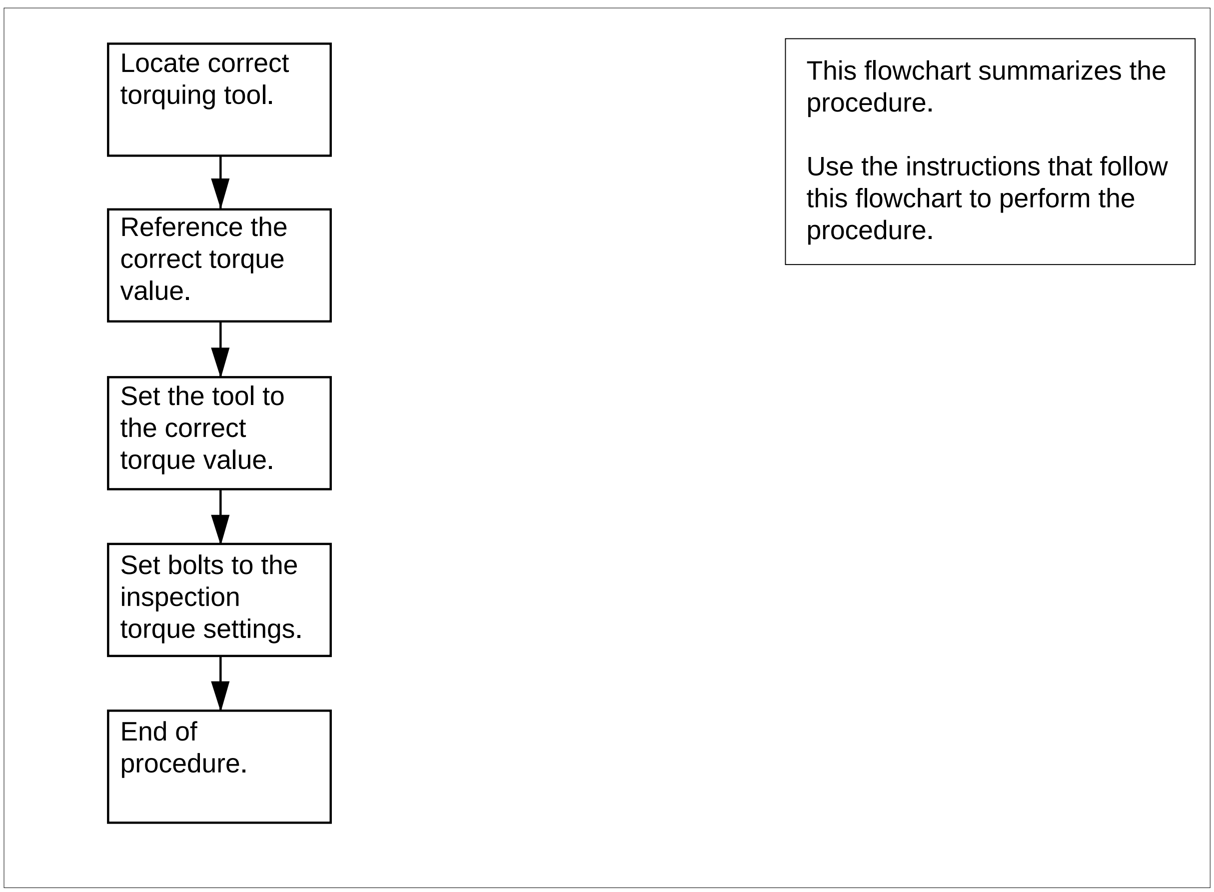
Common procedures

Does not apply

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the steps to perform this procedure.

Summary of checking torque on grounding bolts



Checking torque on grounding bolts (end)

Checking torque on grounding bolts

At your Current Location

1 Locate the T9958 click-type preset torque wrench.

2 Align the small fractions on the edge of the handle with the center of the main torque scale.

3 To set the correct inspection torque value, turn clockwise to increase value or turn counter-clockwise to decrease value.

If grounding bolts are type	Do
1/4-20 backplane, -48 V ground first nut	step 4
1/4-20 backplane, -48 V ground second nut	step 5

4 Set inspection torque to 5 ft/lb. Proceed to step 6.

5 Set inspection torque to 25 in./lb.

6 Position the wrench on the grounding bolts and tighten to the inspection torque specification.

7 Return the T9958 torque wrench to the appropriate location.

8 The procedure is complete.

Cooling unit replacement

Application

Use this procedure to replace a defective cooling unit (NTRX91AA) in the following cabinetized frames:

- NTMX89GA, Remote Switching Center Equipment (RSCE)
- NTMX89FA, Cabinetized Remote Switching Center/Line Concentrating Module (CRSC/LCM)
- NTMX89FB, Cabinetized Remote Switching Center/Integrated Services Digital Network (CRSC/ISDN)
- NTMX89FC, Cabinetized Extension Module (CEXT)
- NTRX30CA, Cabinetized Line Concentrating Equipment (CLCE)
- NTRX30DA, Cabinetized Line Module ISDN (CLMI)
- NTRX34BA, Cabinetized Miscellaneous Equipment (CMIS)
- NTRX31AA, Cabinetized Power Distribution Cabinet (CPDC)

Interval

Perform this procedure when a cooling unit cannot operate. An illuminated fan fail indicator on the front of the MSP indicates a defective cooling unit.

Common procedures

There are no common procedures.

Action

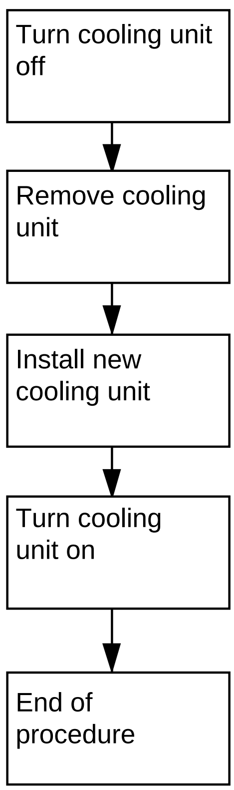
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Cooling unit replacement (continued)

Summary of cooling unit replacement

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Cooling unit replacement (end)

Cooling unit replacement

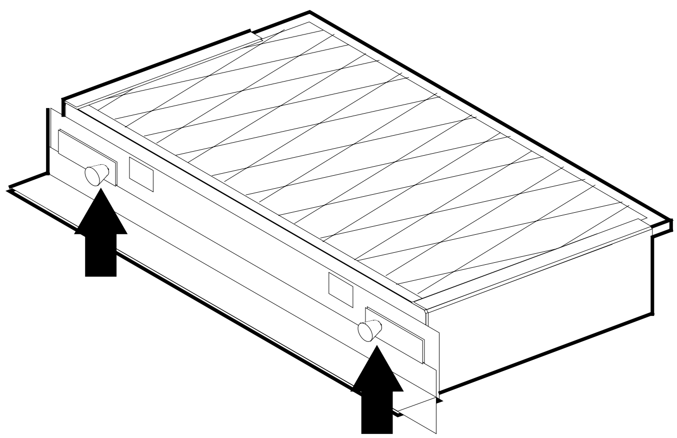
At your current Location

1

DANGER
To prevent overheating
Do not leave the cooling unit fans off for longer than 30 min.

To make sure the cooling unit fans are off, remove the two fuses in slot position 19 on the faceplate of the MSP.

2 Turn the two knobs on the front panel of the cooling unit counterclockwise. Slide the cooling unit to remove the cooling unit.



3 Replace with the same part number as the number of the old unit. Slide in the new cooling unit until both sides lock in place.

4 Replace the two fuses removed in step 1.

5 This procedure is complete.

Fuse replacement in the LCME

Application

Use this procedure to replace fuses in the enhanced line concentrating module (LCME) fuse panel. This fuse panel is the LCME fuse panel of the CRSC and CEXT cabinets on an RSCE site.

Interval

Perform this action as required.

Common procedures

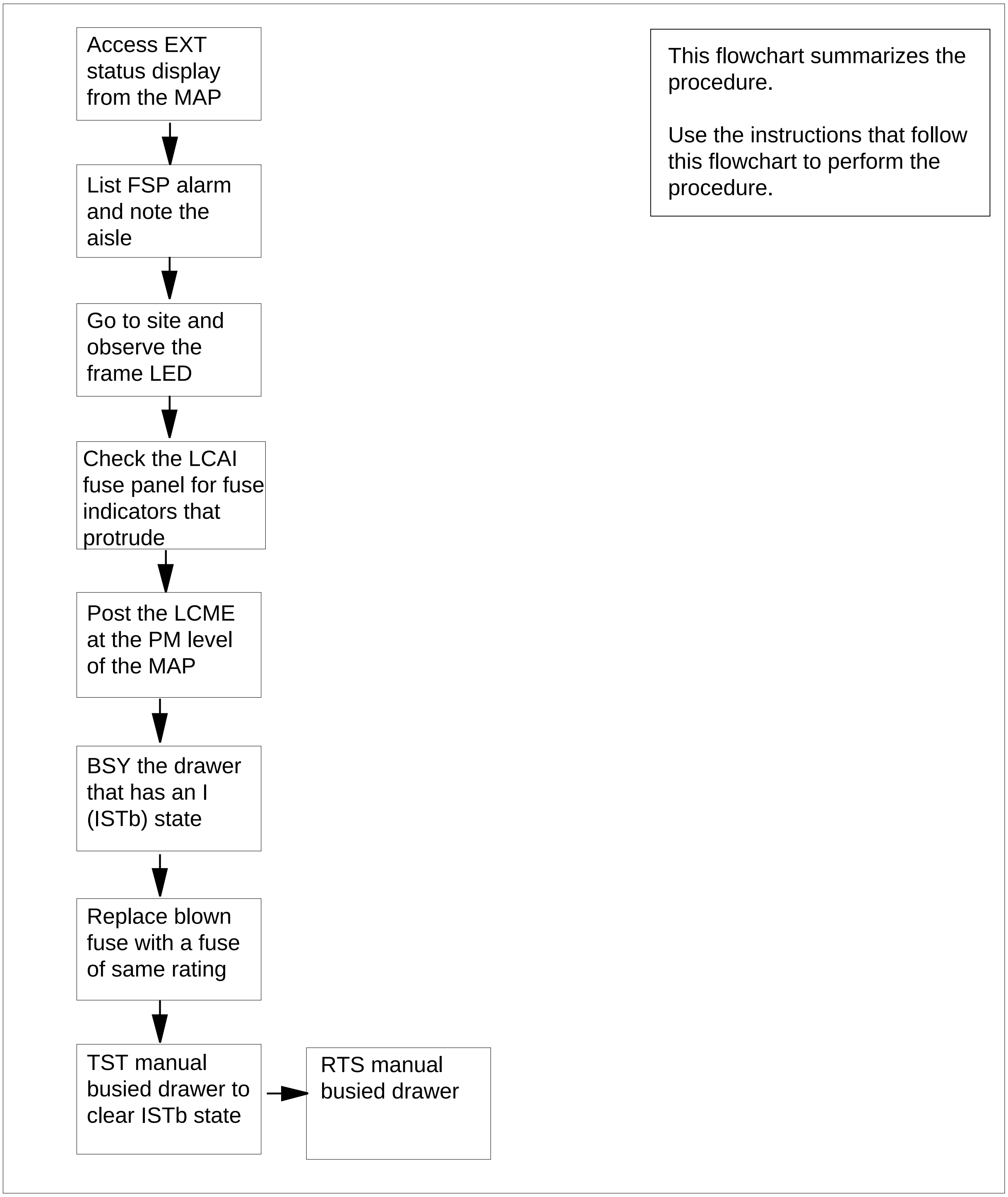
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Fuse replacement in the LCME (continued)

Summary of fuse replacement in the LCME



Fuse replacement in the LCME (continued)

Fuse replacement in the LCME

At the MAP terminal

1 To access the EXT level of the MAP terminal, type

>MAPCI;MTC;EXT

and press the Enter key.

2 To list the MSP alarm, type

>LIST FSP

and press the Enter key.

3 Note the location of the MSP alarm.

At the RSC-S site

4 Observe the frame LED. The LED must be on.

5 Check both ISDN line concentrating array (LCAI) fuse panels for fuse indicators that protrude.

6 To post the LCME, type

>POST LCME site cabinet module

and press the Enter key.

where

site
is the name of the RSC-S site

cabinet
is the CRSC or CEXT cabinet number

module
is the LCME module number

Example of a MAP display:

```
LCME    RemL  00 0 ISTb   Links_OOS:  CSide 1
Unit0:   InSv               /RG:  0
Unit1:   InSv               /RG:  0
                     11 11 11     RG:Pref 0 InSv
Drwr: 01 23 45 67 89 01 23 45        Stby:1 InSv
      II .. .. .. .. .. .. .. .. ..
```

7 To busy (BSY) the drawers that have an I (in-service trouble[ISTb]) condition, type

>BSY DRWR number

and press the Enter key.

where

number
is the line subgroup number

Fuse replacement in the LCME (continued)

8 Replace the blown fuse with a new fuse of the same rating. Refer to figure LCME fuse panel.

If the fuse	Do
blows again, suspect defective NTBX36 card	*Card Replacement Procedures* for card replacement.
does not blow and alarm clears	step 9

9 To test the drawer with the new fuse installed, type

`>TST DRWR number`

and press the Enter key.

where

number
is the line subgroup number

10 To return to service (RTS) the drawer with the new fuse installed, type

`>RTS DRWR number`

and press the Enter key.

where

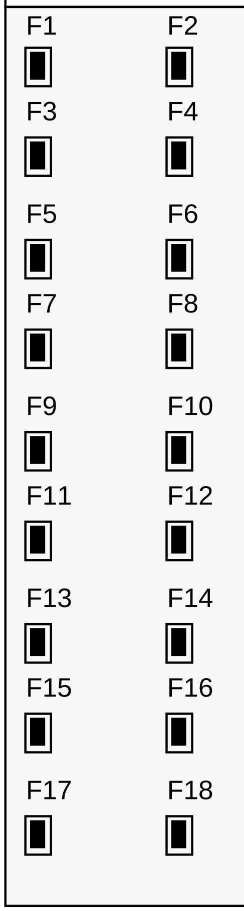
number
is the line subgroup number

The following figure shows an example of an LCME fuse panel and fuse assignments.

Fuse replacement in the LCME (end)

LCME fuse panel

Fuse panel



LCME/LCAI fuse assignments

–48 V battery return
F1 to drawer 0 or 4
F2 to drawer 1 or 5
F3 to drawer 2 or 6
F4 to drawer 3 or 7

–48 V battery
F5 to drawer 0 or 4
F6 to drawer 1 or 5
F7 to drawer 2 or 6
F8 to drawer 3 or 7

+15 Volts
F9 to drawer 0 or 4
F10 to drawer 1 or 5
F11 to drawer 2 or 6
F12 to drawer 3 or 7

–48 V talk battery
F13 to drawer 0 or 4
F14 to drawer 1 or 5
F15 to drawer 2 or 6
F16 to drawer 3 or 7

Ringing
F17 even/odd subgroup ringing
F18 not used

Note: Drawers: 0–3, shelf position 33; 4–7, shelf position 47.

Inspecting and changing bulbs

Application

Use this procedure to inspect and replace defective fan fail, aisle end, and modular supervisory panel (MSP) bulbs.

Interval

Perform this procedure one time each month.

Common procedures

There are no common procedures.

Action

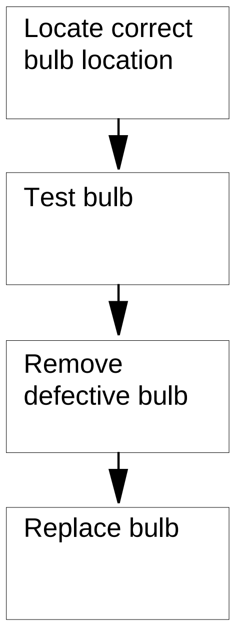
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Inspecting and changing bulbs (continued)

Summary of Inspecting and changing bulbs

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Inspecting and changing bulbs (end)

Inspecting and changing bulbs

At your current location

1 Use the following procedures to inspect the fan fail, aisle end, and MSP bulbs.

If bulbs	Do
are fan fail bulbs	step 2
are aisle end bulbs	step 3
are MSP bulbs	step 4

2 Flip the alarm (ALM) override switch, that is located on the MSP, to ON.

If fan fail bulb	Do
does not light	step 5
lights	step 9

3 Press a fuse on the fuse pad located on the MSP.

If aisle end bulb	Do
does not light	step 6
lights	step 9

4 Press a fuse on the fuse pad located on the MSP.

If MSP bulb	Do
does not light	step 6
lights	step 9

5 Remove bulb cover. Grasp the bulb tight with two fingers, squeeze, and pull to remove the bulb. Go to step 5.

6 Remove the bulb frame casing. Grasp the aisle end or MSP bulb tight with two fingers, squeeze, and pull to remove the end or bulb. Go to step 5.

7 Replace with new bulb.

8 Attach bulb cover or bulb frame casing again.

9 This procedure is complete.

Inspecting cooling unit filters

Application

Use this procedure to inspect cooling unit filters in the following cabinetized frames:

- NTMX89GA, Remote Switching Center Equipment (RSCE)
- NTMX89FA, Cabinetized Remote Switching Center/Line Concentrating Module (CRSC/LCM)
- NTMX89FB, Cabinetized Remote Switching Center/Integrated Services Digital Network (CRSC/ISDN)
- NTMX89FC, Cabinetized Extension Module (CEXT)
- NTRX30CA, Cabinetized Line Concentrating Equipment (CLCE)
- NTRX30DA, Cabinetized Line Module ISDN (CLMI)
- NTRX34BA, Cabinetized Miscellaneous Equipment (CMIS)
- NTRX31AA, Cabinetized Power Distribution Cabinet (CPDC)

Interval

Perform this procedure every two weeks.

Common procedures

There are no common procedures.

Action

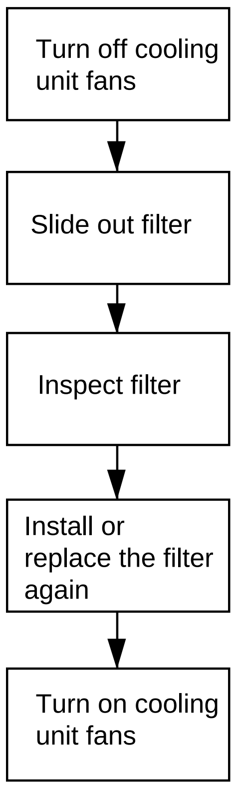
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Inspecting cooling unit filters (continued)

Summary of Inspecting cooling unit filters

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Inspecting cooling unit filters (continued)

Inspecting cooling unit filters

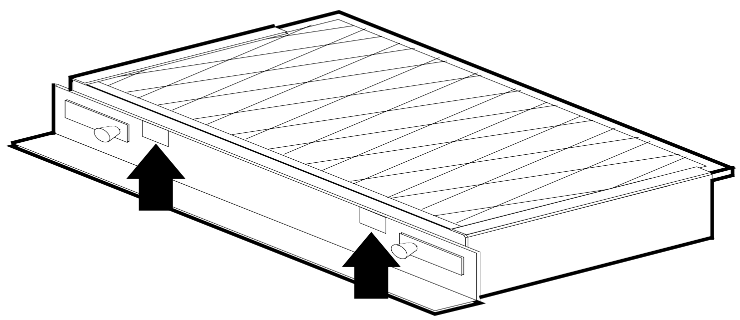
At your Current Location

1

DANGER
To prevent overheating
Do not leave the cooling unit fans off for longer than 30 min.

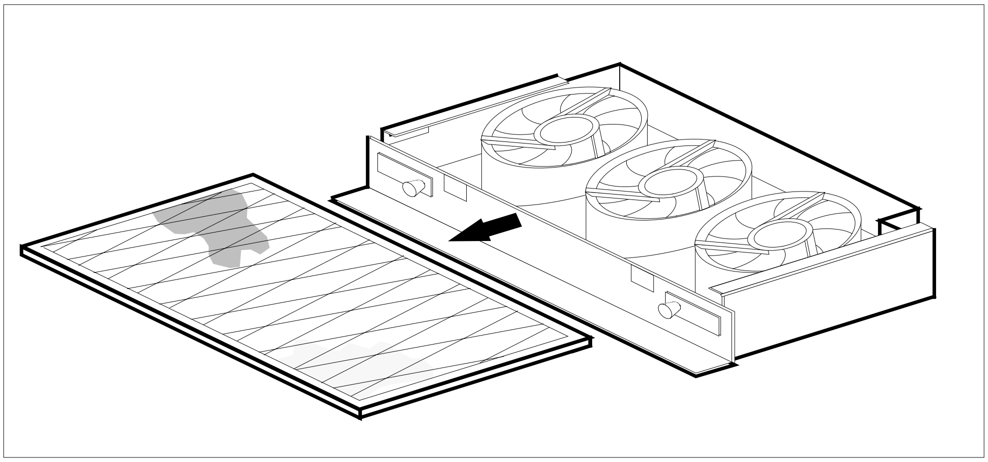
Remove the two fuses in slot position 19 on the faceplate of the modular supervisory panel (MSP). This action makes sure the cooling unit fans are off.

2 Use the two filter access tabs to grip the filter.



3 Slide the filter out of the cabinet.

Inspecting cooling unit filters (end)



If filter surfaces	Do
appear dirty	step 4
appear clean	step 5

4 Replace the filter with the same part number as the number of the old unit. Go to step 6.

5 Install the filter in the cabinet again.

6 Replace the two fuses you removed in step 1.

7 The procedure is complete.

Inspecting spare fuse holders

Application

Use this procedure to inspect spare fuse holders. Fill the fuse holders again as needed.

Interval

Perform this procedure at two week intervals.

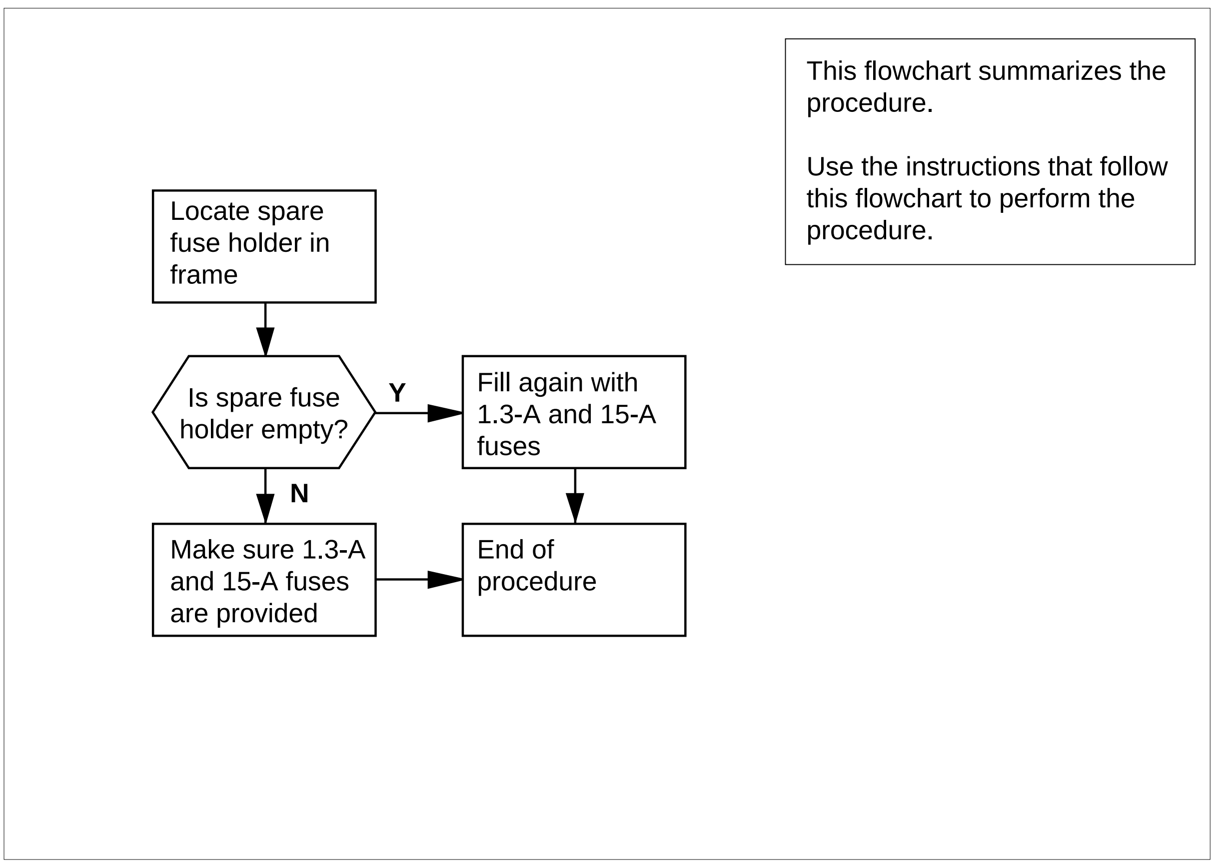
Common procedures

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.

Summary of Inspecting spare fuse holders



Inspecting spare fuse holders (end)

Inspecting spare fuse holders

At your current location

1 Locate the spare fuse holder in the MSP.

If spare fuse holder	Do
is empty	step 2
is not empty	step 3

2 Fill the spare fuse holder again with the following fuses and circuit breakers:

- 15-A circuit breakers (for the -48 V shelf feeds)
- 1.3-A fuses (for the alarm battery supply [ABS] feeds)

Go to step 4.

3 To make sure that enough of the following fuses and circuit breakers are provided:

- 15-A circuit breakers (for the -48 V shelf feeds)
- 1.3-A fuses (for the ABS feeds)

4 The procedure is complete.

Replacing cooling unit filters

Application

Use this procedure to replace cooling unit filters in the following cabinetized frames:

- NTMX89GA, Remote Switching Center Equipment (RSCE)
- NTMX89FA, Cabinetized Remote Switching Center/Line Concentrating Module (CRSC/LCM)
- NTMX89FB, Cabinetized Remote Switching Center/Integrated Services Digital Network (CRSC/ISDN)
- NTMX89FC, Cabinetized Extension Module (CEXT)
- NTRX30CA, Cabinetized Line Concentrating Equipment (CLCE)
- NTRX30DA, Cabinetized Line Module ISDN (CLMI)
- NTRX34BA, Cabinetized Miscellaneous Equipment (CMIS)
- NTRX31AA, Cabinetized Power Distribution Cabinet (CPDC)

Interval

Perform this procedure at intervals of three months.

Common procedures

There are no common procedures.

Action

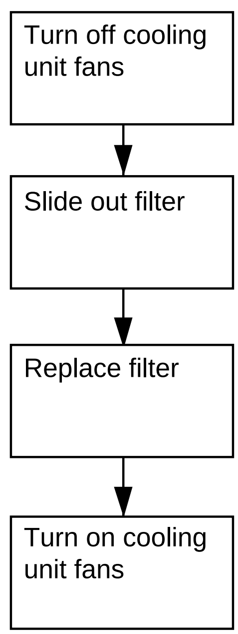
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Replacing cooling unit filters (continued)

Summary of Replacing cooling unit filters

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Replacing cooling unit filters (continued)

Replacing cooling unit filters

At your Current Location

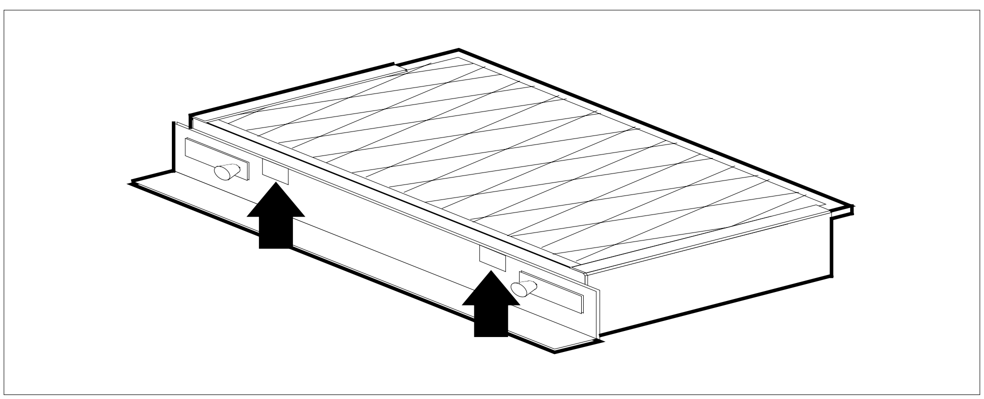
1

> **DANGER**
> **To prevent overheating**
> Do not leave the cooling unit fans off for longer than 30 min.

> **DANGER**
> **To prevent overheating**
> Do not leave the cooling unit fans off for longer than 30 min.

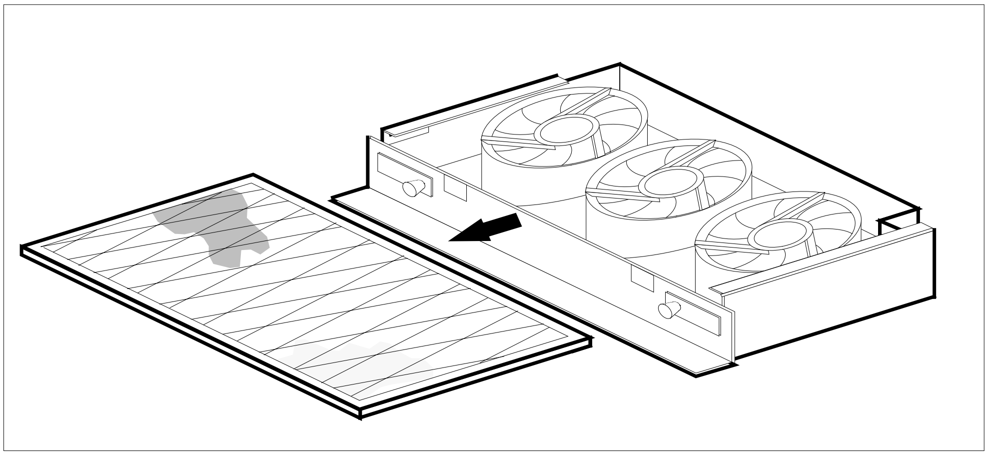
Make sure the cooling unit fans are off. To perform this requirement, remove the two fuses in slot position 19 on the faceplate of the MSP.

2 Use the two filter access tabs to grip the filter.



3 Slide the filter out of the cabinet.

Replacing cooling unit filters (end)



If filter surfaces	Do
appear dirty	step 4
appear clean	step 5

4 Replace the filter with the same part number as the part number of the old unit.

5 Replace the fuses removed in step 1.

6 This procedure is complete.

Returning a card for repair or replacement

Application

Use this procedure to return a circuit card, like a power converter, to Northern Telecom for repair or replacement. Your location, Canada or the United States, determines the documents you must complete. You location determines to which address you must return the card.

Interval

Perform this procedure as needed.

Common procedures

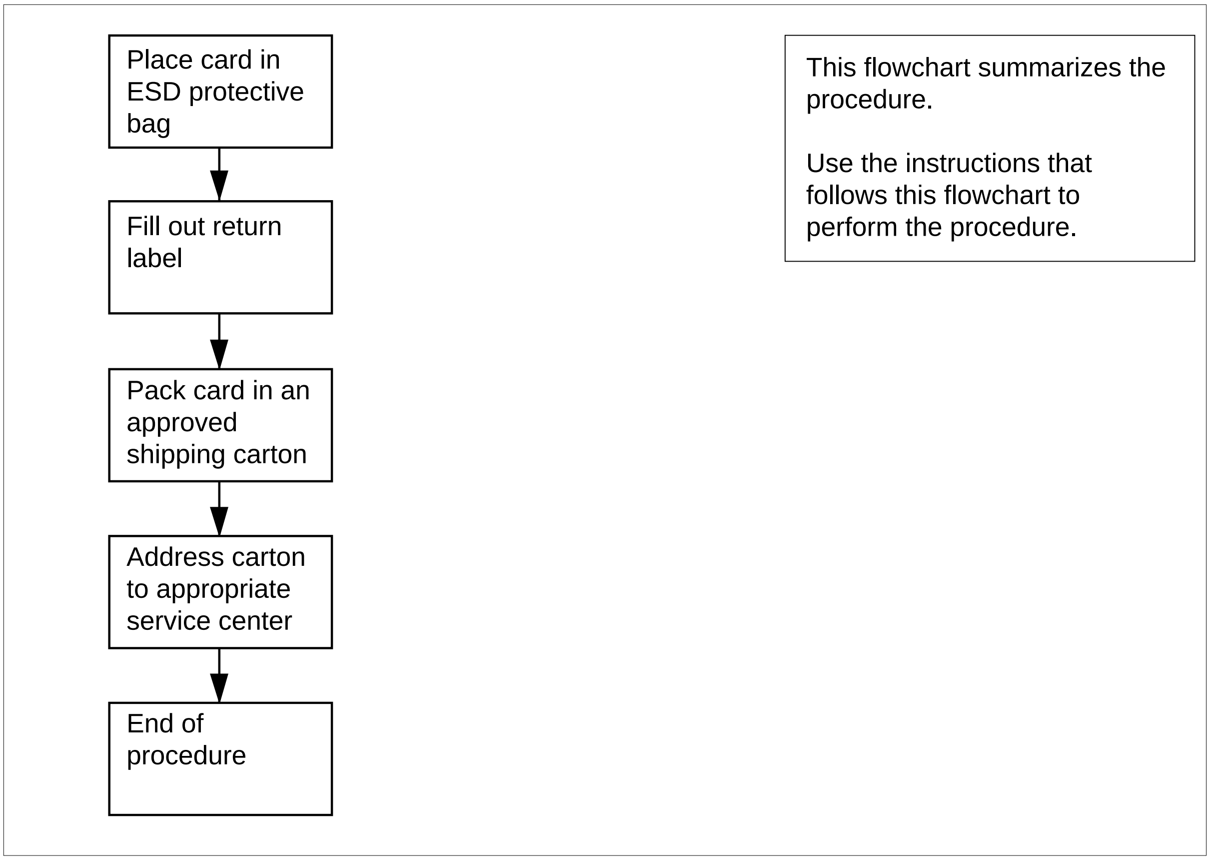
There are no common procedures.

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.

Returning a card for repair or replacement (continued)

Summary of Returning a card for repair or replacement



Returning a card for repair or replacement

At your current location

1 Place the card in an electrostatic-discharge (ESD) protective bag.

If your location	Do
is in Canada	step 6
is in the United States	step 2

2 Fill in the return label for each card you return. If no return labels are available, use any blank label. For help to fill out these labels, call the Nortel Customer Service Center at 1-800-347-4850.

3 Pack the card or assembly in a Nortel card shipping carton and seal the carton.

Returning a card for repair or replacement (continued)

If a Nortel shipping carton is not available, use any available carton. Make sure that you perform the following actions:

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secure each card or assembly in the carton so that no card or assembly can shift around

4 Address the carton and send the carton to Nortel as follows:

`Nortel Customer Service Center`

`4600 Emperor Blvd.`

`Morrisville, North Carolina  27560`

5 Go to step 11.

6 Fill in one return label (form 24-115) for each card or assembly you return.

Make sure you include the following information:

- return authorization number from customer service
- Nortel product engineering code (PEC)
- serial number
- release number
- batch change supplement (BCS) release software used at the time of replacement
- peripheral module load name
- description of the failure and action taken to repair
- fault code that describes the fault best (see the bottom of the label)
- name of your company
- office identifier code
- your name
- site name

For help to fill out the label, call 905-454-2808. In the event of an emergency, call 905-457-9555.

7 Attach one copy of the card label to a card latch.

8 Keep the other copies of the label for your records.

9 Pack the card or assembly in a Nortel shipping carton and seal the carton.

If a Nortel shipping carton is not available, use any available carton. Make sure that you perform the following actions:

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secure each card or assembly in the carton so that no card or assembly can shift

10 Address the carton to the following address:

`Nortel Customer Operations`

Returning a card for repair or replacement (end)

`c/o Wesbell Transport`

`1630 Trinity Road`

`Unit #3, Door #4`

`Mississauga, Ontario`

`L5T 1L6`

11 This procedure is complete.

Testing wrist strap grounding cords

Application

Use this procedure to verify the resistance of wrist strap grounding cords. The resistance must be suitably low, to allow static electricity to discharge from the user. The resistance must be suitably high to prevent electrocution if the equipment develops a short-circuit while the user wears the strap.

Interval

Perform this procedure one time each month.

Common procedures

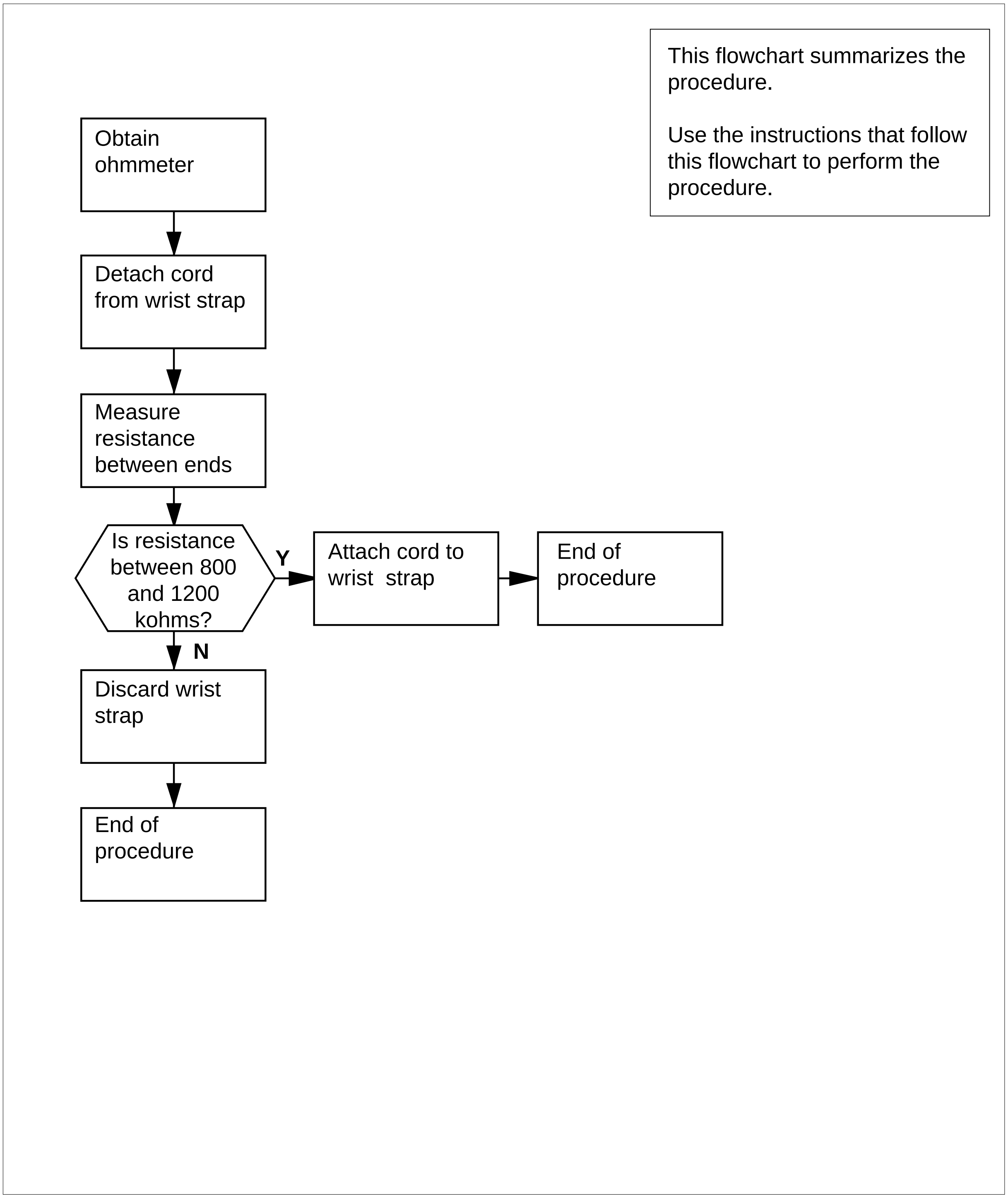
There are no common procedures

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing wrist strap grounding cords (continued)

Summary of Testing wrist strap grounding cords



Testing wrist strap grounding cords (end)

Testing wrist strap grounding cords

At your Current Location

1 Obtain an ohmmeter.

2 Detach the grounding cord from the wrist strap.

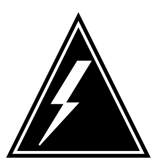
3 Measure the resistance between opposite ends of the grounding cord with the ohmmeter.

If resistance	Do
is between 800 kohms and 1200 kohms	step 4
is not between 800 kohms and 1200 kohms	step 5

4 You can use the grounding cord and wrist strap assembly. Assemble the wrist strap to the grounding cord. Go to step 6.

5

DANGER
Risk of electrocution
A grounding cord is safe to use if its resistance is higher than 800 kohms only. Lower resistance exposes the the user to the risk of electrocution if equipment short-circuits while the user wears the wrist strap.



WARNING
Damage to electronic equipment
A grounding cord with a resistance higher than 1200 kohms cannot conduct static charges to ground correctly. It will not protect sensitive electronic equipment against build-ups of damaging static charges.

Discard the assembly. *Do not attempt to use it.*

6 The procedure is complete.

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DMS-100 Family

Remote Switching Center

Remote Switching Center Maintenance Manual

Volume 2 of 2

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Electronic mail: cits@nortelnetworks.com

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