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Data Networking Products
Multispeed Module Reference

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Preface

The *Data Networking Products Multispeed Module Reference* provides the information needed to install, configure, and administer the Multispeed Module (MSM). Procedures for routine operations, maintenance, and troubleshooting are also included.

Document Organization

The *Multispeed Module Reference* explains all aspects of module hardware, software, and troubleshooting in the following six chapters:

MSM Overview	includes a physical description of the MSM and an overview of MSM features.
MSM Installation	explains input/output (I/O) board and module installation and removal.
MSM Cabling	describes the cables and adapters required to connect compatible devices and equipment to an MSM and illustrates cabling configurations.
MSM Administration	discusses the implications of choosing certain port options and provides procedures for initial and routine administration.
MSM Troubleshooting	provides the information and procedures needed to troubleshoot the MSM.
MSM Commands	provides a detailed reference of the commands needed to administer, control, and maintain the MSM. Included are command syntax sections, explanations of parameter options, input/output examples, report field definitions, and system responses.

In addition, three appendices give cabling information for remote connections, database entry forms, and explanations of Electronics Industries Association (EIA) lead states. Tables of contents and an index help to locate information quickly.

Related Documentation

Publications describes the complete documentation set available for the product line; see the inside front cover for ordering information. Documents required for use with the *Multispeed Module Reference* include the following:

- the *Data Networking Products Planning Guide*
- the *BNS-2000 Node Reference*, if the MSM is installed in a BNS-2000 or BNS-2000 VCS node
- the *Data Networking Products Multipurpose Concentrator Reference*, if the MSM is installed in a BNS-2000 MPC
- the *Data Networking Products Messages Reference*

Data Networking Products Terminology lists and defines many technical terms found within this document. In addition, documents for interface and trunk modules supported by your system are available; vendor documents might be necessary for end devices connected to this and other modules.

MSM Overview

MSM Overview

The Multispeed Module (MSM) provides high-speed, remote access to devices on local area networks (LANs) and connectivity to higher speed dial-in modem pools. The MSM supports asynchronous communications at speeds greater than 19.2 Kbps with the reliability provided by Grade of Service 5 (GOS5). Modems, terminal servers, terminal emulation packages, and workstations including V.32 bis modems, V.34 (V.fast) modems, and vendor terminal servers that support a range of speeds above and including 19.2 Kbps (such as 28.8, 38.4, 57.6, 76.8, 115.2 Kbps) are supported. In addition, speeds at 19.2 Kbps and below (such as 75, 110, 150, 300, 1200, 2400, 4800, 9600, and 14,400) are supported for traditional asynchronous communication.

Physical Description

The MSM is a removable circuit pack (TN2111B) that resides in a node or BNS-2000 MPC. The module provides 12 serial, asynchronous, full-duplex EIA ports. It is used with an AWJ4 (ED5P059-30, G1) input/output (I/O) distribution board that plugs into the rear of the backplane. This I/O board provides the wiring for 12 RS-232-C ports.

The interconnecting cabling causes the MSM interface leads to provide a physical connection to a data terminal equipment (DTE) or data communications equipment (DCE) device. Functional operation is determined by the service type, which identifies the function of the interface to the connected end device.

The module faceplate contains three light-emitting diodes (LEDs), a reset push button, a three-state mode switch, and a latch. When pressed, the reset push button reinitializes the module and clears the connections. The mode switch states of Enab, Diag, and Disab and the green, yellow, and red LEDs indicate the module's current mode of operation and its service state. The latch is used to remove or insert the module and to secure it in place.

Features

The MSM provides serial asynchronous start-stop protocol transmission to the Control Computer and to other asynchronous port devices. Options, which are administrable on a per-port basis, include speed conversion, parity translation, flow control protocol conversions, and call processing. Diagnostics and reports are provided from the node console. Asynchronous services are fully supported to Computer Port Module - High Speed (CPM-HS) channels, and to Synchronous/Asynchronous Multiplexer (SAM), Transparent Synchronous Module 8-port (TSM8), TY, X.25, X.25P, and X.75, ports; support of other asynchronous services is documented in the *BNS-2000 System Description*.

Transmission Capabilities

The MSM can connect up to 12 asynchronous, full-duplex devices at speeds up to 115.2 Kbps with an aggregate throughput of up to 900 Kbps. Higher data rates on a per-port basis are supported with an equivalent drop in line utilization.

To allow two external network endpoints to communicate through the network at different transmission speeds, the MSM supports *speed conversion* for any asynchronous device. Internal node buffering provides some margin against data loss; but the connected end device is responsible for managing data throughput. Flow control helps to support this throughput management. If an end device must run at the same speed, the host autobaud feature, which is sometimes referred to as *speed matching*, is available. Matching both end speeds of a connection helps to regulate data flow.

The MSM supports a GOS5 transmitter, which provides flow control, error detection, and retransmission to recover lost data for end-to-end network integrity for asynchronous protocol transport.

Diagnostic Capabilities

Module diagnostic capabilities consist of loopback tests, which help diagnose internal and external ports and local and remote modems. Without removing the module from service, network administrators can also display the status of the device input and module output interface control leads.

In addition, the MSM executes a self-test each time a reset occurs. The MSM self-test determines the integrity of cache memory, EPROM, FROM, timer, and USART.

Interworking

The MSM interworks with other MSMs and other supported asynchronous endpoints in BNS-2000 and BNS-2000 VCS nodes, and in a BNS-2000 MPC through mutually supported trunk/link modules. In addition, asynchronous port connections to all models of SAMs are supported.

The MSM interworks with all TYs and it supports asynchronous predefined destinations (PDDs) to a TSM8.

Interworking between the MSM and the Computer Port Module–High Speed (CPM-HS) and the Computer Port Module–422B (CPM-422B) hosts is supported, including connections made through the Network Access Control System. The MSM interworks with the LCS50 Network Interface for Ethernet (LCS50E) for traditional terminal-to-host traffic.

In addition, the MSM accepts the Serial Line Internet Protocol (SLIP) and the Point-to-Point Protocol (PPP), which are used to pass IP traffic from an LCS60 Network Interface for Ethernet (LCS60E).

The X.25, X.25P, and the X.75 Modules interwork with the MSM when in PAD mode. The supported MSM speeds not recognized by the X.3 profile, but supported by the MSM, include 38400, 57600, 76800, 115200 bps. The MSM passes the configured port speed to the PAD; however, non-supported speeds default to the speed configured in the existing PAD profile.

The MSM interworks with *StarKeeper* II Network Management System (NMS) Release 6.1.1 and later; MSM is not supported by the *StarKeeper* II NMS Customer Control System (CCS).

Administration Options

Through the **msm** command set, numerous options can be administered in the database. They include:

- service types such as *console, terminal, host, 2way,* or *modem* service allow a port to originate or receive calls, or to do both
- baud rate and, depending on the service type, *autobaud* up to 19.2 Kbps
- stop bit and bits per character options
- flow control options that include ASCII *xon/xoff*, hardware *eia,* or *none*
- parity settings for *odd, even,* or *off* (no parity)
- predefined destinations (PDDs) that associate an originating device to a network destination so automatic call setup can occur when the device is powered up
- logging of billing data for *modem, terminal,* and *2way* service types
- call hold capability
- permanent activated ports to indicate whether a call is to be established or maintained independently of DTR EIA lead state changes
- an attention signal, which is administered for originating or two-way service, to disconnect or toggle a port between command mode and originate or transmit mode
- a query regarding whether the Voice/Data Multiplexer (VDM) communications layer should be enabled or disabled so special VDM diagnostic testing can be performed
- endpoint number (EPN) and closed user group (CUG) assignments for the direct addressing and extended security of MSM ports.

Many of these administration options are explained in detail in **MSM Administration.**

MSM Installation

MSM Installation

Installing an MSM in a node or BNS-2000 MPC requires a few precautions and some simple procedures, as follows:

- Ensure protection from electromagnetic interference (EMI) and electrostatic discharge (ESD); see inside front cover. Wear an ESD wrist strap to prevent module damage; see the *BNS-2000 Node Reference* and the *Data Networking Products Multipurpose Concentrator Reference* for grounding locations and other details.
- Verify that the I/O distribution board (AWJ4) to be installed is the type for the module and the application.
- Ensure that the node or MPC slot intended for the module is not being used by another module; see the *Data Networking Products Planning Guide*, the *BNS-2000 Node Reference*, or the *Data Networking Products Multipurpose Concentrator Reference* for module placement.

  CAUTION: To prevent damage to module circuitry, always insert the I/O distribution board **before** inserting its corresponding module board. Never remove the I/O distribution board before removing the module board.

- Insert the I/O distribution board; see Procedure 2-1.
- Insert the MSM board; see Procedure 2-3.
- Cable ports to support external devices. See **MSM Cabling**.

The following sections give more detail on inserting the I/O distribution board and the module board, and directions for removing the module board and its I/O distribution board.

Inserting and Removing the I/O Distribution Board

The MSM AWJ4 I/O distribution board plugs into the rear of the node or the BNS-2000 MPC. It is held in place by shrouds on the backplane pin field, and secured with two screws. An I/O distribution board should always be in place before its corresponding MSM board is installed.

To avoid possible damage to MSM circuitry, never remove the I/O distribution board before its corresponding MSM is removed from its backplane slot. If the I/O distribution board must be removed for checking (for type or damage) or for relocating or replacing MSMs, follow **Procedure 2-2.**

PROCEDURE 2-1. Inserting the I/O Distribution Board

1. Verify that the MSM board **is not** inserted into its appropriate slot.
2. Align the I/O distribution board's backplane connector with the backplane pin field, and align the screws with the screw holes. Slip the backplane connector onto the pins.

   The I/O distribution board should seat easily. If seating is difficult, the I/O distribution board might be canted or some pins might be bent.
3. Insert the screws, and tighten them securely.

PROCEDURE 2-2. Removing the I/O Distribution Board

1. Unseat the MSM board.
2. Disconnect all cabling to I/O distribution board ports, labeling the cable ends if appropriate.
3. Remove the screws holding the I/O distribution board in place.
4. Rock the I/O distribution board carefully as you pull it out.

Inserting and Removing the MSM Board

The MSM board, TN2111B, is inserted into a slot at the front of the node cabinet or the BNS-2000 MPC. To prevent damage to module circuitry if the node is powered up, the I/O distribution board must be in place at the rear of the slot before the MSM board is inserted.

Interface modules can be removed and replaced in an operating node with minimal disruption and without damaging the module. If the module was in service, all calls on the module are dropped.

Do not remove the I/O distribution board before removing the module board.

PROCEDURE 2-3. Inserting the MSM Board

1. Confirm that the I/O distribution board is installed and residing in the appropriate slot.
2. Set the mode switch on the module faceplate to Disab.
3. With the module latch extended, carefully push the module all the way into the slot. The backplane pins will slip into the module receptacle.
4. Close the latch to lock the module into position.
5. Move the mode switch on the module faceplate to Enab.

PROCEDURE 2-4. Removing the MSM

1. If the mode switch is in the Enab position, move it to Disab to take down all calls in progress on the module.
2. Open the latch on the module faceplate.
3. Pull the MSM board straight out of the slot, using the latch as a handle.

MSM Cabling

MSM Cabling

This chapter describes cabling for the MSM. Each cabling configuration represents the required connections between the MSM and other equipment associated with the communications path such as terminals, modems, host computers, and patch panels. Each cabling configuration is also accompanied with ordering information.

WARNING: The first 25 feet of data cabling connected to the node or BNS-2000 MPC must be shielded to meet Federal Communications Commission (FCC) Electromagnetic Interference (EMI) requirements. If longer cable runs are needed for a given configuration, unshielded cables can be used after the first 25 feet.

When Lucent Technologies cables and other components are specified, no other cables and components can be used. Otherwise, Lucent is not liable for failure to meet FCC regulations.

Cabling MSM Directly to Terminal or Host Computer

The cabling for this part of the configuration originates at the I/O distribution board on the node or BNS-2000 MPC. An I/O distribution board equipped with connectors provides the means for cable connections.

- The MSM consists of a TN2111B main circuit pack and an AWJ4 I/O distribution board.
- The node or BNS-2000 MPC requires B25FS-1MOD shielded cable for the first 25 feet.
- Each B25FS-1MOD 25-pair cable supports six 8-wire interface ports.
- Two 50-pin connectors on the AWJ4 I/O distribution board link an MSM to B25FS-1MOD 25-pair connectorized cables. Therefore, each MSM requires two cables.
- Although a B25FS-1MOD shielded cable is required for the initial 25 feet from the node or from the BNS-2000 MPC, a B25A unshielded cable can be used at the customer's option after the first 25 feet.
- The B25FS-1MOD may be connected to an M48EX cable assembly that provides six connectorized female ends that connect directly to terminals and host computers, or it may be connected to a 258AF or 258BF adapter that provides six 8-wire modular jacks.

  NOTE: The M48EX cable does not provide for the DSR lead. Use the 25AF or 258BF adapter when the connecting terminal or host requires the DSR signal.

- If the 258AF or 258BF adapter is used, the connection from the adapter to the terminal depends on the gender of the terminal connector.
  - Use D8AG cables for terminals with male connectors.
  - Use D8AN cables for terminals with female connectors.
- As an alternative cabling method, use D8W cables from the 258BF adapter to a D8AG-F adapter for a terminal or host with a male connector or a D8AN-M adapter for a terminal or host with a female connector.

TABLE 3-1. Ordering Information: MSM Directly to Terminal or Host

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
258AF adapter	50-pin-F 6 mod sockets, side entry	G(152)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
D8AG	25-pin-F mod plug, null modem wiring	G(130), G(G)
D8AN	25-pin-M mod plug, null modem wiring	G(132), G(G)
D8W	mod plug mod plug, straight through	G(137), G(G)
D8AG-F adapter	25-pin-F mod socket, null modem wiring	G(138)
D8AN-M adapter	25-pin-F mod socket, null modem wiring	G(140)
M48EX	50-pin 90-F 6 x 25-pin-F, null modem wiring	G(168), G(E)

Cabling MSM to Terminal or Host Computer via 110 Patch Panel

With use of the indicated cables, asynchronous connections from a node or BNS-2000 MPC are compatible with standard non-SYSTIMAX PDS 110 patch panels. Asynchronous connections from the node and BNS-2000 MPCs are compatible with SYSTIMAX PDS 110 patch panels.

Non-SYSTIMAX PDS 110 Patch Panels

The cabling from an MSM to a non-SYSTIMAX PDS 110 patch panel can be configured as follows:

- The MSM consists of a TN2111B main circuit pack and an AWJ4 I/O distribution board.
- A 110 patch panel can accept up to thirty-six 25-pair cables. Each 25-pair cable supports six 8-wire interface ports.
- For 110 patch panels that require field termination of building cables, use B25FS-1MOD from the MSM I/O board along with an A25R-SE to connect to a 110 patch panel.
- Depending on the type of 110 patch panel used and the specific distribution method required, connections from the patch panel to the terminating equipment may be made with 4-pair "D" wire to 103A connecting blocks or they may be made with a B25A cable to a 258A or 258B adapter. In either case, the final connection to the terminating equipment will be made with modular cables or adapters.
  - Use the D8AG cable for equipment with male connectors.
  - Use the D8AN cable for equipment with female connectors.
- As an alternative to using the D8AG and D8AN cables, a D8W cable may be connected to D8AG-F or D8AN-M adapters to provide the same respective connections.

SYSTIMAX PDS 110 Patch Panels

The cabling from an MSM to a SYSTIMAX PDS 110 patch panel can be configured as follows:

- The MSM consists of a TN2111B main circuit pack and an AWJ4 I/O distribution board.
- The MSM requires an M42P or M30P shielded cable for the first 25 feet.
  - The M42P cable provides flow control signaling (SYSTIMAX PDS compatible).
  - The M30P cable is used where flow control signaling is not required (SYSTIMAX PDS compatible).
- The M42P or M30P cables may terminate directly to the 110 patch panel or they may be extended with B25A or A25U cables as required.

- For 110 patch panels that require field termination of building cables, use B25FS-1MOD from the MSM I/O board along with an A25R-SE to connect to a 110 patch panel.
- Depending on the type of 110 patch panel used and the specific distribution method required, connections from the patch panel to the terminating equipment may be made with 4-pair "D" wire to 103A connecting blocks or they may be made with a B25A cable to a 258A or 258B adapter. In either case, the final connection to the terminating equipment will be made with modular cables or adapters.
  - Use the D8AG cable for equipment with male connectors.
  - Use the D8AN cable for equipment with female connectors.
- As an alternative to using the D8AG and D8AN cables, a D8W cable may be connected to D8AG-F or D8AN-M adapters to provide the same respective connections.
- A 110 patch panel can accept up to thirty-six 25-pair cables. Each 25-pair cable supports six 8-wire interface ports.

TABLE 3-2. Ordering Information: MSM to Terminal or Host via 110 Patch Panel

Cable/Adapter	Description	ED5P055-31 Group Number
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
A25R-SE	50-pin 90-F single-ended	G(103), G(A)
M42P	50-pin 180-M 50-pin 90-F	G(177), G(AR)
M30P	50-pin 180-M 50-pin 90-F	G(176), G(AR)
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
A25U	50-pin 90-M 50-pin 90-M	G(114), G(F)
258A adapter	50-pin-M 6 mod sockets, side entry	G(153)
258B adapter	50-pin-M 6 mod sockets, rear entry	G(154)
D8AG	25-pin-F mod plug, null modem wiring	G(130), G(G)
D8AN	25-pin-M mod plug, null modem wiring	G(132), G(G)
D8W	mod plug mod plug, straight through	G(137), G(G)
D8AG-F adapter	25-pin-F mod socket, null modem wiring	G(138)
D8AN-M adapter	25-pin-M mod socket, null modem wiring	G(140)
B25FS-1MODF	50-pin 180-M 50-pin 90-M	G(262), G(C)

Cabling MSM to Terminal or Host Computer via Modem or FOM

The cabling for this part of the configuration originates at the I/O distribution board on the node or BNS-2000 MPC where the MSM resides. The I/O distribution board plugs into the backplane and provides connections between the MSMs and the modems or fiber-optic multiplexers (FOMs) housed in a separate cabinet.

The cabling configurations of the MSM to terminals or host computers via modems or FOMs is as follows:

- The MSM consists of a TN2111B main circuit pack and an AWJ4 I/O distribution board.
- The MSM requires B25FS-1MOD shielded cable for the first 25 feet.
- Each B25FS-1MOD 25-pair cable supports six 8-wire interface ports.
- Two 50-pin connectors on the AWJ4 I/O distribution board link an MSM to B25FS-1MOD 25-pair connectorized cables. Therefore, each MSM requires two cables.
- Although a B25FS-1MOD shielded cable is required for the initial 25 feet from the node or BNS-2000 MPC, a B25A unshielded cable can be used at the customer's option after the first 25 feet.
- The terminating end of the B25FS-1MOD cable may be connected to an M48D cable assembly that provides six connectorized male ends that connect directly to modems or multiplexers, or the B25FS-1MOD cable may be connected to a 258AF or 258BF adapter that provides six 8-pin modular jacks.
  - If the 258-type adapter is used, the connection from the adapter to the modem or multiplexer should be made with a D8AH cable.
  - As an alternative to the D8AH cable, a D8W modular cable may be used with an adapter. If the modem or multiplexer has a male connector, use the D8AH-F adapter. If the modem or multiplexer has a female connector, use the D8AH-M adapter.
  - Terminal and host computer connections are made at the terminating modems or multiplexers using M25A and M25B cables. The cable selected depends on the gender of the modem or multiplexer.
- Another option is to use a B25FS-1MOD cable from the node or BNS-2000 MPC plugged directly into a 50-pin connector on an FOM. *Canoga Data Systems*® Model CDS372 and Optical Data Systems Model ODS310 are two FOMs that provide 50-pin connectors.

TABLE 3-3. Ordering Information: MSM to Terminal or Host via Modem or FOM

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
258AF adapter	50-pin-F 6 mod sockets, side entry	G(152)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
D8AH	25-pin-M mod plug	G(131), G(G)
D8W	mod plug mod plug, straight through	G(137), G(G)
D8AH-F adapter	25-pin-F mod socket	G(147)
D8AH-M adapter	25-pin-M mod socket	G(139)
M48D	50-pin 90-F 6 x 25-pin-M	G(109), G(E)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Cabling MSM to R-VDM via VDM Cabinet

The cabling for an MSM residing in a node or BNS-2000 MPC to a Remote-Voice/Data Multiplexer (R-VDM) via a VDM cabinet can be configured as follows:

- A VDM cabinet can have up to 12 shelves. Each shelf provides four 50-pin data connectors that support six circuits each. Therefore, a fully populated VDM cabinet with 12 shelves and 288 circuits requires 48 data interface cables.
- The MSM provides 12 circuits via two 50-pin connectors (J1 and J2) on its associated AWJ4 I/O distribution board.
- A B25FSX-1MOD cable is required to connect each 50-pin connector on the AWJ4 to the VDM shelf 50-pin connectors.
- For each VDM circuit in a Central Office (CO), a corresponding R-VDM is required at the customer or end user equipment location. The connection between the VDM cabinet in the CO and the R-VDM at the customer or end user equipment location is provided as follows:
  - The VDM voice and voice/data circuits are connected to the CO Main Distribution Frame (MDF) with an A25RX cable. Each of the 50-pin A25RX cables provides voice and voice/data connections for 12 circuits.
  - The connectorized end of the A25RX cable connects to one of the 50-pin plugs on the VDM backplane. The butt end is then connected to the MDF.
  - Voice channels are wired from the MDF to the CO voice switch.
  - Voice/data channels are wired from the MDF to the R-VDM over 2-wire unloaded loop (maximum length is 18,000 feet) or via a Subscriber Loop Carrier (SLC 96) system.

TABLE 3-4. Ordering Information: MSM to R-VDM via VDM Cabinet

Cable/Adapter	Description	ED5P055-31 Group Number
B25FSX-1MOD	50-pin 180-M 50-pin 180-M	G(204), G(C)
A25RX	50-pin 180-F single-ended	G(115), G(A)

Cabling MSM to R-VDM via VDM Stand-Alone Shelf

The cabling for an MSM residing in a node or BNS-2000 MPC to an R-VDM via a VDM Stand-Alone Shelf can be configured as follows:

- The VDM Stand-Alone Shelf is equipped with 18 DB25 connectors for data interface connections.
- The MSM provides 12 circuits via two 50-pin connectors (J1 and J2) on its associated AWJ4 I/O distribution board.
- A B25FS-1MOD cable from the AWJ4 plugs into a 258BF adapter or M48D cable.
- A 258BF adapter provides six 8-pin modular jacks for RS-232 connections. Use D8AH cords to complete the connections from the 258BF adapter to the VDM Stand-Alone Shelf.
- Alternately, an M48D cable splits the 50-pin cable into six RS-232 cables with DB25 male connectors. Each leg of the M48D cable can connect directly to one of the DB25 connectors on the VDM Stand-Alone Shelf backplane.
- For each VDM circuit in a CO, a corresponding R-VDM is required at the customer or end user equipment location. The connection between the VDM Stand-Alone Shelf in the CO and the R-VDM at the customer or end user equipment location is provided as follows:
  - The VDM Stand-Alone Shelf voice and voice/data circuits are connected to the CO Main Distribution Frame (MDF) with an A25RXM cable. Each of the 50-pin A25RXM cables provides voice and voice/data connections for 12 circuits.
  - The connectorized end of the A25RXM cable connects to one of the 50-pin plugs on the VDM backplane. The butt end is then connected to the MDF.
  - Voice channels are wired from the MDF to the CO voice switch.
  - Voice/data channels are wired from the MDF to the R-VDM over 2-wire unloaded loop (maximum length is 18,000 feet) or via a Subscriber Loop Carrier (SLC 96) system.

TABLE 3-5. Ordering Information: MSM to R-VDM via VDM Stand-Alone Shelf

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
M48D	50-pin 90-F 6 25-pin-M	G(109), G(E)
D8AH	25-pin-M mod plug	G(131), G(G)
A25RXM	50-pin 180-M single-ended	G(167), G(A)

Cabling MSM to R-VDM via Model 045CS VDM

The cabling for an MSM residing in a node or BNS-2000 MPC to an R-VDM via a Model 045CS VDM can be configured as follows:

- The Model 045CS VDM is equipped with one DB25 data connector.
- The MSM provides 12 circuits via two 50-pin connectors (J1 and J2) on its associated AWJ4 I/O distribution board.
- A B25FS-1MOD cable connects from the AWJ4 I/O distribution board of the MSM to a 258BF adapter or M48D cable.
- A 258BF adapter provides six 8-pin modular jacks for RS-232 connections. Use one D8AH cord to complete each connection from the 258BF adapter to one Model 045CS VDM.
- Alternatively, an M48D cable splits the 50-pin cable into six RS-232 legs with DB25 male connectors. Each leg of an M48D cable can connect directly to the DB25 connector at the back of a Model 045CS VDM.
- For each VDM circuit in a CO, a corresponding R-VDM is required at the customer or end user equipment location. The connection between the Model 045CS VDM in the CO and the R-VDM at the customer or end user equipment location is provided as follows:
  - The Model 045CS VDM voice and voice/data circuits are connected to the CO Main Distribution Frame (MDF) through D6AM modular cables and 635B connecting blocks. Each pair of the D6AM modular cables provides one voice and one voice/data connection.
  - One end of each of the D6AM modular cables connects to the TEL and LINE receptacles on the Model 045CS VDM. The other end of these cables connects to receptacles on a 635B connecting block that, in turn, is connected to the CO MDF.
  - Voice channels (from the TEL receptacle) are wired from the MDF to the CO voice switch.
  - Voice/data channels (from the LINE receptacle) are wired from the MDF to the R-VDM over 2-wire unloaded loop (maximum length is 18,000 feet) or via a Subscriber Loop Carrier (SLC 96) system.

TABLE 3-6. Ordering Information: MSM to R-VDM via Model 045CS VDM

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
D8AH	25-pin-M mod plug	G(131), G(G)
M48D	50-pin 90-M 6 25-pin-M	G(109), G(E)
D6AM	6-pin mod 6-pin mod	G(144), G(H)

Cabling MSM to R-VDM via D4 and VDM Cabinet

The cabling for an MSM residing in a node or BNS-2000 MPC to an R-VDM via D4 and the VDM cabinet can be configured as follows:

- A VDM cabinet can have up to 12 shelves. Each shelf provides four 50-pin data connectors that support six circuits each. Therefore, a fully populated VDM cabinet with 12 shelves and 288 circuits requires 48 data interface cables.
- The MSM provides 12 circuits via two 50-pin connectors (J1 and J2) on its associated AWJ4 I/O distribution board.
- Connections to the D4 RS-232 DSU-II Dataport, used for CO-LAN Foreign Serving Office (FSO) arrangements of the VDM and the node or BNS-2000 MPC, may be made via a DB25 connection on the faceplate of the DSU-II Dataport plug-in unit or via direct connections to the backplane of the D4 channel bank.
- A DSU-II Dataport plug-in supports one circuit with a female DB25 RS-232 connector.
- A B25FS-1MOD cable is required to connect each 50-pin connector on the AWJ4 I/O distribution board to a 258BF adapter. This adapter provides six 8-pin modular jacks for RS-232 connections.
- Use D8AHX cords to make the connection from the adapter to the DSU-II Dataport.
- At the remote end, use D8ANX cords to make the connection from a DSU-II Dataport to a jack in a 258BF adapter.
- Use a B25F 50-pin cable to connect the 258BF adapter to the VDM cabinet.
- For each VDM circuit in a CO, a corresponding R-VDM is required at the customer or end user equipment location. The connection between the VDM cabinet in the CO and the R-VDM at the customer or end user equipment location is provided as follows:
  - The VDM voice and voice/data circuits are connected to the CO Main Distribution Frame (MDF) with an A25RX cable. Each of the 50-pin A25RX cables provides voice and voice/data connections for 12 circuits.
  - The connectorized end of the A25RX cable connects to one of the 50-pin plugs on the VDM backplane. The butt end is then connected to the MDF.
  - Voice channels are wired from the MDF to the CO voice switch.
  - Voice/data channels are wired from the MDF to the R-VDM over 2-wire unloaded loop (maximum length is 18,000 feet) or via a Subscriber Loop Carrier (SLC 96) system.

TABLE 3-7. Ordering Information: MSM to R-VDM via D4 and VDM Cabinet

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
D8AHX	25-pin-M mod plug	G(193), G(G)
D8ANX	25-pin-M mod plug	G(194), G(G)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
B25F	50-pin 180-M 50-pin 90-M	G(100), G(F)
A25RX	50-pin 180-F single-ended	G(115), G(A)

Cabling MSM to R-VDM via D4 and VDM Stand-Alone Shelf

The cabling for an MSM residing in a node or BNS-2000 MPC to an R-VDM via D4 and Stand-Alone Shelf can be configured as follows:

- The VDM Stand-Alone Shelf supports 18 circuits. Female DB25 RS-232 connectors are provided for each circuit, requiring 18 data cables per shelf.
- The MSM provides 12 circuits via two 50-pin connectors (J1 and J2) on its associated AWJ4 I/O distribution board.
- Connections to the D4 RS-232 DSU-II Dataport, used for CO-LAN Foreign Serving Office (FSO) arrangements of the VDM and the node or BNS-2000 MPC, may be made via a DB25 connection on the faceplate of the DSU-II Dataport plug-in unit or via direct connections to the backplane of the D4 channel bank.
- A DSU-II Dataport plug-in supports one circuit with a female DB25 RS-232 connector.
- A B25FS-1MOD cable is required to connect each 50-pin connector on the AWJ4 I/O distribution board to a 258BF adapter. This adapter provides six 8-pin modular jacks for RS-232 connections.
- Use D8AHX cords to make the connection from the adapter to the D4 DSU-II Dataport.
- At the remote end, an M25B-DSU cable connects the DSU-II Dataport to one of the DB25 connectors at the back of the VDM Stand-Alone Shelf.
- For each VDM circuit in a CO, a corresponding R-VDM is required at the customer or end user equipment location. The connection between the VDM Stand-Alone Shelf in the CO and the R-VDM at the customer or end user equipment location is provided as follows:
  - The VDM Stand-Alone Shelf voice and voice/data circuits are connected to the CO Main Distribution Frame (MDF) with an A25RXM cable. Each of the 50-pin A25RXM cables provides voice and voice/data connections for 12 circuits.
  - The connectorized end of the A25RXM cable connects to one of the 50-pin plugs on the VDM backplane. The butt end is then connected to the MDF.
  - Voice channels are wired from the MDF to the CO voice switch.
  - Voice/data channels are wired from the MDF to the R-VDM over 2-wire unloaded loop (maximum length is 18,000 feet) or via a Subscriber Loop Carrier (SLC 96) system.

TABLE 3-8. Ordering Information: MSM to R-VDM via D4 and VDM Stand-Alone Shelf

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
D8AHX	25-pin-M mod plug	G(193), G(G)
M25B-DSU	25-pin-M 25-pin-M	G(166), G(AM)
A25RXM	50-pin 180-M single-ended	G(167), G(A)

Cabling MSM to R-VDM via D4 and Model 045CS VDM

The cabling for an MSM residing in a node or BNS-2000 MPC to an R-VDM via D4 and the Model 045CS VDM can be configured as follows:

- The Model 045CS VDM supports one circuit. A female DB25 RS-232 connector is provided, requiring one data cable per 045CS VDM.
- The MSM provides 12 circuits via two 50-pin connectors (J1 and J2) on its associated AWJ4 I/O distribution board.
- Connections to the D4 RS-232 DSU-II Dataport, used for CO-LAN Foreign Serving Office (FSO) arrangements of the VDM and the node or BNS-2000 MPC may be made via a DB25 connection on the faceplate of the DSU-II Dataport plug-in unit or via direct connections to the backplane of the D4 channel bank.
- A DSU-II Dataport plug-in supports one circuit with a female DB25 RS-232 connector.
- A B25FS-1MOD cable is required to connect each 50-pin connector on the AWJ4 I/O distribution board to a 258BF adapter. This adapter provides six 8-pin modular jacks for RS-232 connections.
- Use D8AHX cords to make the connection from the adapter to the D4 DSU-II Dataport.
- At the remote end, an M25B-DSU cable connects the DSU-II Dataport to the DB25 connector at the back of the Model 045CS VDM.
- For each VDM circuit in a CO, a corresponding R-VDM is required at the customer or end user equipment location. The connection between the Model 045CS VDM in the CO and the R-VDM at the customer or end user equipment location is provided as follows:
  - The Model 045CS VDM voice and voice/data circuits are connected to the CO Main Distribution Frame (MDF) through D6AM modular cables and 635B connecting blocks. Each pair of the D6AM modular cables provides one voice and one voice/data connection.
  - One end of each of the D6AM modular cables connects to the TEL and LINE receptacles on the Model 045CS VDM. The other end of these cables connects to receptacles on a 635B connecting block that, in turn, is connected to the CO MDF.
  - Voice channels (from the TEL receptacle) are wired from the MDF to the CO voice switch.
  - Voice/data channels (from the LINE receptacle) are wired from the MDF to the R-VDM over 2-wire unloaded loop (maximum length is 18,000 feet) or via a Subscriber Loop Carrier (SLC 96) system.

TABLE 3-9. Ordering Information: MSM to R-VDM via D4 and Model 045CS VDM

Cable/Adapter	Description	ED5P055-31 Group Number
B25A	50-pin 90-M 50-pin 90-F	G(106), G(F)
B25FS-1MOD	50-pin 180-M 50-pin 90-M	G(262), G(C)
258BF adapter	50-pin-F 6 mod sockets, rear entry	G(155)
D8AHX	25-pin-M mod plug	G(193), G(G)
M25B-DSU	25-pin-M 25-pin-M	G(166), G(AM)
D6AM	6-pin mod 6-pin mod	G(144), G(H)

MSM Administration

MSM Administration

Before MSM port administration can begin, the appropriate groups with which the port or ports can be associated must be entered into the database with the **enter group** command. Group association is restricted to hardware type and service type likeness. If required, host autobaud must be administered with the receive group administration. For more information on groups and other database elements that should be entered before administering MSM ports, see the *Node Reference.*

StarKeeper II NMS Administration

MSM administration via *StarKeeper*® II NMS is accomplished by using the cut-through mode of *StarKeeper* II NMS. MSM commands are entered and executed almost as they would be entered and executed on the direct console connection. *StarKeeper* II NMS does not allow all of the abbreviations that can be used at the console nor does it validate input information. Refer to the following sections on MSM administration, and see *StarKeeper* II NMS documentation for information on accessing the cut-through mode for your node.

Command Set

MSM port information is added to the database, and thereafter manipulated and checked, with the **enter msm**, **change msm**, **delete msm**, and **verify msm** commands. The **enter** and **change** commands have an extensive parameter prompting sequence in which configurable options are specified in the database. Once specified, these options can be checked with the **verify** command and removed with the **delete** command.

The **restore msm** and **remove msm** commands control the service state of the module ports; these commands, which affect hardware performance and call processing, are often used in conjunction with administration and maintenance procedures. The **remove** and **restore** commands can be used with **verify oosmods** and **verify oosports**, which list all out-of-service modules and ports.

In general, the **enter**, **change**, **delete**, **remove**, and **restore** commands function on a per-port or per-module basis, unlike the **verify** command, which functions on a module basis. For example, you can remove one port from service, make database changes to the information regarding the port, and restore the port to service. When you verify the information, the system outputs information pertaining to every administered port on that module.

The **diagnose msm** command is used for module maintenance and troubleshooting, along with other maintenance- and status-related commands, such as **verify epn** and **dstat msm**.

TABLE 4-1. MSM Command Set

Administration	Operation	Maintenance	Related Objects	
change msm	**remove msm**	**diagnose msm**	**address***	**module**
delete msm	**restore msm**	**dstat msm**	**concentrator**	**oosmods**
enter msm			**connections**	**oosports**
verify msm			**epn**	**periodic_bill**
			group*	**profile***
			held	**schedule**
				traffic**

* This object should be entered before administering an MSM in the database.

** BNS-2000 only.

Parameter Considerations

Some parameter specifications that are made during an iteration of **enter msm** or **change msm** do not affect other parameters or database elements entered, or the general performance of the network or node. Other parameters require special consideration because of the nature of the hardware configuration or the application being supported. These parameters are explained in this section.

The syntax of **enter msm** described in **MSM Commands** and the database entry forms provided in **Appendix B** furnish the correct prompting sequence for the service type being entered. In addition, the parameter definitions provided in **enter msm** supplement the following sections.

Module Address

The **MODULE ADDRESS** parameter is used to identify the location of a particular piece of hardware known as a module. The address of the module depends on its physical placement in a node or supported concentrator slot. When a module is installed directly in a node slot, its address is typically represented as

<module>

where *module* represents the node slot number that the module occupies.

If the module is installed in a concentrator, the concentrator is then connected to the node by a link interface module (LIM) and the link itself. When a module is installed in a concentrator slot, its address is represented as

<concentrator/module>

where *concentrator* is a number indicating the node slot number that the LIM occupies; and *module* is a number indicating the concentrator slot number that the module occupies. (See the *Data Networking Products Multipurpose Concentrator Reference*.)

If a single address entry is allowed, only one module address can be specified. This addressing method is indicative of the **verify** commands, and many of the **enter** and **change** commands. For example:

verify msm 27/2

A slight variation of this addressing method is demonstrated with the **verify** command, which allows you to specify either **one** module address or, with the word *all*, **every** module address. For example:

verify msm all

Port Number

The **PORT NUMBER** parameter for an MSM is a number from *1* to *12* that identifies a physical port on a module. A port number or port numbers can be entered as a single port number entry or as a multiple port number entry. For a single port number entry, enter only **one** port number:

```
PORT NUMBER [1-12: +(1-12)]: 1
```

For a multiple port number entry, enter a series of numbers (x,y,z), a range of numbers (x-z), or a combination of both (w,x-z):

```
PORT NUMBER [1-12: +(1-12)]: 6,9,10
PORT NUMBER [1-12: +(1-12)]: 6-12
PORT NUMBER [1-12: +(1-12)]: 1,6-12
```

When entering multiple port numbers, the parameter specifications made apply to all port numbers input at the **PORT NUMBER** prompt.

Service Type and Group

The **SERVICE TYPE** parameter enables you to specify if a particular device is to be designated for *console*, *host*, *modem*, *2way*, or *terminal* service. By entering the appropriate group name with the **group** command and by specifying that name at the **GROUP** prompt in the MSM prompting sequence, you can associate the selected service type with a logical bundle of ports that can *originate* or *receive* calls or do both (*2way*).

- *console* and *host*

  Console and host service types must belong to groups that receive calls because they are destinations on the node.

  The host service type requires the connected host to assert DTR (pin 20) (unless it is a permanently activated port) to complete a virtual circuit and asserts DCD to the connected host to indicate that the connection is active. On disconnect, the host service type drops DCD toward the connected host. The connected host can terminate the connection by dropping DTR.

The console service type ignores the DTR circuit initially and does not expect the connected end device to require DCD. This service type is used for host computer ports that do not implement control functions.

- *modem* and *terminal*

  Modem and terminal service types must belong to groups that originate calls because they are node originators. Ports that are connected to modems for dial-in service to the node use the modem service type and provide control lead interactions to terminate external connections. Ports for user terminals are administered with the terminal service type and expect control from the connected terminal for disconnecting node calls.

  Both modem and terminal ports support a 60-second timeout at the **`DESTINATION:`** prompt. The modem service type also supports dropping DTR (output control lead toward the connected modem) at timeout and at the end of a node connection. If a password is administered for originating ports, both modem and terminal service types provide for a network access password timeout. Host computer ports that are used for making calls to remote resources should be designated as modem service types.

- *2way*

  The two-way service type belongs to a *2way* group and allows the connected end device to originate and receive calls. It is typically used for a small computer with a limited number of ports; the computer can connect to other resources and have other resources access it. Switching from the default receiving mode to the originating mode is activated from the connected end device.

Predefined Destination

The **`PREDEFINED DESTINATION`** parameter, which is commonly referred to as *PDD,* enables you to specify a service address and an optional physical address or other secondary address so an originating device—such as a modem, terminal, or two-way—can automatically connect to its hosts and service when it is turned on.

A predefined destination is a string of *1* to *72* characters that designates this service address and optional physical address. For internodal connections, the PDD designates the receiving network, area, and exchange as well as the service address and physical address. The format of a PDD is

[[[<network>/]<area>/]<exchange>/]<local>[.<module/concentrator>.<channel>]

A PDD can be a security mechanism; for instance, it can be an automatic connection to a security server. If you do not specify a PDD for a port, an end user can connect to any destination address allowed for the group to which the port is assigned.

Two-wire Modem

In special situations, the two-wire, half-duplex modem is used. For most applications, the typical four-wire modem is used.

When entering an MSM port for console, host, modem, two-way, or terminal service, you must specify whether the port is connected to a two-wire modem. If you respond *no* to the **CONNECTED TO A 2-WIRE MODEM** prompt, you must then specify the flow control method the port is to use. If you respond *yes* to the prompt, you are not prompted for the flow control method.

Baud Rate and Stop Bits

The **BAUD RATE** parameter enables you to specify a particular transmission speed at which the module port is to communicate with its connected device. Port speed and device speed must match.

Bauds supported range from 75 bps to 115200 bps. Each port can be administered independently for any supported speed. The number of ports supported at different bauds must be engineered so they do not exceed the aggregate module throughput constraint of 900 Kbps.

Modem, terminal, and two-way service types can also be administered for *autobaud* (*auto*). A port administered for autobaud matches its transmission speed to that of its connected end device at the beginning of a session when the user presses Return. For two-way ports set to *auto*, which works when the two-way functions as a call originator only, a receive baud rate must be specified. This rate is used when the port is in receive mode. The autobaud option is useful when users exchange terminals. If the terminal port is configured for autobaud, the user can change the speed as often as necessary, without database reconfiguration.

For receiving ports, the *host autobaud* option is available on a per-group basis; see the *Node Reference* for details on administering groups.

The number of stop bits is the number of bits needed to determine the end of data transmission. Administrable choices per port are *1, 1.5, or 2*. Typically, bauds at or below 110 bps use more than one stop bit.

Parity and Flow Control

To ensure the most accurate and reliable data transmission, parity and flow control are administrable on a per-port basis.

Parity, the type of error checking done on the port, can be administered for all service types. Parity can also be turned off.

Flow control can be administered for MSM ports not connected to 2-wire modems. For these ports—which are designated as DCEs—software, hardware, and no flow control is supported with the options *xon/xoff, eia,* and *none*.

Administration of flow control provides a receiving device with the capability of requesting transmission interruption from a transmitting device. Typically, flow control is administered in the direction of the higher capacity data stream. Therefore, for service type *host*, which usually sends data in volume, **FLOW CONTROL OF DEVICE BY MSM** is usually administered.

To continue in the direction of the data flow, service type *terminal* normally expects to receive a data stream from a host for display on a local terminal. So **FLOW CONTROL OF MSM BY DEVICE** is the typical administration. Flow control is administered independently of direction, so it is typical to enable flow control by choosing *xon* or *xoff* in the high data stream direction and to disable it (by choosing *none*) in the reverse direction.

Since flow control is an end-to-end protocol, both ends should be administered with compatible choices. Enabling flow control options allows the node to use its universal receiver protocol (URP) GOS5 to manage the internal buffering resources. Disabling the flow control option allows the connected end device to support software flow control as data. There is a risk of overrunning the internal buffering resources, which may result in data loss.

For software flow control, the MSM supports *xon* and *xoff*. It does not support the *ixany* option available on some connected host resources.

For hardware flow control, which is administered as *eia*, the MSM uses its output CTS lead to control input data, and its input RTS lead to control output data. CTS and RTS designations are relative to a connected DTE device. Refer to **Appendix C** for additional information on EIA lead states.

For no flow control, the internal MSM buffering of 127 buffers of 29 bytes each per port is available, but indications of data overrun are not made apparent. The MSM internal protocol includes error detection, correction, and retransmission to recover lost data.

Connect-time Billing

If billing is to be logged for the MSM port and reported to the billing service, an associated address called *billing* must be entered with the **address** command. In addition, billing output can only be logged for modem, terminal, or two-way devices (functioning as call originators) if a PDD is administered. In the output of **verify schedule**, any billing reports scheduled appear as:

```
Periodic Billing reports scheduled: <time>
```

Permanently Activated Port (PAP)

If a port is administered to be permanently active at the **PERMANENTLY ACTIVATED PORT** prompt, that port becomes active as soon as it is put into service. Calls between ports can be established and/or remain up regardless of EIA (DTR) lead state changes in network endpoints.

When a permanently active modem, terminal, or two-way port is administered for autobaud and the baud of the port's attached device changes, the port must be removed and restored to service in order to match the new baud of the attached device.

Attention Character and Attention Action

The **ATTENTION CHARACTER** parameter lets you specify up to two characters, from a set of characters, for an attention signal. Each port belonging to an originating or two-way group can transmit this signal to the node to indicate its need for system attention. The module interprets the character and sends a control signal to the node.

The character set that the MSM allows for the assignment of an attention character includes *1brk, 2brk, del, none,* or any ASCII character (*a character*). Any ASCII character can be specified by typing just the character (*a,A,b,B*) or by preceding the character with a caret to form a control character (*^a*).

When defining an attention character, do not define a character sequence that the host recognizes as a command sequence. If the host recognizes the attention character as a command sequence, the end user must access the node's command mode and change the attention character to a non-interfering sequence. Consult the host administrator before administering an attention signal.

If binary data is being transferred, an ASCII character sequence should not be used as the attention character because it can appear in the data stream. Use a single or double Break signal instead.

Once the attention character is administered, you can also specify the response or action. If you choose *disconnect* as the action, the attention character simply ends the session.

If you choose *command mode*, the end user has access to full terminal user mode, including call hold and parameter setting (subject to other options you choose for the port). Consider whether end users should have access to command mode and should be allowed to change the baud rate, flow control, or attention character options. This capability can be helpful when troubleshooting (to identify the originating module and channel, group, and baud rate), but it can also lead to problems if used incorrectly.

Administrative Procedures

The initial administration of an MSM (**Procedure 4-1**) is not hardware dependent—that is, the MSM does not have to be physically installed before its information is entered in the database. However, for routine administration and operations procedures, such as removing and restoring a module and its ports to service or displaying the status of the hardware, module installation is required.

For minor database changes, such as modifications to only a few parameters, follow **Procedure 4-3**. For database changes involving extensive configuration adjustments, follow **Procedure 4-4**.

PROCEDURE 4-1. Entering an MSM

1. Use **enter msm module** to commence administration. Have your completed database entry forms handy and remember that default values can be specified by pressing Return or + .
2. Use **verify msm** to check your entries.
3. If you made any errors or have to change parameter specifications, use **change msm module.** If you need to start over, use **delete msm module** to eliminate all entries made; then begin again with **enter msm module.**
4. If the module was installed, use **restore msm module.**

PROCEDURE 4-2. Entering MSM Ports

1. For MSM ports, use **verify address, verify group,** and **verify profile** to determine if the appropriate addresses (for the predefined destination, billing, and EPNs), groups, and profiles are entered. If they do not appear in the database as required (they were deleted; they have changed; they are misspelled), see the *Node Reference* for procedures on how to make the necessary changes.
2. Use **enter msm port** to commence administration. Have your completed database entry forms handy and remember that default values can be specified by pressing Return or + .
3. Use **verify msm** to check your entries.
4. If you made any errors or have to change parameter specifications, use **change msm port.** If you need to start over, use **delete msm port** to eliminate all entries made; then begin again with **enter msm port.**
5. If the module was installed, use **restore msm port** to return ports to service.

PROCEDURE 4-3. Making Minor Database Changes

A minor database change constitutes a change to a few parameter options for the module or for one or two ports.

1. If changes involve addresses (predefined destination, billing, or EPNs), groups, or profiles, make the needed changes with iterations of the **address**, **group**, or **profile** commands. Input **verify** <**object**> to check additions/modifications. See the *Node Reference* for details.
2. For port changes, remove ports from service with **remove msm port.** For module changes, remove the module from service with **remove msm module.**
3. Make modifications with **change msm.**
4. Check changes with **verify msm.**
5. For module changes, return the module to service with **restore msm module.** For port changes, return ports to service with **restore msm port.**

PROCEDURE 4-4. Making Extensive Database Changes

An extensive database change constitutes a change made to most of the parameter options for all configured ports on one or more modules.

1. If changes involve addresses (predefined destination, billing, or EPNs), groups, or profiles, make the needed changes with iterations of the **address**, **group**, or **profile** commands. Input **verify** <**object**> to check additions/modifications. See the *Node Reference* for details.
2. Input **verify msm** to get a report of the existing parameter options specified. If you feel the need to, complete the database entry forms furnished in **Appendix B**.
3. Remove module ports from service with **remove msm.**
4. Eliminate all database information with **delete msm**.
5. Re-enter all information with **enter msm**.
6. Verify changes with **verify msm**.
7. Return module ports to service with **restore msm**.

PROCEDURE 4-5. Moving Database Information to Another Module Address

Module information can be moved to another module address with the **move** command or with a combination of **delete** and **enter**.

Method 1:

1. Remove module ports from service with **remove msm**.
2. Input **verify module** to ensure that a database entry has not been made for the new module address. (If a database address does exist for the specified module address, the command fails.)
3. Input **move module** to transfer database information from one module address to another.
4. Physically move the hardware.
5. Using the new module address, put module ports back into service with **restore msm**.

Method 2:

1. If **move module** is not appropriate for the situation, input **verify msm** to get a report of the configuration data.
2. Input **remove msm** to remove the port from service.
3. Input **delete msm** to eliminate all information at the existing module address.
4. Input **enter msm** to add the information to the new address.
5. Check information entered at the new address with **verify msm**.
6. Physically move the hardware.
7. Restore the new MSM port to service with **restore msm**.

PROCEDURE 4-6. Copying Database Information to Another Module Address

Module port information can be duplicated from one module address to another module address with the **copy** command or with a combination of **verify** and **enter**. (Remember that the **copy module** command does not duplicate any endpoint numbers or ranges.)

Method 1:

1. If an additional MSM must be installed that will require **exactly** the same parameter specifications as a currently installed and configured module, input **remove msm** to take the module port out of service.
2. Input **verify module** to ensure that a database entry has not been made for the new module address. (If a database entry does exist for the specified module address, the command fails.)
3. Input **copy module** to duplicate the database information from one module address to another.
4. Input **restore msm** to put the module and its ports back into service.

Method 2:

1. If **copy module** is not appropriate for the situation, input **verify msm** to get a report of the existing parameter options specified. If you feel the need to, complete the database entry forms furnished in **Appendix B**.
2. Re-enter the information with **enter msm**.
3. Check information entered with **verify msm**.

Reports

The following table explains the reports available to assist with analysis of module/network performance, system expansion, troubleshooting, and other routine tasks.

TABLE 4-2. Available Reports for the MSM

Report Topic	Command	Description
billing	**verify schedule**	Lists the billing schedule for ports administered as PDDs.
connection/traffic	**display connections** **display traffic**	Lists established connections for modules, groups, or hosts. Group names are included. For BNS-2000, lists established connections for modules, groups, or hosts. Segment counts are included. See the *Node Reference*.
call hold data	**display held**	Lists all held calls for in-service ports by group. See the *Node Reference*.
database size	**dbaudit**	Shows where database space expenditures occur. If **dbresize** is used, the database tables are readjusted automatically. See the *Node Reference*.
EPNs	**verify epn**	Lists all assigned endpoint numbers or ranges of endpoint numbers.
module data	**dstat msm** **dstat module**	Lists hardware/software module data, including EIA lead states.
module/port data	**verify msm**	Lists hardware/software module/port data as it currently appears in the configuration database. Module does not have to be installed.
out-of-service modules	**verify oosmods**	Lists all configured modules that are currently out of service.
out-of-service ports	**verify oosports**	Lists all configured module ports that are currently out of service.

MSM Troubleshooting

MSM Troubleshooting

For information about a general, systematic approach to troubleshooting, refer to the *Node Reference.* Using the method outlined there, you can diagnose problems affecting the entire node and isolate localized problems to a specific interface module.

Once the problem is isolated to the MSM, this chapter can help identify and further isolate MSM-related problems. It provides problem indicators that are MSM specific, a checklist of problem areas, and detailed procedures or further references to remedy the problem. This chapter furnishes a brief explanation of problem indicators, such as faceplate LEDs, that are common to all modules; the *Node Reference* provides an in depth explanation. In addition, this chapter does not provide problem isolation techniques or procedures for end users or their connected end devices. Refer to the *Node Reference* for this information.

Problem Indicators

The LEDs and the three-position switch on the module faceplate along with the output of certain commands are often problem indicators that are specific to the MSM.

Faceplate Indicators. The LEDs on the faceplate are green, yellow, and red. They indicate on-line, off-line, and fault states. When the green LED (power light) is lit, the module is in service. When the yellow LED is lit, the faceplate switch is in the middle position. When the red LED (fault light) is lit, the module circuitry and the database are inconsistent or the diagnostics have found a hardware failure.

When pressed, the reset push button clears the module buffers and registers, and restarts the module application program. Ports are taken out of service and connections are terminated.

The MSM has a three position faceplate switch. The upper position is Enab, which is the only allowed position for normal operation. The middle position is Diag, which forces the module to run diagnostics. The lower position is Disab, which is used only when the module is inserted or removed from its slot.

Command Output. The output of operations commands—such as **diagnose msm** and those listed in the following table—can indicate an existing or potential problem.

TABLE 5-1. Command Output

Command	Description	Further Reference
diagnose msm	Enables execution of port loopback tests. Test patterns can be looped from the Control Computer to internal and external ports, local and remote modems, and Voice/Data Multiplexers (VDMs).	See MSM diagnostic procedures in this chapter. See **diagnose msm** in **MSM Commands**. See appropriate vendor documentation for connected end device.
display connections	Shows established connections for modules, groups, or hosts. Group names are included.	See **Procedure 5-3. Solving Terminal and/or Data Device Problems**. See **display connections** in the *Node Reference*.
display held	Shows call hold information for all in-service MSM ports, including module address, port number, and group name of the call originating port; and held status, slot, port number, tag name, and group name of the call destination port. Helps determine if the call hold limit (seven calls at one time per port) has been reached.	See **display held** in the *Node Reference*.
display traffic	For BNS-2000 only, output of this command shows established connections for modules, groups, or hosts. Segment counts are included.	See **Procedure 5-3. Solving Terminal and/or Data Device Problems**. See **display traffic** in the appropriate *Node Reference*.
dstat msm	Provides useful hardware and software troubleshooting information, such as the number of module resets, parity errors, and sanity errors that occurred during a five-minute interval; and module service state and mode state information as determined by status packet data. Output can be compared to that of **verify msm** and module faceplate indicators.	Also see **dstat module** in the *Node Reference*.
verify msm	Shows all parameter options administered for a specified MSM module or its administered ports; useful to determine if currently administered parameter options of module and connected end device options match.	See **verify msm** in **MSM Commands**.

Problem Areas

Once you have determined that the problem does not involve the node or its critical modules, or any connected end device, the problem can be isolated to the MSM. The following tables further isolate MSM-specific problems into asynchronous transmission problems and module problems.

TABLE 5-2. Asynchronous Transmission Checklist

√ Symptoms/Indicators	Possible Causes	Actions
____ Transmission problems	EIA leads	See **Procedure 5-1. Resolving Asynchronous Transmission Problems.**
	Faulty cabling	See **MSM Cabling.**
____ Data loss	Incorrect software options set	See **Procedure 5-2. Resolving Data Loss by Checking Software Options.** See appropriate documentation for connected end device.
____ No communication between node and host	Incorrect cables, adapters, or grounding	See **MSM Cabling.** See the *Node Reference* for grounding requirements and end-user troubleshooting procedures.
	Incorrect software options set	See **Procedure 5-2. Resolving Data Loss by Checking Software Options.** See appropriate documentation for connected end device.
	Improper seating of 50-pin cable device	Check seating of connectors, especially if device has a plastic shroud. Some ports can work fine while other ports (at other end of connector) fail to work due to improper seating.

TABLE 5-3. Module Problems Checklist

√ Symptoms/Indicators	Possible Causes	Actions
____ No calls in progress or cannot make calls (shown via alarms or **display connections or display traffic**, for BNS-2000, output) ____ Red LED lit on module	Bad cabling connection Module faulty Blown slot fuse Ports not in service Module faulty	See **Procedure 5-3. Solving Terminal and/or Data Device Problems.** See the *Node Reference* for slot fuse and command information. See MSM diagnostic procedures in this chapter.
____ End users unable to connect to node. (They report no **`DESTINATION:`** prompt or garbled characters on terminal.)	Group to which remote port is assigned has host autobaud option on and system has set the remote port speed to the originator's port speed. Inconsistent terminal and MSM port options. Problem with connected end device.	See **Procedure 5-3. Solving Terminal and/or Data Device Problems.** See the *Node Reference* for procedures regarding end user problems. See MSM diagnostic procedures in this chapter. See the *Node Reference* for procedures regarding connected end device (VDM/modem pool). See appropriate vendor documentation for connected end device.
____ Output of **diagnose msm** indicates problems.	Faulty connection Faulty module Problem with connected end device	See MSM diagnostic procedures in this chapter. See the *Node Reference* for troubleshooting procedures regarding end user problems and connected end devices (VDMs/modem pools). See appropriate vendor documentation for connected end device.

Procedures

The following sections explain the considerations that should be taken into account and the procedures that should be followed when troubleshooting an MSM.

- **Procedure 5-1. Resolving Asynchronous Transmission Problems** explains the areas that should be checked to resolve transmission problems.
- **Procedure 5-2. Resolving Data Loss by Checking Software Options** furnishes an in-depth explanation of the administrable software parameter options that might not match those options set for the connected end device.
- **Procedure 5-3. Solving Terminal and/or Data Device Problems** lists the areas that should be checked when module problems are suspected.

The MSM diagnostics section furnishes procedures that should be followed when running loopback tests. These include the following:

- **Procedure 5-4. Starting Loopback Tests**
- **Procedure 5-5. Running Internal Port Test**
- **Procedure 5-6. Running External Port Test**
- **Procedure 5-7. Running Local Modem Test on a Modem with Loopback Capability**
- **Procedure 5-8. Running Remote Modem Test on a Modem with Loopback Capability**
- **Procedure 5-9. Running External Port Test on Local or Remote Modems without Loopback Capability**
- **Procedure 5-10. Running VDM Check Loop Test**
- **Procedure 5-11. Completing MSM Tests**

PROCEDURE 5-1. Resolving Asynchronous Transmission Problems

Since most call setup problems can be pinpointed to EIA lead problems, observing the states of RS-232-C control leads is a vital troubleshooting aid. EIA lead states can be observed via the LEDs on a breakout box or the output of the **dstat msm** command. If a breakout box is connected to the line, the information received from the output of **dstat msm** can be compared to the information received by inspecting the LEDs on the breakout box and manipulating its DIP switches.

1. Verify that the cables are appropriate for the configuration. Refer to **MSM Cabling** for specific cable types and configurations.
2. Use **dstat module** <**mod addr**> to check for possible problems and to verify that the node is asserting and receiving the correct EIA leads. Hook up a breakout box on the node side and then on the device side. Detach the cables (one end at a time), and verify that the signals are originating from the expected side and conflicts are not present. Compare the information to that shown in **dstat msm** output.

   For more information regarding the implications of EIA RS-232-C lead states in conjunction with administered MSM service types that have flow control enabled, see **Appendix C**.
3. Verify data transport by checking the receive data (RD) and transmit data (TD) indicators on a breakout box.

PROCEDURE 5-2. Resolving Data Loss by Checking Software Options

Many administrable software options (such as flow control, baud rate, and parity) must often match those options specified for the network or the connected end device. These administrable software options can be checked for a particular module port or for all ports with **verify msm**. If an administrable option is incorrectly specified, refer to procedures in **MSM Administration** to make the necessary database modifications.

1. Flow Control Considerations
   - Data loss typically occurs because of the selection of incorrect flow control options. The two flow control parameters are:
     - **FLOW CONTROL OF MSM BY DEVICE**

       This parameter controls the data flow from the network to the connected end device. The end device, such as a terminal, is connected to a computer through a network. When a file is output from the computer, the data flows from the network to the terminal. If the concatenation is faster than the capability of the terminal to receive the data and flow control is not administered, data is lost. If intermediate resources are slower than the computer, data can also be lost.

PROCEDURE 5-2. Resolving Data Loss by Checking Software Options (continued)

— **FLOW CONTROL OF DEVICE BY MSM**

This parameter controls the data flow from the connected end device to the network. Usually computer ports default to enable flow control of the device by the node.

If the data flow is from a connected end device (such as a PC transmitting a file) to a computer, default parameter options should be readministered so the terminal end provides flow control of the device by the node, and the computer end provides flow control of the node by the device.

- The standard flow control option is the *xon/xoff* protocol. Selecting this parameter option allows the network port to interpret the two control characters, XON and XOFF, to control data flow. These characters are removed from the data stream.

  Hardware, or *eia*, flow control is an alternative that can be administered on an MSM. This option uses the RTS lead from the device to control the data flow from the port, and the CTS lead from the port to control the data flow to the port. Use of this option requires supplying wires between the device and the port, and should be implemented on both ends of the connection.

  Flow control can be turned off by specifying *none* while administering parameter options. This selection negates any flow control action by the network.

- Flow control is required when large amounts of data must be transmitted between two devices with different port speeds.

  Flow control is also required when throughput is affected by two devices sharing or vying for network resources, or because of the activity level at the receiving device, regardless of adequacy of port speeds. For example, a temporary peak load on a trunk can overload a channel; a busy computer can cause reception to slow down.

- Scenarios that may show flow control problems include:

  — A binary file transfer, which contains the flow control characters in the data stream, causes the port to appear to be locked up, when it is actually flow controlled. Hardware flow control or using an end-to-end protocol that does not require network flow control action can correct this problem.

  — Network devices have fairly large, but limited, buffer space. If a connected end device, such as a computer port, does not detect the flow control signal and does not stop sending data, the input buffer of the network device overflows and data is lost. If a device responds to the flow control signal too slowly, data can also be lost. Changing the device configuration so it responds to the flow control signal solves this problem.

  — Incompatible protocols, such as selecting XANY as a host parameter option while supporting XON at the network terminal, cause the host to start on the wrong signal. Data is lost and an apparent lockup of the connected end device might be observed. Select compatible protocols.

PROCEDURE 5-2. Resolving Data Loss by Checking Software Options (continued)

The network combination of hardware flow control at one port and software flow control at the connected port works over the network but might cause end-to-end problems. Make sure hardware flow control users call computer ports with the same protocol implemented.

— Data transfer protocols can include data that can be interpreted as flow control signals. Examples are older implementations of *uucp* and some of the XMODEM file transfer protocols. These protocols include checksums that will, at some time, include the values for the flow control signals. Another example is the use of an application that might include flow control signals in the application data, such as *layers.* In addition to flow control, parity incompatibility can also be part of the problem in these applications. See Parity Considerations in this procedure.

— If flow control is turned off at the network level, connected end devices can still implement the function. In this case, the flow control characters are simply transported with other data in the data stream. Depending on the amount of data being sent in both directions and the overall connection delay through the network, the flow control signal might be delayed.

2. Baud Rate Considerations

   The baud rates for the MSM port and its connected end device must match. In addition, when a two-way port functioning as a call originator is set to *auto*, a receiving baud rate must also be specified.

3. Parity Considerations

   If terminal and MSM ports are set to different parities, garbled data can occur. If the terminal is set to validate parity and only displays data of the correct parity from the port, the MSM port should be set to match the terminal.

4. Predefined Destination Considerations

   Addressing problems can arise if the predefined destination entered in the database has changed. Use **verify address** to determine current address; then if you suspect that the predefined destination might be incorrectly specified, refer to routine administration procedures to make the necessary database modifications.

5. Attention Character and Attention Action

   If the attention character defined is one that the host recognizes as a command sequence, the end user must access the node's command mode to change the attention character to a non-interfering sequence.

   When binary data is being transferred, a single or double Break signal should be used as the attention character. Do not use an ASCII character because it can appear in the data stream.

PROCEDURE 5-2. Resolving Data Loss by Checking Software Options (continued)

6. Window Size

   While administered flow control is an end-to-end protocol, window size is a parameter that is prompted for during an iteration of **enter node** or **change node**. All node modules are compatible when the window size option has not been set; that is, when the response to the **`SET SMALL WINDOW SIZE`** prompt is *no*. And, if set to *yes*, meaning the node is to use the small window size setting, MSM performance degrades.

   However, interworking with other nodes might present connections to modules that require a small window setting. A problem—such as blocks of data being dropped—can occur when a large window size device transmits streams of data to a small window size device. Make sure the administration only allows compatible hardware to interwork.

PROCEDURE 5-3. Solving Terminal and/or Data Device Problems

1. Check the cabling for loose connections.
2. Check the terminal configuration. Make sure it is compatible with the configurations entered into the node database for flow control, parity, baud rate, and duplex. (For details, see the previous procedure.) In addition, use **dstat msm** to verify that the primary EIA control leads are in the correct state.
3. Have end users enter the host speed switching signal so the host adjusts its baud rate. Check the host documentation for the correct speed switching signal.
4. Use **remove msm** to take the port out of service and **restore msm** to put the port back into service.
5. Check for a blown slot fuse. See the *Node Reference*.
6. Run module diagnostics. See MSM diagnostic procedures in this chapter.
7. If the configuration includes a connected end device (for example, VDM, modem pool, etc.), see the *Node Reference*.

MSM Diagnostics

MSM diagnostics, which consist of on-line and off-line diagnostic tests, are used to verify the integrity of the module and its ports. The following procedures explain how to begin running MSM tests, and the cables and connectors needed. Testing begins with the internal, then external, port tests, and progresses to the local and remote modems (with and without loopback capability). This section is supplemented by information contained in **diagnose msm** which explains the diagnostic prompting sequence and the meaning of each parameter and its options. System responses are also included.

Some general testing guidelines are as follows:

- If end user problems occur after database administration changes were made or after an end user changed terminal options, verify port options by entering **verify msm** before entering **diagnose msm**.
- When installing or changing an MSM, run **diagnose msm** on all ports.

Loopback Connectors

Loopback connectors are used with the **diagnose msm** command to perform incremental loopback tests of the data circuit between the MSM and connected end device. When connectors are not available, loopback connectors for use with a modular jack or 110 patch panel can be built. The MSM external port test, however, requires the ED5P056-30, G1 loopback connector.

The following figures illustrate how to build loopback connectors.

The top portion of the figure below shows how to modify one end of an 8-conductor modular plug. The bottom portion is a wiring schematic for the plug.

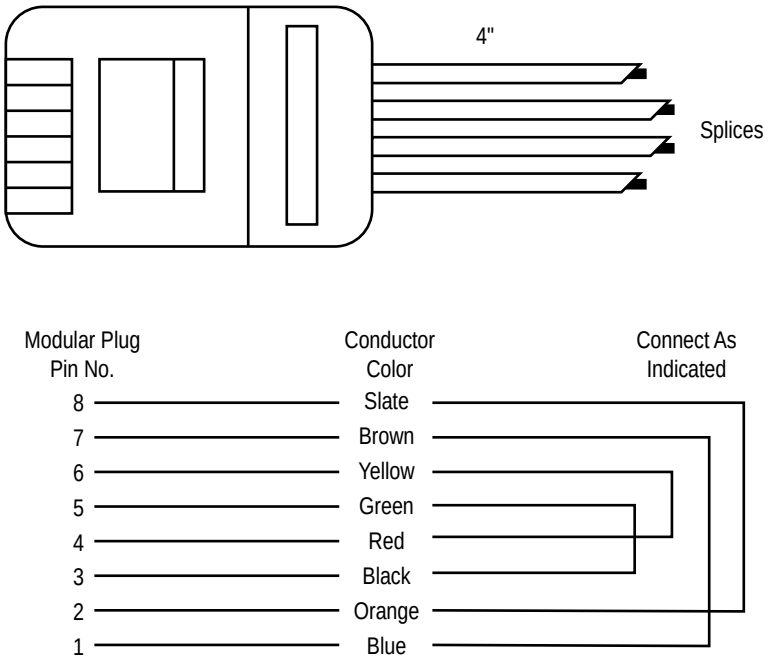

FIGURE 5-1. Loopback Connector for Use with a Modular Jack

The top portion of the figure below shows how to modify one end of a 4-pair 110 patch panel patchcord. The bottom portion is a wiring schematic for the plug.

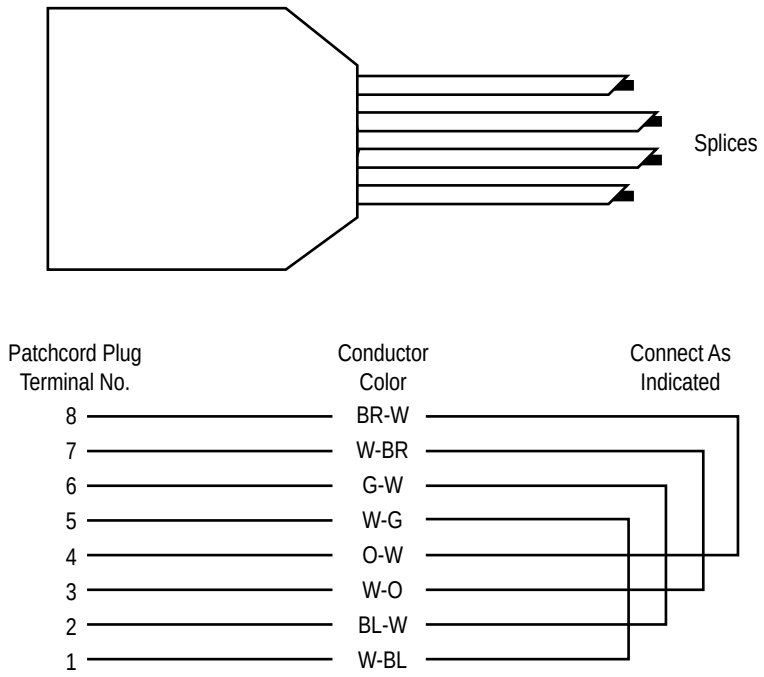

FIGURE 5-2. Loopback Connector for Use with a 110 Patch Panel

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PROCEDURE 5-4. Starting Loopback Tests

1. The module to be tested must be in service. Remove the port to be tested from service: **remove msm port** <**mod addr**> <**port num**>.
2. Verify that the port has been taken out of service: **verify msm** <**mod addr**>.
3. Put any modems in loopback mode, and attach appropriate loopback connectors and cables. If appropriate loopback connectors are unavailable, refer to the preceding directions that explain how to build a suitable set of connectors. Only the *external_port* test requires a loopback connector (ED5P056-30, G1).

   In addition, put the local or remote modem into its loopback mode. See **diagnose msm** in **MSM Commands** for details.

   NOTE: Improperly installed connectors and cables can produce diagnostic errors.

PROCEDURE 5-5. Running Internal Port Test

1. Enter **diagnose msm port** <**mod addr**> <**port num**> **internal_port**.
2. If the test fails, the module port might be faulty. Replace the module and repeat the test.
3. If the test passes, run the external port test.

PROCEDURE 5-6. Running External Port Test

1. Enter **diagnose msm port** <**mod addr**> <**port num**> **external_port**.
2. If the test fails when the loopback connector is connected to the MSM, the MSM I/O distribution board or the port cable might be faulty. Replace the faulty component and repeat the test.
3. If the test passes, move the loopback connector to the next farther location from the MSM. Repeat the test.
4. Continue moving the connector to farther locations and repeat the test until the entire path has been tested. If a modem is in the path, run the appropriate modem tests.
5. If a test fails, trouble might exist in the cable between the current point being tested and the previous loopback point. Replace the cable and repeat the test.
6. If all tests pass, MSM diagnostics are completed.

PROCEDURE 5-7. Running Local Modem Test on a Modem with Loopback Capability

1. Enter **diagnose msm port** <**mod addr**> <**port num**> **local_modem**.
2. Put the local modem in loopback mode when the system prompts you.
3. If the port baud rate is set to *auto*, a baud rate prompt to set the MSM to the local modem baud rate appears. Enter the specific baud rate for the local modem.
4. If the test fails, the local modem or the cables between the local modem and the module might be faulty. Replace the faulty component and repeat the test.
5. If the test passes, take the local modem out of loopback mode and run the remote modem test next.

PROCEDURE 5-8. Running Remote Modem Test on a Modem with Loopback Capability

1. Ensure that the modem is connected and in service.
2. Enter **diagnose msm port** <**mod addr**> <**port num**> **remote_modem**.
3. Put the remote modem in loopback mode when the system prompts you.
4. If the port baud rate is set to *auto*, the baud rate prompt to set the MSM to the local modem baud rate appears. Enter the specific baud rate for the local modem.
5. If the test fails, the data facility (the transmission path between modems) is faulty or the remote modem is faulty. Replace the faulty component and repeat the test.
6. If the test passes, the transmission path from the local Control Computer to the remote modem is working.
7. If the test passes, but a problem still exists with the remote terminal end, the connection between the remote modem and the remote terminal might be faulty, or the terminal interface on the remote modem might be faulty. Test this path by running the external port test with the loopback connectors shown in the previous figures. Replace the faulty component and repeat the test. If the test passes, the terminal might be faulty or it might be administered incorrectly. Verify terminal options. If the terminal is faulty, replace it.

PROCEDURE 5-9. Running External Port Test on Local or Remote Modems without Loopback Capability

1. Enter **diagnose msm port** <**mod addr**> <**port num**> **external_port**.
2. If the test fails, the data facility (the transmission path between modems) is faulty, or the local or remote modem is faulty. Replace the faulty component and repeat the test.
3. If the test passes, the transmission path from the local Control Computer to the remote modem is working.
4. If the test passes, but a problem still exists with the remote terminal, the connection between the remote modem and the remote terminal might be faulty. Test the path by running *external_port* with the loopback connectors shown in the previous figures. Replace the faulty component and repeat the test. If the test passes, the terminal might be faulty; if it is, replace it. Or, the terminal might be configured incorrectly; verify terminal options.

PROCEDURE 5-10. Running VDM Check Loop Test

Requirements: If a VDM is connected to the port and you have already run the local and remote modem tests, you do not have to run this test. See **diagnose msm** in **TSM Commands** for more information.

1. Enter **diagnose msm port** <**mod addr**> <**port num**> **vdm_ckloop**.
2. If the test pattern is not returned, the test passes.
3. If the VDM fails the test (the test pattern is returned), restore the port to service, then remove it from service and repeat the test. If the test fails again, replace the VDM.
4. If the R-VDM fails the test (the test pattern is returned), the remote administrator might have mistakenly moved the loopback switch to the wrong position. Check with the administrator to eliminate this possibility. If this was not the cause, the R-VDM is most likely faulty; replace the R-VDM.

PROCEDURE 5-11. Completing MSM Tests

1. Remove any loopback connectors and cables.
2. Restore the port to service: **restore msm port** <**mod addr**> <**port num**>.
3. Verify that the port has been restored to service: **verify msm** <**mod addr**>.

MSM Commands

MSM Commands

This chapter describes the commands related to the administration, operation, and maintenance of an MSM. Commands that include the object **msm** appear in alphabetical order by verb. System responses for all **msm** commands conclude this chapter.

All commands show the full prompting sequence; the **enter msm** command contains a list of parameter definitions that are also applicable to other **msm** commands. Additional information on the parameters used in the prompting sequence of **enter msm** and **change msm** is furnished in **MSM Administration**. In addition, the database entry forms, provided in **Appendix B**, follow the prompting sequence for each service type entered.

Procedures for running diagnostics can be found in **MSM Troubleshooting.**

Other command objects that are related to the administration, operation, and maintenance of the MSM are documented in the *Node Reference*.

change msm

The **change msm** command enables you to modify information, which was previously entered in the database, for an MSM module or its ports. For all parameters except **COMMENT** , the module or port must be taken out of service with **remove msm** before parameter options can be changed with **change msm**.

Syntax

You can input **change msm** in prompted entry only. The syntax for **enter msm** and **change msm** is similar. You are not prompted for the **INITIAL SERVICE STATE** of the port; however, you can change all parameter options for which you are prompted. The command loops to the **MODULE ADDRESS** prompt. Defaults for **change msm** are those values, conditions, or states that currently exist in the database. They are displayed within parentheses in the parameter prompt.

Parameters

Refer to the parameter definitions supplied in **enter msm**.

Prompted Entry: Changing MSM Terminal Port Information

```
CC0> change
OBJECTS [...msm...]: msm
MODULE ADDRESS: 30
PORT NUMBER [1-12: +(1-12)]: 3
COMMENT [up to 60 chars double quoted, none:
 +("Ent 6/94")]:
 +
SERVICE TYPE [console, host, modem, 2way, terminal: +(terminal)]: +
GROUP [up to 8 chars: +(o2)]: +
PREDEFINED DESTINATION [+(msmhome)]: +
CONNECTED TO 2-WIRE MODEM [yes, no: +(no)]: +
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200,
          28800, 38400, 57600, 76800, 115200, auto: +(auto)]: 19200
PARITY [even, odd, off: +(off)]: +
FLOW CONTROL OF MSM BY DEVICE [xon_xoff, eia, none: +(none)]: +
FLOW CONTROL OF DEVICE BY MSM [xon_xoff, eia, none: +(none)]: +
NODE ECHOES USER INPUT [yes, no: +(yes)]: no
CALL HOLD [on, off: +(off)]: +
AT&T VDM ON THIS PORT [yes, no: +(no)]:'+
PERMANENTLY ACTIVATED PORT [yes, no: +(no)]: +
CONNECT-TIME BILLING [on, off: +(off)]: +
ATTENTION CHARACTER [none, 1brk, 2brk, del, a character: +(2brk)]: 1brk
ATTENTION ACTION [command_mode, disconnect: +(command_mode)]: +
BITS PER CHARACTER [5, 6, 7, 8: +(8)]: +
NUMBER OF STOP BITS [1, 1.5, 2: +(1)]: +
ENDPOINT NUMBER OR RANGE [0000-9999, none: +(3102-3104)]: +
CLOSED USER GROUP PROFILE ID [up to 8 chars, none: +(selmsm)]: orgmsm
PORT NUMBER [1-12: +(1-12)]:  Delete
CC0>
```

delete msm

The **delete msm** command enables you to eliminate all information regarding an MSM port or module from the database. To delete port information, the port cannot be in service. Before any module information can be deleted, all ports must be taken out of service with **remove msm**, all port information must be deleted from the database with **delete msm**, then the module must be taken out of service with **remove msm**.

Syntax

You can input **delete msm** in prompted or one-line entry.

```
CC0> delete
OBJECTS [...msm...]: msm
COMPONENT [module, port]:
MODULE ADDRESS:
```

If COMPONENT is "port":

```
PORT NUMBER [1-12: +(12)]:
```

Parameters

Refer to the parameter definitions supplied in **enter msm**.

Prompted Entry: Deleting MSM Port Information

```
CC0> delete
OBJECTS [...msm...]: msm
COMPONENT [module, port]: port
MODULE ADDRESS: 30
PORT NUMBER [1-12: +(12)]: 3
CC0>
```

Prompted Entry: Deleting MSM Information

```
CC0> delete
OBJECTS [...msm...]: msm
COMPONENT [module, port]: module
MODULE ADDRESS: 30
CC0>
```

One-line Entry: Deleting MSM Information

```
CC0> delete msm port 30 3
CC0> delete msm module 30
```

diagnose msm

The **diagnose msm** command enables you to run on-line or off-line diagnostics to test MSM components. Off-line diagnostics verify the integrity of MSM hardware when the module is out of service. These diagnostics check the state of the memory system and processor hardware. In addition, they can also help diagnose the state of the module and its ports.

On-line diagnostics can be run on modules and ports. Module diagnostics determine the state of the module without having to take the module out of service. Port diagnostics consist of a set of loopback* tests that check the integrity of the port. Loopback points include internal and external ports, local and remote modems, and Voice/Data Multiplexers (VDMs). For all on-line port diagnostics, the port to be tested must be out of service.

This section is supplemented by diagnostic procedures in **MSM Troubleshooting**.

Syntax

You can input **diagnose msm** in prompted or one-line entry.

```
CC0> diagnose
OBJECTS [...msm...]: msm

DIAGNOSTIC TYPE [off-line, on-line]:
```

If DIAGNOSTIC TYPE is "on-line":

```
COMPONENT [module, port]:
```

If DIAGNOSTIC TYPE is "on-line" or "off-line":

```
MODULE ADDRESS:
```

If DIAGNOSTIC TYPE is "on-line" and COMPONENT is "port":

```
PORT NUMBER [1-12]:
```

If a VDM is not connected to the port:

```
TEST TYPE: [internal_port, external_port, local_modem,
        remote_modem: +(external_port)]:
```

If a VDM is connected to the port:

```
TEST TYPE: [internal_port, external_port, local_modem,
        remote_modem, vdm_ckloop: +(external_port)]:
```

If TEST TYPE is "local_modem" or "remote_modem" and baud rate is auto:

```
BAUD RATE [75, 110, 150, 300, 1200, 2400, 9600, 14400, 19200: +(9600)]:
```

If TEST TYPE is "external port", or if TEST TYPE is "local_modem" or "remote_modem" and a VDM is not connected to the port:

```
CONTINUE TESTING [yes, no +(yes)]:
```

Command loops to the TEST TYPE prompt.

---

* These tests are referred to as *LOOP-AROUND* in the software and system responses.

Parameters

This section contains explanations of parameters used in the **diagnose msm** prompting sequence that differ from those used in **enter msm**. Refer to Syntax for the prompting sequence, system defaults, and parameter options.

BAUD RATE

If the port baud rate is set to *auto*, it specifies the speed at which the local or remote modem is to communicate with the port when the *local_modem* or *remote_modem* test is run. If the modem baud rate is fixed, the modem and port rates must match. If the modem baud rate is not fixed, set the port baud rate to the highest allowed rate for a modem.

COMPONENT

If **DIAGNOSTIC TYPE** is *on-line*, specifies if diagnostics are to be run on the MSM *module* or *port*.

CONTINUE TESTING

Specifies whether (*yes* or *no*) testing should be continued.

TEST TYPE

Specifies the type of diagnostic to be run. Each begins and ends at the Control Computer:

- *external_port* extends through the port to an external loopback connector. It checks the integrity of the I/O board and the interface terminators and receivers. In addition, *external_port* can also be run to verify the integrity of local and remote modems that do not have loopback capabilities.

  The connector can be attached to the port; but, depending on the building wiring, it can also be located at the patch panel or in the office with the terminal.

- *internal_port* extends to the Dual Universal Synchronous/Asynchronous Receiver/Transmitter (DUSART) within the port being diagnosed. It does not check the integrity of the interface terminators and receivers.

- *local_modem* extends to the port's local modem. The modem must be in the loopback mode. (You are prompted for the remote modem baud rate if the port baud rate is set to *auto*.)

- *remote_modem* extends to the port's remote modem. The modem must be in the loopback mode. (You are prompted for the remote modem baud rate if the port baud rate is set to *auto*.)

  NOTE: If a VDM is connected to the line when *local_modem* or *remote_modem* is run, the Control Computer automatically puts the VDM in the loopback mode. The Control Computer then runs the *vdm_ckloop* test on the port before and after running either test. If a message indicating that the VDM is stuck in the loopback mode appears, it means either test is being run; let the test finish. This procedure typically takes the modem out of loopback mode. In addition, power problems can cause remote VDMs to become stuck in loopback mode. Ask the remote administrator to make sure the switch on the VDM is not in the loopback position.

Parameters *(continued)*

- *vdm_ckloop,* which appears only if a VDM is connected, consists of two parts. The first part detects if the local (central office) VDM is stuck in the loopback mode; the second part detects if the remote VDM is stuck in the loopback mode. During the test, a test pattern is sent to the VDM. If the pattern is not returned, the VDM is not stuck in loopback mode and the test is successful. If the pattern is returned, the test fails; the VDM is stuck in loopback mode because of hardware or software failure or human error.

Prompted Entry: Running Off-Line Diagnostics

```
CC0> diagnose
OBJECTS [...msm...]: msm
DIAGNOSTIC TYPE [off-line, on-line]: off-line
MODULE ADDRESS: 30

<system responses>

Diagnostic download in progress - .

 94-12-31 10:38:12 NODE=Redqueen
M diagnose msm off-line 30
Offline module diagnostic test: PASS
CC0>
```

Prompted Entry: Running On-line Module Diagnostics

```
CC0> diagnose
OBJECTS [...msm...]: msm
DIAGNOSTIC TYPE [off-line, on-line]: on-line
COMPONENT [module, port]: module
MODULE ADDRESS: 30

<system responses>

 94-12-31 10:38:12 NODE=Redqueen
M diagnose msm on-line module 30
Online module diagnostic test: PASS
CC0>
```

Prompted Entry: Running On-line Port Diagnostics

```
CC0> diagnose
OBJECTS [...msm...]: msm
DIAGNOSTIC TYPE [off-line, on-line]: on-line
COMPONENT [module, port]: port
MODULE ADDRESS: 30
PORT NUMBER [1-12]: 3
TEST TYPE [internal_port, external_port, local_modem,
       remote_modem: +(external_port)]: +
```

<system responses>

```
CONTINUE TESTING [yes, no: +(yes)]: +
```

<system responses>

```
 94-12-31 10:38:12 NODE=Redqueen
M diagnose msm on-line 30 3 external_port
Diagnose completed - PORT 3, LOOP-AROUND COMPLETED SUCCESSFULLY
```

<system responses>

```
TEST TYPE [internal_port, external_port, local_modem,
       remote_modem: +(external_port)]:  Delete
CC0>
```

One-line Entry: Running MSM Tests

```
CC0> diagnose msm off-line 30
```
<diagnostic output and system responses>

```
CC0> diagnose msm on-line module 30
```
<diagnostic output and system responses>

```
CC0> diagnose msm on-line port 30 3 external_port
```
<diagnostic output and system responses>

dstat msm

The **dstat msm** command enables you to display the status of an in-service module and its associated ports. High detail, which includes all hardware data and on-board software information, is available.

Syntax

You can input **dstat msm** in prompted or one-line entry.

```
CC0> dstat
OBJECTS [...msm...]: msm
MODULE ADDRESS:
DETAIL [low, high: +(low)]:
```

Parameters

The parameter definitions for **dstat msm** are the same as those for **enter msm**. Refer to the definitions supplied in **enter msm**.

Prompted Entry: Displaying High Detail MSM Status

```
CC0> dstat
OBJECTS [...msm...]: msm
MODULE ADDRESS: 5
DETAIL [low, high: (+low)]: high
<report output>
```

One-line Entry: Displaying Low Detail MSM Status

```
CC0> dstat msm 5 low
<report output>
```

One-line Entry/Output: MSM High Detail Status

```
CC0> data msm 5 high
   94-12-31 10:34:40 NODE=Redqueen
M  dstat msm 5 high
  ******************************** MODULE 5 ********************************
  MODULE TYPE
  msm
  SERVICE STATE   HARDWARE ERROR COUNT    SERIAL NUMBER
  in service      0                       34696
  LAST HARDWARE ALARM
  none
  ONLINE  ENABLED
  yes     yes
  ------------------------------ HIGH DETAIL ---------------------------------
  MODULE  FM NODE  FM NODE  FIFO
  RESET   PARITY   OVERFLO  RESET
  0       0        0        0
  EXPECT  FULL     EMPTY    ACTUAL  ACTUAL  EXPECT  EXPECT
  TYPE    PACKETS  PACKETS  STAT1   STAT2   STAT1   STAT2
  msm     75333    0        1       0       1       0
  RANGE    BAD
  ERRORS   PACKETS
  0        0
  ------------------------------------------------------------------------------
   94-12-31 10:34:40 NODE=Redqueen
M  dstat msm  5 high
  MSM PORT STATUS:
  -----------------
    PORT     SERVICE   SERVICE      MOD EIA LEADS     DEV EIA LEADS
    NUMBER   TYPE      STATE       DCD-DTR  CTS-TRS  DCD-DTR CTS-RTS
      1      terminal  in            on       on       on      on
      2      host      in            on       on       on      on
      3      terminal  in            on       on       off     off
CC0>
```

One-line Entry/Output: Displaying MSM Low Detail Status

```
CC0 dstat msm 5
   94-12-31 11:33:40 NODE=Redqueen
M  dstat msm  5
  ******************************** MODULE 5 ********************************
  MODULE TYPE
  msm
  SERVICE STATE   HARDWARE ERROR COUNT    SERIAL NUMBER
  in service      0                       2743
  LAST HARDWARE ALARM
  none
  ONLINE  ENABLED
  yes     yes
  ------------------------------------------------------------------------

   94-12-31 11:33:40 NODE=Redqueen
M  dstat msm  5
  MSM PORT STATUS:
  ----------------
    PORT     SERVICE   SERVICE      MOD EIA LEADS     DEV EIA LEADS
    NUMBER   TYPE      STATE       DCD-DTR  CTS-TRS  DCD-DTR CTS-RTS
      1      terminal  in            on       on       on      on
      2      host      in            on       on       on      on
      3      modem     in            on       on       on      on
      4      host      in            on       on       on      on
CC0>
```

Report Fields

The following alphabetized report field descriptions are those that would appear for *every* variation of **dstat msm** output. References made to alarms refer to those alarms messages cited in the *Data Networking Products Messages Reference*.

ACTUAL STAT1

The actual value of the hardware status byte of the most currently received status packet for the given module.

ACTUAL STAT2

The actual value of the software status byte of the most currently received status packet for the given module.

BAD PACKETS

The count of packets with envelope parity errors transmitted by the module and detected by the switch. To determine if the module is defective, run module diagnostics.

Report Fields *(continued)*

CTS

Indicates if the status of clear to send is *on* or *off*. For an MSM port with DTE connector type, the attached device raises and lowers CTS. As such, CTS is an output signal from the DCE device to the DTE port. It appears under the **DEV EIA LEAD** heading under the **CTS-RTS** field. For an MSM port with DCE connector type, the module controls the CTS lead. As such, CTS is an output signal from the port It appears under the **MOD EIA LEAD** heading under the **CTS-RTS** field.

DCD

Indicates if the status of data carrier detect is *on* or *off* for the port. For an MSM port with DTE connector type, the attached device raises and lowers DCD. As such, DCD is an output signal from the DCE device to the DTE port. It appears under the **DEV EIA LEAD** heading under the **DCD-DTR** field. For an MSM port with DCE connector type, the module controls the DCD lead. As such, DCD is an output signal from the port It appears under the **MOD EIA LEAD** heading under the **DCD-DTR** field.

DTR

Indicates if the status of data terminal ready is *on* or *off* for the port. For an MSM port with DTE connector type, the module raises and lowers DTR. As such, DTR is an output signal from the port to the DTE device. It appears under the **MOD EIA LEAD** heading under the **DCD-DTR** field.

For an MSM port with DCE connector type, the attached device controls the DTR lead. As such, DTR is an output signal from the DTE device. It appears under the **DEV EIA LEAD** heading under the **DCD-DTR** field.

EMPTY PACKETS

The number of empty status packets received from the module. If a module is present and this number is high and continues to increase, a module hardware problem could exist. (Empty packets are also received when a module is not physically present in the given shelf slot. See **EMPTY SLOT** alarm.)

ENABLED

Shows a status of *yes* only if the module MODE switch is in the Enab position or *U/A* to indicate this information is not available. See **MODE SWITCH NOT ENABLED** alarm.

EXPECT STAT1

The expected value of the hardware status byte for the given module.

EXPECT STAT2

The expected value of the software status byte for the given module.

EXPECT TYPE

The expected type of hardware in the shelf slot. The value of this field is determined by status information. See **WRONG MODULE TYPE** alarm.

Report Fields *(continued)*

FIFO RESET
The number of times the hardware failed to send a packet due to an invalid packet address or packet format.

FM NODE OVERFLO
Any difference between the rate information arrives at a module and the rate the subscriber processes that information. Overflow errors can occur during typical operation and do not necessarily indicate a problem.

FM NODE PARITY
How many packets coming from the node had parity errors. See **FROM BUS PARITY ERROR** alarm.

FULL PACKETS
The number of full status packets received. (Full packets are received when a module is physically present in the given shelf slot.)

HARDWARE ERROR COUNT
An approximate sum of module errors detected since the last module restore. Counts of three or four can be typical for a given module; higher counts could indicate a problem.

LAST HARDWARE ALARM
The last alarm for the given module, based on status packet data. This data is not stored across reboots of the Control Computer.

MODULE RESET
The number of module resets. See **MODULE WAS RESET** alarm.

MODULE TYPE
According to status packet information received, what type of module is actually present. It does not reflect information supplied by the administrator through the **enter** command. This field is initialized to empty.

ONLINE
Shows a status of *yes* if only the green LED on the module is on or *U/A* to indicate this information is not available. If the green is not on, or if the green and the yellow lights are on, this field reads *no*.

PORT NUMBER
The number of the port for which information is being shown.

RANGE ERRORS
The count of packets transmitted by the module on a channel that is beyond the limit for which the module is configured. Range error counts might be attributed to a defective module that is corrupting the address field of the packet . To determine if the module is defective, run module diagnostics.

Report Fields *(continued)*

RTS

The status of request to send is *on* or *off* for the port. For an MSM port with DTE connector type, the module raises and lowers RTS. RTS is an output signal from the port to the attached device. It appears under the **MOD EIA LEAD** heading under the **CTS-RTS** field. For an MSM port with DCE connector type, the attached device controls the RTS lead. RTS is an output signal from the DTE device. It appears under the **DEV EIA LEAD** heading under the **CTS-RTS** field.

SERIAL NUMBER

A unique factory-encoded number.

SERVICE STATE

The current service state of the module or or port. The module states are *in service* (via **restore**), *oos,manual* (out of service via **remove**), or *oos,fault* (automatically taken out of service due to a fault).

The port states are *in-service, out,* and *rfs.*

SERVICE TYPE

The service connection provided by the port can be that of a *console, host, modem, terminal,* or *2way* device.

enter msm

The **enter msm** command enables you to add information on the MSM or its ports in the database.

Syntax

You can input **enter msm** in prompted entry only. The sequence of prompts depends on your response to the **COMPONENT** and **SERVICE TYPE** prompts. If multiple ports are being entered that require EPNs and/or CUG security, the sequence of the **ENDPOINT NUMBER OR RANGE, CLOSED USER GROUP PROFILE ID,** and **PORT FOR EPN/CUG ASSIGNMENT** prompts is repeated until all ports have been assigned EPNs/CUGs or the Delete key is pressed. Defaults are shown in parentheses.

```
CC0> enter
OBJECTS [...msm...]: msm
COMPONENT [module, port]:
MODULE ADDRESS:
```

If COMPONENT is "module":

```
DOWNLOAD SERVER [+(controller)]:
```

If DOWNLOAD SERVER is "controller":

```
SOFTWARE VERSION [+(standard)]:
```

If DOWNLOAD SERVER is not "controller":

```
SOFTWARE VERSION:
```

If COMPONENT is "port":

```
PORT NUMBER [1-12: +(1-12)]:
COMMENT [up to 60 chars double quoted]:
SERVICE TYPE [console, host, modem, 2way, terminal: +(terminal)]:
GROUP [up to 8 chars]:
```

If SERVICE TYPE is "modem", "2way", or "terminal":

```
PREDEFINED DESTINATION [+(none)]:
```

For all SERVICE TYPEs:

```
CONNECTED TO 2-WIRE MODEM [yes, no: +(no)]:
```

If SERVICE TYPE is "modem", "2way", or "terminal":

```
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400,
57600, 76800, 115200, auto: +(auto)]:
```

If SERVICE TYPE is "console" or "host":

```
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400,
57600, 76800, 115200 : +(9600)]:
```

If SERVICE TYPE is "2way" and BAUD RATE is "auto":

```
RCV BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200: +(9600)]:
```

For all SERVICE TYPEs:

```
PARITY [even, odd, off: +(off)]:
```

If CONNECTED TO 2-WIRE MODEM is "no":

```
FLOW CONTROL OF MSM BY DEVICE [xon_xoff, eia, none: +(none)]:
FLOW CONTROL OF DEVICE BY MSM [xon_xoff, eia, none: +(none)]:
```

Syntax *(continued)*

If SERVICE TYPE is "modem", "2way", or "terminal":

```
NODE ECHOES USER INPUT [yes, no: +(yes)]:
```

If SERVICE TYPE is "modem", "2way", or "terminal" and if PREDEFINED DESTINATION is "none":

```
CALL HOLD [on, off: +(off)]:
```

For all SERVICE TYPEs, if BAUD RATE is less than or equal to "19200" and FLOW CONTROL OF MSM BY DEVICE or FLOW CONTROL OF DEVICE BY MSM is "xon/xoff" or "none" or CONNECTED TO 2-WIRE MODEM is "yes":

```
AT&T VDM ON THIS PORT [yes, no: +(no)]:

PERMANENTLY ACTIVATED PORT [yes, no: +(no)]:
```

If SERVICE TYPE is "modem", "2way", or "terminal":

```
CONNECT-TIME BILLING [on, off: +(off)]:
ATTENTION CHARACTER [none, 1brk, 2brk, del, a character: +(2brk)]:
```

If ATTENTION CHARACTER is not "none:"

```
ATTENTION ACTION [command_mode, disconnect: +(command_mode)]:
```

For all SERVICE TYPEs,
if PARITY is "even" or "odd":

```
BITS PER CHARACTER [5, 6, 7, 8: +(7)]:
```

If PARITY is "none":

```
BITS PER CHARACTER [5, 6, 7, 8: +(8)]:

NUMBER OF STOP BITS [1, 1.5, 2: +(1)]:
INITIAL SERVICE STATE [in, out: +(out)]:
```

For all SERVICE TYPES, for a single port:

```
ENDPOINT NUMBER OR RANGE [0000-9999, none: +(none)]:
```

If ENDPOINT NUMBER OR RANGE is not "none":

```
CLOSED USER GROUP PROFILE ID [up to 8 chars, none: +(none)]:
```

For multiple ports (looping continues until you enter all ports or press Delete **):**

```
INFO: Assign EPNs and CUGs to ports using the following prompts.
      Hit <DEL> once when finished making assignments.

   PORT FOR EPN/CUG ASSIGNMENT [<X>: +(<Y>)]:
   ENDPOINT NUMBER OR RANGE (0000-9999, none: +(none)]:
   CLOSED USER GROUP PROFILE ID [up to 8 chars, none: +(none)]:
   PORT FOR EPN/CUG ASSIGNMENT [<X>: +(<Y>)]:  Delete
```

Command loops to COMPONENT prompt.

Parameters

This section contains an explanation of a parameter used in the **enter msm** prompting sequence. Refer to Syntax for the prompting sequence, system defaults, and parameter options.

ATTENTION ACTION

If **ATTENTION CHARACTER** is not *none*, specifies whether the attention signal can *disconnect* the port or toggle the port between *command_mode* and originate or transmit mode.

Parameters *(continued)*

ATTENTION CHARACTER

If **SERVICE TYPE** is *modem, terminal,* or *2way*, specifies the character sequence that is to constitute an attention signal for the port to be *none, 1brk, 2brk, del,* or any ASCII character (*a character*).

AT&T VDM ON THIS PORT

If **BAUD RATE** is up to and including 19200, and if **FLOW CONTROL OF MSM BY DEVICE** or **FLOW CONTROL OF DEVICE BY MSM** is *xon/xoff* or *none* or if **CONNECTED TO 2-WIRE MODEM** is yes, specifies whether (*yes* or *no*) an AT&T Voice/Data Multiplexer (VDM) is connected to the port.

BAUD RATE

Depending on **SERVICE TYPE,** specifies the speed in which the port is to communicate with its connected device.

BITS PER CHARACTER

Depending on parity, specifies if the number of data bits per character (data word size excluding parity) to be transmitted is *5, 6, 7,* or *8*. If **PARITY** is *odd* or *even,* character size is calculated by adding a single bit to this value; otherwise, this value equals the character size.

CALL HOLD

If **SERVICE TYPE** is *modem, terminal,* or *2way*, specifies if call hold should be activated (*on* or *off*) for the port.

CLOSED USER GROUP PROFILE ID

If **ENDPOINT NUMBER OR RANGE** is specified, a string of 1 to 8 characters that identifies an existing CUG profile.

COMMENT

An optional string of 1 to 60 characters, enclosed in double quotation marks, that contains useful administrative information.

COMPONENT

Specifies if the MSM component is the *module* or *port*.

CONNECTED TO 2-WIRE MODEM

Specifies whether (*yes* or *no*) the port is connected to a two-wire modem. When the port is connected to a two-wire modem (*yes*), it is configured as data terminal equipment (DTE); if the port is not connected to a two-wire modem (*no*), it is configured as data communications equipment (DCE).

CONNECT-TIME BILLING

If **SERVICE TYPE** is *modem, terminal,* or *2way* and a **PREDEFINED DESTINATION** is administered, specifies whether (*on* or *off*) billing information is to be logged for the port and reported to the billing process.

Parameters *(continued)*

DOWNLOAD SERVER

If **COMPONENT** is *module*, specifies whether the software to be downloaded is the name of a service address or the local *controller*.

ENDPOINT NUMBER OR RANGE

A unique four-digit address ranging from *0000* to *9999* that can be a single four-digit address or two four-digit addresses separated by a dash; where the first address is the low end of the range and the second address is the high end. The word *none*, meaning no endpoint number, can also be specified.

FLOW CONTROL OF DEVICE BY MSM

If **CONNECTED TO 2-WIRE MODEM** is *no*, specifies the flow control method used by the MSM to control the connected asynchronous device to be *xon/xoff*, *eia*, or *none*.

FLOW CONTROL OF MSM BY DEVICE

If **CONNECTED TO 2-WIRE MODEM** is *no*, specifies the flow control method used by the connected asynchronous device to be *xon/xoff*, *eia*, or *none*.

GROUP

A string of 1 to 8 characters that identifies the group to which the port belongs. MSM ports must be assigned to a previously entered group that has the same hardware.

INITIAL SERVICE STATE

Specifies if—upon completion of the initial database entry—the module or port being administered is to be put *in* or *out* of service.

MODULE ADDRESS

A set of numbers identifying the address of the MSM. If the MSM is installed in the node, the address is <*module*>; where *module* is the node slot number of the MSM.

If the MSM is installed in a concentrator, the address is <*concentrator/module*>; where *concentrator* is the node slot number that the LIM, which connects the concentrator to the module, occupies; and *module* is a number indicating the BNS-2000 MPC (*frs*) slot that the MSM occupies. Multiple address entries are allowed.

NODE ECHOES USER INPUT

If **SERVICE TYPE** is *modem*, *terminal*, or *2way*, specifies whether (*yes* or *no*) the node is to echo characters it receives from the connected device.

NUMBER OF STOP BITS

Specifies if the time needed to determine the end of character transmission is *1*, *1.5*, or *2* bits.

PARITY

Specifies if the error checking done on the port is the type associated with *even* or *odd* parity or whether error checking is to be turned *off* for the port.

Parameters *(continued)*

PERMANENTLY ACTIVATED PORT

Specifies whether (*yes* or *no*) a call is to be established or stay up independently of DTR EIA lead state changes. If a permanently activated port is administered for *autobaud* and the baud of the connected device changes, the permanently activated port must be removed and restored to service so it automatically can match the new baud of the device.

PORT FOR EPN/CUG ASSIGNMENT

Specifies the port numbers entered at the **PORT NUMBER** prompt that can be assigned a unique EPN/CUG; where *X* is the upper end of this range or list of ports entered and *Y* is a port within this range or list. Each port can be assigned an EPN(s) and/or CUG profile ID. If the default is not specified, it does not appear in subsequent prompts.

PORT NUMBER

A number from *1* to *12* designating an unconfigured port. A single or multiple port number entry is allowed. If you enter a range or series of ports, **all** subsequent parameters pertain to the ports specified.

PREDEFINED DESTINATION

If **SERVICE TYPE** is *modem, terminal,* or *2way,* an optional string of 1 to 72 characters that specifies the service address to which the connected end device is to connect automatically when a connection with the node is established, or the word *none* (meaning a PDD is not to be established).

RCV BAUD RATE

For a two-way device with **BAUD RATE** set to *auto,* specifies a particular speed in which the device is to *receive* data.

SERVICE TYPE

Specifies if the type of service connection provided by the port is the type associated with a *console, host, modem, terminal,* or *2way* device. A *console* or *host* receives calls. A *modem* or *terminal* originates calls. A *2way* receives calls as a host and originates calls as a terminal.

SOFTWARE VERSION

A string of 1 to 14 characters specifying the **SOFTWARE VERSION** filename to be downloaded to the module. If **DOWNLOAD SERVER** is *controller,* the default is *standard*. If **DOWNLOAD SERVER** is not *controller,* enter the filename of the valid software release.

Prompted Entry: Entering MSM Information

```
CC0> enter
OBJECTS [...msm...]: msm
COMPONENT [module, port]: module
MODULE ADDRESS: 30
DOWNLOAD SERVER [+(controller)]: +
SOFTWARE VERSION [+(standard)]: +
MODULE ADDRESS:    Delete
CC0>
```

Prompted Entry: Entering MSM Terminal Port Information

```
CC0> enter
OBJECTS [...msm...]: msm
COMPONENT [module, port]: port
MODULE ADDRESS: 30
PORT NUMBER [1-12: +(1-12)]: 3-4
COMMENT [up to 60 chars double quoted]:
 "Ent 6/94"
SERVICE TYPE [console, host, modem, 2way, terminal: +(terminal)]: terminal
GROUP [up to 8 chars]: o2
PREDEFINED DESTINATION [+(none)]: msmhome
CONNECTED TO 2-WIRE MODEM [yes, no: +(no)]: +
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800,
          38400, 57600, 76800, 115200, auto: +(auto)]: 19200
PARITY [even, odd, off: +(off)]: +
FLOW CONTROL OF MSM BY DEVICE [xon_xoff, eia, none: +(none)]: +
FLOW CONTROL OF DEVICE BY MSM [xon_xoff, eia, none: +(none)]: +
NODE ECHOES USER INPUT [yes, no: +(yes)]: +
CALL HOLD [on, off: +(off)]: +
AT&T VDM ON THIS PORT [yes, no: +(no)]: +
PERMANENTLY ACTIVATED PORT [yes, no: +(no)]: +
CONNECT-TIME BILLING [on, off: +(off)]: +
ATTENTION CHARACTER [none, 1brk, 2brk, del, a character: +(2brk)]: 1brk
ATTENTION ACTION [command_mode, disconnect: +(command_mode)]: +
BITS PER CHARACTER [5, 6, 7, 8: +(8)]: +
NUMBER OF STOP BITS [1, 1.5, 2: +(1)]: +
INITIAL SERVICE STATE [in, out: +(out)]: +

INFO: Assign EPNs and CUGs to ports using the following prompts.
      Hit <DEL> once when finished making assignments.

   PORT FOR EPN/CUG ASSIGNMENT [3-4: +(3)]: +
   ENDPOINT NUMBER OR RANGE [0000-9999, none: +(none)]: 3102-3104
   CLOSED USER GROUP PROFILE ID [up to 8 chars, none: +(none)]: selmsm
   PORT FOR EPN/CUG ASSIGNMENT [3-4: +(4)]: +
   ENDPOINT NUMBER OR RANGE [0000-9999, none: +(none)]: 3105-3107
   CLOSED USER GROUP PROFILE ID [up to 8 chars, none: +(none)]: selmsm

PORT NUMBER [1-12: +(1-12)]:  Delete
CC0>
```

remove msm

The **remove msm** command enables you to take the MSM or its ports out of service. A module port must be removed from service before **change msm**, **delete msm,** or **diagnose msm** can be executed for that port. In addition, this command interrupts any calls in progress on designated ports.

Syntax

You can input **remove msm** in prompted or one-line entry.

```
CC0> remove
OBJECTS [...msm...]: msm
COMPONENT [module, port]:
MODULE ADDRESS:
```

If COMPONENT is "port":

```
PORT NUMBER [1-12: +(1-12)]:
```

Parameters

Refer to the parameter definitions supplied in **enter msm**.

Prompted Entry: Removing an MSM Port from Service

```
CC0> remove
OBJECTS [...msm...]: msm
COMPONENT [module, port]: port
MODULE ADDRESS: 30
PORT NUMBER [1-12: +(1-12)]: 3
CC0>
```

Prompted Entry: Removing an MSM from Service

```
CC0> remove
OBJECTS [...msm...]: msm
COMPONENT [module, port]: module
MODULE ADDRESS: 30
CC0>
```

One-line Entry: Removing MSM Components from Service

```
CC0> remove msm port 30 3
CC0> remove msm module 30
```

restore msm

The **restore msm** command enables you to put currently out-of-service ports or ready-for-service ports, which already exist in the database, into service. Typically, these ports were either left out of service when the ports were configured with **enter msm** or were taken out of service with **remove msm**.

Syntax

You can input **restore msm** in prompted or one-line entry. To have module downloading execute as a background process, press Delete only after the module download has started. Pressing Delete during the prompting sequence terminates the command process.

```
CC0> restore
OBJECTS [...msm...]: msm
COMPONENT [module, port]:
MODULE ADDRESS:
```

If COMPONENT is "port":

```
PORT NUMBER [1-12: +(1-12)]:
```

Parameters

Refer to the parameter definitions supplied in **enter msm**.

Prompted Entry: Restoring an MSM to Service

```
CC0> restore
OBJECTS [...msm...]: msm
COMPONENT [module, port]: module
MODULE ADDRESS: 30
<system responses>
CC0>
```

Prompted Entry: Restoring an MSM Port to Service

```
CC0> restore
OBJECTS [...msm...]: msm
COMPONENT [module, port]: port
MODULE ADDRESS: 30
PORT NUMBER [1-12: +(1-12)]: 3
CC0>
```

One-line Entry: Restoring MSM Components to Service

```
CC0> restore msm module 30
Download in progress for module 30.
Download(s) in progress.  <DEL> puts process in background.
Download proceeding>>>>>>>>>>>>>
Download complete for module 30.
CC0> restore msm port 30 3
```

verify msm

The output of the **verify msm** command enables you to check existing information in the database for a specified MSM and its ports or for all MSMs and their ports.

Syntax

You can input **verify msm** in prompted or one-line entry.

```
CC0> verify
OBJECTS [...msm...]: msm
MODULE ADDRESS [+(all)]:
```

Parameters

Except for being able to specify the word *all*, meaning every MSM, the **MODULE ADDRESS** parameter definition for **verify msm** is the same as that for **enter msm**.

Prompted Entry: Verifying MSM Port Information

```
CC0> verify
OBJECTS [...msm...]: msm
MODULE ADDRESS [+(all)]: 30
<report output>
```

One-line Entry/Output: Verifying MSM Information

```
CC0> verify msm 30
   94-12-31 12:05:45 NODE=Redqueen
M  verify msm 30

   MODULE ADDRESS:  30
   MODULE TYPE: msm                  NCHLS: 12
   SERVICE STATE: in
   DOWNLOAD SERVER: controller
   VERSION: standard

               DEV  NWK          ATTN  ATTN
   PORT  TYPE  FC   FC    BAUD   CHAR  ACT  PARITY  SRVC  BILL  VDM  GROUP
    3    term  none none  19200  1brk   c    off     in   off   no   o2

         CALL         NODE      2WIRE DATA  STOP
   PORT  HOLD  RBAUD  ECHO  PAP CONN  BITS  BITS
    3    off   N/A    no    no   no    8     1

   94-12-31 12:05:45 NODE=Redqueen
M  verify msm 30 1

   PORT  EPN         CUG PROFILE
    3    3102-3104   selmsm

   PORT  PDD
    3    msmhome

   PORT  COMMENT
    3    Ent 6/94
CC0>
```

Report Fields

This table correlates each report field heading shown in the output of **verify msm** to the parameter for which you are prompted in **enter msm** or **change msm**. The information beneath each report field heading reflects the parameter option specified in either command. An *N/A* indicates that the parameter is *not applicable* or *not used*.

Report Field Name	Corresponding Parameter Name
ATTN ACT	**ATTENTION ACTION**
ATTN CHAR	**ATTENTION CHARACTER**
BAUD	**BAUD RATE**
CALL HOLD	**CALL HOLD**
COMMENT	**COMMENT**
CUG PROFILE	**CLOSED USER GROUP PROFILE ID**
DATA BITS	**BITS PER CHARACTER**
DEV FC	**FLOW CONTROL OF MSM BY DEVICE**
DOWNLOAD SERVER	**DOWNLOAD SERVER**
EPN	**ENDPOINT NUMBER OR RANGE**
GROUP	**GROUP**
MODULE ADDRESS	**MODULE ADDRESS**
NCHLS	None: shows the total number of channels
NODE ECHO	**NODE ECHOES USER INPUT**
NWK FC	**FLOW CONTROL OF DEVICE BY MSM**
PAP	**PERMANENTLY ACTIVATED PORT**
PARITY	**PARITY**
PDD	**PREDEFINED DESTINATION**
PORT	**PORT NUMBER**
RBAUD	**RCV BAUD RATE**
SERVICE STATE	**INITIAL SERVICE STATE or**
	None: shows the component state
SRVC	None: shows port service state
STOP BITS	**NUMBER OF STOP BITS**
2WIRE CONN	**CONNECTED TO 2-WIRE MODEM**
TYPE	**SERVICE TYPE**
VDM	**AT&T VDM ON THIS PORT**
VERSION	**SOFTWARE VERSION**

MSM System Responses

The following sections contain applicable system responses for the **msm** commands. These sections are organized by the key phrases that preface each response.

INFO:

Assign EPNs and CUGs to ports using the following prompts. Hit <DEL> once when finished making assignments.

Endpoint numbers or closed user groups must be assigned to ports during an iteration of **enter msm** or **change msm**.

COMMAND FAILED:

Unable to obtain data. Module failed to return data. Try again.

During an iteration of **dstat msm**, the system was unable to collect any status information for the MSM. Wait a few minutes and retry the command.

INPUT ERROR:

All modules/ports must be configured identically.

To change a range of modules or a range of ports on a module, all modules/ports within the specified range must be administered with the same parameter options.

Configured ports must be deleted before deleting module <addr>.

The module specified has one or more ports administered in the configuration database. Information regarding these ports must first be deleted using **delete msm port** before module information can be deleted.

Group <name> is assigned module type <type>. Cannot mix with MSM.

The group name specified is associated with a hardware type other than an MSM. MSM hardware cannot be mixed with other hardware except when specifying *select* for a group. Use **verify group** to check the groups entered, then retry the command using the correct group name.

Group <name> is not <originating/receiving/2way> group, as required.

The group specified must correspond with the service type associated with the port.

ISN Concentrator Not Allowed.

The module address specified is on an Information Systems Network (ISN) concentrator. The MSM can reside on the node backplane or on a BNS-2000 MPC only.

IVDMs cannot be used with EIA flow control

If an IVDM is connected to MSM, flow control for the device can only administered as *xon/off* or *none*.

Module Does Not Exist

The specified module is not configured.

INPUT ERROR:

Module Has Wrong Hardware Type: <addr>
The module address specified does not contain the module type expected.

Module is downloading and range of ports entered. Remove from service to change port parameters or enter only one port to change comment.
The port number specified during an iteration of **change msm** is on a module that is downloading. You can only change the parameter option for comments on one port.

Module <addr> is not an MSM.
The specified module address does not reflect an MSM. Retry the command with a different module address.

Module <addr> is not <configured/entered>.
The specified module address is not administered in the configuration database.

Module <addr> not currently administered in the database.
The remove/restore process cannot execute because the specified module is not entered in the configuration database.

Module <addr> must be in service for on-line diagnostics.
The specified module address must be in service before running **diagnose msm**.

Module <addr> must be out of service for module level off-line diagnostics.
The specified module address must be removed from service before running **diagnose msm**.

Module <addr> port <num> is not entered.
Port number specified for diagnostic testing is not entered in the configuration database.

Module <addr> <port <num>> must be out of service to delete.
The module and/or its port is in service. The module and/or its specified port must be removed with **remove msm** before information can be deleted.

MSM module must be in service.
The MSM must be in service before running **diagnose msm** for on-line diagnostics.

No Default Allowed
Data was not entered in response to the prompt. This parameter does not have any provision for a default value.

No ports configured on module <addr>.
The remove/restore process cannot execute because ports were not entered in the database for this module.

Not an Allowed Value
The value specified is not within the allowed range.

INPUT ERROR:

Parameter out of Range: <input>
The parameter specified is not within the allowed range.

Port in service and range of ports entered. Remove from service to change port parameters or enter only one port to change comment.
The port number specified during the iteration of **change msm** must be out of service or ready for service to change port parameters. Port comments, however, can be changed with the port is service.

Port <num> is not entered.
The specified port number is not administered in the database.

Port <num> is not one of those being entered.
When assigning EPNs/CUGs to ports, specify a port that was administered at the **PORT NUMBER** prompt.

Port <num> must be out of service for on-line diagnostics.
The specified port number must be taken out of service before on-line diagnostics can be run.

Port <num> on MSM module <addr> is not currently administered in the database.
The remove/restore process cannot execute because the specified port is not entered in the configuration database.

Range Specification Error
The values specified are out of range.

Slot <addr> does not contain an MSM module.
The remove/restore process cannot execute because the module entered in the specified address is a type other than an MSM.

REMOVE/RESTORE FAILED:

Control computer in slot <addr>. Delete module and re-enter.
The module address specified is reserved for the Control Computer. The MSM must be re-entered in a valid slot before trying to restore the module.

Could not send message to module <addr> port <num>. Try again later.
All valid MSM ports were specified for the remove/restore operation, but the instructions could not be sent to a specific port in the range.

Could not send message to msmmaint. Try again later.
The remove/restore operation cannot be executed at this time due to system internals. Retry the command again later.

Download failed for module <addr>.
The software download failed for the module residing at the specified address. Refer to alarm information.

No acknowledgment of download initiation received. Try again later.
The command processor timed out waiting for an acknowledgment of download initiation for a module restore. A potentially serious condition could exist.

No response from module.
The command processor sent a message to the MSM regarding removal/restoration of MSM port(s). It did not receive any response.

Not all of the ports on module <addr> have been <removed/restored>.
The default port number range was specified and an error occurred during the remove/restore process. Use **verify msm** to determine which ports were removed/restored.

MSM module <addr> is being downloaded. Try again later.
The command process attempted to remove/restore an MSM module or port(s) while the module was being downloaded.

MSM type mismatch for module <addr> - expected: <mod type>.
Following the module download, the MSM type stored in the database (expected type) disagrees with the actual type obtained from the module.

system too busy to process command. Try again later.
The system is under a heavy load. Retry the command in a while. If retries are unsuccessful, use **initialize controller** to initialize and reboot the Control Computer and to synchronize the database to disk.

Unexpected acknowledgement from module <addr> port <num>.
The remove/restore process for the specified MSM port failed because of an unexpected acknowledgment from msmmaint or from the module.

Unknown message received. Try again later.
The command process received an unknown message from the configuration or msmmaint process.

DIAGNOSTICS:

Diagnose not completed -
cannot start msmp.
download failed.
error acknowledgment for message sent to the MSM module.
illegal message received during port initialization.
message cannot be sent to MSM module.
Module address beyond clock.
module <addr> is downloading.
no MSM module structure returned.
port process did not respond to diagnostic request.
Slot is empty or wrong hardware module.
system too busy to process command.
unexpected error code from config(error code:<ack code>).
unexpected error code from msmmaint process: <ack code>.
unexpected message from port process.

The diagnostic process cannot complete because of one of the indicated reasons.

DIAGNOSTIC EXITS <DUE TO DELETE>

Diagnostic testing completed normally or testing completed because the Delete key was pressed.

Offline diagnostics: PASS/FAIL
<Offline/Online> diagnostic MSM module test: PASS/FAIL
<Offline/Online> module diagnostic test: PASS/FAIL

The previous messages indicate which test ran and its status.

Place <local/remote> modem in loop-around mode.

Put the indicated modem in the specified state.

Place <local/remove> modem back into non-looping mode to avoid activating alarms.

Put the indicated modem in the specified state.

Replace the loop-around connector with normal connection to avoid activating alarms.

Remove the loop-around connector and return to the normal operating state.

Test requires a loop-around connector on the port.
Replace port cable with loop-around connector.

Install a looparound connector on the port.

Test requires a loop-around connector.
Terminate each cable or port on the board with a loop-around connector.

Install a looparound connector on the port.

WARNING:

Module <addr> is downloading. Only the comment field can be changed while the module is downloading.

The port number specified during the iteration of **change msm** is on a module that is downloading. Retry command when the download is complete. Only the comment parameter for the port can be changed while the module is downloading.

Module <addr> port <num> must be out of service to delete.

Before information regarding the specified module port can be removed from the database, the port must be taken out of service.

Unknown message received. Try again later.

The remove/restore process cannot execute because, while attempting to restore the MSM component to service, the Break key was pressed.

NO KEY PHRASE:

All ports are entered for module <addr>.

All module ports are already entered in the configuration database, so the port specified cannot be entered.

All ports on module <addr> already <in/out of/ready for> service.

The remove/restore process cannot execute because all valid MSM ports specified were already in the requested service state.

Cannot Make Maintenance Process Special

The remove/restore process cannot execute because of an internal maintenance process.

Command did not execute.

The remove/restore process cannot execute for module or port specified because of an invalid entry or database access problem. Retry the command.

Download server <name> is not a valid service address.

The download server specified is not valid.

Maximum of <num> modules allowed.

The remove/restore process cannot be executed because the range of modules specified exceeds the maximum number allowed for simultaneous software download.

Module <addr> already <in/out of/ready for> service.

The remove/restore process cannot execute because the module address specified is already in the requested service state.

Module <addr> cannot be changed while in service.

Module parameters cannot be changed for the specified module while the module is in service. To change module parameters, first remove the module from service.

NO KEY PHRASE:

Module <addr> is already entered.
The module address specified is already entered in the configuration database.

Module <addr> is a <mod type> type module, msm expected.
The module address for which information is to be entered, changed, or deleted is not that of an MSM.

Module <addr> is downloading.
The specified operation cannot be executed because the module is downloading.

Module <addr> is not entered.
The module address specified for the enter/change/delete operation, is not entered in the configuration database.

Module <addr> must be out of service for off-line diagnostics.
The module residing at the specified module address must be taken out of service before running off-line diagnostics.

Module <addr> port <num> is already entered.
The port specified is already entered in the configuration database.

Module <addr> port <num> is in service. Only the comment field can be changed on an in service port.
Parameter options for the specified module port cannot be changed while the port is in service except for the comment field. To change other port parameters, first remove the port from service.

Module <addr> port <num> is not entered.
The port number specified for the change/delete operation is not entered in the configuration database.

Port <num> on module <addr> already <service state>.
The remove/restore process cannot be executed because the port number specified is already in the requested state.

Predefined destination <addr> is not a valid service address.
The predefined destination specified is not valid.

Appendix A.
MSM and Remote-VDM Connections

Appendix A provides cabling information for Remote Voice/Data Multiplexers (R-VDMs) used in node access applications. Three basic configurations are addressed:

- R-VDMs used in single-line applications
- R-VDMs used in multi-line key set applications
- R-VDMs used in Merlin key set applications

Remote VDM applications may use the Model 045R VDM which provides one voice/data circuit or the VDM Stand-Alone Shelf which provides up to 18 voice/data circuits. The following figure illustrates the rear panel of the Model 045R VDM.

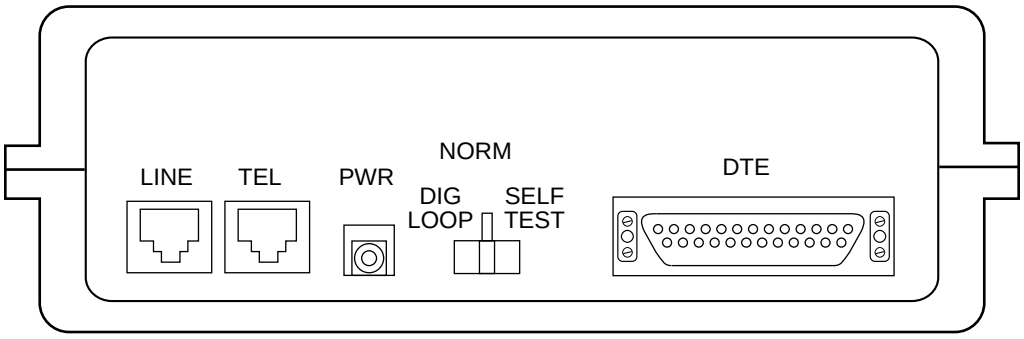


FIGURE A-1. Model 045R VDM Rear Panel

The following figure illustrates the backplane of the VDM Stand-Alone Shelf.

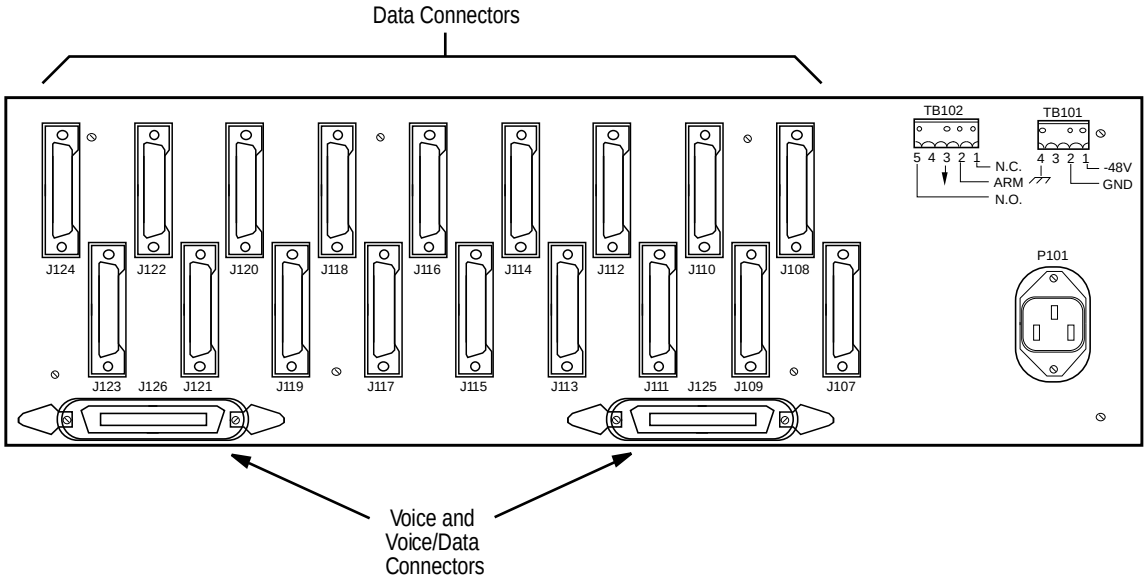


FIGURE A-2. VDM Stand-Alone Shelf Backplane

Cabling R-VDMs in Single-Line Applications

For single-line applications, the Model 045R VDM or VDM Stand-Alone Shelf may be used. Cabling information for each of these VDMs is described in the following sections.

Connections for Model 045R VDM

Cabling to the Model 045R VDM used in single-line applications may be configured as follows:

- A voice/data circuit is wired from the originating VDM into the remote wiring distribution system and then into an information outlet (IO) near the Model 045R VDM.
- A D6AM cable is connected from the IO receptacle to the LINE receptacle of the Model 045R VDM.
- Using D6AM cable, the telephone set is connected to the TEL receptacle of the Model 045R VDM.
- The terminal is connected to the DTE port on the Model 045R VDM with an M25A cable if the terminal has a male connector. An M25B cable is used if the terminal has a female connector.

See the following figure for an illustration of this configuration.

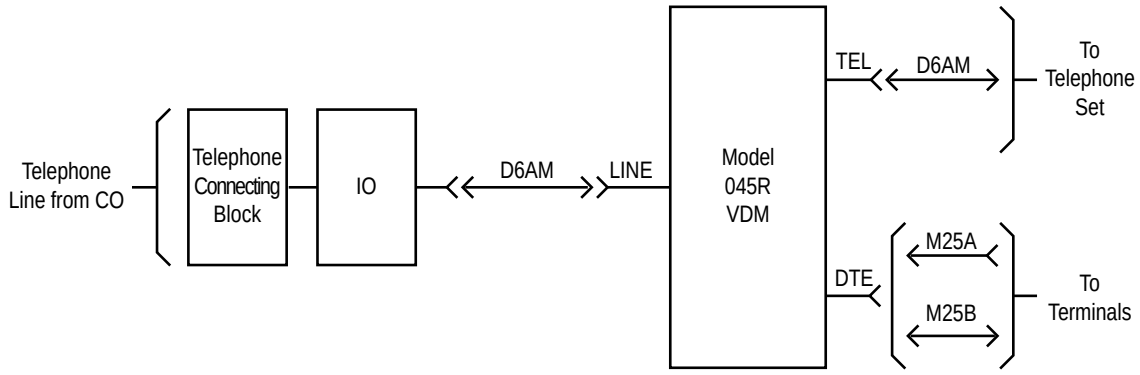


FIGURE A-3. Single-Line Applications Using Model 045R VDM

TABLE A-1. Ordering Information: Model 045R VDM Single-Line Connections

Cable/Adapter	Description	ED5P055-31 Group Number
D6AM	6-pin mod 6-pin mod	G(144), G(H)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

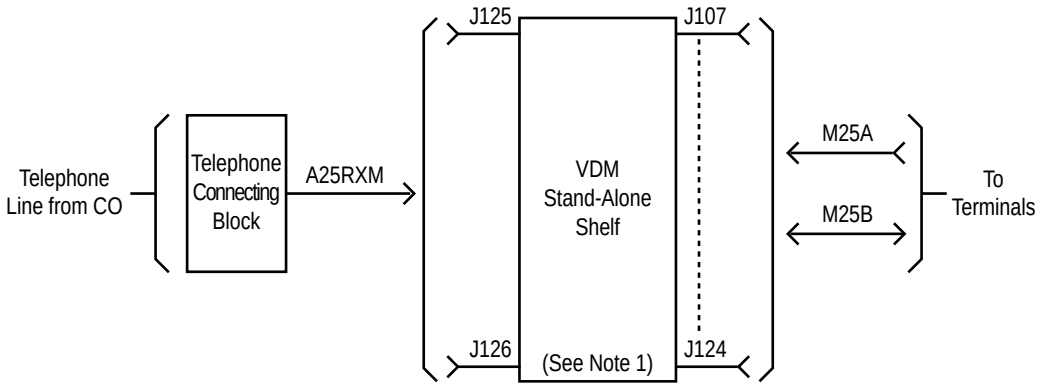
Connections for VDM Stand-Alone Shelf

Cabling to the remote VDM Stand-Alone Shelf used in single line applications may be configured as follows:

- A voice/data circuit is wired from the originating VDM into the remote wiring distribution system and then into a telephone connecting block.
- An A25RXM cable is wired to the connecting block and is connected to the VDM Stand-Alone Shelf. If all 18 VDM circuits are used, two A25RXM cables will be required. These cables connect to the J125 and J126 connectors on the VDM Stand-Alone Shelf.

  All twelve circuits on J125 may be wired and only the first six circuits on J126 may be wired.
- Terminals are connected to ports J107 through J124 with an M25A cable if the terminal has a male connector. An M25B cable is used if the terminal has a female connector.

See the following figure for an illustration of this configuration.



Note 1: Wire all circuits on J125 and only the first six circuits on J126. The VDM Stand-Alone Shelf supports a maximum of 18 circuits.

FIGURE A-4. Single-Line Applications Using VDM Stand-Alone Shelf

TABLE A-2. Ordering Information: VDM Stand-Alone Shelf Single-Line Connections

Cable/Adapter	Description	ED5P055-31 Group Number
A25RXM	50-pin 180-M single-ended	G(167), G(A)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Cabling R-VDMs in Multi-Line Key Set Applications

The Model 045R VDM is used in the multi-line key set application.

Depending on the availability of spare wire pairs in the existing wiring system and local preferences, there are four recommended methods for cabling the R-VDM.

In each method described in the following sections, a voice/data circuit is wired from the originating VDM into the remote wiring distribution system terminating in a patch panel.

Using Two Spare Pairs in Existing Cabling

If two spare pairs are to be used in cabling the R-VDM:

- An existing 25-pair cable from the patch panel connects to a breakout device. A Y-cable then connects the break-out device to the LINE and TEL receptacles of the Model 045R VDM.
- An M25A or M25B cable will connect from the DTE port of the Model 045R VDM to the terminal. The M25A will be required if the terminal has a male connector and the M25B will be required if the terminal has a female connector.

See the following figure for an illustration of this configuration.

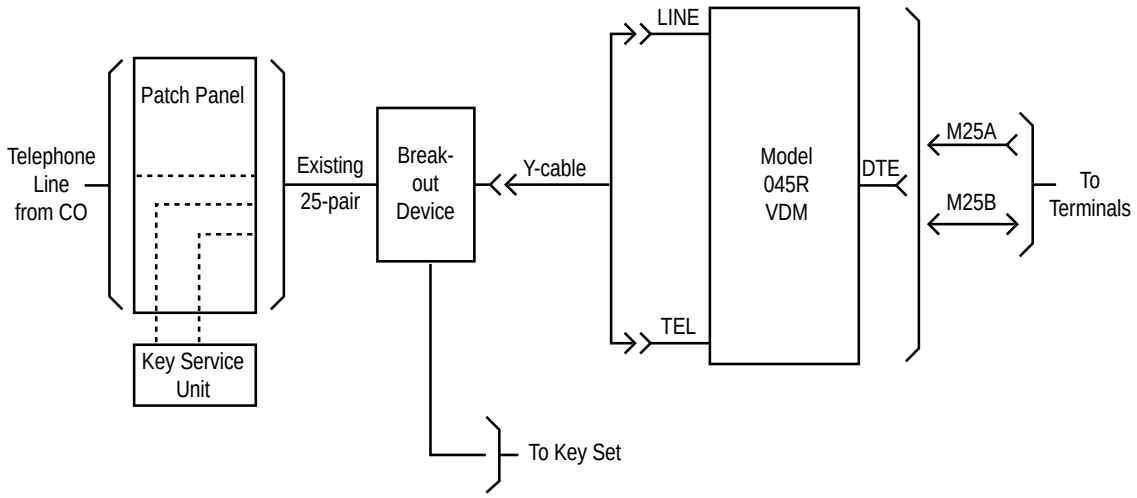


FIGURE A-5. Cabling R-VDMs in Multi-Line Key Set Applications Using Two Spare Pairs in Existing Cabling

TABLE A-3. Ordering Information: R-VDMs in Multi-Line Key Set Using Two Spare Pairs in Existing Cabling

Cable/Adapter	Description	ED5P055-31 Group Number
Y-cable	8-pin mod two 8-pin mod	G(143), G(G)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Using Two New Pairs in New Cabling

If two new pairs are to be used in cabling the R-VDM:

- The new pairs should be wired from the patch panel to a 635B connecting block. A Y-cable then connects the 635B connecting block to the LINE and TEL receptacles of the Model 045R VDM.
- An M25A or M25B cable will connect from the DTE port of the Model 045R VDM to the terminal. The M25A will be required if the terminal has a male connector and the M25B will be required if the terminal has a female connector.

See the following figure for an illustration of this configuration.

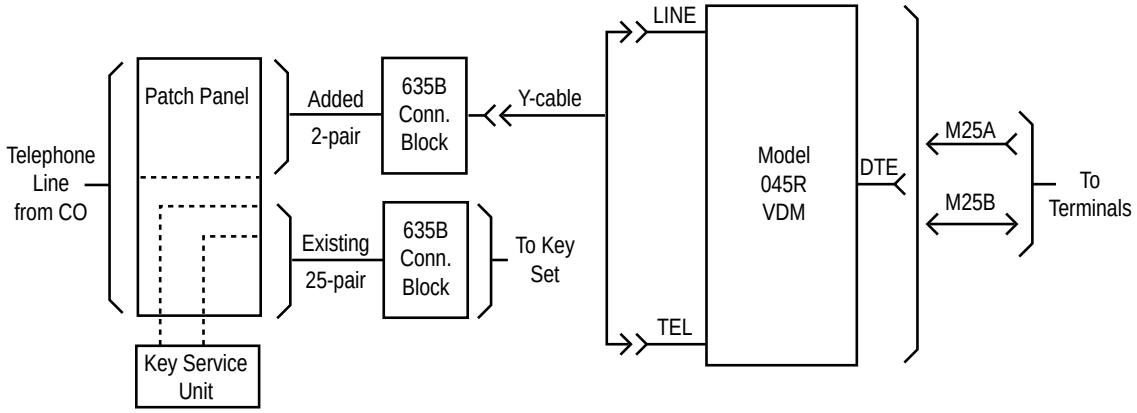


FIGURE A-6. Cabling R-VDMs in Multi-Line Key Set Applications Using Two New Pairs in New Cabling

TABLE A-4. Ordering Information: R-VDMs in Multi-Line Key Set Using Two New Pairs in New Cabling

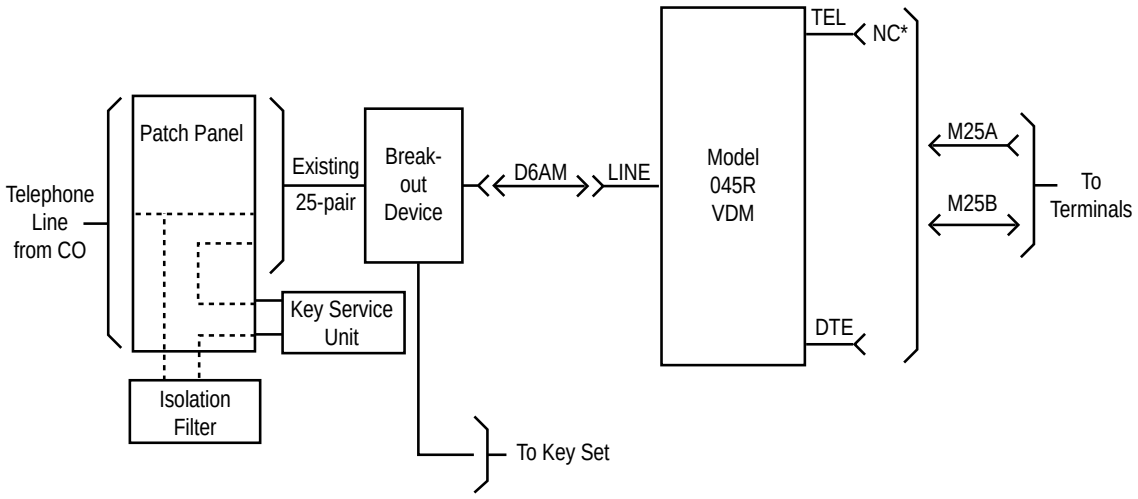
Cable/Adapter	Description	ED5P055-3 Group Number
Y-cable	8-pin mod two 8-pin mod	G(143), G(G)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Using One Spare Pair in Existing Cabling

If one spare pair is to be used in cabling the R-VDM:

- An existing 25-pair cable from the patch panel connects to a break-out device. A D6AM cable then connects the break-out device to the LINE receptacle of the Model 045R VDM.
- An M25A or M25B cable will connect from the DTE port of the Model 045R VDM to the terminal. The M25A will be required if the terminal has a male connector and the M25B will be required if the terminal has a female connector.

See the following figure for an illustration of this configuration.



**NC=no connection*

FIGURE A-7. Cabling R-VDMs in Multi-Line Key Set Applications Using One Spare Pair in Existing Cabling

TABLE A-5. Ordering Information: R-VDMs in Multi-Line Key Set Using One Spare Pair in Existing Cabling

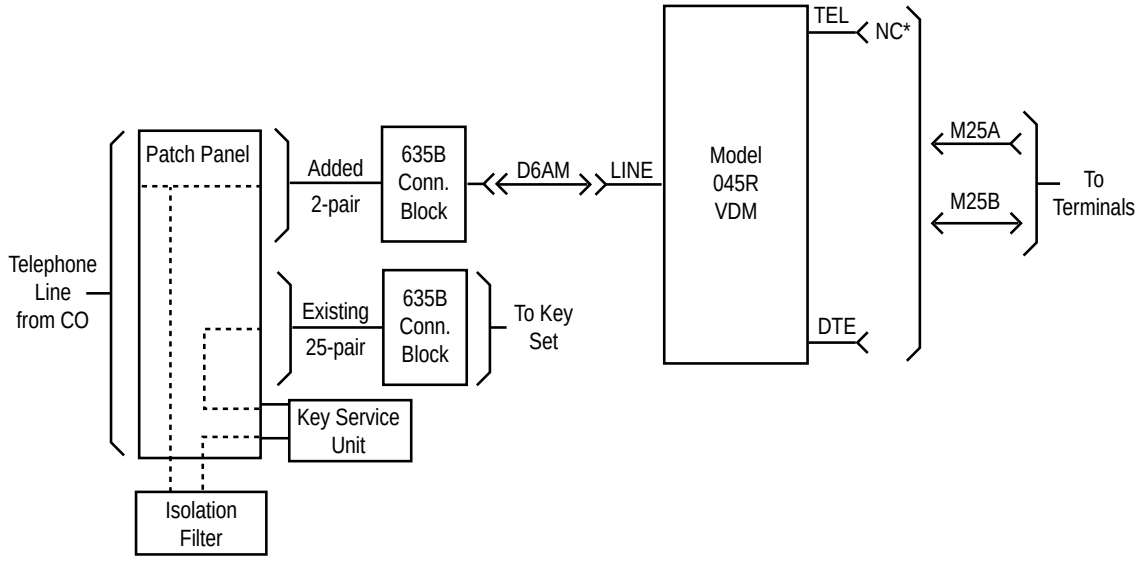
Cable/Adapter	Description	ED5P055-31 Group Number
D6AM	6-pin mod 6-pin mod	G(144), G(H)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Using One New Pair in New Cabling

If one new pair is to be used in cabling the R-VDM:

- The new pair should be wired from the patch panel to a 635B connecting block. A D6AM cable then connects the 635B connecting block to the LINE receptacle of the Model 045R VDM.
- An M25A or M25B cable will connect from the DTE port of the Model 045R VDM to the terminal. The M25A will be required if the terminal has a male connector and the M25B will be required if the terminal has a female connector.

See the following figure for an illustration of this configuration.



**NC=no connection*

FIGURE A-8. Cabling R-VDMs in Multi-Line Key Set Applications Using One New Pair in New Cabling

TABLE A-6. Ordering Information: R-VDMs in Multi-Line Key Set Using One New Pair in New Cabling

Cable/Adapter	Description	ED5P055-31 Group Number
D6AM	6-pin mod 6-pin mod	G(144), G(H)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Cabling R-VDMs in Merlin Key Set Applications

The Merlin key set application uses the the Model 045R VDM. Cabling information for this configuration is described as follows:

- A voice/data circuit is wired from the originating VDM into the remote wiring distribution system and then into an information outlet (IO).
- A D4BU cable is connected from the IO receptacle to an ED1P933-30, G(16) filter card.
- The filter card is connected to the LINE receptacle of the Model 045R VDM with a D8W cable.
- The telephone is connected to the TEL receptacle on the Model 045R VDM with a D8AA cable.
- An M25A or M25B cable will connect from the DTE port of the Model 045R VDM to the terminal. The M25A will be required if the terminal has a male connector and the M25B will be required if the terminal has a female connector.

See the following figure for an illustration of this configuration.

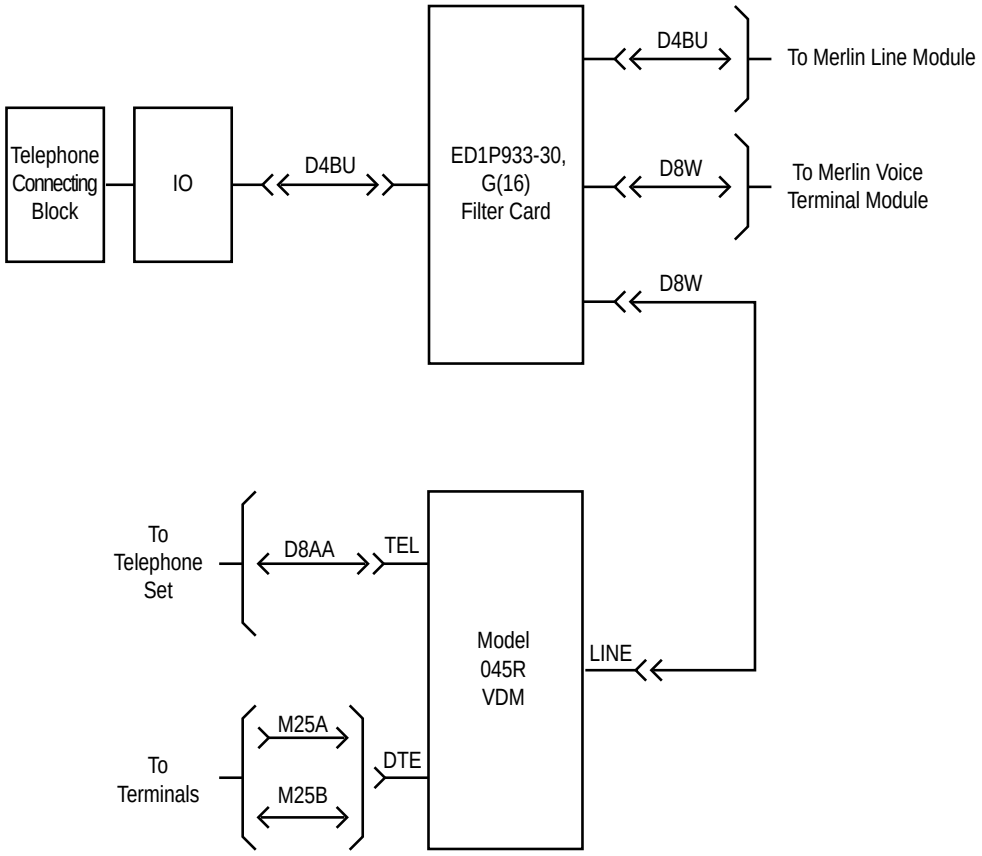


FIGURE A-9. Cabling R-VDMs in Merlin Key Set Applications

TABLE A-7. Ordering Information: R-VDMs in Merlin Key Sets

Cable/Adapter	Description	ED5P055-31 Group Number
D4BU	4-pin mod 4-pin mod	See *SYSTIMAX PDS Component Guide*
D8W	8-pin mod 8-pin mod	G(137), G(G)
D8AA	8-pin mod 8-pin mod	G(134), G(G)
M25A	25-pin-M 25-pin-F	G(107), G(P)
M25B	25-pin-M 25-pin-M	G(108), G(P)

Appendix B.
MSM Database Entry Forms

This appendix contains sample database entry forms that should be used when initially entering TY service types into the database or when making any extensive changes. They should be used in conjunction with similar forms completed for addresses (for billing, PDD, and EPN), groups, and profiles. These forms are provided in the *Node Reference*.

This appendix contains sample database entry forms for these MSM service types:

The forms list prompts that appear when the **enter** command is used, and the possible values (or range of values) that can be entered in response to the prompts. Default values are shown in *italics*. The information contained in this appendix is supplemented by explanations furnished in **MSM Administration** and **MSM Commands.**

FORM B-1. Entering an MSM

COMPONENT [module, port]	module	module	module	module
MODULE ADDRESS				
COMMENT [up to 60 chars double-quoted, *none*]				
DOWNLOAD SERVER [*controller*]				
If DOWNLOAD SERVER is "controller": **SOFTWARE VERSION** [*standard*]				
If DOWNLOAD SERVER is not "controller": **SOFTWARE VERSION**				

FORM B-2. Entering a Console or Host

COMPONENT [module, port]	port	port	port	port
MODULE ADDRESS				
PORT NUMBER [1-12, *1-12*]				
COMMENT [up to 60 chars double-quoted, *none*]				
SERVICE TYPE [console, host, modem, 2way, *terminal*]	console__ host__	console__ host__	console__ host__	console__ host__
GROUP [up to 8 chars]				
PREDEFINED DESTINATION [*none*]				
CONNECTED TO 2-WIRE MODEM [yes, *no*]				
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, *9600*, 14400, 19200, 28800, 38400, 57600, 76800, 115200]				
PARITY [even, odd, *off*]				
If port is not CONNECTED TO 2-WIRE MODEM: **FLOW CONTROL OF MSM BY DEVICE** [xon_xoff, eia, *none*]				
If port is not CONNECTED TO 2-WIRE MODEM: **FLOW CONTROL OF DEVICE BY MSM** [xon_xoff, eia, *none*]				
If BAUD RATE is less than or equal to "19200" **AND** if both flow control parameters are "xon/xoff" or "none" or if the port is CONNECTED TO 2-WIRE MODEM: **AT&T VDM ON THIS PORT** [yes, *no*]				

FORM B-2. Entering a Console or Host (continued)

PERMANENTLY ACTIVATED PORT [yes, *no*]				
BITS PER CHARACTER If PARITY is "even" or "odd": [5, 6, *7*, 8] If PARITY is "none": [5, 6, 7, *8*]				
NUMBER OF STOP BITS **[***1*, 1.5, 2]				
INITIAL SERVICE STATE **[in,** *out*]:				
For a single port: **ENDPOINT NUMBER OR RANGE** [0000-9999, *none*]				
If ENDPOINT NUMBER OR RANGE is entered: **CLOSED USER GROUP PROFILE ID** [up to 8 chars, *none*] For multiple ports: **PORT FOR EPN/CUG ASSIGNMENT** [<X>]				
ENDPOINT NUMBER OR RANGE [0000-9999, *none*]				
If ENDPOINT NUMBER OR RANGE is entered: **CLOSED USER GROUP PROFILE ID** [up to 8 chars, *none*]				

FORM B-3. Entering a Modem or Terminal

COMPONENT [module, port]	port	port	port	port
MODULE ADDRESS				
PORT NUMBER [1-12, *1-12*]				
COMMENT [up to 60 chars double-quoted, *none*]				
SERVICE TYPE [console, host, modem, 2way, *terminal*]	modem__ terminal__	modem__ terminal__	modem__ terminal__	modem__ terminal__
GROUP [up to 8 chars]				
PREDEFINED DESTINATION [*none*]				
CONNECTED TO 2-WIRE MODEM [yes, *no*]				
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, *auto*]:				
PARITY [even, odd, *off*]				
If port is not CONNECTED TO 2-WIRE MODEM: **FLOW CONTROL OF MSM BY DEVICE** [xon_xoff, eia, *none*]				
If port is not CONNECTED TO 2-WIRE MODEM: **FLOW CONTROL OF DEVICE BY MSM** [xon_xoff, eia, *none*]				
NODE ECHOES USER INPUT [*yes*, no]				
CALL HOLD [on, *off*]				

FORM B-3. Entering a Modem or Terminal (continued)

If BAUD RATE is less than or equal to "19200" **AND** if both flow control parameters are "xon/xoff" or "none" or if the port is CONNECTED TO 2-WIRE MODEM: **AT&T VDM ON THIS PORT** [yes, *no*]				
PERMANENTLY ACTIVATED PORT [yes, *no*]				
CONNECT-TIME BILLING [on, *off*]				
ATTENTION CHARACTER [none, 1brk, *2brk,* del, a character]				
If ATTENTION CHARACTER is specified: **ATTENTION ACTION** [*command_mode,* disconnect]:				
BITS PER CHARACTER If PARITY is "even" or "odd": [5, 6, *7,* 8] If PARITY is "none": [5, 6, 7, *8*]				
NUMBER OF STOP BITS [*1,* 1.5, 2]				
INITIAL SERVICE STATE [in, *out*]:				
For a single port: **ENDPOINT NUMBER OR RANGE** [0000-9999, *none*] If ENDPOINT NUMBER OR RANGE is entered: **CLOSED USER GROUP PROFILE ID** [up to 8 chars, *none*] For multiple ports: **PORT FOR EPN/CUG ASSIGNMENT** [<X>]				

FORM B-3. Entering a Modem or Terminal (continued)

ENDPOINT NUMBER OR RANGE [0000-9999, *none*]				
If ENDPOINT NUMBER OR RANGE is entered: **CLOSED USER GROUP PROFILE ID** [up to 8 chars, *none*]				

FORM B-4. Entering a Two-way

COMPONENT [module, port]	port	port	port	port
MODULE ADDRESS				
PORT NUMBER [1-12, *1-12*]				
COMMENT [up to 60 chars double-quoted, *none*]				
SERVICE TYPE [console, host, modem, 2way, *terminal*]	2way__	2way__	2way__	2way__
GROUP [up to 8 chars]				
PREDEFINED DESTINATION [*none*]:				
CONNECTED TO 2-WIRE MODEM [yes, *no*]				
BAUD RATE [75, 110, 150, 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, *auto*]:				
If SERVICE TYPE is "2way" and BAUD RATE is "auto": **RCV BAUD RATE** [75, 110, 150, 300, 1200, 2400, 4800, *9600*, 14400, 19200]:				
PARITY [even, odd, *off*]				
If port is not CONNECTED TO 2-WIRE MODEM: **FLOW CONTROL OF MSM BY DEVICE** [xon_xoff, eia, *none*]				
If port is not CONNECTED TO 2-WIRE MODEM: **FLOW CONTROL OF DEVICE BY MSM** [xon_xoff, eia, *none*]				
NODE ECHOES USER INPUT [*yes*, no]				

FORM B-4. Entering a Two-way (continued)

CALL HOLD [on, *off*]				
If BAUD RATE is less than or equal to "19200" **AND** if both flow control parameters are "xon/xoff" or "none" or if the port is CONNECTED TO 2-WIRE MODEM: **AT&T VDM ON THIS PORT** [yes, *no*]				
PERMANENTLY ACTIVATED PORT [yes, *no*]				
CONNECT-TIME BILLING [on, *off*]				
ATTENTION CHARACTER [none, 1brk, *2brk*, del, a character]				
If ATTENTION CHARACTER is specified: **ATTENTION ACTION** [*command_mode*, disconnect]:				
BITS PER CHARACTER If PARITY is "even" or "odd": [5, 6, *7*, 8] If PARITY is "none": [5, 6, 7, *8*]				
NUMBER OF STOP BITS [*1*, 1.5, 2]				
INITIAL SERVICE STATE [in, *out*]:				
For a single port: **ENDPOINT NUMBER OR RANGE** [0000-9999, *none*]				
If ENDPOINT NUMBER OR RANGE is entered: **CLOSED USER GROUP PROFILE ID** [up to 8 chars, *none*] For multiple ports: **PORT FOR EPN/CUG ASSIGNMENT** [<X>]				

FORM B-4. Entering a Two-way (continued)

ENDPOINT NUMBER OR RANGE [0000-9999, *none*]				
If ENDPOINT NUMBER OR RANGE is entered: **CLOSED USER GROUP PROFILE ID** [up to 8 chars, *none*]				

Appendix C.
MSM EIA Lead States

This appendix explains the implications of EIA RS-232-C lead states when MSM service types, which are not connected to two-wire modems (DCEs), are administered as *console, host, terminal, modem,* or *2way* and flow control is administered as *eia*. The information in this appendix supplements **MSM Troubleshooting** and the information on the **dstat msm** command in **MSM Commands**.

MSMs and the Host Interface

A host that connects to the node through an MSM can be administered in the database as **SERVICE TYPE** *host* or *console*, depending on its use of EIA leads. A host that was administered for *host* service allows connections to the host computer only when the DTR lead is up. A host that was administered for *console* service allows connections to the host computer without regard to the DTR lead. The DTR lead is simply ignored. (This service is intended for three-wire host ports.) The following tables show MSM-supported leads. The leads are designated from the host perspective, including the node cable specified for the application.

Hosts as Call Receivers

When a host is the call receiver, the node acts as DCE. The supported RS-232-C leads, from the call-receiving host perspective, including the node cable specified for the application, are shown in the following tables.

TABLE C-1. Supported Lead States for Host Interface

RS-232-C Lead	Pin	Controlled By	Action
DTR	20	host	If DTR drops during a call, the call is taken down. For host service, this lead must be up for the node to accept a call to the host. For console service, the node accepts a call to the host regardless of the DTR state.
DCD	8	node	Asserts DCD to signal the start of a call; drops DCD at the end of a call.
DSR	6	node	Asserts DSR to signal start of call; drops DSR at the end of a call.

TABLE C-1. Supported Lead States for Host Interface (continued)

RS-232-C Lead	Pin	Controlled By	Action
RTS	4	host	Ignored unless EIA flow control is enabled. See Table C-5.
CTS	5	node	Follows DCD unless EIA flow control is enabled. See Table C-5.
TD	2		Carries data transmitted to node.
RD	3		Carries data received from node.

TABLE C-2. Supported Lead States for Host Interface (EIA Flow Control Enabled)

RS-232-C Lead	Pin	Controlled By	Action
RTS	4	host	During a call, if RTS is up, the node can transmit data to the host. If down, the node cannot transmit data.
CTS	5	node	During a call, if CTS is up, then the host can transmit data to the node. If down, the host cannot transmit data.

MSMs and the Terminal Interface

A terminal that connects to the node through an MSM can be administered in the database as **SERVICE TYPE** *terminal* or *2way*. A terminal administered for *terminal* service originates calls; a terminal administered for *2way* service can originate and receive calls.

Terminals as Call Originators

When a terminal is the call originator, the node acts as DCE. The terminal interface is administered for *terminal* service. The supported RS-232-C leads, from the call-originating terminal perspective, including the node cable specified for the application, are shown in the following tables.

TABLE C-3. Supported Lead States for Terminal Interface

RS-232-C Lead	Pin	Controlled By	Action
DTR	20	terminal	If DTR drops during a call, the call is taken down. If DTR goes up, the node prompts for destination and sets up a circuit.
DCD	8	node	Asserts DCD all the time. On the recommended cord, DCD is strapped to DSR.
DSR	6	node	On the recommended cord, DCD is strapped to DSR.
RTS	4	terminal	Ignored unless EIA flow control is enabled. See Table C-7.
CTS	5	node	Asserts CTS all the time unless EIA flow control is enabled. See Table C-7.
TD	2		Carries data transmitted to node.
RD	3		Carries data received from node.

TABLE C-4. Supported Lead States for Terminal Interface (EIA Flow Control Enabled)

RS-232-C Lead	Pin	Controlled By	Action
RTS	4	terminal	During a call, if RTS is up, the node can transmit data to the terminal. If down, the node cannot transmit.
CTS	5	node	During a call, if CTS is up, then the terminal can transmit data to the node. If down, the terminal cannot transmit.

Terminals as Call Originators and Receivers

When a terminal is a call originator and receiver, the node acts as DCE. The terminal interface is administered for *2way* (two-way) service. The supported RS-232-C leads, from the terminal perspective, including the node cable specified for the application, are shown in the following tables.

TABLE C-5. Supported Lead States for Two-way Interface as a Call Receiver

RS-232-C Lead	Pin	Controlled By	Action
DTR	20	terminal	If DTR drops during a call, the call is taken down. Must be up for the port to accept or receive a call to the terminal.
DCD	8	node	Asserts DCD at the start of a call and drops it at the end of the call.
DSR	6	node	Asserts DSR to signal start of a call; drops DSR at the end of the call.
RTS	4	terminal	Ignored unless EIA flow control is enabled. See Table C-9.
CTS	5	node	Is asserted unless EIA flow control is enabled. See Table C-9.
TD	2		Carries data transmitted to the node.
RD	3		Carries data received from the node.

TABLE C-6. Supported Lead States for Two-way Interface as a Call Receiver (EIA Flow Control Enabled)

RS-232-C Lead	Pin	Controlled By	Action
RTS	4	terminal	During a call, if RTS is up, the node can transmit data to the terminal. If down, the node cannot transmit.
CTS	5	node	During a call, if CTS is up, the terminal can transmit data to the node. If down, the terminal cannot transmit.

Entry of a Return or an attention signal in receive mode from the connected end device switches the port to originate mode, which asserts DCD/RTS. If the connected end device cannot output data with DCD/RTS down, then it can never switch to originate mode.

MSMs and the Modem Interface

A modem that connects to the node through an MSM can be administered in the database as **SERVICE TYPE** *modem* or *console*. Modem service is used when a modem originates calls to the node. Console service provides an interface to the modem so the user can dial out from the node. A list of these modems can be found in the *System Description.*

Modems as Call Originators (Modem Service)

When a modem is a call originator, the node acts as DTE. The modem is administered in the database as **SERVICE TYPE** *modem.* The supported RS-232-C leads, from the call-originating modem perspective, including the node cable specified for the application, are shown in the following tables.

TABLE C-7. Supported Lead States for Modem Interface (Call Originator)

RS-232-C Lead	Pin	Controlled By	Action
DTR	20	node	Keeps DTR up except after the end of a call. Lowers DTR shortly after the modem drops DCD, then asserts it after a two-second delay. Lowers DTR if the other end of a PDD connected through a modem hangs up. After two seconds, the node asserts DTR. Lowers DTR if the modem asserts DCD but does not transmit a dial string. After two minutes, the node drops DTR, waits two seconds, then reasserts DTR.
DCD	8	modem	When DCD is asserted, the node prompts for destination and sets up a circuit. If DCD is dropped during a call, the connection is taken down.
RTS	4	node	Follows DTR unless EIA flow control is enabled. See Table C-8.
CTS	5	modem	Ignored unless EIA flow control is enabled. See Table C-8.
TD	2		Carries data received from the node.
RD	3		Carries data transmitted to the node.

TABLE C-8. Supported Lead States for Modem Interface (Call Originator/EIA Flow Control Enabled)

RS-232-C Lead	Pin	Controlled By	Action
RTS	4	node	During a call, if RTS is up, the modem can transmit data to the node.
CTS	5	modem	During a call, if CTS is up, the node can transmit data to the modem.

Some modems assert DCD whenever they sense that DTR is asserted or they echo data transmitted to them by the node. This echoing can cause an infinite echo loop, waste Control Computer resources, and cause the alarm **`REPORT FAILURE: Too Many Invalid Attempts`** to be printed. When the *Penril*® DATACOMM 300/1200 Modem (equipped with the automatic repertory dialer option) is administered for *modem* service, this problem occurs.

Modems as Call Receivers (Console Service)

When a modem is a call receiver, the node acts as the DTE. The modem is administered in the database as **`SERVICE TYPE`** *console*. The supported RS-232-C leads, from the call-receiving modem perspective, including the node cable specified for the application, are shown in the following tables.

TABLE C-9. Supported Lead States for Modem Interface (Call Receiver)

RS-232-C Lead	Pin	Controlled By	Action
DTR	20	node	Raises DTR to signal the start of a call. Lowers DTR to signal the end of a call.
DCD	8	modem	May assert DCD.
RTS	4	node	Follows CTS unless EIA flow control is enabled. See Table C-10.
CTS	5	modem	May be asserted by modem, unless EIA flow control is enabled. See Table C-10.
TD	2		Carries data received from the node.
RD	3		Carries data transmitted to the node.

TABLE C-10. Supported Lead States for Modem Interface (Call Receiver/EIA Flow Control Enabled)

RS-232-C Lead	Pin	Controlled By	Action
RTS	4	node	During a call, if RTS is up, then the modem can transmit data to the node.
CTS	5	modem	During a call, if CTS is up, then the node can transmit data to the modem.

Console service can be administered for any intelligent modem that supports RS-232-C type connections. EIA flow control does not function with standard modems; but it does function with some statistical multiplexers and fiber-optic multiplexers.

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