System Release 7.17
ASTRO® 25
INTEGRATED VOICE AND DATA

Voice Processor Module

NOVEMBER 2016

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Document History

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About Voice Processor Module

This manual provides description of the components of the Voice Processor Module and its function in an ASTRO®25 radio system.

This manual is intended for use by experienced technicians familiar with similar types of equipment. In keeping with the maintenance philosophy of Field Replaceable Units (FRU), this manual contains functional information sufficient to give service personnel an operational understanding of the equipment.

Helpful Background Information

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths.

Related Information

See the following documents for associated information about the radio system.

Related Information	Purpose
Standards and Guidelines for Communication Sites (6881089E50)	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as R56 manual. This manual may be purchased on CD 9880384V83 by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Overview and Documentation	Provides an overview of the ASTRO® 25 new system features, documentation set, technical illustrations, and system-level disaster recovery that support the ASTRO® 25 radio communication system.
SmartX Site Converter Feature Guide	Provides information about the SmartX Site Converter, which is using the Voice Processor Module hardware.
MCC 7500 Dispatch Console with Voice Processor Module	Provides information about the VPM hardware as it is being used as the audio interface for the MCC 7500 console subsystem.
MCC 7500 Dispatch Console/AIS with VPM Setup Guide	Describes the process and procedures needed to install and configure the MCC 7500 Dispatch Console and the MCC 7500 Archiving Interface Server.
Enhanced Telephone Interconnect Feature Guide	Provides information about the Enhanced Telephone Interconnect subsystem feature, which is using the Voice Processor Module hardware for the Telephone Media Gateway (TMG).

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Chapter 1

Voice Processor Module Hardware Description

This chapter provides a high-level description of the Voice Processor Module and the function it serves on your system.

1.1 Voice Processor Module Overview

The Voice Processor Module (VPM) is a device that combines the functionality of a voice card, an encryption card, dedicated auxiliary input/output ports, and line interface circuitry (T1/E1 interfaces) in one device.

The VPM is designed as a flexible platform that can be used in different subsystems with only a change of software. The current uses are the audio interface for the MCC 7500 console subsystem, the SmartX Site Converter at remote sites, and the Telephone Media Gateway (TMG) in the zone core for the Enhanced Telephone Interconnect subsystem.

Also, the VPM communicates with the Console Telephony Media Gateway to support telephony audio sessions with the Public Switched Telephone Network (PSTN). See the *MCC 7500 Dispatch Console with Voice Processor Module* manual.

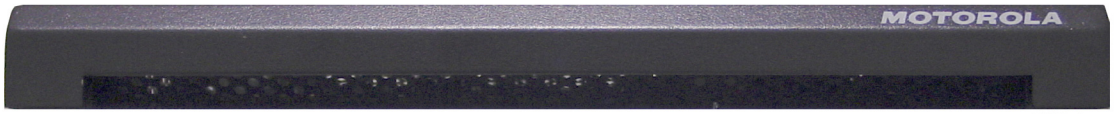
1.2 Voice Processor Module — Hardware Overview

This section describes the front and rear of the Voice Processor Module device, as well as the necessary power supply.

1.2.1 Voice Processor Module — Front View

The following figure shows the front of the device, which provides venting and displays the Motorola Solutions branding.

Figure 1: VPM— Front View

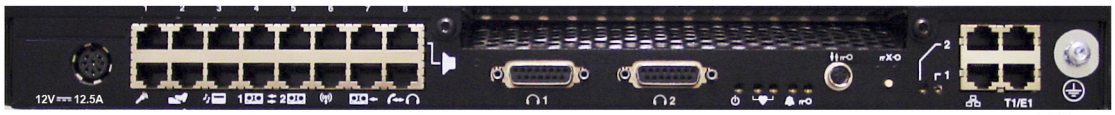


VPM_front

1.2.2 Voice Processor Module — Rear View

The following figure shows the rear of the device where the connectors, ports, and LEDs are located.

Figure 2: VPM— Rear View



VPM_rear

1.2.3
Voice Processor Module — Power Supply

The following figure shows the VPM power supply, cable, and line cord.

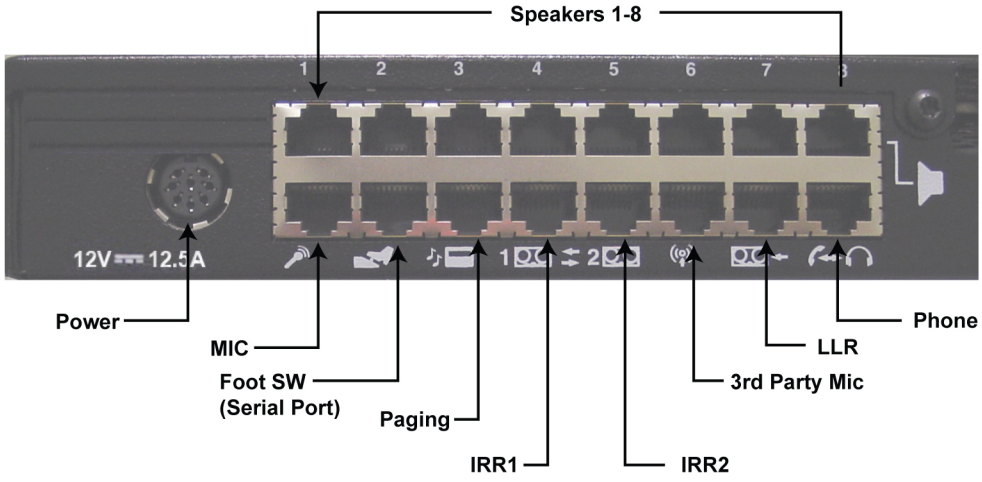
Figure 3: VPM Power Supply

VPM_power_supply

1.3
VPM Rear Connections

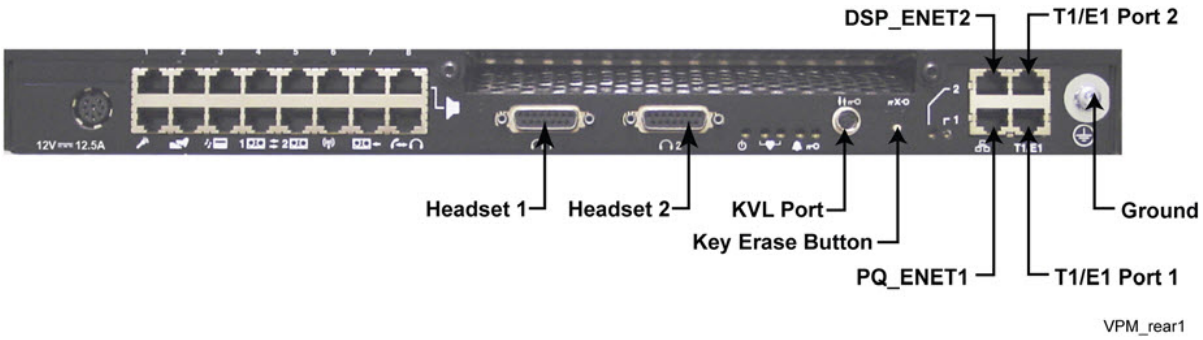
The following figures show the VPM ports on the rear of the VPM.

Figure 4: VPM J1 Port Connections



VPM_rear_ports1

Figure 5: Other VPM Port Connections



The VPM rear panel includes the following port connections:

- J7700 power connector
- J1 port connector:
  - eight speakers
  - microphone
  - footswitch
  - external paging encoder
  - two Instant Recall Recorders (IRR)
  - third-party microphone
  - Local Logging Recorder (LLR)
  - telephone handset
- two headset port connectors — J2 and J3
- Key Variable Loader (KVL) port
- key erase button
- Ethernet and T1/E1 J8000 port connector :
  - DSP_ENET 2
  - PQ_ENET 1
  - T1–E1 (port 1 and port 2)

NOTICE: The use of T1/E1 ports is application-specific.

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Chapter 2

Voice Processor Module Theory of Operation

This chapter provides a basic description of the Voice Processor Module components.

2.1 Voice Processor Module Circuit Description

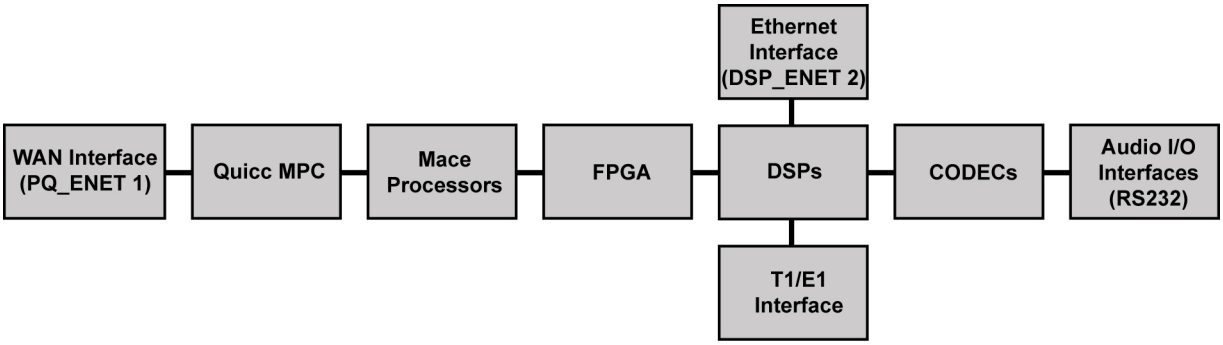
The VPM includes sensitive encrypted information (such as keys) required to be inaccessible. A shield with tamper detection protects the Motorola Advanced Crypto Engines (MACE), their RAM, and Field Programmable Gate Array (FPGA).

The VPM has two networking interface types: Ethernet and T1/E1, that can be used to communicate with other equipment.

The RS232 port is used to initially program the VPM. It also serves as a test and debug interface. There is a second Ethernet port (DSP_ENET 2) on the Digital Signal Processor (DSP). It is intended for future use.

The following figure illustrates the VPM architecture.

Figure 6: VPM Architecture



2.1.1 VPM Network Interface Card

The Network Interface Card (NIC) section of the VPM is responsible for Ethernet communication outside the physical chassis of the VPM.

The main responsibilities of the NIC are:

- switching the 100Base-T Ethernet bus IP packets to/from the serial buses to the MACE devices
- receiving control packets from the radio network and sending control information up to the radio network
- serving as a control interface to the auxiliary relays and optocouplers.

The NIC includes the following components:

- MPC8360 PowerQUICC microprocessor (QUICC)
- 100/1000BaseT Ethernet LAN connection

- RS232 connection
- Auxiliary Input circuits
- Auxiliary Output circuits

2.1.1.1
QUICC

The MPC8360 QUICC microprocessor is the main processor for the VPM and serves as the main switching engine for the NIC.

The PowerQUICC switches the 100Base-T Ethernet bus IP packets to/from the serial buses to the MACE devices. The QUICC is also responsible for receiving and sending control packets to/from a radio network.

2.1.1.2
Ethernet LAN Connection

The NIC supports an Ethernet LAN connection, utilizing the MPC8360 Universal Communications Controller (UCC) port and a Broadcom physical interface chip. The speed and duplex of Ethernet operation is fixed at 100 Mbps full duplex by software configuration.

The NIC Ethernet port (PQ_ENET_1) interfaces with the MPC8360 QUICC microprocessor. This port is a part of the 2x2 RJ-45 connector (J8000). For more details, see the “VPM Connector Diagrams and the Ports to Function Mapping” section in the “Voice Processor Module Reference” chapter of this manual. The DSP_ENET_2 port is not functional at this time.

2.1.1.3
RS232 Connection

The RS232 port is used when setting the IP address through the CSS.

The RS232 port is also used for development engineering. The physical connection for RS232 is on the footswitch port of the J1 (8 x 2 RJ-45) connector. See the “VPM J1 Port Connections” figure in the “VPM Rear Connections” section.

2.1.1.4
Auxiliary Input

There are 16 auxiliary input circuits in a VPM.

Each circuit consists of an optocoupler with its output connected to a microprocessor. The microprocessor reads the state of all auxiliary inputs in one operation. The embedded software has a polling interval between each reading of the auxiliary input ports to allow for circuit de-bouncing. All the auxiliary inputs are dedicated to peripheral functions. The VPM has no local generic use auxiliary inputs.

These inputs connect to the J1 and headset port connectors. For more details, see the “VPM Connector Diagrams and the Ports to Function Mapping” section in the “Voice Processor Module Reference” chapter of this manual.

2.1.1.5
Auxiliary Output

There are four auxiliary output circuits on the VPM. Each circuit consists of a Double Pole Double Throw (DPDT) relay under microprocessor control.

Relay activation occurs when a bit is set to 1, and deactivation when the bit is set to 0 (zero). The relays can handle a maximum input of 24 VDC and up to 1 A. All the auxiliary outputs are dedicated to

peripheral functions. The VPM has no local generic use auxiliary outputs. See the *MCC 7500 Dispatch Console with VPM* manual for more information on the AUX I/O port assignments specific to that device.

These outputs connect to the speaker ports numbered 5-8. For more details, see the “VPM Connector Diagrams and the Ports to Function Mapping” section in the “Voice Processor Module Reference” chapter of this manual.

2.1.2
MACE

The MACE section is the cryptography section of the VPM, responsible for encrypting and decrypting audio.

There are four MACE processors used as the main crypto engines. Each MACE has a dedicated connection to the data router FPGA. The MACEs are connected together by a Synchronous Serial Controller (SSC) serial port for inter-MACE communication.

One MACE is designated as *master*. It provides crypto functions and an interface to an external KVL. The master MACE is responsible for distributing encryption keys, algorithms, and ROM updates to the other MACE devices.

Each MACE has a dedicated connection to:

- The QUICC processor UCC on a 4-wire SSC serial port. The ports operate at 1.024 Mbps with an effective data rate of 1 Mbps.
- A data router FPGA on its own external processor bus. The bus operates at half the system clock speed or 48 MHz.

MACE to MACE inter-communication is handled over the SSC1 port. The return data path of each Slave MACE routes back to the Master MACE through the FPGA.

2.1.3
FPGA

The Field-Programmable Gate Array (FPGA) is responsible for routing audio and control data between the MACE Integrated Circuits (ICs) and the Digital Signal Processors (DSPs).

The FPGA is also capable of carrying data between individual MACEs and DSPs. It may include control data. At power up, the FPGA is configured for operation by the DSP0.

2.1.4
DSP and Memory

The Digital Signal Processor (DSP) section of the VPM is responsible for processing audio.

There are two DSP blocks on the VPM, along with circuitry for interfacing the DSPs to the MACEs and DSP peripherals (CODECs, Ethernet, and T1/E1).

The VPM implements two multi-core DSPs to process audio vocoding tasks.

2.1.4.1
DSP to FPGA Interface

Each DSP has a dedicated connection to the data router FPGA on its external processor bus. Each DSP core is addressable by the FPGA.

2.1.4.2
Ethernet Connection

One DSP supports an Ethernet LAN connection, utilizing the MII (Media Independent Interface) port of the DSP and a Broadcom physical interface chip.

The user interface to the Ethernet LAN connection is labeled (DSP_ENET 2) and is a part of the 2x2 RJ-45 connector (J8000). This connection port is not functional and is intended for future use. For more details, see the “VPM Connector Diagrams and the Ports to Function Mapping” section in the “Voice Processor Module Reference” chapter of this manual.

2.1.4.3
T1/E1

The DSPs support a two-channel connection to the T1/E1 Line Interface IC.

Each channel operates at a 2.048 Mbps data rate with an 8 kHz frame rate. Each channel is routed to an RJ-48 connector on the enclosure. For certain applications, this interface is intended to connect to the external circuit switched networks through an approved channel service unit or channel bank.

2.1.4.4
CODEC

The word codec is a portmanteau of “compressor-decompressor” or, more commonly, “coder-decoder.” In the VPM, this component of the Network Interface Card converts audio I/O paths.

The DSPs connect to eight audio CODECs to interface the DSPs to the analog circuitry. The CODECs provide the A/D (Audio/Digital) and D/A (Digital/Audio) conversion for the audio I/O paths. The CODECs also provide audio gain through an internal software Programmable Gain Amplifier (PGA). One DSP (designated DSP0) is responsible for the interface connection to the CODECs. Both DSPs can send and receive audio data to the CODECs.

2.2
VPM Circuit Interaction

This section describes the example audio receive and transmit paths.

The audio receive path is as follows:

1 The encrypted inbound audio is routed from the local network to the QUICC, processed, and then forwarded to the MACE.

2 The MACE decrypts the data, repackages it, and forwards it to a DSP.

3 The DSP decodes and processes the audio data and routes it to a CODEC.

4 The CODECs convert the audio data to analog audio, and route the audio to a receiving peripheral device, such as a speaker.

Transmit audio, such as from a microphone, is processed as follows:

1 Transmitting peripheral device routes the analog audio to the CODECs which convert it to audio data and route it to the DSP.

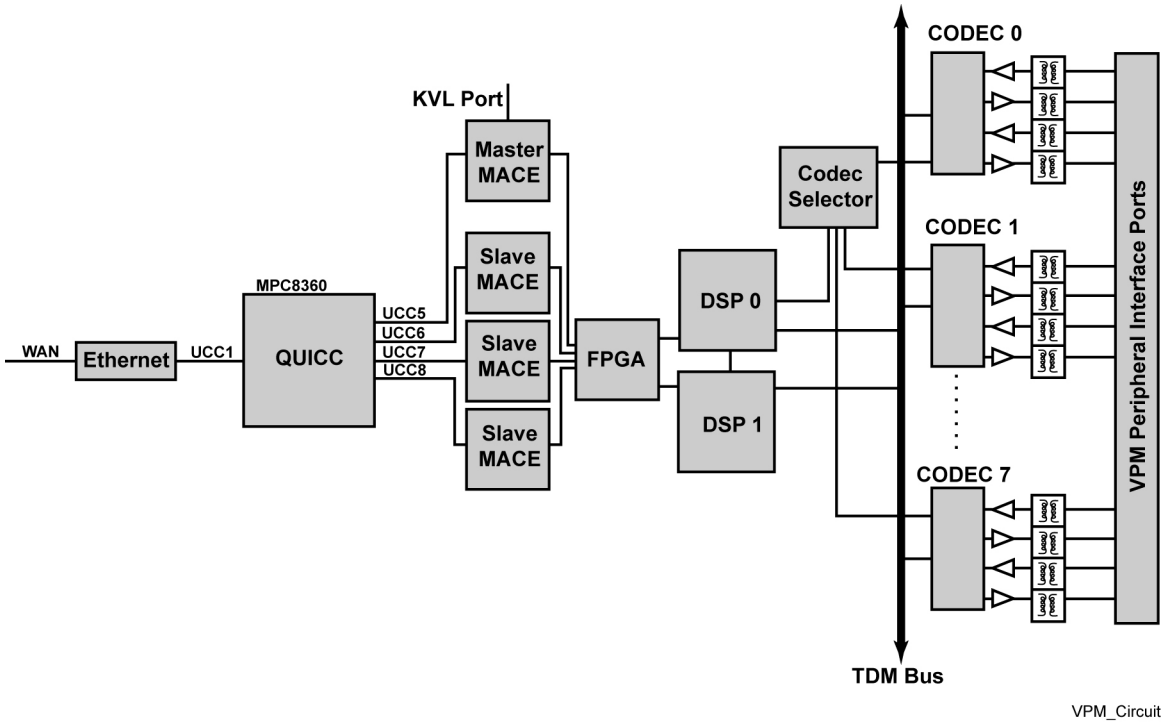
2 The DSP processes and encodes the audio data, and forwards it to the MACE.

3 The MACE encrypts data and routes it to the QUICC.

4 The QUICC passes the processed audio out to the local network.

This diagram shows the receive and transmit audio paths.

Figure 7: VPM Architecture — Receive/Transmit Path



In addition, the QUICC processes inbound call control data coming from the radio network over the Ethernet interface. MACE routes the control information between QUICC and DSPs.

The VPM interfaces to audio and auxiliary devices (such as microphones, speakers, and recorders). It can support 16 audio input paths and 16 audio output paths simultaneously and independently. Additionally, it can detect 16 auxiliary input signals and control four relay closures.

2.3 VPM Power Distribution Circuit

The VPM is provided with power by an AC-powered 12 VDC, 108 W external regulated power supply.

The power supply is connected to the AC line voltage at one end and the 12 VDC connector on the VPM at the other end. The 12 VDC input to the VPM powers a range of external system elements: microphones, speakers, headsets, and internal analog and digital circuitry.

2.3.1 Analog Circuitry

Analog power circuitry consists of linear Low-Drop Out (LDO) regulators lowering 12 VDC to 10.0 VDC and to 3.3 VDC. The advantage of these regulators is low electrical noise at their DC outputs.

2.3.1.1 On-board (12 V)

The on-board 12 V supplies the source of power for the internal board components.

On-board 12 V is fused from input with a 5 A fuse. Regulated input 12 V is routed to the speaker and headset ports to power those peripherals. Each port supply is fused with a 2.5 A Positive Temperature Coefficient (PTC) fuse.

2.3.1.2
Analog Output (10.0 V)

A 10.0 V, 1.0 A linear regulator provides power for the analog audio output circuit.

There are 16 circuits that present a nominal load current of 111 mA.

2.3.1.3
Analog Input (3.3 V)

A 3.3 V, 1.0 A linear regulator provides power for the analog audio input circuit, and is used as analog power for the CODEC IC analog core.

There are 16 circuits that present a nominal load current of 126 mA. The power sequencer circuitry enables the LDO regulator shortly before enabling the 1.8 V CODEC power source.

2.3.2
Digital Circuitry

Digital power circuitry consists of a primary Pulse Width Modulator (PWM) converter with a 12 V input and 3.3 V output.

This DC source provides input voltage to all the other PWM and LDO sources powering the digital logic and control circuitry. The digital load circuitry is subdivided into large microcontroller-based subsystems. Each subsystem has specific requirements for accurate core and I/O voltages, and for the sequence in which these voltages are applied to the microcontroller circuitry. Monitoring output voltages for accuracy and controlling the start-up is performed within a single power sequencing IC.

2.3.2.1
Back-end (3.3 V)

The Back-end 3.3 V provides power to all digital power regulators and the power sequencer circuit.

Back-end 3.3 V is derived from regulated 12 V using a 15 A switching regulator circuit. Back-end power is provided shortly after 12 V is powered.

2.3.2.2
Board 3.3 V

Board 3.3 V is a FET-switched output derived from the back-end 3.3 V.

The 3.3 V board is switched to provide correct timing to 3.3 V board power. The power sequencer that controls the switch handles up to 13.6 A. Board 3.3 V provides power to all 3.3 V circuits, including I/O voltage for dual-power devices (such as the QUICC and the DSPs).

2.3.2.3
QUICC 1.2 V

The QUICC processor requires a 1.2 V, 6 A switching regulator to supply core power.

This regulator is powered from the back-end 3.3 V and enabled by the power sequencer.

2.3.2.4
QUICC DDR SDRAM 1.8 V

A 1.8 V, 3 A switching regulator powers the QUICC DDR2 SDRAM. The QUICC also uses this supply to power the DDR bus driver I/O. This regulator is powered from the back-end 3.3 V and enabled by the power sequencer.

2.3.2.5
MACE 1.8 V

MACE circuitry requires a 1.8 V, 3 A switching regulator to supply core power to four devices. Due to the power sequencing requirements of the MACE device, power is provided in two stages: a bulk 1.8 V powered directly from the 1.8 V regulator and a switched 1.8 V power FET-switched after bulk 1.8 V power is applied. The power sequencer controls both the bulk 1.8 V regulator and the FET switch.

2.3.2.5.1
MACE 1.8 V Battery Backup

A 3 V coin cell battery provides battery backup power to each MACE to ensure the key retention when the VPM is unpowered. This battery is regulated down to 1.8 V to power the MACE battery backup power pins.

2.3.2.6
FPGA Core 1.2 V

A 1.2 V, 1.0 A linear regulator powers the FPGA core. This regulator is powered from the back-end 3.3 V and enabled by the power sequencer.

2.3.2.7
FPGA PLL 2.5 V

A 2.5 V, 1.0 A linear regulator powers the FPGA PLL. This regulator is powered from the back-end 3.3 V and enabled by the power sequencer.

2.3.2.8
DSP 1.2 V

A single 1.2 V, 6 A switching regulator applied to two devices powers the Digital Signal Processor (DSP) cores. This regulator is powered from the back-end 3.3 V and enabled by the power sequencer.

2.3.2.9
CODEC 1.8 V

The CODEC digital core is powered by a 1.8 V, 1.0 A linear regulator. This regulator is powered from the back-end 3.3 V and enabled by the power sequencer.

2.3.2.10
Digital Power Sequencing

A Lattice IC is used for the power sequencing of the digital power supplies.

This sequencer allows the sections of the board to be powered according to their required sequence. It monitors each of the subsystem voltages to assure they are within a required tolerance. It is also used as the main power-on reset controller for the board. Power sequencing does not monitor the 12 V input voltage, 10.0 V or 3.3 V analog voltages, or backup battery voltage. Of these voltages, only the 3.3 V analog voltage is sequenced.

The following sequence describes the events that occur during the start-up process:

1 12 VDC is applied to the 3.3 V back-end source which then powers the Lattice IC circuit.

2 The Lattice IC internal programming establishes the sequence and logic outputs.

3 The MACE bulk 1.8 V source is powered.

4 The QUICC microprocessor is powered.

5 The FPGA device is powered.

6 The 3.3 V analog source and the CODEC devices are powered.

7 The DSP system is powered.

8 The MACE switched 1.8 V and also the switched 3.3 V I/O source power for all logic subsystems is enabled.

9 After the digital sources are started, a “power good” logic signal is generated for each of the sections that are functioning correctly.

After the initial start-up, the Lattice IC operates in a continuous loop, repeatedly monitoring each of the digital power sources for proper voltage tolerance. Any faulty voltage causes either a portion of the circuitry to turn off or forces the entire VPM circuitry to restart (at step 3).

2.4 Key Erase Circuit

The key erase circuit is required to protect encryption keys.

In situations where it is necessary, the operator can press the key erase button triggering the MACE to immediately erase the encryption keys. Pressing the key erase button results in the immediate termination of call processing by the VPM. The MACE ICs are forced into a reset. After the QUICC detects the MACE IC reset, the entire VPM resets.

Chapter 3

Voice Processor Module Installation

This chapter details installation procedures relating to the Voice Processor Module.

3.1 VPM Mounting

There are three options for mounting the Voice Processor Module.

The Voice Processor Module can be:

- Electronic Industries Association (EIA) 19” rack mounted:
  - without clearances above or below it
  - front-chassis, mid-chassis, and rear-chassis rack mounted
- console furniture mounted
- flat surface mounted:
  - supports a weight of 80 pounds (36 kilograms) when mounted on a flat surface
  - on the underside of the writing surface
  - on the top side of the writing surface

3.2 Cable Connections

The VPM receives 12 VDC power from an external power supply. The external power supply is powered from nominal 100 VAC to 240 VAC and provides nominal 12 VDC output to the VPM.

Proper grounding of the chassis enclosure and T1/E1 cabling to the chassis enclosure is important. See the “VPM Other Port Connections” figure for the location of the chassis enclosure ground screw.

When the Voice Processor Module is used in applications that require the T1/E1 interface, it is installed in a central location, and connects to a remote site over an external PSTN line, it is important to connect to the external PSTN circuit through an intervening Channel Service Unit (CSU). This CSU provides the necessary protection between the VPM T1/E1 interface and the Telco equipment. In other words, do not connect the VPM T1/E1 interface to an external circuit. If the VPM is colocated at the remote site, then its T1/E1 interface can be directly connected to a channel bank.

3.3 Software Installation

The VPM is pre-loaded with its application-specific software at the factory. Details on the installation and configuration of the VPM device is dependent on the application.

See the following manuals for the complete installation and configurations tasks for a specific VPM-based device:

- *Enhanced Telephone Interconnect Feature Guide* manual (for Telephone Media Gateway)
- *MCC 7500 Dispatch Console with Voice Processor Module* manual
- *SmartX Site Converteuider Feature G* manual

3.4

Software Download Manager Installation and Data Transfer

Software Download Manager (SWDL) is an application that can transfer only, install only, or transfer and install new software to devices.

The new software can be installed either locally at a site or on the Network Management subsystem. Individual devices not connected to the system can be downloaded using single device mode.

Perform data transfer using one of the following settings:

Clear SWDL
Transfer operations without security, based on the File Transfer Protocol (FTP). This setting is the default transfer mode for VPM-based devices.

Secure SWDL
Transfer operations are encrypted, based on the Secure File Transfer Protocol (SFTP).

IMPORTANT: Before initiating transfer, SWDL connects to the zone and site to discover all devices. The transfer mode of all devices displays in the SWDL window. It is important that all devices have the same SWDL transfer mode. Otherwise, the SWDL flags a mismatch of the SWDL transfer modes across site devices.

NOTICE: CSS can configure the SWDL transfer mode of the device using the Remote Access/ Login Banner Screen on one device at a time. Unified Network Configurator (UNC) can schedule and configure all devices in the system at once. After the SWDL credentials are initially configured, user intervention is not required during the SWDL process.

For information on how to configure the secure or clear SWDL transfer mode, see the *Unified Network Configurator* manual and “Device Security Configuration” in the *CSS Online Help*.

SWDL operation can be fault managed through UEM, syslog, local SWDL log files, user messages, and device reports. See the *Software Download Manager* manual.

Chapter 4

Voice Processor Module Configuration

This chapter details configuration procedures relating to Voice Processor Module.

4.1 Local Configuration

There are no accessible DIP switches for the VPM. DIP switches, internal to the chassis (S1 and S6000_6), are preset at the time of manufacture and do not require any changes in their default positions. By default, the S1 is set to ON, and S6000_6 is set to OFF.

4.2 Network Management Configuration

The Voice Processor Module is configured, managed, and serviced using the Unified Network Configurator (UNC) and Configuration/Service Software (CSS).

Details on the installation and configuration of the VPM hardware is dependent on the application. See these manuals for the complete installation and configurations tasks for a specific VPM-based device:

- *Enhanced Telephone Interconnect Feature Guide* manual (for Telephone Media Gateway)
- *MCC 7500 Dispatch Console with Voice Processor Module* manual
- *SmartX Site Converter Feature Guide* manual

The VPM is also used for the enhanced console telephony feature. You can configure the VPM to communicate with the Console Telephony Media Gateway. See “Console Telephony - Installation and Configuration Sequence” in the *MCC 7500 Dispatch Console with Voice Processor Module* manual.

4.2.1 VPM Configuration in the Unified Network Configurator

The configuration with the Unified Network Configurator (UNC) is not required until the VPM is installed as a specific application in a system.

4.2.2 VPM Configuration in the CSS

This section covers the initial configuration of the Voice Processor Module in the Configuration/Service Software (CSS). See the *CSS Online Help*.

4.2.2.1 Setting the IP Address of the VPM Device in the CSS

This procedure describes the steps required to set the IP address of the VPM device.

Prerequisites: This procedure assumes that the CSS is loaded on your computer and the VPM is powered and operating. See the *Private Network Management Client* manual or *CSS Online Help*, if necessary.

When and where to use:

Use this procedure during the initial configuration of the device.

NOTICE: The serial port is labeled as footswitch port on the J1 connector. Use the DB9F/RJ-45 VPM Programming Adapter (see the “FRU/FRE Parts List” section) and the RS232 cable. For pinout details, see the “Voice Processor Module Reference” chapter.

IMPORTANT: Changing the device IP address causes the SNMPv3 configuration and user credentials to be reset.

Procedure:

1. Connect a serial cable between the COM1 port (on the laptop or the PC running the CSS application) to the footswitch (serial) port on the rear panel of the VPM.

   The laptop with the CSS application connects to the device.

2. Launch the CSS application.

   The CSS application opens

3. Do one of the following actions:
   - Select **Tools** → **Connection Configuration**.
   - On the toolbar, click **Connect to Device**.

   The **Connection Screen** dialog box appears.

4. From the **Type of Connection** form, select **Serial**.

   The **Serial** form on the dialog box becomes active.

5. Select the communication port in the **Serial Port** field that matches the one selected on the PC.
6. Select `19200` as the baud rate in the **Baud Rate** field.
7. Click **Connect**.

   NOTICE: If the device requires authentication, a login prompt appears. Type the user name, password, and elevated privileges password in the pop-up window. Click **OK**.

   The **Communications Setup Verified** dialog box appears.

8. Click **OK** to close the dialog box.

   The blank **CSS** main window appears. The **Service** menu is not available until you read the configuration file from the device.

9. Select **Tools** → **Set IP Address/Box Number**.

   The **IP Address/Box Number** window appears.

10. Type the IP address in the **Device IP Address** field. Click **Set IP Address**.

    The IP address is set and the system prompts you to click the Reset button.

11. Type the Netmask value in the **Netmask** field. Click **Set Netmask**.

    The Netmask is set and the system prompts you to click the Reset button.

12. Click **Reset**.

    NOTICE: After a VPM device reset, the SNMPv3 user credentials and configuration are reset to defaults. You can reconfigure SNMPv3 user credentials or settings only after the device is reset.

    SNMPv3 user credentials reset to their factory default values.

13 Reconfigure the SNMPv3 user credentials using the CSS. See the VPM-based feature manual for details.

The SNMPv3 user credentials are set.

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Chapter 5

Voice Processor Module Operation

This chapter details tasks to perform once the Voice Processor Module is installed and operational on your system.

The operational tasks, such as logging on, differ based on the specific use of the VPM.

5.1 Turning On the VPM

Perform this procedure to turn on the VPM and verify that it is working.

Prerequisites: Ensure that the device is securely mounted before performing this procedure.

When and where to use: Perform this procedure to begin using the VPM hardware in your ASTRO® 25 system.

WARNING: Before performing this procedure, ensure that VPM power supply line cord is not connected to an AC source.

Procedure:

1. Connect the VPM power supply 12 V output cable between the power supply output connector and the VPM rear panel connector.

   The power supply attaches to the rear panel of the VPM.

2. Connect the VPM power supply line cord to an AC source.

   The VPM attaches to the power source.

3. Verify that the power LED illuminates. See the “VPM LEDs” section in the “Voice Processor Module Reference” chapter.

   The Power LED illuminates.

5.2 Turning Off the VPM

Perform this procedure to turn off the VPM.

When and where to use:
Perform this procedure to discontinue using the VPM hardware in your ASTRO® 25 system.

CAUTION: Do not remove the cover while the device is turned on. If you do not follow this procedure, arcing or damage to connected equipment may occur though the VPM contains low, safe voltage levels. Unplug the power supply 12 V cable from the VPM when preparing to service this equipment.

Procedure:

1. Disconnect the VPM power supply line cord from an AC source.

   The device is no longer attached to the power source.

2 Disconnect the power supply 12 V cable from the rear of the VPM chassis.

The power supply is no longer attached to the device.

The Power LED no longer illuminates.

Chapter 6

Voice Processor Module Maintenance

This chapter describes periodic maintenance procedures relating to the Voice Processor Module.

6.1 VPM Hardware Maintenance

Other than periodic replacement of the VPM backup battery, there are no serviceable parts in the VPM that require maintenance or calibration. Exterior cleaning using a clean, lint-free cloth, or a soft brush is sufficient.

The following table lists the suggested replacement times for the MACE's battery backup.

CAUTION: Risk of damage to the battery or VPM circuitry if the battery is replaced with an incorrect type. Properly dispose of used batteries.

Table 1: VPM Backup Battery Replacement Schedule

VPM State	Replacing Time
Installed in the system	Every two years
Stored	Once a year

6.1.1 Replacing the VPM Backup Battery

This procedure describes how to replace the VPM backup battery.

When and where to use:
Use this procedure to replace the battery during scheduled preventive maintenance or as the result of a failure.

CAUTION: There is a risk of damage to the battery or VPM circuitry if the battery is replaced with an incorrect type. Properly dispose of used batteries. Replace the battery as soon as you receive the low battery warning.

Procedure:

1. Close all applications.
2. Unplug the VPM power supply line cord from an AC source.

   The device is no longer attached to the power source.
3. Disconnect all power and data/control connections to and from the VPM.

   The device is no longer attached to the power supply and data/control connections.
4. Dismount the VPM from the equipment rack or furniture where it is mounted.

   The device is easily accessible.
5. Remove the cover screws and the chassis cover from the VPM.
6. Unpack the replacement battery.

CAUTION: Replacement must be completed within 30 seconds to avoid the loss of stored electronic security code keys. Study the next two steps to make sure that you can perform them in a short time.

7 The Renata battery holder has a latching feature, which ensures that the battery does not come loose during normal operation. Release the latch before removing the battery

CAUTION: Take appropriate anti-static precautions before attempting battery removal.

a With the thumb and forefinger of one hand, grasp the sides of the battery in the holder.

b With the fingers of the other hand, pull back on two of the latch arms to release the latch feature.

c Rotate the battery up and out of the holder.

CAUTION: Failure to release the latch may result in damage to the battery holder and/or the PC board.

8 Place the new battery carefully on top of the holder and with a slight rocking action, push it downward into the holder.

The new battery is in place.

9 Reinstall and secure the VPM chassis cover.

The VPM is ready for re-installation.

10 Remount the VPM into the equipment rack or furniture.

11 Reconnect all data/control and power connections to the VPM.

12 Reconnect the power supply 12 V cable.

13 Reconnect the power supply line cord to an AC source.

14 Verify the Power LED status and restore the proper operation of the VPM within the system.

15 Properly dispose of the old (Lithium) battery.

The VPM has a new battery, which lasts for two years.

6.2 VPM Software Maintenance

The Operating System configuration updates depend on the specific use of the VPM and are accomplished in the Unified Network Configurator (UNC) application.

Chapter 7

Voice Processor Module Troubleshooting

This chapter provides fault management and troubleshooting information relating to the Voice Processor Module.

7.1 VPM Troubleshooting Overview

After removing a failed VPM, the hardware must be shipped to the Motorola Solutions Infrastructure Depot Operations (IDO) for further troubleshooting and repair.

The Motorola Solutions Support Center (SSC) provides technical support, return material authorization (RMA) numbers, and confirmations for troubleshooting results. Call the SSC for information about returning faulty equipment or ordering replacement parts. North America: 1-800-221-7144 / International: 302-444-9800.

CAUTION: Do not attempt to repair or service subcomponents in the VPM equipment.

7.2 Software Download Troubleshooting for the VPM

The Unified Network Configurator (UNC) management software provide secure Software Download (SWDL) to all VPM-based devices. When you are unable to download the software using secure SWDL, you can download in clear mode (default). See the *Unified Network Configurator* manual for more information.

7.3 Local Tools Troubleshooting for the VPM

The VPM does not have any field-replaceable parts and must be returned to a Motorola Solutions-authorized representative or a repair facility for repair. However, before doing so, use the following troubleshooting table to ensure that the VPM, not some other component, is defective.

Table 2: VPM — General Troubleshooting

Symptom	Possible Problem or Action
No power (no front panel LED is lit)	• Check the power cord connection to the VPM and to the power source. • Check the power source to ensure that it is operating properly.
Only one front panel LED is lit	• Unplug and reconnect the VPM power supply AC line cord to force the VPM power system to restart.

Table continued…

Symptom	Possible Problem or Action
Security Alarm LED is on	• A major critical hardware failure at MACE chips is detected. Power down and then power up the VPM (see “Voice Processor Module Operation” chapter).
Red Status LED is flashing	• A software upgrade failed. Perform a rollback of a software upgrade using the UNC.
VPM emitting an unusual odor or sound	• A possible indication of a severe problem, such as an impending power failure, blockage of air movement, introduction of a foreign element, or radio-frequency interference. Immediately disconnect the VPM from its power source and visually inspect it for any visible problems.
A peripheral device is not responding or is not responding properly	• Check for a defective connection or cable. • Check the peripheral device for proper operation. • Check the configuration data to ensure that the VPM is configured to support the peripheral devices. • Unplug and reconnect the VPM power supply AC line cord to force system power restart.
Unable to connect to VPM using serial cable	Uncheck the Use **FIFO buffer (requires 16550 compatible UART)** option in the **Advanced Settings** for the com port. Click **OK**.

7.4 Resetting Passwords and SNMPv3 Passphrases

You can enable/disable the password reset mechanism in the CSS application. See the *CSS Online Help's* “Device Security Configuration - Security Services (Serial)” screen for information. To obtain the keys for resetting either password or SNMPv3 passphrases, contact the Motorola Solution Support Center.

NOTICE: The keys for resetting the local password and passphrases in these troubleshooting scenarios vary by system release and are sensitive information provided to you through secured communication.

Table 3: Local Password and SNMPv3 Passphrase Troubleshooting

Scenario	SNMPv3 Passphrase Known	Local Password Known	To Reset SNMPv3 Passphrase	To Reset Local Login Password
User is locked out of local login, but knows SNMPv3 passphrases	✔	✘	See the *CSS Online Help's* “SNMPv3 User Configuration”.	See the *CSS Online Help's* “Resetting Device Passwords”.
User knows local login, but not the SNMPv3 passphrases	✘	✔	See the *CSS Online Help's* “Reset	See the *CSS Online Help's* “Device Security Configu-

Table continued…

Scenario	SNMPv3 Passphrase Known	Local Password Known	To Reset SNMPv3 Pass-phrase	To Reset Local Login Password
			SNMPv3 Configu-ration (Serial)".	ration – Security Services (Serial)".
User knows both passphrases and local service password	✓	✓	See the *CSS On-line Help's* "SNMPv3 User Configuration".	See the *CSS On-line Help's* "Device Security Configu-ration – Security Services (Serial)".
User does not know SNMPv3 passphrase nor service account password	✗	✗	Contact the Motor-ola Solutions Sup-port Center.	Contact the Motor-ola Solutions Sup-port Center.

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Chapter 8

Voice Processor Module FRU/FRE Procedures

This chapter lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs), and includes replacement procedures applicable to the Voice Processor Module.

8.1 FRU/FRE Parts List

The following table provides the VPM parts list.

Table 4: VPM Parts List

Kit/Part Number	Description
B1933A	Motorola Solutions Dispatch/Archiving Interface Server (AIS) Voice Processor Module, includes the external power supply
T7599A	Motorola Solutions SmartX Site Converter Voice Processor Module, includes the external power supply
T7589A	Motorola Solutions Telephone Media Gateway Voice Processor Module, includes the external power supply
B1934A	MCC 7500 Voice Processor Module FRU
B1936A	SmartX Voice Processor Module FRU
01009513002	VPM Power Supply FRU
30009351001	DC Cable (connects 12V DC from the power supply to the VPM)
1575395h01_revD	Power Supply Tray
42009052001_revB	Power Supply Velcro Fastener (for use with tray)
600092-560-01	Backup Battery
58009256065	DB9F/RJ-45 VPM Programming Adapter
CDN6637	Channel Service Unit (CSU)

8.2 Replacing the VPM

The VPM does not have any field-replaceable parts. Follow this procedure to replace the VPM and then prepare to return the decommissioned VPM to Motorola Solutions.

When and where to use: Use this procedure when a deployed VPM has failed and you have received a replacement unit from the Motorola Solutions Support Center (SSC).

Procedure:

1. Close all applications.
2. Unplug the VPM power supply line cord from an AC source.

3. Disconnect all power and data/control connections to and from the VPM.
4. Dismount the VPM from the equipment rack or furniture where it is mounted.
5. Mount a serviceable VPM into the equipment rack or mounting furniture.
6. Reconnect all data/control and 12 V power supply connection to the VPM.
7. Reconnect the power supply line cord to an AC source.
8. Verify the status of the Power LED and restore the proper operation of the VPM within the system.
9. Properly package the replaced VPM for transport and send it to the appropriate repair facility.

The new VPM is ready for software installation and configuration.

8.3 VPM Component Disposal

After removing a failed VPM, it must be shipped to the Motorola Solutions Infrastructure Depot Operations (IDO) for further troubleshooting and repair. For details, see the “General Troubleshooting” section in the “Voice Processor Module Troubleshooting” chapter of this manual.

Properly dispose of any replaced backup batteries (Lithium type).

Chapter 9

Voice Processor Module Reference

This chapter contains supplemental reference information relating to the Voice Processor Module.

9.1 VPM Specifications

The following table lists the physical specifications for the Voice Processor Module.

Table 5: VPM Specifications

Voice Processor Module	Specifications
Physical dimensions	Height: 1.75 inches (44.5 millimeters) — 1 Rack Unit (RU)
	Width: 16.9 inches (430 millimeters)
	Depth: 12.3 inches (312 millimeters)
Weight	3.6 lbs (1.6 kg)
AC Operating Voltage	96 VAC — 264 VAC
	(47 Hz — 63 Hz)
Power Consumption (nominal)	0.4 A at 120 VAC
	0.2 A at 240 VAC
Thermal Output	171 British Thermal Units (BTUs)/hour
Standard	• Underwriters Laboratories (UL) / Canadian Standards Association (CSA) • European Conformity (CE) • Chinese Materials Management (CMM) • Federal Communications Commission (FCC) • Reduction of Hazardous Substances (RoHS) • Waste Electrical and Electronic Equipment (WEEE)
Operating Temperature	5 °C (41 °F) — 40 °C (104 °F)
Non-operating Temperature	-10 °C (14 °F) — 60 °C (140 °F)
Relative Humidity - Operating	0% — 90% relative humidity at 40 °C non-condensing
Relative Humidity - Non-operating	0% — 90% relative humidity at 60 °C non-condensing

9.2 VPM Connector Diagrams and the Ports to Function Map

The schematic diagrams in this section show the pinout arrangement of each VPM connector.

The tables map the VPM I/O ports J1, J2, and J8000 to their respective audio, auxiliary, and power function. Each port has its pin pairs with the polarity “+” and “–” symbols mapped to the pin function.

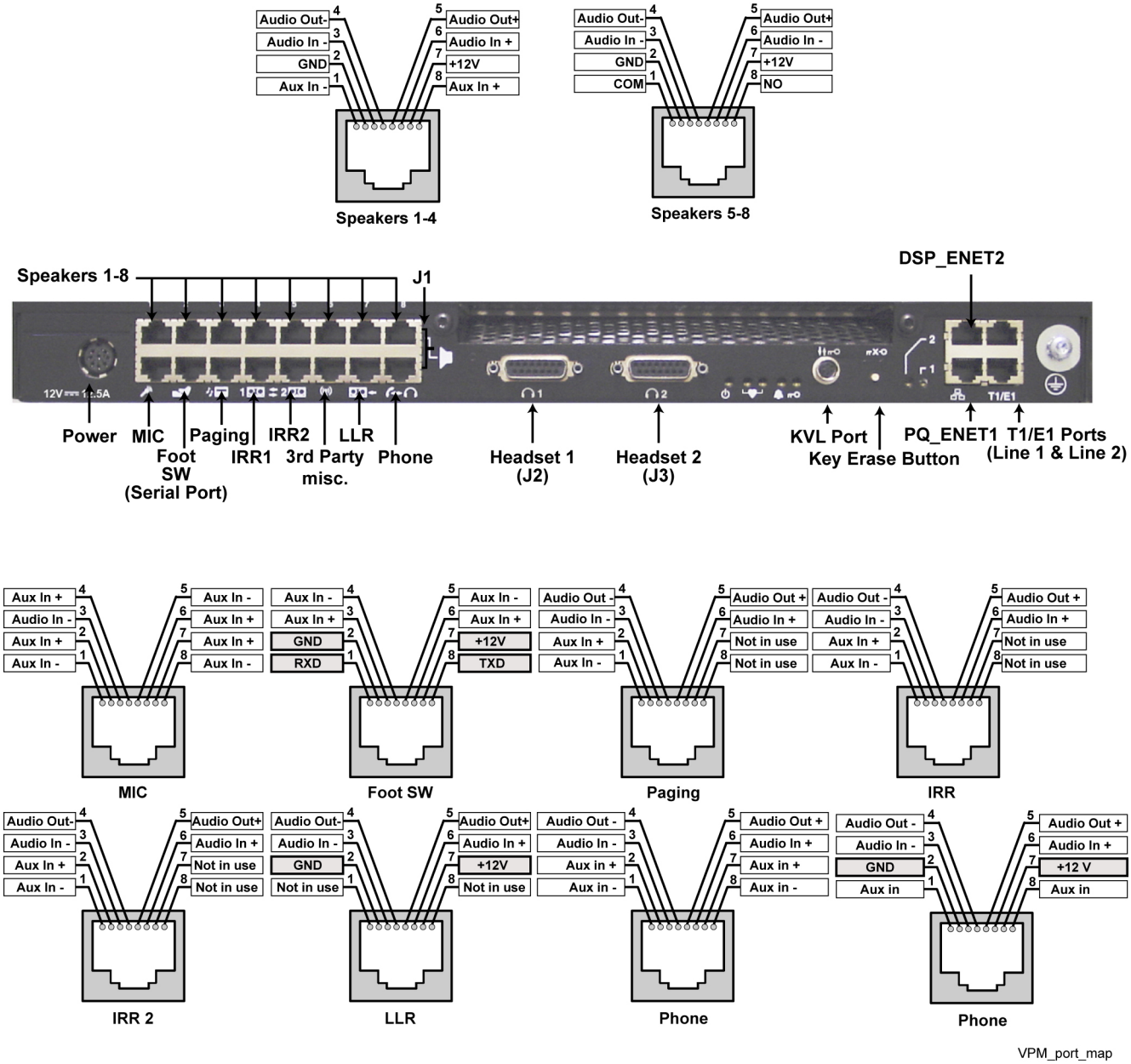
Pins with NO/COM/NC designations see the relay positions of common, normally open, and normally closed.

NOTICE: See the *MCC 7500 Dispatch Console with Voice Processor Module* manual for more information on the AUX I/O port assignments specific to that device.

9.2.1
J1 Ports to Function Mapping

The following illustration shows the pinout for the J1 RJ-45 connectors.

Figure 8: J1 RJ-45 Connectors



VPM_port_map

The following table illustrates the J1 port connectors.

Table 6: J1 Port to Function Map

RJ-45 Port	J1 RJ-45 Stacked 8x2 Assembly							
SPKR (1)	8(+)	1(-)	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	Aux in (8)		Audio In CH [1]		Audio Out CH [1]		+12V	GND Filtered
SPKR (2)	8(+)	1(-)	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX In (9)		Audio In CH [2]		Audio Out CH [2]		+12V	GND Filtered
SPKR (3)	8(+)	1(-)	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX In (14)		Audio In CH [3]		Audio Out CH [3]		+12V	GND Filtered
SPKR (4)	8(+)	1(-)	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX In (15)		Audio In CH [4]		Audio Out CH [4]		+12V	GND Filtered
SPKR (5)	8/NO	1/COM	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX Out (3)		Audio In CH [5]		Audio Out CH [5]		+12V	GND Filtered
SPKR (6)	8/NO	1/COM	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX Out (2)		Audio In CH [6]		Audio Out CH [6]		+12V	GND Filtered
SPKR (7)	8/NO	1/COM	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX Out (1)		Audio In CH [7]		Audio Out CH [7]		+12V	GND Filtered
SPKR (8)	8/NO	1/COM	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	AUX Out (0)		Audio In CH [8]		Audio Out CH [8]		+12V	GND Filtered
MIC	4(+)	5(-)	6(+)	3(-)	2(+)	1(-)	7(+)	8(-)
	AUX In (1)		Audio In CH [15]		AUX In CH [0]		AUX In (10)	
PAGER ENCODER	2(+)	1(-)	6(+)	3(-)	5(+)	4(-)	8	7
	AUX In (11)		Audio In CH [14]		Audio Out CH [14]		Not used	
IRR1	2(+)	1(-)	6(+)	3(-)	5(+)	4(-)	8	7
	AUX In (8)		Audio In CH [9]		Audio Out CH [9]		Not used	
IRR2	2(+)	1(-)	6(+)	3(-)	5(+)	4(-)	8	7
	AUX In (15)		Audio In CH [10]		Audio Out CH [10]		Not used	
3rd party Mic	8	1	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)

Table continued…

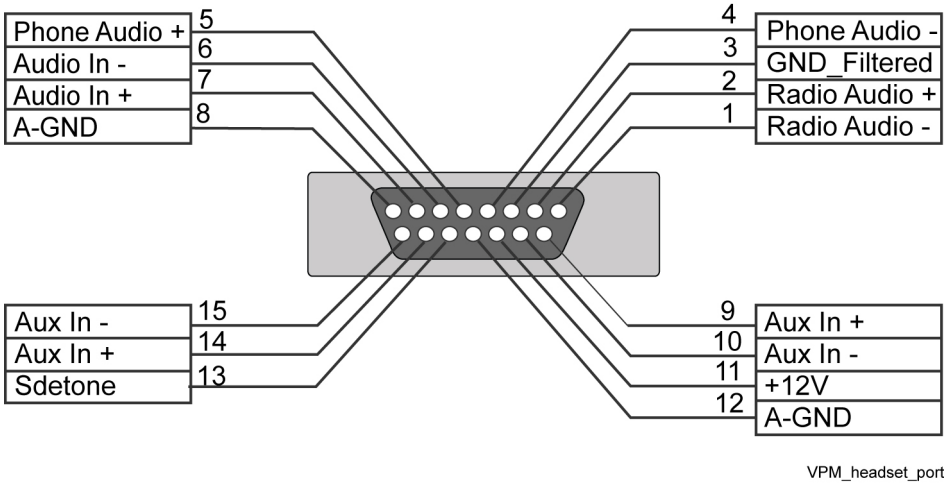
RJ-45 Port	J1 RJ-45 Stacked 8x2 Assembly							
	AUX In (15)		Audio In CH [16]		Audio Out CH [16]		+12V	GND Filtered
LLR Logging Recorder	8	1	6(+)	3(-)	5(+)	4(-)	7(+)	2(-)
	Not used		Audio In CH [12]		Audio Out CH [12]		+12V	GND Filtered
PHONE	2(+)	1(-)	6(+)	3(-)	5(+)	4(-)	7(+)	8(-)
	AUX In (12)		Audio In CH [13]		Audio Out CH [11]		AUX In (13)	
FOOT SWITCH	1	8	3(+)	4(-)	6(+)	5(-)	7(+)	2(-)
	RXD	TXD	AUX In (6)		AUX In (7)		+12V	GND Filtered

9.2.2

J2 Port to Function Mapping

The following figure illustrates headset 1, two port (J2/J3) connector.

Figure 9: Headset 1, two Port (J2/J3) Connector



The following table illustrates the headset 1 port (J2) port connector.

Table 7: Headset 1 Port (J2) to Function Map

Headset 1 Port (J2)	
DB15 Pin	**Description (+) and (–) symbols indicate pin polarity**
1	Radio Audio (-) Audio Out CH [15] (-)
2	Radio Audio (+) Audio Out CH [15] (+)
3	GND Filtered
4	Phone Audio(-) Audio Out CH [13] (-)
5	Phone Audio(+) Audio Out 9 CH [13] (+)

Table continued…

Headset 1 Port (J2)	
DB15 Pin	**Description (+) and (–) symbols indicate pin polarity**
6	Audio In CH [11] (-)
7	Audio In CH [11] (+)
8	A-GND
9	AUX In (2) (+)
10	AUX In (2) (-)
11	12V
12	A-GND
13	HS_ST_1
14	AUX In (3) (+)
15	AUX In (3) (-)

9.2.3

J3 Port to Function Mapping

The following table illustrates the headset 2 port (J3) port connector. The connector pinout is the same as headset 1 port (J2).

Table 8: Headset 2 Port (J3) to Function Map

Headset 2 Port (J3)	
DB15 Pin	**Description (+) and (–) symbols indicate pin polarity**
1	Radio Audio (-) Audio Out CH [16] (-)
2	Radio Audio (+) Audio Out CH [16] (+)
3	GND Filtered
4	Phone Audio(-) Audio Out CH [14] (-)
5	Phone Audio(+) Audio Out 9 CH [14] (+)
6	Audio In CH [12] (-)
7	Audio In CH [12] (+)
8	A-GND
9	AUX In (4) (+)
10	AUX In (4) (-)
11	12V
12	A-GND
13	HS_ST_2
14	AUX In (5) (+)
15	AUX In (5) (-)

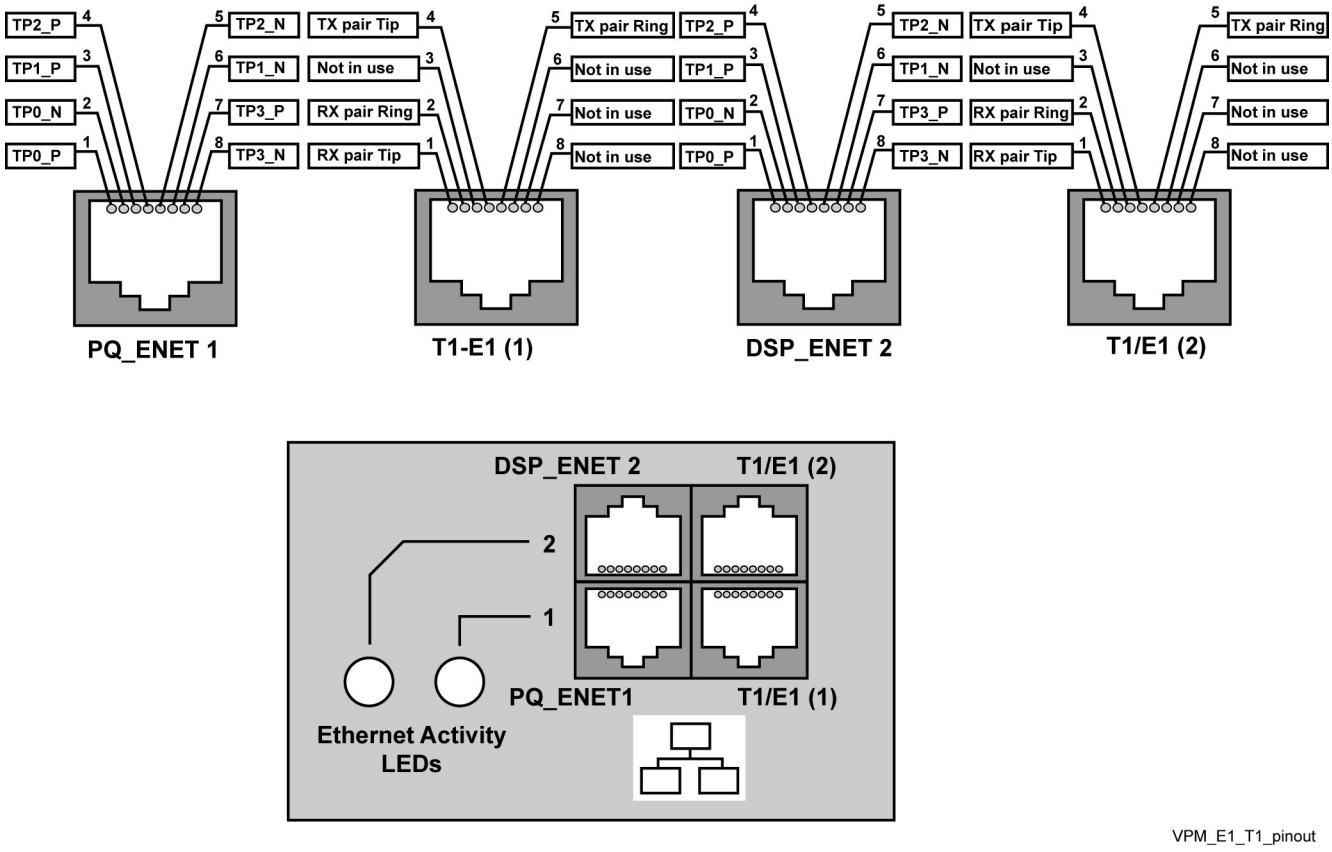
9.2.4

J8000 Ethernet and T1/E1 Mapping

The following figure illustrates J8000 Ethernet and T1-E1 port connector pinout and front panel icons.

NOTICE: The use of T1/E1 ports is application-specific.

Figure 10: J8000 Ethernet and T1-E1 Port Connector Pinout



The following table illustrates the Ethernet and T1-E1 port (J8000) port connector.

Table 9: J8000 Ethernet and T1-E1 Port Map

RJ-45 Port	J8000							
QUICC - Ethernet Port	A1	A2	A4	A5	A3	A6	A7	A8
	TP0_P	TP0_N	TP2_P	TP2_N	TP1_P	TP1_N	TP3_P	TP3_N
DSP Ethernet Port	B1	B2	B4	B5	B3	B6	B7	B8
	TP0_P	TP0_N	TP2_P	TP2_N	TP1_P	TP1_N	TP3_P	TP3_N
DSP T1-E1 Port (1)	C1	C2	C4	C5	C3	C6	C7	C8
	Receive pair		Transmit Pair		Not used		Not used	
	Tip	Ring	Tip	Ring				
DSP_T1-E1 Port (2)	D1	D2	D4	D5	D3	D6	D7	D8
	Receive pair		Transmit Pair		Not used		Not used	

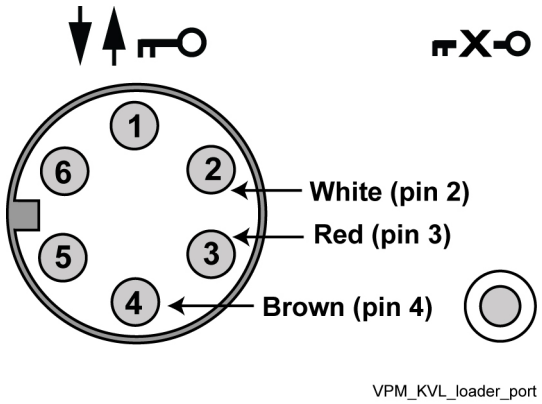
Table continued…

RJ-45 Port	J8000			
	Tip	Ring	Tip	Ring

9.2.5
KVL Port to Function Mapping

The following figure illustrates the view into the connector of the KVL port cable at the front panel of the VPM.

Figure 11: KVL Loader Port and the Key Erase Button



The following table describes the serial cable connector used to configure the device using the Configuration/Service Software (CSS) application.

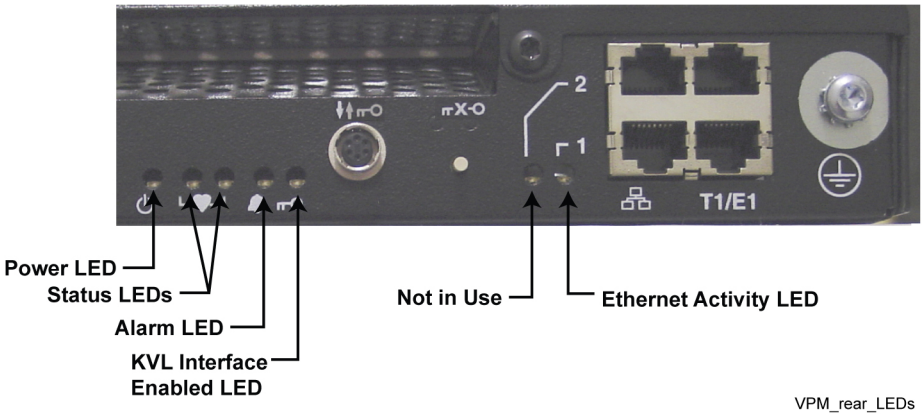
Table 10: VPM Serial Cable Connector Pinout

DB9	RJ-45
1	
2	8
3	1
4	
5	2
6	
7	
8	
9	

9.3
VPM LEDs

The VPM has five types of LEDs indicating the general conditions for the VPM and its Ethernet activities.

Figure 12: VPM LEDs



All types of VPM LEDs and their definitions are described in the following sections.

9.3.1
Power LED

If the power is supplied to the device from the external power supply, the Power LED is on (solid green).

9.3.2
Status LEDs

The following table describes the definitions for the VPM Status LEDs.

Table 11: Status Definitions for the VPM Status LEDs

State	Status LED (Green)	Status LED (Red)	Description
Online	On	Off	VPM is fully functional.
Link Down	Flashing	Off	VPM is functional but the control link is not ready yet or the link cannot be established (most likely because the Ethernet link is unplugged).
Impaired	On	Flashing	VPM is running but is impaired (likely because the software upgrade failed).
Failure	Off	On	Fatal failure detected.

9.3.3
Security Alarm LED

The Security Alarm LED is on when a major critical hardware failure at MACE chips is detected.

9.3.4
KVL Interface Enabled LED

The KVL Interface Enabled LED is on when the VPM is ready to perform key loading. This LED also blinks once during the power up of the VPM to indicate that the Federal Information Processing Standard (FIPS) self-test has been passed.

9.3.5

Ethernet Activity LEDs

There are two Ethernet Activity LEDs, but only the one, marked with a “1”, is functional.

The following table describes the definitions for the VPM Ethernet Activity LED.

Table 12: Ethernet Activity LEDs

State	Activity LED (Green)	Description
Link Inactive	Off	The link is not established.
Link Established	On	The link is established but there is no current activity.
Link Active	Flashing	Ethernet activity

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Chapter 10

Voice Processor Module Disaster Recovery

This chapter provides references and information that enables you to recover a Voice Processor Module in the event of a failure.

10.1 Recovering the VPM

The following process provides details on recovering the VPM hardware in the event of a system failure.

Prerequisites: This process requires that you have new VPM hardware and a service laptop with CSS software, in addition to the software needed for the feature that the VPM is supporting.

When and where to use: Use this process to install the VPM hardware and install and configure the VPM software for use in an ASTRO® 25 system.

Process:

1. Replace the VPM hardware as described in “Replacing the VPM” procedure in the *Voice Processor Module* manual.
2. Perform basic device configuration using the serial port. See “Configuring the VPM in the CSS” in the *Voice Processor Module* manual.
3. See the “Disaster Recovery” chapter in the following feature manual depending on the software being used on the VPM you are recovering:
   - *Enhanced Telephone Interconnect Feature Guide* manual (for Telephone Media Gateway)
   - *MCC 7500 Dispatch Console with Voice Processor Module* manual
   - *SmartX Site Converter Feature Guide* manual

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