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ASTRO® 25
INTEGRATED VOICE AND DATA

ASTRO 25 Repeater Site with HPD Overlay

OCTOBER 2015

MN000608A01-A

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Document History

Version	Description	Date
MN000608A01-A	Original release of the *ASTRO 25 Repeater Site with HPD Overlay* manual	October 2015

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Contents

List of Figures

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List of Tables

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List of Processes

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List of Procedures

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About ASTRO 25 Repeater Site with HPD Overlay

This manual provides information on the installation, configuration, and management of an ASTRO® 25 repeater site with HPD Overlay from the site perspective.

What is Covered in This Manual?

This booklet contains the following chapters:

- ASTRO 25 Repeater Site with HPD Overlay Description on page 21 provides a high-level overview of the ASTRO® 25 repeater site with the HPD overlay.
- ASTRO 25 Repeater Site with HPD Overlay Technical Overview on page 23 provides a description of the HPD overlay equipment and how it acts within the system.
- ASTRO 25 Repeater Site with HPD Overlay Installation on page 27 provides the system-level hardware and software installation procedures for the HPD overlay equipment that may be installed at an ASTRO® 25 repeater site.
- ASTRO 25 Repeater Site with HPD Overlay Configuration on page 45 provides the system-level procedures for configuring the HPD equipment.
- ASTRO 25 Repeater Site with HPD Overlay Feature Expansion on page 49 provides the system-wide feature expansion information necessary to add HPD overlay to an existing site.

Helpful Background Information

Motorola 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	Provides standards and guidelines that should be followed when setting up a Motorola communications site. Also known as R56 manual. This 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 Documentation Overview	For an overview of the ASTRO® 25 system documentation, open the graphical user interface for the ASTRO® 25 system documentation set and select the **System Documentation Overview** link. A file opens that includes: • ASTRO® 25 system release documentation descriptions • ASTRO® 25 system diagrams For an additional overview of the system, review the architecture and descriptive information in the manuals that apply to your system configuration.

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Chapter 1

ASTRO 25 Repeater Site with HPD Overlay Description

This chapter contains a high-level overview of the ASTRO® 25 repeater site with the HPD overlay.

1.1 Overview

HPD remote site equipment can be added to a new or existing ASTRO® 25 repeater site. It provides HPD services to mobile subscriber units in the coverage area. The HPD overlay equipment at the site shares the network transport path (switch, router, and site link) as the IV&D equipment at the site. However, the HPD overlay equipment operates separately from the IV&D equipment. Having its own HPD GCP 8000 Site Controller platform, HPD GTR 8000 Base Radios, and MOSCAD Network Fault Management (NFM) monitoring platform, the HPD overlay equipment does not interact with the IV&D equipment at the ASTRO® 25 repeater site.

Simulcast subsystems with the HPD overlay are supported by the Dynamic System Resilience (DSR) feature. For in-depth information on DSR, see the *Dynamic System Resilience* manual.

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Chapter 2

ASTRO 25 Repeater Site with HPD Overlay Technical Overview

This chapter explains how the ASTRO® 25 repeater site with the HPD overlay works in the context of your system.

2.1 ASTRO 25 Repeater Site with HPD Overlay

HPD overlay equipment on an ASTRO® 25 repeater site consists of an HPD GCP 8000 Site Controller (with redundant modules), and up to five HPD GTR 8000 Base Radios. The HPD overlay equipment shares the network medium to the master site through one or two Ethernet connections on the ASTRO® 25 repeater site LAN.

An ASTRO® 25 Repeater site can have single switch or dual switches installed at the site. Dual switch configuration can include two external Ethernet switches or internal switches embedded in the two GCP 8000 Site controllers (standalone or GTR 8000 Expandable Site Subsystem). The specific configuration installed in a system depends on your organization requirements and transport resources.

In the single switch configuration, only the primary HPD GCP 8000 Site Controller has a connection to the LAN. In this site configuration, the Ethernet link between the two HPD GCP 8000 Site Controllers must be enabled.

NOTICE: Figure 1: Example of a Repeater Site with HPD Overlay on page 24 shows T1–E1 links implemented from the ASTRO® 25 repeater site to the master site. If your system implements the Flexible Site and InterZone Links feature, see the *Flexible Site and InterZone Links* manual for details regarding that implementation.

In the dual switch configuration (external switches or internal switches integrated in Site controllers), both HPD GCP 8000 Site Controllers have a connection to their respective site switch. Optionally, the site may include a backup router and backup site link to provide a high availability path to the master site.

NOTICE: When two switches or two GCP 8000 Site Controllers are installed at the site, both HPD GCP 8000 Site Controllers are connected to the LAN. To prevent a switched network loop, disable the Ethernet link between the two HPD GCP 8000 Site Controllers.

2.2 HPD Overlay Equipment

HPD overlay at a site operates in the same fashion as a standalone HPD site to provide an RF interface to mobile subscriber units in the region. The HPD overlay equipment includes a site controller with redundant modules to service registration requests, administer site operations, and handle inbound/outbound HPD traffic. One site controller module operates as the active site controller at the site, while the redundant module remains in standby mode.

The site may include up to five HPD channels. Implement each channel at the site as a full-duplex GTR 8000 Base Radio with HPD capability. These GTR 8000 Base Radios maintain periodic communication with the site controller for site control messaging and status updates. Registration requests/responses between the HPD GTR 8000 Base Radios and zone controller are routed through

the active HPD GCP 8000 Site Controller. HPD user data is routed between the HPD GTR 8000 Base Radios and the HPD RNG in the zone through the HPD GCP 8000 Site Controller.

Alarms and RFDS fault management for the HPD equipment can be handled through the MOSCAD NFM equipment that is supporting the remainder of the IV&D equipment at the site.

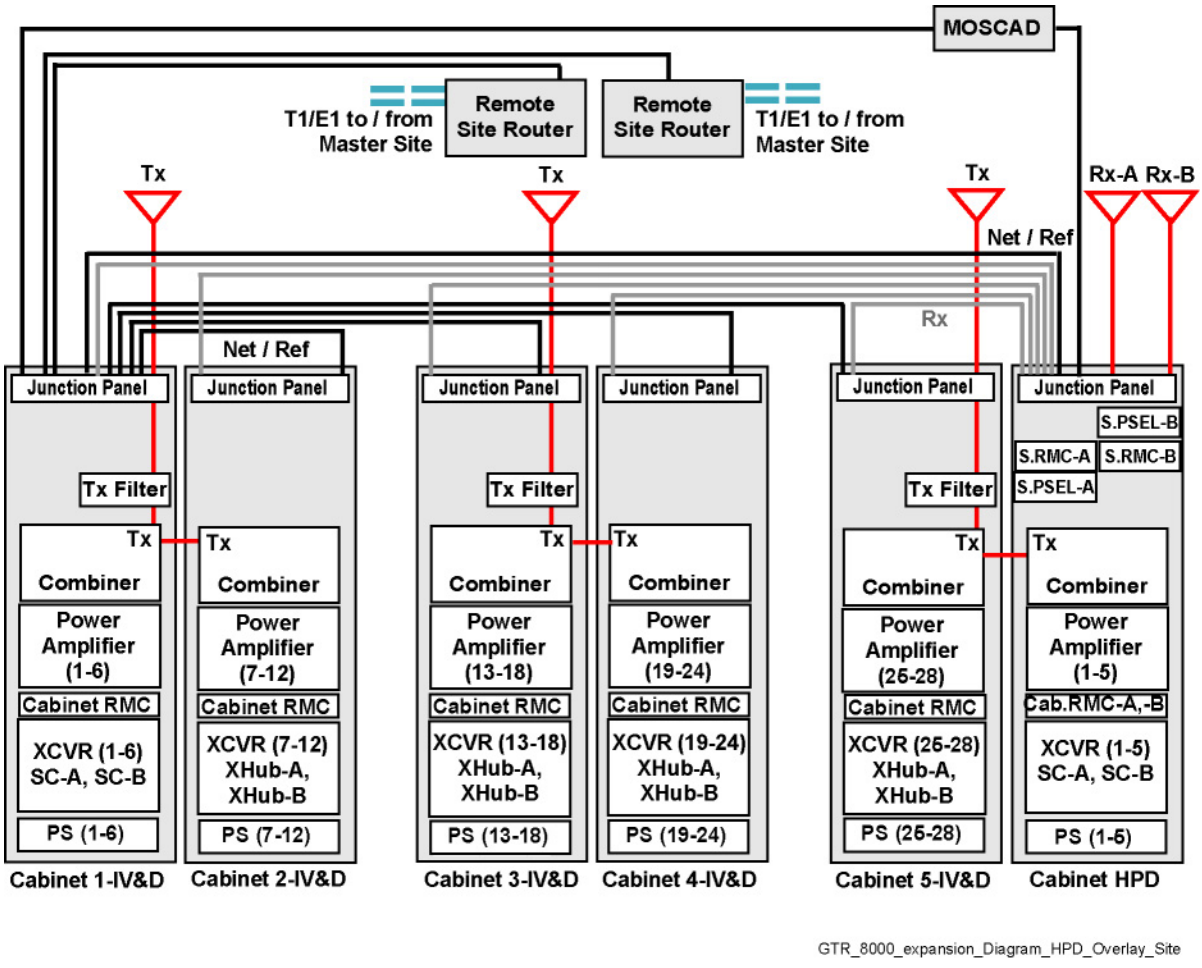
The HPD overlay equipment at the ASTRO® 25 repeater site may consist of the following platforms.

- HPD GCP 8000 Site Controller, standalone (with redundant modules)
- HPD GTR 8000 Base Radios, standalone (for 700 MHz and 800 MHz HPD channels)
- HPD GTR 8000 Site Subsystem
- GTR 8000 Expandable Site Subsystem

2.2.1 Example of a Repeater Site with HPD Overlay

An example of a GTR 8000 Expandable Site Subsystem configuration for a repeater site with HPD Overlay is shown in the following diagram.

Figure 1: Example of a Repeater Site with HPD Overlay



NOTICE:
The two Net/Ref connections to and from each cabinet are represented by one line in the example.

A maximum of one HPD GTR 8000 Expandable Site Subsystem can be added to a repeater site. The example shows the maximum configuration. The Integrated Voice and Data (IV&D) GTR 8000 Base

Radio application software supports a maximum of 28 GTR 8000 Base Radios. The HPD GTR 8000 Base Radio application software supports a maximum of five GTR 8000 Base Radios.

The paths for receive, transmit, and network/site frequency reference (Net/Ref) are shown in the example:

Receive path

HPD has receiver diversity, so two Rx antennas are required (Rx-A and Rx-B), which can handle a maximum of 48 GTR 8000 Base Radios (24 times 2). Therefore, the HPD cabinet can be the main Rx cabinet for the combined IV&D and HPD site, as shown in the example. The two RX antennas connected to the HPD GTR 8000 Expandable Site Subsystem are supporting the 5 HPD GTR 8000 Base Radios and the 28 IV&D GTR 8000 Base Radios in the example shown. Other configurations are also possible.

Transmit path

In the example shown, the line between combiners represents a phasing harness. A pair of cabinets connected by a phasing harness must be 1 inch apart or less.

Net/Ref path

The GTR 8000 Expandable Site Subsystem containing the IV&D site controllers must be the main Network/Site Reference cabinet for the HPD Overlay as well as the IV&D site. The internal LAN switches in the HPD GCP 8000 Site Controllers connect to the internal LAN switches in the IV&D site controllers. The Ethernet cables connect through the Network Expansion ports labeled Cab #5 (A, B) on the junction panel of the cabinet with the IV&D site controllers.

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Chapter 3

ASTRO 25 Repeater Site with HPD Overlay Installation

This chapter details installation procedures relating to the HPD overlay equipment that may be installed at an ASTRO® 25 repeater site.

3.1 HPD GCP 8000 Site Controller

Connect the HPD GCP 8000 Site Controller with the site switches, HPD GTR 8000 Base Radios, and remote GPS units. The site controller includes additional connections for auxiliary power and alarm monitoring.

WARNING: The HPD GCP 8000 Site Controller switch configuration must be set up properly before plugging the HPD site into the voice site network. If the HPD GCP 8000 Site Controller is being installed at a site with two Ethernet switches or two GCP 8000 Site Controllers, the redundant switch connection (port 20) must be disabled for each HPD GCP 8000 Site Controller. Disable through Configuration/Service Software (CSS) to prevent a network loop at the site. For more information, see Configuring an HPD Site on page 45.

NOTICE: The Comparator A/B, EXT FREQ REF, and 1PPS connection are not used for HPD operation.

Figure 2: HPD GCP 8000 Site Controller – Front Connections

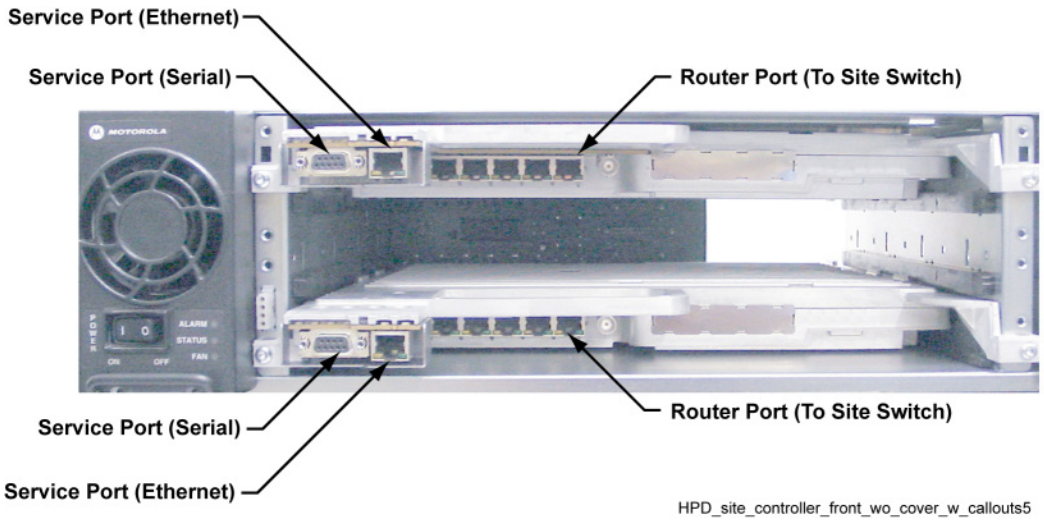
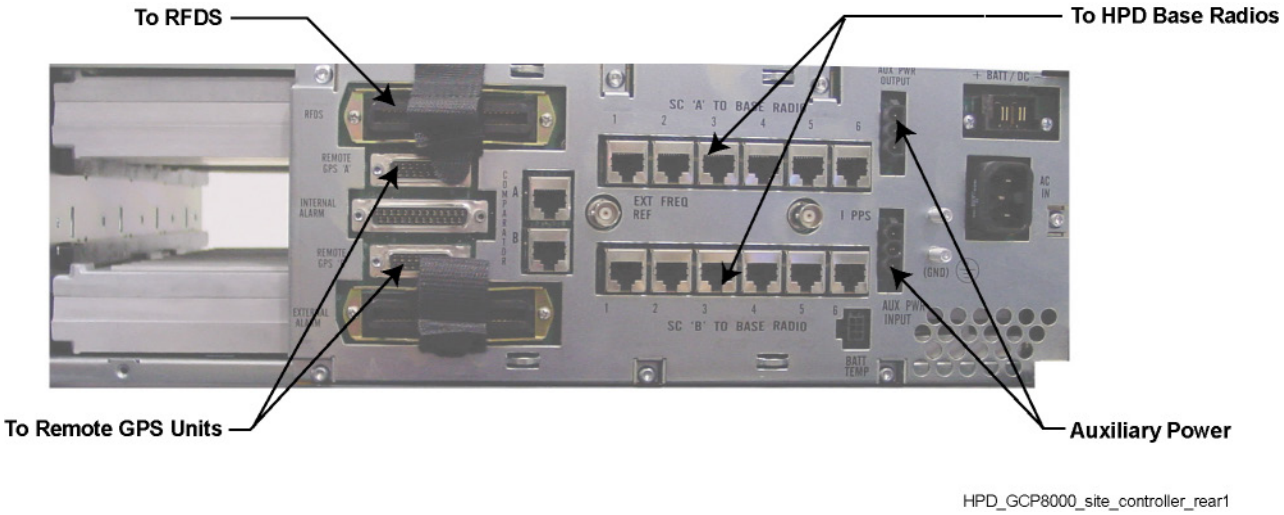


Figure 3: HPD GCP 8000 Site Controller – Rear Connections



HPD_GCP8000_site_controller_rear1

Table 1: HPD GCP 8000 Site Controller Connections

Device	Port / Type	Device	Port / Type	Description
HPD GCP 8000 Site Controller (Module A)	Router port, RJ-45	Ethernet Switch #1	Port 18 or Port 24/ RJ-45	**IMPORTANT:** A cross-over cable must be used for this connection. The connection depends on the number of switches at the site. • If only one switch is installed at the site, then the router port on HPD GCP 8000 Site Controller A connects with the port 18 on the site switch. • If two switches are installed at the site, then the router port on HPD GCP 8000 Site Controller A connects with the port 24 on a site switch #1.
HPD GCP 8000 Site Controller (Module A)	Router Port/ RJ-45	GCP 8000 Site Controller A	NetAux/ RJ-45	**IMPORTANT:** A cross-over cable must be used for this connection. The NetAux port on GCP 8000 Site Controller A speed must be configured to 100/Full.
HPD GCP 8000 Site Controller (Module B)	Router port, RJ-45	Ethernet Switch #2 – if installed	Port 20, RJ-45	**IMPORTANT:** A cross-over cable must be used for this connection. If the site has two switches, the router port on HPD GCP 8000 Site

Table continued…

Device	Port / Type	Device	Port / Type	Description
				Controller B must be connected. Otherwise, HPD GCP 8000 Site Controller B is not connected to the LAN.
HPD GCP 8000 Site Controller (Module B)	Router Port/ RJ-45	GCP 8000 Site Controller B	NetAux/ RJ-45	**IMPORTANT:** A cross-over cable must be used for this connection. The NetAux port on GCP 8000 Site Controller B speed must be configured to 100/Full. The HPD GCP 8000 Site Controller B router port must be connected. Otherwise, the HPD GCP 8000 Site Controller B is not connected to the LAN.
HPD GCP 8000 Site Controller	SC 'A' to Base Radio 1-5, RJ-45	HPD GTR 8000 Base Radio (1-5)	SITE CTRL A	Connection between the site controller A and each of the GTR 8000 Base Radios at the site.
HPD GCP 8000 Site Controller	SC 'B' to Base Radio 1-5, RJ-45	HPD GTR 8000 Base Radio (1-5)	SITE CTRL B	Connection between the site controller B and each of the GTR 8000 Base Radios at the site.
HPD GCP 8000 Site Controller	Remote GPS 'A'	Lightning Arrestor for RGPS Unit A	Line terminals	For terminal connection details on the lightning arrestor, see Figure 9: RGPS and Lightning Arrestor – System Connections on page 42.
HPD GCP 8000 Site Controller	Remote GPS 'B'	Lightning Arrestor for RGPS Unit B	Line terminals	For terminal connection details on the lightning arrestor, see Figure 9: RGPS and Lightning Arrestor – System Connections on page 42.
HPD GCP 8000 Site Controller	Service port, RJ-45	Service Computer/Laptop	LAN port/ RJ-45	Service port for local access by using CSS and performing localized software downloads. This service port also mirrors all the other Ethernet ports on the HPD GCP 8000 Site Controller.
HPD GCP 8000 Site Controller	Service port, D-9	Service Computer/Laptop	RS232 port/ DB9	Service port for initial configuration of the site controller IP address.

Table continued…

Device	Port / Type	Device	Port / Type	Description
HPD GCP 8000 Site Controller	Frequency calibration, BNC	Frequency monitor/calibration	BNC	Port available on the site controller module for measuring and calibrating the frequency reference.
HPD GCP 8000 Site Controller	Aux Pwr Input	HPD GTR 8000 Base Radio	Aux Pwr Output	The auxiliary output input can be connected with an HPD GTR 8000 Base Radio as a secondary power source.
HPD GCP 8000 Site Controller	Aux Pwr Output	Receive multicoupler		Can be connected with RMC to provide an auxiliary power source.
HPD GCP 8000 Site Controller	RFDS, 50-pin	RFDS equipment (power monitor, receive multicoupler)		Monitors RFDS alarms from the power monitor, receive multicoupler.
HPD GCP 8000 Site Controller	External Alarm, 50-pin	Punch block / terminal strip		External alarm interface to the punch block or terminal strip.
HPD GCP 8000 Site Controller	Internal Alarm, DB25	External integrated alarm card connections.		Allows additional alarm sources to be supplied to the site controller integrated alarm card.
HPD GCP 8000 Site Controller	Bat Temp, 4-pin	Battery temperature sensor		Connection for monitoring the backup battery temperature.
HPD GCP 8000 Site Controller	Batt/DC	DC power supply or battery		Input from a 48 VDC power supply or backup battery.
HPD GCP 8000 Site Controller	AC	120/240 VAC power source.		Input from 120/240 VAC nominal power source.

3.2 HPD GTR 8000 Base Radio

The standalone HPD GTR 8000 Base Radio connects with each of the HPD GCP 8000 Site Controllers and connects to the transmit and receive paths.

NOTICE: Connections for RX C, EXT FREQ REF, and 1PPS port are not used for HPD operation.

Figure 4: HPD GTR 8000 Base Radio – Rear Connections

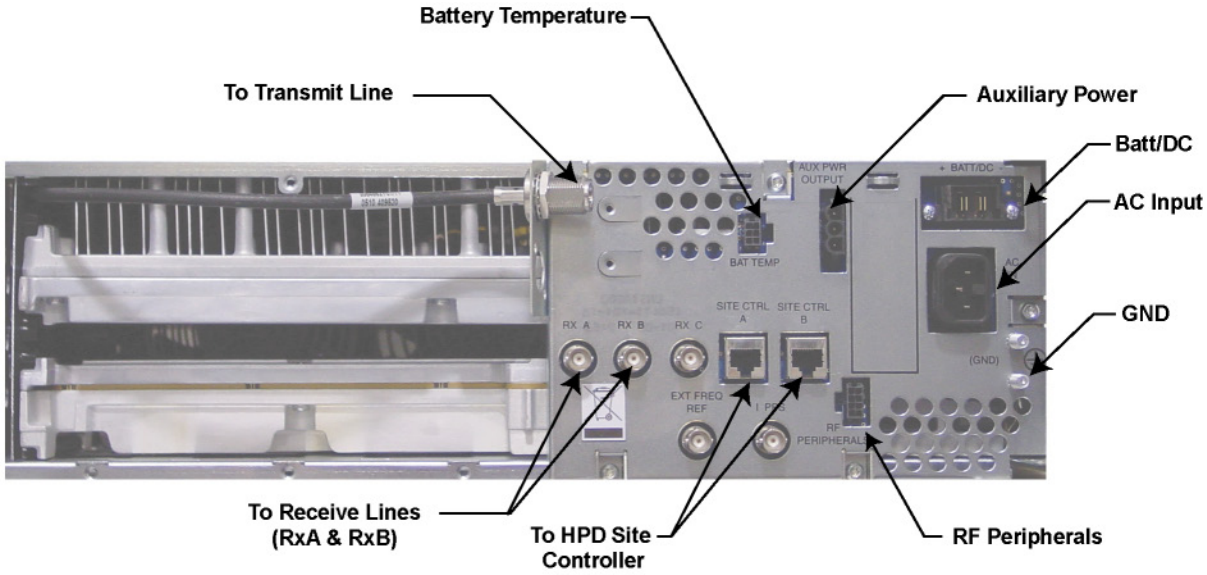


Table 2: HPD GTR 8000 Base Radio Connections

Device	Port / Type	Device	Port / Type	Description
HPD GTR 8000 Base Radio	SITE CTRL A port, RJ-45	HPD GCP 8000 Site Controller A	SC 'A' to Base Radio (1-5) / RJ-45	Connects to the site controller A GTR 8000 Base Radio port for this channel (1-5).
HPD GTR 8000 Base Radio	SITE CTRL B port, RJ-45	HPD GCP 8000 Site Controller B	SC 'B' to Base Radio (1-5) / RJ-45	Connects to the site controller B GTR 8000 Base Radio port for this channel (1-5).
HPD GTR 8000 Base Radio	RX A, BNC	Receive line A	BNC	RF coax to receive path for antenna A.
HPD GTR 8000 Base Radio	RX B, BNC	Receive line B	BNC	RF coax to receive path for antenna B.
HPD GTR 8000 Base Radio	Transmit port, N-type	Transmit line	N-type	RF coax to transmit antenna.
HPD GTR 8000 Base Radio	Service port, RJ-45	Service Computer/ Laptop	LAN port/ RJ-45	Service port for local access by using Configuration/ Service Software (CSS). Also may be used for localized software downloads. Located on the front of the transceiver module.

Table continued…

Device	Port / Type	Device	Port / Type	Description
				NOTICE: The RJ-45 service port supports only 10 Mb half duplex operation.
HPD GTR 8000 Base Radio	Service port, DB9	Service Computer/ Laptop	RS232 port/ DB9	Service port for initial configuration of the GTR 8000 Base Radio IP address. Located on the front of the transceiver module.
HPD GTR 8000 Base Radio	Aux Pwr Output	HPD GCP 8000 Site Controller or RMC	Aux Pwr Input	The auxiliary output power can be connected with the HPD GCP 8000 Site Controller or RMC to provide secondary power to the device.
HPD GTR 8000 Base Radio	Bat Temp, 4-pin	Battery temperature sensor		Connection allowing the HPD GTR 8000 Base Radio to monitor the battery temperature.
HPD GTR 8000 Base Radio	RF Peripherals	RF peripheral sensor ports		Antenna relay and presence detect, external circulator load temperature (external wattmeter not supported).
HPD GTR 8000 Base Radio	Batt/DC	DC power supply or battery		Input from a 48 VDC power supply or backup battery.
HPD GTR 8000 Base Radio	AC	120/240 VAC power source.		Input from 120/240 VAC nominal power source.

3.3 HPD GTR 8000 Site Subsystem

The HPD GTR 8000 Site Subsystem contains a standalone site controller, standalone GTR 8000 Base Radio, and an RF distribution system, mounted in a single rack. The RF distribution system consists of an isolator, duplexer, two branch RMCs, and a preselector.

WARNING: The HPD GCP 8000 Site Controller switch configuration must be set up properly before plugging the HPD site into the voice site network. If the HPD GCP 8000 Site Controller is being installed at a site with two Ethernet switches or two GCP 8000 Site Controllers, the redundant switch connection (port 20) must be disabled for each HPD GCP 8000 Site Controller through Configuration/Service Software (CSS) to prevent a network loop at the site. See Configuring an HPD Site on page 45 for details.

Figure 5: HPD GTR 8000 Site Subsystem – Junction Panel

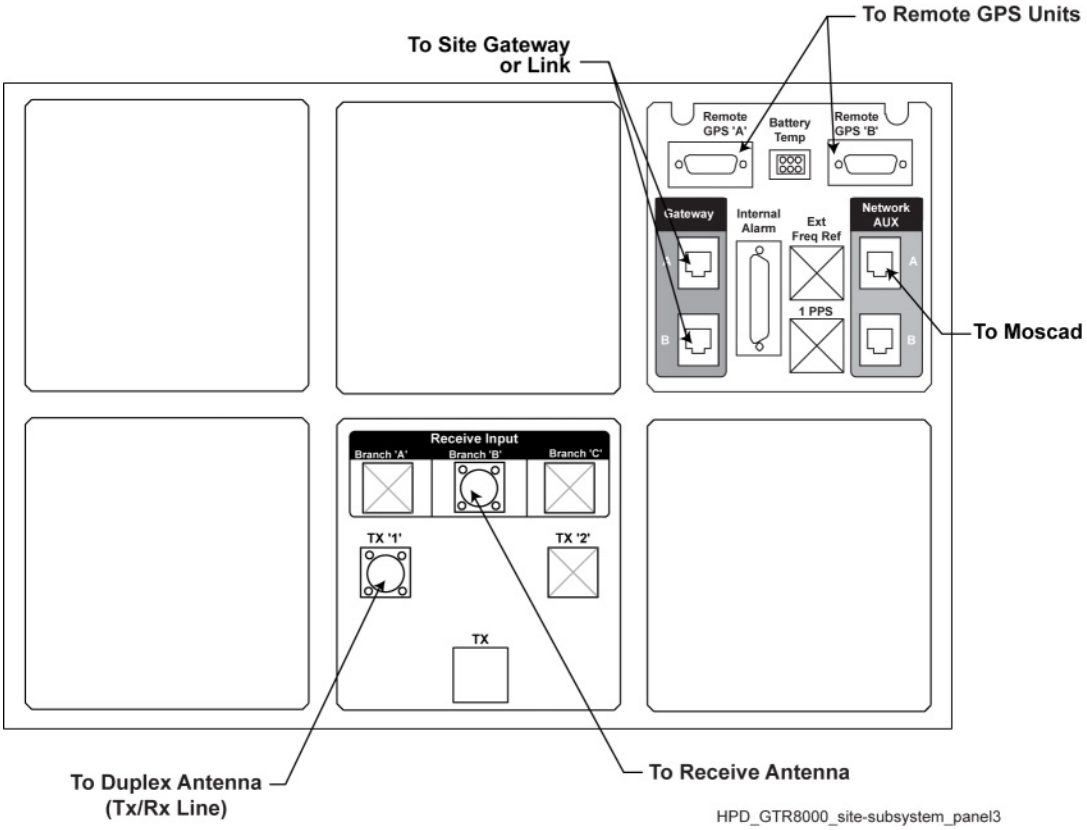


Table 3: HPD GTR 8000 Site Subsystem Connections

Device	Port / Type	Device	Port / Type	Description
HPD GTR 8000 Site Subsystem, Junction Panel	Gateway A port, RJ-45	Ethernet Switch #1	Port 18 or Port 24/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. The connection depends on the number of switches at the site. • If only one switch is installed at the site, then the gateway port on HPD GCP 8000 Site Controller A connects with the port 18 on the site switch. • If two switches are installed at the site, then the gateway port on HPD GCP 8000 Site Controller A connects with the port 24 on the site switch #1.

Table continued…

Device	Port / Type	Device	Port / Type	Description
HPD GTR 8000 Site Subsystem, Junction Panel	Gateway A port/ RJ-45	GCP 8000 Site Controller A	Net Aux/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. NetAux port on GCP 8000 Site Controller A must be configured for 100/Full.
HPD GTR 8000 Site Subsystem, Junction Panel	Gateway B port, RJ-45	Ethernet Switch #2 – if installed	Port 20/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. If the site has two switches, the gateway port on HPD GCP 8000 Site Controller B must be connected. Otherwise, HPD GCP 8000 Site Controller B is not connected to the LAN.
HPD GTR 8000 Site Subsystem, Junction Panel	Gateway B, port/ RJ-45	GCP 8000 Site Controller B	Net Aux/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. NetAux port on GCP 8000 Site Controller B must be configured for 100/Full. Gateway port on HPD GCP 8000 Site Controller B must be connected. Otherwise, HPD GCP 8000 Site Controller B is not connected to the LAN.
HPD GTR 8000 Site Subsystem, Junction Panel	Battery Temp	Backup Battery Temperature Sensor		See battery temperature sensor instructions for connection requirements.
HPD GTR 8000 Site Subsystem, Junction Panel	Remote GPS A, DB15	Lightning Arrestor for RGPS Unit A	Line terminals	For terminal connection details on the lightning arrestor, see Figure 9: RGPS and Lightning Arrestor – System Connections on page 42.
HPD GTR 8000 Site Subsystem, Junction Panel	Remote GPS B, DB15	Lightning Arrestor for RGPS Unit B	Line terminals	For terminal connection details on the lightning arrestor, see Figure 9: RGPS and

Table continued…

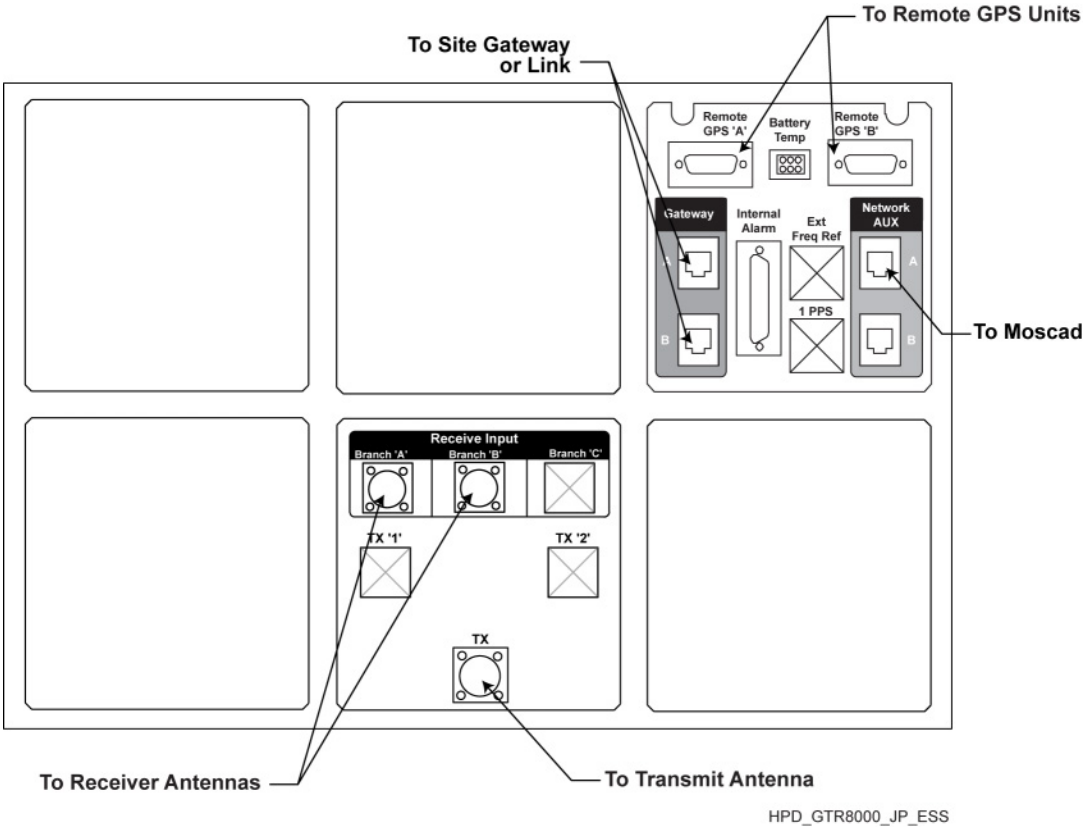
Device	Port / Type	Device	Port / Type	Description
				Lightning Arrestor – System Connections on page 42.
HPD GTR 8000 Site Subsystem, Junction Panel	Internal Alarm, DB25	External integrated alarm card (IAC) connections.		Allows additional alarm sources to be supplied to the integrated alarm card in the site controller.
HPD GTR 8000 Site Subsystem, Junction Panel	RX 'B', N-type	Receive antenna		RF coax to receive antenna.
HPD GTR 8000 Site Subsystem, Junction Panel	TX 'A', N-type	Transmit/receive (full-duplex) antenna		RF coax to transmit/receive antenna for full-duplex operation.

3.4
HPD GTR 8000 Expandable Site Subsystem

The GTR 8000 Expandable Site Subsystem includes two site controller modules, up to five transceivers and power amplifier modules, and RF distribution equipment. Internal connections between modules are made through the backplane. A junction panel is at the top of the rack for connections to other devices at the HPD remote site as shown in the following figure.

WARNING: The HPD GCP 8000 Site Controller switch configuration must be set up properly before plugging the HPD site into the voice site network. If the HPD GCP 8000 Site Controller is being installed at a site with two Ethernet switches or two GCP 8000 Site Controllers, the redundant switch connection (port 20) must be disabled for each HPD GCP 8000 Site Controller through Configuration/Service Software (CSS) to prevent a network loop at the site. For more information, see Configuring an HPD Site on page 45.

Figure 6: GTR 8000 Expandable Site Subsystem – Junction Panel



The subsystem rack accepts up to six 120/240 VAC inputs and two separate 48 VDC inputs (for the battery or DC power source input). The DC terminals on the top left of the rack internally connect the left three power supplies. The DC terminals on the top right corner of the rack internally connect with the three power supplies in the lower right portion of the subsystem rack.

Table 4: HPD GTR 8000 Expandable Site Subsystem Connections

Device	Port / Type	Device	Port / Type	Description
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Gateway A port, RJ-45	Ethernet Switch #1	Port 18 or Port 24/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. The connection depends on the number of switches at the site. • If only one switch is installed at the site, then the gateway port on HPD GCP 8000 Site Controller A connects with port 18 on the site switch.

Table continued…

Device	Port / Type	Device	Port / Type	Description
				• If two switches are installed at the site, then the gateway port on HPD GCP 8000 Site Controller A connects with the port 24 on the site switch #1.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Gateway A port, RJ-45	GCP 8000 Site Controller A	NetAux	**IMPORTANT:** A crossover cable must be used for this connection. NetAux port on GCP 8000 Site Controller A must be configured for 100/Full.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Gateway B port, RJ-45	Ethernet Switch #2 – if installed	Port 20/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. If the site has two switches, the gateway port on HPD GCP 8000 Site Controller B must be connected. Otherwise, HPD GCP 8000 Site Controller B is not connected to the LAN.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Gateway B port , RJ-45	GCP 8000 Site Controller B	NetAux/ RJ-45	**IMPORTANT:** A crossover cable must be used for this connection. NetAux port on GCP 8000 Site Controller B must be configured for 100/Full. The gateway port on HPD GCP 8000 Site Controller B must be connected. Otherwise, HPD GCP 8000 Site Controller B is not connected to the LAN.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Battery Temp, Molex	Backup Battery Temperature Sensor		See battery temperature sensor instructions for connection requirements.

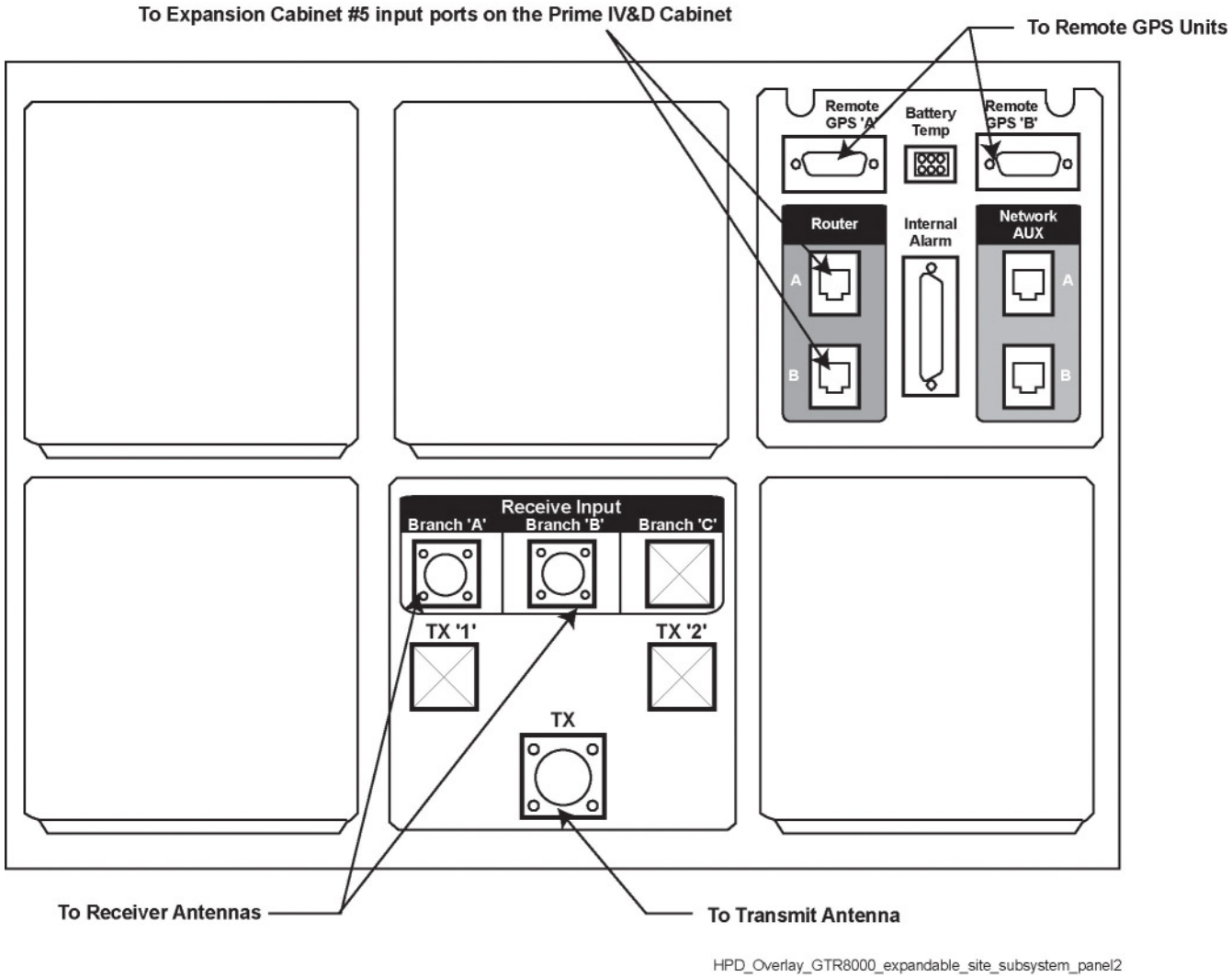
Table continued…

Device	Port / Type	Device	Port / Type	Description
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Remote GPS A, DB15	Lightning Arrestor for RGPS Unit A	Line terminals	For terminal connection details on the lightning arrestor, see Figure 9: RGPS and Lightning Arrestor – System Connections on page 42.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Remote GPS B, DB15	Lightning Arrestor for RGPS Unit B	Line terminals	For terminal connection details on the lightning arrestor, see Figure 9: RGPS and Lightning Arrestor – System Connections on page 42.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	Internal Alarm, DB25	External integrated alarm card (IAC) connections.		Allows additional alarm sources to be supplied to the integrated alarm card in the site controller.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	RX A, N-type	Receive antenna A	TTA output port	RF coax to receive branch A.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	RX B, N-type	Receive antenna B	TTA output port	RF coax to receive branch B.
HPD GTR 8000 Expandable Site Subsystem, Junction Panel	TX, 7/16	Transmit antenna	Tx input port	RF coax to transmit antenna.

3.4.1
Junction Panel Connections for HPD Overlay Site

The HPD overlay site includes two site controller modules, up to five transceivers and power amplifier modules, and RFDS. Internal connections between modules are made through the backplane. A junction panel is at the top of the rack for connections to other devices at the site as shown in the following figure.

Figure 7: GTR 8000 Expandable Site Subsystem – Junction Panel for HPD Overlay Site



The subsystem rack accepts up to six 120/240 VAC inputs and two separate 48 VDC inputs (for the battery or DC power source input). The DC terminals on the top left of the rack internally connect the left three power supplies. The DC terminals on the top right corner of the rack internally connect with the three power supplies in the lower right portion of the subsystem rack.

Table 5: GTR 8000 Expandable Site Subsystem Connections for HPD Overlay Site

Device	Port / Type	Device	Port / Type	Description
HPD Overlay Site, Junction Panel	Router A port, RJ-45	Primary Site Switch (site controller A in cabinet 1)	LAN 1/, RJ-45	Ethernet link between the site controller A and the primary site router.
HPD Overlay Site, Junction Panel	Router B port, RJ-45	Secondary Site Switch (site controller B in cabinet 1)	LAN 1/ RJ-45	Ethernet link between the site controller B and secondary site router (if installed).

Table continued…

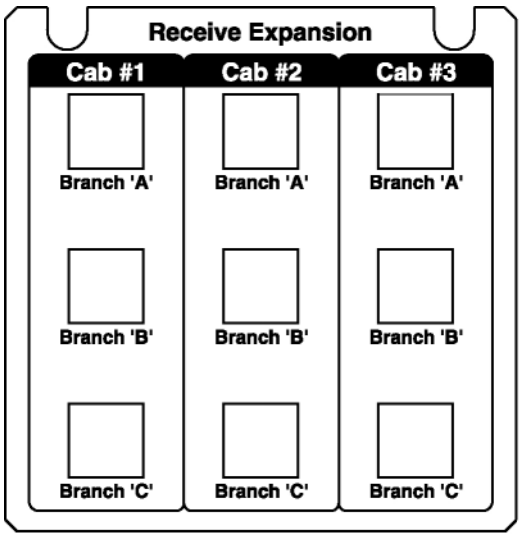
Device	Port / Type	Device	Port / Type	Description
HPD Overlay Site, Junction Panel	Network AUX A, RJ-45	MOSCAD NFM	LAN Port 1/ RJ-45	Ethernet link for the MOSCAD NFM device.
HPD Overlay Site, Junction Panel	Network AUX B, RJ-45	Conventional Channel Interface Device	LAN 1/ RJ-45	This connection would only be used if there were one site link and two routers supporting Conventional Channel Interface Device at the site.
HPD Overlay Site, Junction Panel	Battery Temp, 6-pin	Backup Battery Temperature Sensor		See battery temperature sensor instructions for connection requirements.
HPD Overlay Site, Junction Panel	Remote GPS A, DB15	Lightning Arrestor / GPS Unit A	Line terminals	For terminal connection details on the lightning arrestor, see Remote GPS Unit on page 42.
HPD Overlay Site, Junction Panel	Remote GPS B, DB15	Lightning Arrestor / RGPS Unit B	Line terminals	For terminal connection details on the lightning arrestor, see Remote GPS Unit on page 42.
HPD Overlay Site, Junction Panel	Internal Alarm, DB25	External integrated alarm card (IAC) connections.		Allows additional alarm sources to be supplied to the integrated alarm card in the site controller.
HPD Overlay Site, Junction Panel	RX A, N-type	Receive antenna A	TTA output port	RF coax to receive branch A.
HPD Overlay Site, Junction Panel	RX B, N-type	Receive antenna B	TTA output port	RF coax to receive branch B.
HPD Overlay Site, Junction Panel	TX, 7/16	Transmit antenna	Tx input port	RF coax to transmit antenna.

3.4.1.1
Receiver Expansion Sub-Panel (HPD)

The Receiver (RX) Expansion Sub-panel is optional and is used on cabinets containing a site Receiver Multicoupler. This sub-panel is cabled from the outputs of the Site RMC. There are outputs of the branch ‘A’, ‘B’, and ‘C’ to each of three expansion cabinets. HPD has receiver diversity, so two RX antennas are required (RX-A and RX-B), which can handle a maximum of 48 GTR 8000 Base Radios (24 times 2). Therefore, the HPD cabinet can be the main RX cabinet for the combined IV&D and HPD site as shown in Figure 1: Example of a Repeater Site with HPD Overlay on page 24. The two RX antennas connected to the HPD GTR 8000 Expandable Site Subsystem are supporting the 5 HPD GTR 8000 Base Radios and the 28 IV&D GTR 8000 Base Radios. Other configurations are also possible. All connectors are BNCs.

NOTICE: In the example shown, the Receiver Expansion Sub-Panel is not used in the primary IV&D cabinet when an HPD Overlay is added to the site. The HPD Overlay cabinet handles all receive requirements for the site.

Figure 8: GTR 8000 Expandable Site Subsystem – Receiver Expansion Sub-Panel



GTR_8000_JP_XS_Receive_Expansion_Subpanel

Table 6: GTR 8000 Expandable Site Subsystem Receiver Expansion Sub-Panel Connections (HPD)

Port / Type	Device connects to:	Port / Type	Description
Cab #1 Branch ‘A’, BNC	Expansion cabinet #4 Receive Input Branch 'A'.	RX 'A', N	Receive path connection from the HPD cabinet to the RX Branch ‘A’ connector of expansion cabinet #4.
Cab #1 Branch ‘B’, BNC	Expansion cabinet #3 Receive Input Branch 'A'.	RX 'A', N	Receive path connection from the HPD cabinet to the RX Branch ‘A’ connector of expansion cabinet #3.
Cab #1 Branch ‘C’, BNC	Not used.	Not used.	Not used.
Cab #2 Branch ‘A’, BNC	Expansion cabinet #2 Receive Input Branch 'A'.	RX 'A', N	Receive path connection from the primary cabinet to the RX Branch ‘A’ connector of expansion cabinet #2.
Cab #2 Branch ‘B’, BNC	Expansion cabinet #1 Receive Input Branch 'A'.	RX 'A', N	Receive path connection from the HPD cabinet to the RX Branch ‘A’ connector of expansion cabinet #1.
Cab #2 Branch ‘C’, BNC	Not used.	Not used.	Not used.
Cab #3 Branch ‘A’, BNC	Primary IV&D cabinet Receive Input Branch 'A'.	RX 'A', N	Receive path connection from the HPD cabinet to the RX Branch ‘A’ connector of the primary IV&D cabinet.

Table continued…

Port / Type	Device connects to:	Port / Type	Description
Cab #3 Branch ‘B’, BNC	Not used.	Not used.	Not used.
Exp Cab #3 Branch ‘C’, BNC	Not used.	Not used.	Not used.

3.5

Remote GPS Unit

A Remote GPS (RGPS) unit and lightning arrestor is connected for each HPD GCP 8000 Site Controller module. There are two types of lightning arrestors available. Figure 9: RGPS and Lightning Arrestor – System Connections on page 42, Figure 10: Lightning Arrestor DSIX-2L1M1DC48-IG – Wiring on page 43, and Figure 11: Lightning Arrestor DS109-10129H-A – Wiring on page 44 show the required connections and terminal assignments for installing the RGPS unit and two types of lightning arrestor.

Figure 9: RGPS and Lightning Arrestor – System Connections

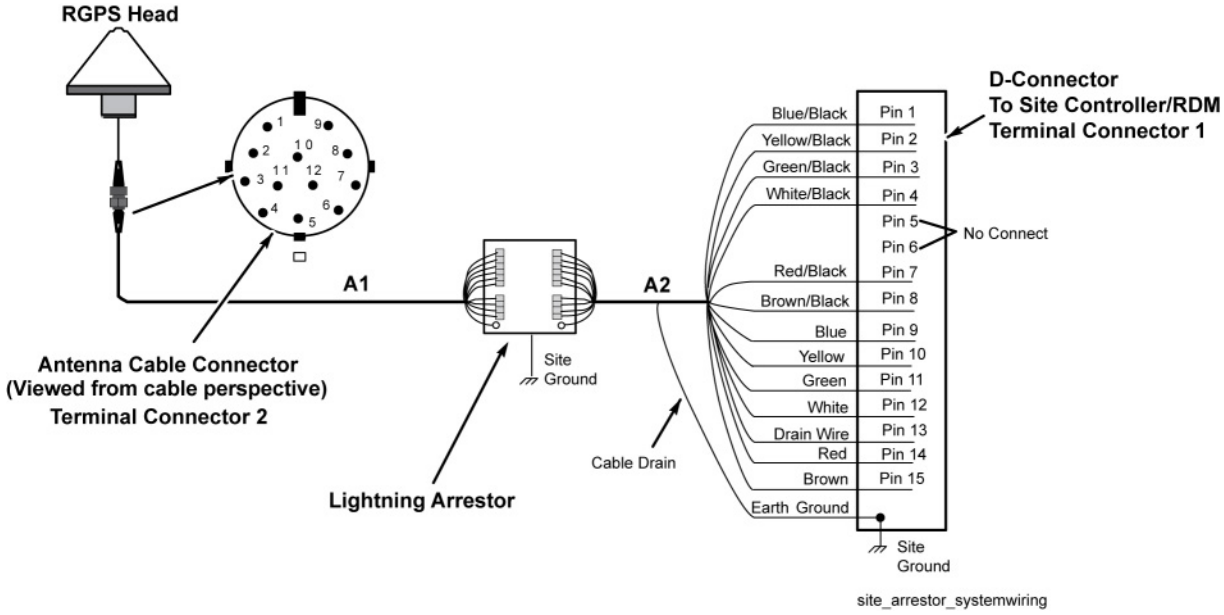
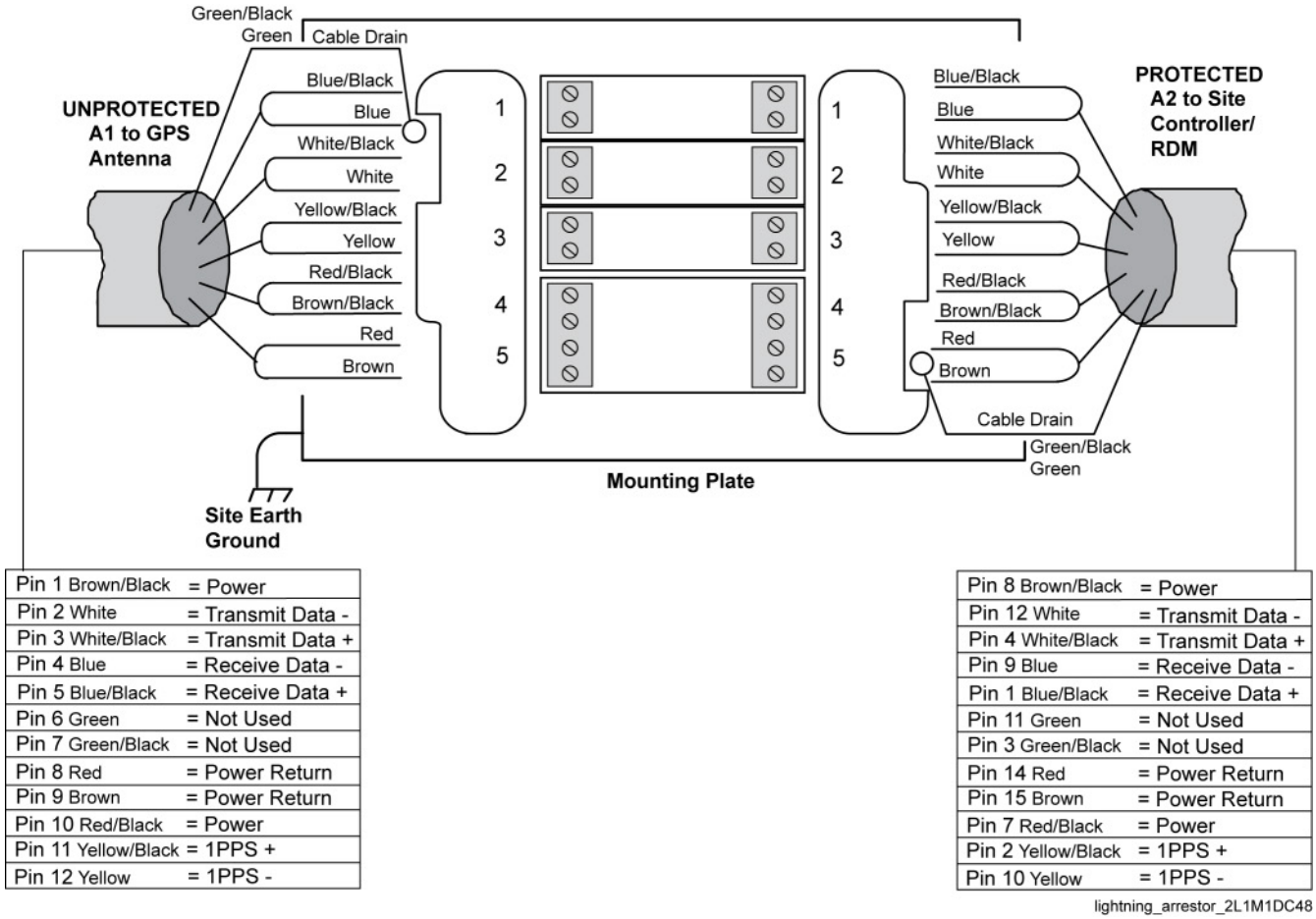


Figure 10: Lightning Arrestor DSIX-2L1M1DC48-IG – Wiring

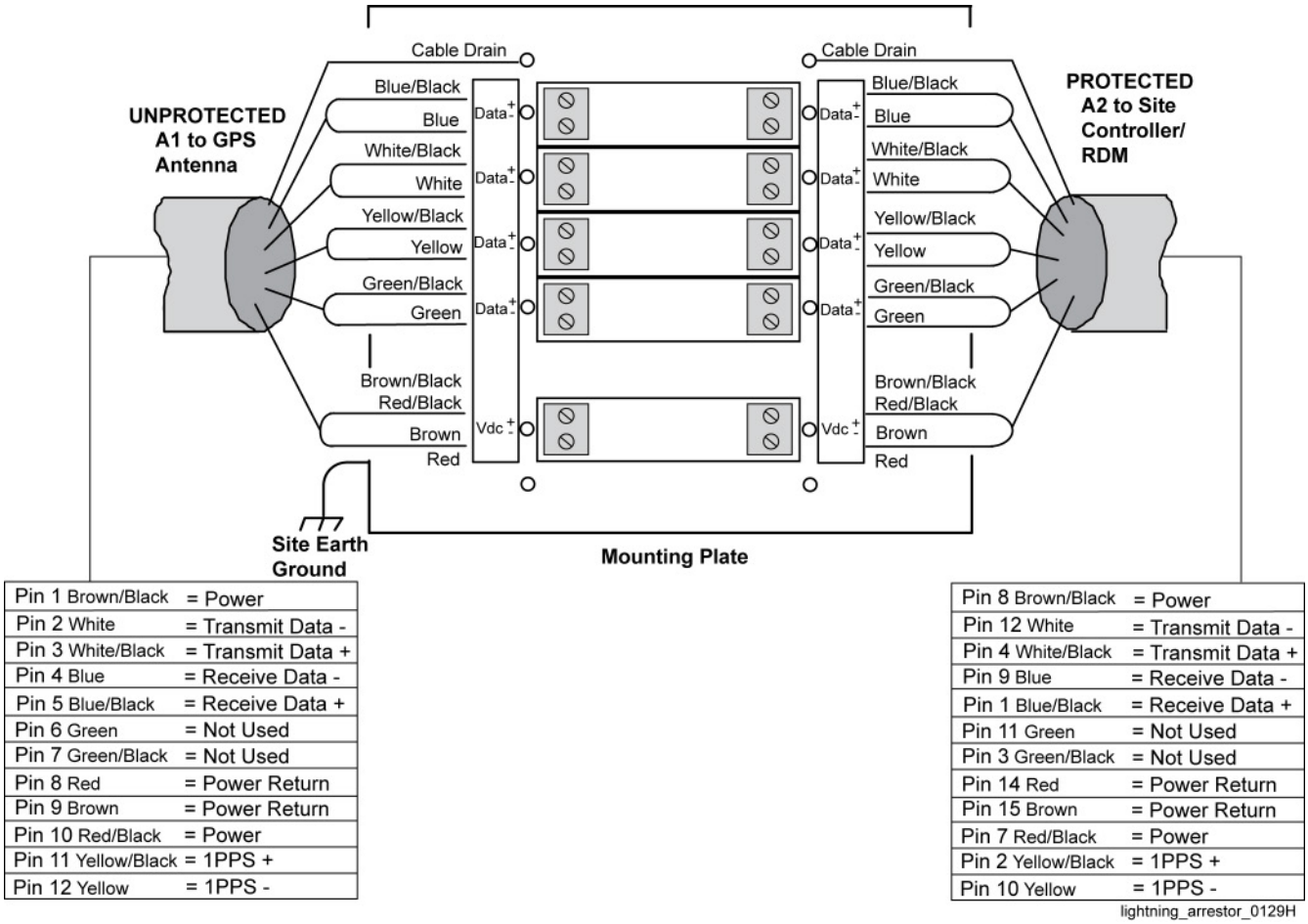


Pin 1 Brown/Black	= Power
Pin 2 White	= Transmit Data -
Pin 3 White/Black	= Transmit Data +
Pin 4 Blue	= Receive Data -
Pin 5 Blue/Black	= Receive Data +
Pin 6 Green	= Not Used
Pin 7 Green/Black	= Not Used
Pin 8 Red	= Power Return
Pin 9 Brown	= Power Return
Pin 10 Red/Black	= Power
Pin 11 Yellow/Black	= 1PPS +
Pin 12 Yellow	= 1PPS -

Pin 8 Brown/Black	= Power
Pin 12 White	= Transmit Data -
Pin 4 White/Black	= Transmit Data +
Pin 9 Blue	= Receive Data -
Pin 1 Blue/Black	= Receive Data +
Pin 11 Green	= Not Used
Pin 3 Green/Black	= Not Used
Pin 14 Red	= Power Return
Pin 15 Brown	= Power Return
Pin 7 Red/Black	= Power
Pin 2 Yellow/Black	= 1PPS +
Pin 10 Yellow	= 1PPS -

lightning_arrestor_2L1M1DC48

Figure 11: Lightning Arrestor DS109-10129H-A – Wiring



Chapter 4

ASTRO 25 Repeater Site with HPD Overlay Configuration

This chapter details configuration procedures relating to HPD equipment at an ASTRO® 25 repeater site.

4.1 HPD Site Configuration with Multiple Managers

The system infrastructure within the ASTRO® 25 system is configured, managed, and serviced by using the Unified Network Configurator (UNC) server application, the Configuration/Service Software (CSS), and Provisioning Manager (PM) applications. For the zone controller and Packet Data Gateway (PDG) configurations, the common parameters are configured in both UNC and Provisioning Manager.

- CSS is used to program all parameters in the site controllers, comparators, and base radios. The programming takes place at the time the equipment is installed at the site, and if network connectivity from UNC server application to the site equipment is not operational.
- UNC is used to program parameters to the site devices, routers, zone controller, PDGs, and links. Once the site is set up, UNC is the recommended configuration manager for the site equipment. Use CSS only when the UNC-to-site equipment network link is not operational.
- Provisioning Manager is used to program system-level parameters for the zone controllers, PDGs, consoles, conventional site controllers, and to set up sites and channels in the zone controller. Data service-related parameters are programmed for the PDG.

For detailed configuration procedures, see the *Provisioning Manager* and *Unified Network Configurator* manuals, and the CSS online help.

4.2 Configuring an HPD Site

Follow this process to configure the equipment at an HPD site.

Use the as-built documentation of your system as your programming aid to ensure that you program the devices to a known baseline. The as-built documentation outlines programming for the HPD overlay equipment and provides the settings for all parameters of the devices at the site. Configuration/Service Software (CSS) default settings provide typical values that are suitable for many sites.

This configuration process is nearly identical to the process used for HPD overlay in a simulcast subsystem. However, configure the HPD site properly as colocated with an ASTRO® 25 repeater site in Unified Network Configurator (UNC).

WARNING: The HPD GCP 8000 Site Controller switch configuration must be set up properly before plugging the HPD site into the voice site network. If the HPD GCP 8000 Site Controller is installed at a site with two Ethernet switches or two GCP 8000 Site Controllers, the redundant switch connection (port 20) must be disabled for each HPD GCP 8000 Site Controller. Disable the connection (port 20) through CSS to prevent a network loop at the site.

IMPORTANT: Do not deviate from specified settings without following the proper change procedures for your organization. If a problem due to programming arises, not following proper change procedures makes troubleshooting more difficult.

Prerequisites: Locate the IP address and physical address for each of the HPD GTR 8000 Base Radios and HPD GCP 8000 Site Controller modules before performing this process. Contact your system administrator for this information.

Process:

1. Transfer and install software to the equipment at the HPD remote site by using Software Download Manager.

   NOTICE: All software is installed by Motorola before shipping the equipment to the intended installation site. SWDL Manager is used to transfer and install software updates to devices in the HPD remote site as needed.

2. The following records must be created and configured in Provisioning Manager (PM) at each site for the zone controller:
   - Sites
   - Channels
3. Set the IP address and physical address for each of the HPD GTR 8000 Base Radios and HPD GCP 8000 Site Controller modules by using a direct serial connection with CSS.
4. Use the Unified Network Configurator Wizard to:
   - Discover devices.
   - Upload configurations for the devices.
   - Generate changes for non-compliant devices.
   - Approve jobs (if any).
5. Configure the HPD GCP 8000 Site Controller settings through CSS. See: Configuring the HPD GCP 8000 Site Controller settings through CSS on page 46.
6. Configure the HPD GTR 8000 Base Radio settings through CSS. See: Configuring the HPD GTR 8000 Base Radio settings through CSS on page 47.

4.2.1 Configuring the HPD GCP 8000 Site Controller settings through CSS

Prerequisites: Perform Configuring an HPD Site on page 45.

Procedure:

1. Connect Configuration/Service Software (CSS) with the active HPD GCP 8000 Site Controller through an Ethernet connection.
2. Configure the channels, band plan, and switch settings. If the site has two Ethernet site switches or two GCP 8000 Site Controllers, then both HPD GCP 8000 Site Controllers are connected to the LAN. In this case, the redundant switch connection (port 20) in each HPD GCP 8000 Site Controller must be disabled through CSS to prevent a network loop. If the site only has one Ethernet switch (and only one HPD GCP 8000 Site Controller connects with the LAN), then the switch connection (port 20) must be enabled through CSS. This must be done before connecting the HPD GCP 8000 Site Controllers to the ASTRO® 25 repeater site LAN.
3. Write the data to the HPD GCP 8000 Site Controller.
4. Check the status report and status panel to verify that the HPD GCP 8000 Site Controller and its components are operating properly.

5 Check the GPS information screen and verify the values. Press the Refresh button to get current GPS values.

6 Through a serial connection, initiate the battery equalization for the HPD GCP 8000 Site Controller by using CSS.

7 Reset the HPD GCP 8000 Site Controller so the other HPD GCP 8000 Site Controller becomes active.

8 Configure the new active HPD GCP 8000 Site Controller in the same manner.

4.2.2
Configuring the HPD GTR 8000 Base Radio settings through CSS

Prerequisites: Perform Configuring an HPD Site on page 45.

Procedure:

1 Connect Configuration/Service Software (CSS) with the HPD GTR 8000 Base Radio through an Ethernet connection.

2 Configure the GTR 8000 Base Radio settings, including the transmit/receive frequencies, band plan settings, battery type, and GTR 8000 configuration (standalone, site subsystem, or expandable site subsystem).

3 If the HPD GTR 8000 Base Radio is in a site subsystem or GTR 8000 Expandable Site Subsystem rack, set the attenuation on the receive multicouplers (RMCs) according to the values in the Receive Multicoupler (RMC) Configuration tab.

4 Press the Validate HW Configuration button to verify that the hardware configuration is valid. A success or error message is displayed.

5 Change the mode from Configuration mode into Normal mode.

6 Write the data to the HPD GTR 8000 Base Radio.

7 Check the status report and status panel to verify that the HPD GTR 8000 Base Radio and its components are operating properly.

8 Initiate a battery alignment in CSS.

9 Set the HPD GTR 8000 Base Radio to Service mode.

10 Initiate tests and measurements for BER and RSSI by using HPD patterns (connect with a service monitor).

11 Set the HPD GTR 8000 Base Radio with the appropriate channel number through CSS.

12 Set the date and time through CSS.

4.3
Software Download

The HPD GCP 8000 Site Controllers and GTR 8000 Base Radios are pre-loaded with software before shipping from the factory. If additional devices are added to the site or if the software has to be upgraded, use the Software Download Manager to transfer and install the software.

The HPD GCP 8000 Site Controllers and HPD GTR 8000 Base Radios each have an active and inactive memory bank. A software transfer is a background process that does not affect system operation. During the transfer, software is loaded into the inactive memory bank of the device. The HPD GCP 8000 Site Controllers act as the proxy devices for the HPD GTR 8000 Base Radios. Any transfers for the HPD GTR 8000 Base Radios are first loaded into the HPD GCP 8000 Site Controllers, which then transfer the software into the HPD GTR 8000 Base Radios at the site.

When the install is selected, reset the devices and initialize by using the new software. The old software remains in the inactive memory bank. A successful transfer and installation process may take between 20 minutes and 1 hour, depending on the number of channels at the site.

Version information, installed files, and other information for both the active (running) software and inactive software can be viewed through Software Download Manager.

4.4 GCP 8000 Site Controller Configuration for HPD Operation with CSS

For detailed configuration procedures about the GCP 8000 Site Controller by using Configuration/ Service Software (CSS), see the *GCP 8000 Site Controller* manual and CSS online help.

4.5 GTR 8000 Base Radio Configuration for HPD Operation with CSS

For detailed configuration procedures about the GTR 8000 Base Radio using the Configuration/Service Software (CSS), see the *GTR 8000 Base Radio* manual and CSS online help.

Chapter 5

ASTRO 25 Repeater Site with HPD Overlay Feature Expansion

This chapter provides the system-wide feature expansion information necessary to add HPD overlay to an existing site.

5.1 Bandwidth Requirements

Since the HPD overlay equipment shares bandwidth on the site link, consider the total amount of bandwidth on the site link. An ASTRO® 25 repeater site does not exceed more than a full T1/E1 link. However, if an existing site is using a fractional T1/E1 site link, then supply the proper amount of bandwidth to support the ASTRO® 25 repeater site equipment, HPD overlay equipment, and any conventional channels supported at the site.

The HPD overlay equipment requires one DS0 of site link bandwidth per HPD channel at the site (with a minimum of two DS0s). So, add a total of 2-5 DS0s to the site link bandwidth calculation for the HPD overlay equipment. For additional information on calculating bandwidth requirements, see the *Console Site Bandwidth Management* manual.