Microwave Digital Radios

Constellation®

Installation Manual

P/N IMN-112871-E13

CONSTELLATION®
MICROWAVE RADIO

INSTALLATION MANUAL
PART NO. IMN-112871-E13
JANUARY 2006

Product Designation	Freq. Band, GHz	Low/Medium Capacity			High Capacity							
		8 DS1	16 DS1	28 DS1	High Gain 16T	High Gain 28T	155 High Gain 1DS3	3DS1 w/1 DS1 WS	2DS3+ 28DS1 w/1DS 1 WS	3DS3 + 28 DS1	3DS3 w/add -drop & WS	4 DS3
Constellation	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	7/8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10/11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓= 16T High Gain & 28T High Gain use modem options 115540-002 and 115540-003 respectively.

HARRIS

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WARNING

Making adjustments and/or modifications to this equipment that are not in accordance with the provisions of this instruction manual or other supplementary documentation may result in personal injury or damage to the equipment, and may void the equipment warranty.

AVERTISSEMENT

Tout réglage ou modification faits à cet équipement hors du cadre édicté par ce guide d’utilisation ou par toute autre documentation supplémentaire pourraient causer des blessures ou endommager l’équipement et peut entraîner l’annulation de sa garantie.

WARNUNG

Die an diesen Geräten gemachte Einstellungen und/oder Änderungen, welche nicht gemäß dieser Bedienungsanleitung, oder gemäß anderen zusätzlichen Anleitungen, ausgeführt werden, können Verletzungen oder Materialschäden zur Folge haben und eventuell die Garantie ungültig machen.

ATENCIÓN

Llevar a cabo ajustamientos y/o modificaciones a este equipo, sin seguir las instrucciones provistas por este manual u otro documento adicional, podría resultar en lesiones a su persona o daños al equipo, y anular la garantía de este último.

警告

不按该说明书有关条例或其它补充文件对该设备所做的调整和／或改型可能会引起人身伤害或损坏设备，并且设备保修也将失效。

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PREFACE

ISO 9001 Certification

The Harris Microwave Communications Division is committed to total customer satisfaction and is I.S. EN ISO 9001: 2000 registered for the design, manufacture, installation and service of microwave radio products and systems.

Technical Assistance Center

Our Technical Assistance Center (TAC) is staffed with factory trained and highly qualified Product Support staff whose task is to provide telephone support to resolve complex customer equipment problems quickly and accurately in a timely manner. Customers who completed product training given by Harris Microwave Communications Division and are equipped with proper test equipment and spare parts will experience quick resolution of their equipment problems.

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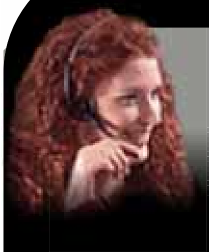
Phone: +60-3-7728-8228 ext. 8319
Fax: +60-3-7722-2826
Email: LeeEH@trisilco.com.my or rahaidah@trisilco.com.my

See Chapter 12 for more information about technical assistance and customer service.



Service Registration Form

Dear Customer,
To facilitate warranty support and to receive product update information, please register on the Harris MCD Premier Customer website:

https://premier.harris.com/microwave

If you are unable to register online, please complete the form at the bottom of this page and return this page to our customer service department.

By Fax: 514-685-4580

By email: crcmtl@harris.com

By mail: Harris Corporation
Microwave Communications Division
3 Hotel de Ville
Dollard-des-Ormeaux, Quebec
CANADA H9B3G4

PLEASE PRINT:

Company Name: ______________________________

Requestor's Name: ______________________________

Title: ______________________ Dept: ______________________

Address: ______________________________

City: ______________________ State/Province: ______________________

ZIP/Postal Code: ______________________ Country: ______________________

Telephone Number: ______________________ Fax Number: ______________________

Email: ______________________________

Original Sales Order/PO Number: ______________________________

Sales order numbers are found in your documentation and are stencilled on the equipment rack base plate, for example, A44044A1.

CHAPTER

1

INTRODUCTION

About This Manual

This manual contains procedures for installing, commissioning, and troubleshooting the Harris Constellation Radio System. It also contains safety and customer service information.

The Constellation system software information in this manual is for Version 6.x. The system software resides in the SPU Controller.

Notices

To protect both personnel and equipment, the following notices are used throughout this manual.

The "exclamation point" in a triangle indicates a Warning or Caution. This notice alerts the personnel to possible damage to equipment, interruption of service, or a violation of a legal requirement.

The “pencil and pad” indicates a Note. This notice clarifies or qualifies a specific point or instruction in the procedure or description.

The “stop sign” indicates a pause in the procedure to perform some other task. Once you have completed the other task, you may continue with the procedure.

Related Publications

- Constellation Systems Application Information
- Constellation Keypad Menus Quick Reference Card

Safety Warnings

General

The installation, maintenance, or removal of radio equipment (including grounding) and the radio antenna system must be performed by qualified personnel. Harris MCD is not responsible or liable for the improper performance of the equipment, damage to the equipment, or injury to personnel caused by improper practices.

To prevent equipment damage and shock hazard caused by lightning, antenna installation and the grounding system must comply with NEC or IEC standards, and local regulatory requirements.

The following general safety precautions must be observed at all times.

- Heed all warning labels that are permanently affixed to the equipment. Failure to heed warnings can result in serious injury to the equipment and/or user.
- Observe all laser, optical, and RF precautions.
- Observe all electrical precautions.
- Verify that the grounding configuration complies with local code practice and requirements.

Personal Safety

RADIATION-FREQUENCY RADIATION HAZARD

Do not open waveguide with RF power on.

Do not connect power to the radio assembly unless the transmitter is properly terminated. The transmitter is terminated when its output is connected to the antenna, to test equipment, or to a dummy load.

Only properly trained personnel should operate this equipment.

Verify grounding before the electrical power source is connected to the equipment.

Do not look into optical connectors. Invisible laser light emitted from optical sources can cause permanent eye injury.

Equipment Safety

Handling Static-sensitive Devices

Some of the components in the Constellation radio are sensitive to static electricity, or electrostatic discharge (ESD) and thus can be damaged or destroyed by ESD that builds up in your body through routine activity. ESD-sensitive components are marked with one of the following symbols:

Before working on the Constellation, discharge any static electricity you may be carrying. Handle the equipment in a static-free environment and use a grounding wrist strap or a heel strap.

Handling Connectors

Avoid touching the edge connectors with your fingers.

Do not touch the optical connector face with your fingers.

Long-term Storage

The Constellation contains moisture-sensitive devices (MSDs) that are shipped in vacuum-sealed packages for protection. Moisture can build up in the MSDs when they are not powered up or not in active use and thus damage sensitive components.

- Store MSDs that are not being used in a dry place.
- Rotate the MSDs every two years.

Regulatory Compliance (USA)

FCC Title 47, Part 101

This equipment requires licensing for operation under FCC Title 47, Part 101.

FCC Part 15 Emission Requirements

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with this instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when it is operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user of the Constellation radio, at the user's own expense, is required to take whatever measures may be required to correct the interference. The test results show that properly shielded cables are required to maintain compliance with the Class A limits for radiated emissions.

The Constellation Radio

The Constellation Radio is a scalable low, medium, and high capacity digital radio. The radios are available in 6, 7, 8, 10, and 11 GHz frequency bands. Refer to the Constellation Systems Application Information (SAI) manual for more information.

The Constellation platform includes both terminal and repeater configurations. The high-capacity Constellation radio is not available in a repeater configuration. Refer to the Constellation SAI manual for more information.

Repeater configuration radio supports an add/drop of up to 16 DS1 signals from each direction. The DS1 signals must be dropped in groups of four.

Low/Medium Capacity Radio

- 8, 16, 28* DS1 (terminal and repeater)
- 1 DS3 (available in back-to-back, but not in repeater configuration)

** Supports a maximum of 16 DS1 add/drop signals from each direction. If more than 16 DS1 signals are to be dropped, then a back-to-back configuration is required.*

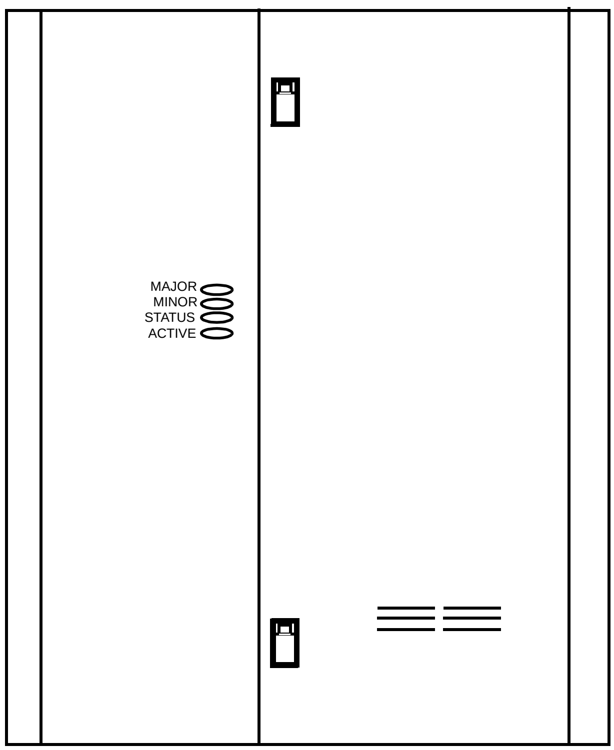
High Capacity Radio

- 4 DS3 with add-drop capabilities on 3 channels
- 3 DS3 with add-drop capabilities and wayside
- 3 DS3 with 1 DS1 wayside
- 2 DS3 + 28 DS1 with 1 DS1 wayside
- OC-3 with 1 DS1 wayside
- STM-1/STS-3 with 1 DS1 or E1 wayside

Physical Description

The Constellation Radio is designed with removable doors for easier access to the shelf and card cage. The alarm LEDs can also be observed without opening the doors. See Figure 1-1.

Figure 1-1: The Constellation Radio



INTRODUCTION

The Constellation Elements

The Constellation Radio contains the following:

- Fuse Panel
- External Alarm/Control Connector
- Antenna Coupling Unit (ACU)
- Radio Frequency Section
  - Transmitter Assembly
  - Receiver Assembly
  - Power Supply
- Signal Processing Section
  - Modem
  - High Level Mux
  - Service Channel
  - SPU Controller
  - M12 Unit (not for all configurations)
- Fan Assembly
- Handset, Keypad, and Customer Access Area

Rack Size

The Constellation radio can be installed in a standard 19-inch equipment rack.

A fully protected terminal configuration requires 15 RMS (rack mounting spaces). A low/medium capacity repeater can be mounted on a single rack, however, an additional RMS is required below for ventilation, and another RMS above for access to the ACU. A high capacity radio repeater is installed in back-to-back terminals.

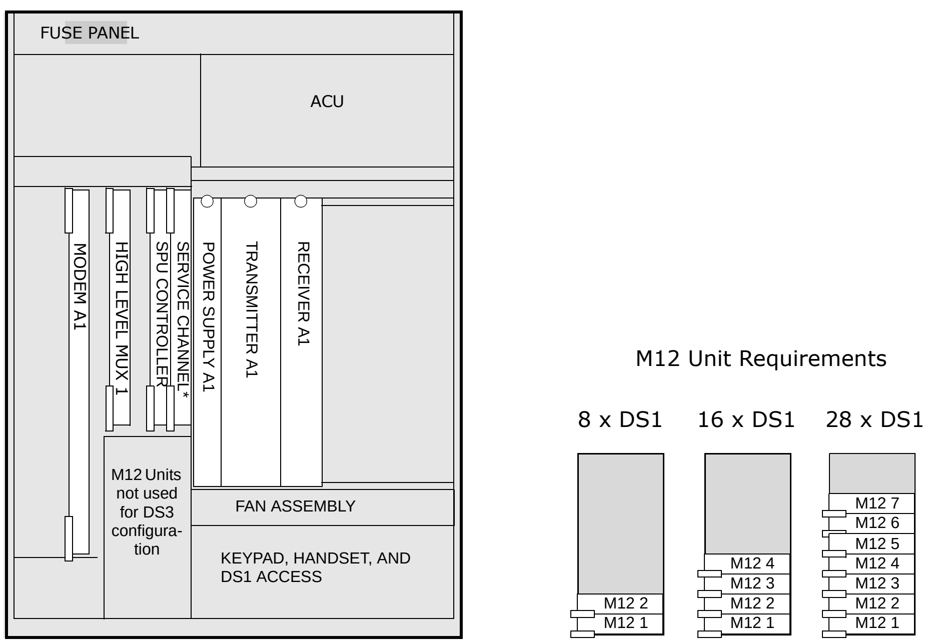
Refer to the Constellation SAI manual for more information.

Shelf Configurations

The following shelf configurations are available for the Constellation Radio. See Figure 1-2 to Figure 1-9.

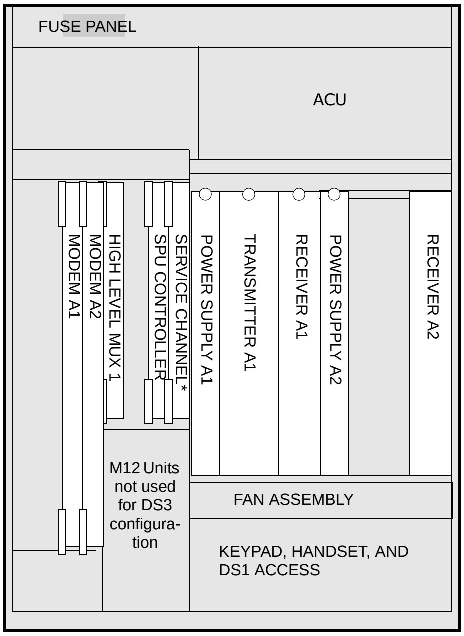
- Nonprotected Terminal
- Nonprotected Tx/Space Diversity (SD) Rx Terminal
- Monitored Hot Standby (MHSB) Terminal
- Nonprotected Add-Drop Repeater
- Protected Add-Drop Repeater
- Optical and Electrical Configurations (OC3 and STS-3 with wayside)
- 4xDS3 (3DS3+28 DS1, 4DS3 with ADM) no wayside
- 3xDS3 (2DS3 + 28 DS1, 3DS3 with ADM) with wayside
- MHSB 155/3xDS3/4xDS3 back-to-back terminal with wayside

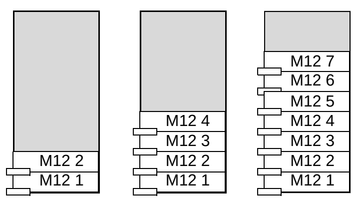
Figure 1-2: Low/medium capacity, nonprotected terminal



*Service Channel is optional.

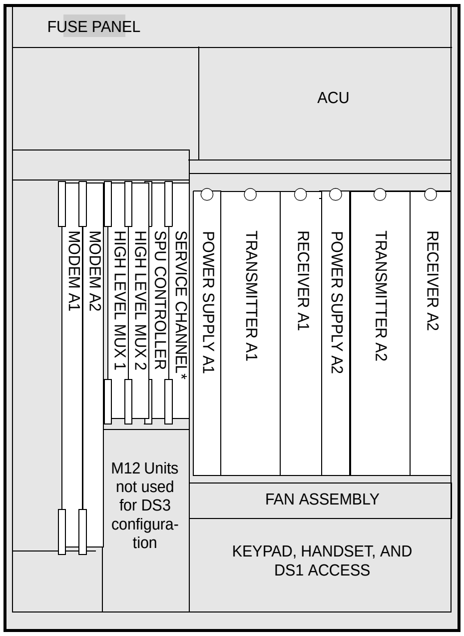
Figure 1-3: Low/medium capacity, nonprotected Tx, SD Rx terminal





*Service Channel is optional.

Figure 1-4: Low/medium capacity, protected terminal (HS, FD, and SD Rx)



*Service Channel is optional.

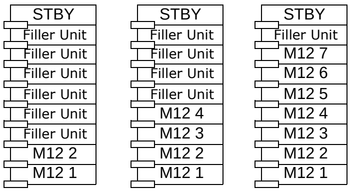
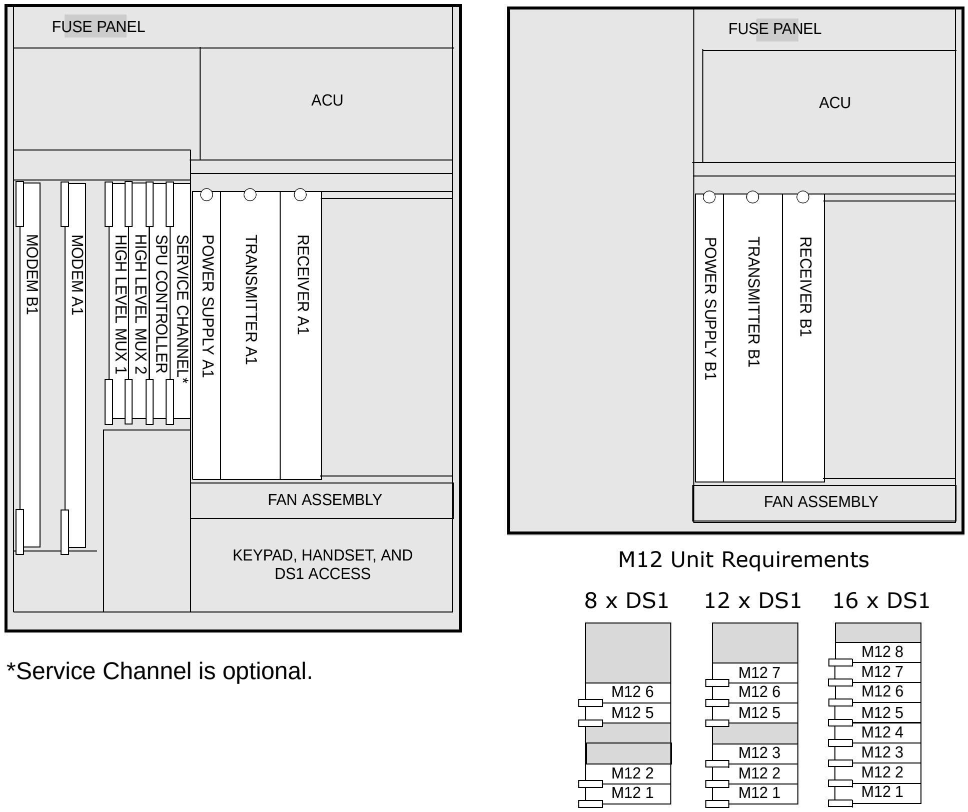
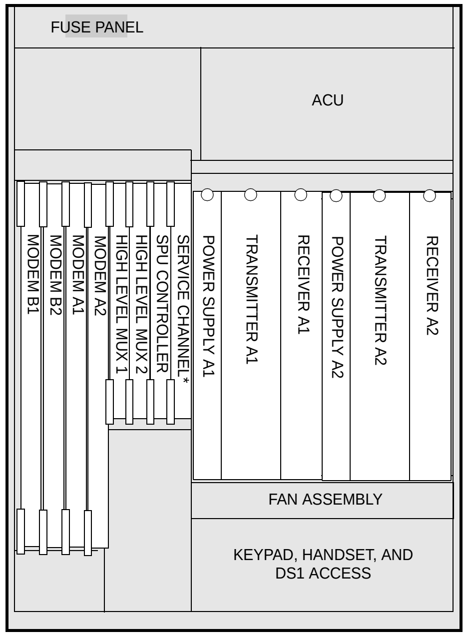


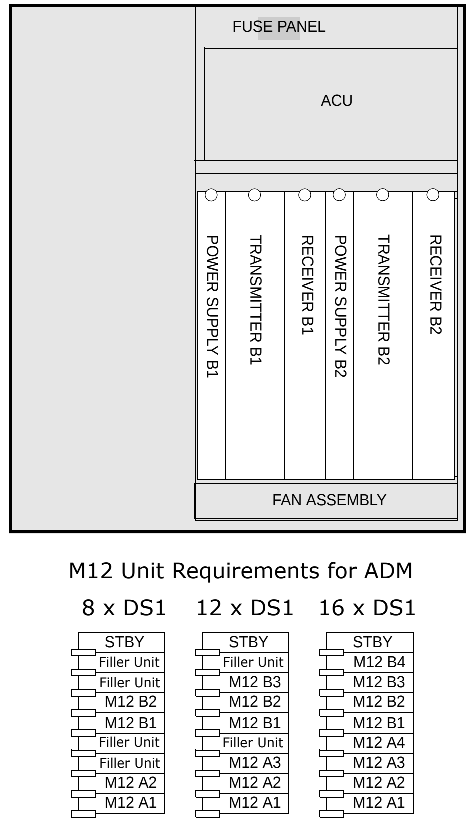
Figure 1-5: Low/medium capacity, nonprotected add-drop repeater



*Service Channel is optional.

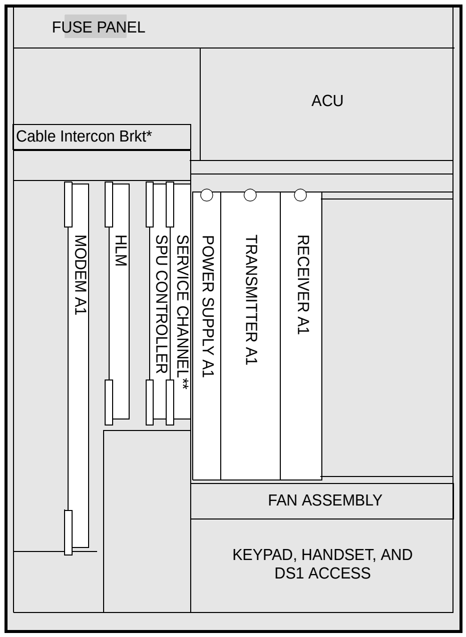
Figure 1-6: Low/medium capacity, protected repeater



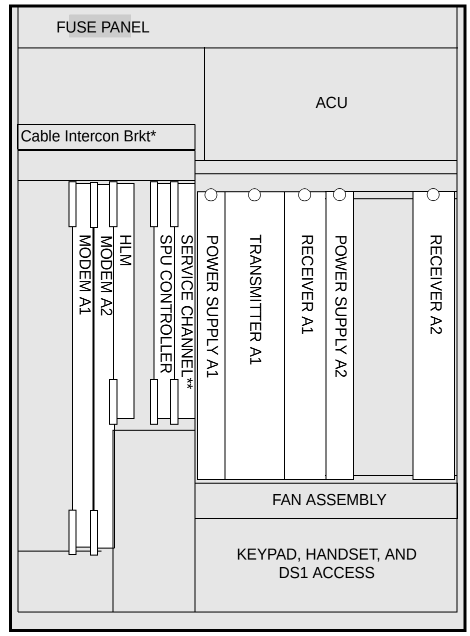


*Service Channel is optional.

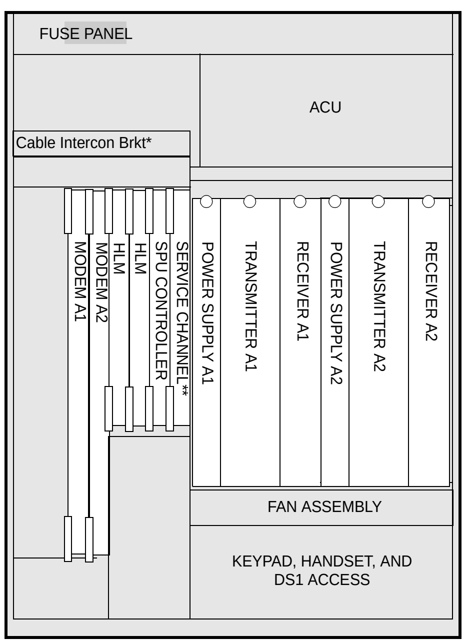
Figure 1-7: High capacity, optical and electrical configurations



Nonprotected Terminal



Nonprotected Tx, SD Rx Terminal

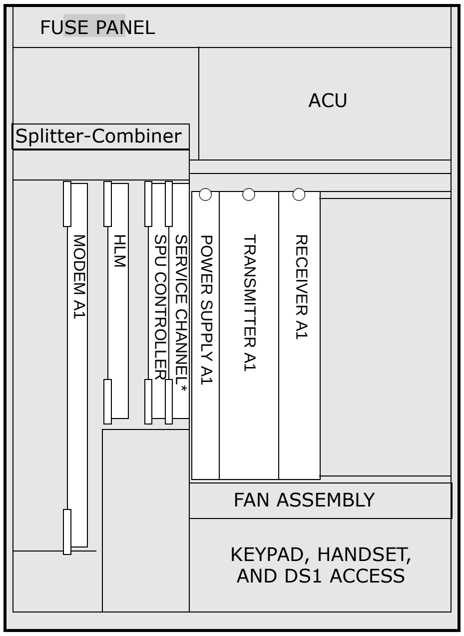


MHSB Terminal
MHSB, SD/FD Terminal

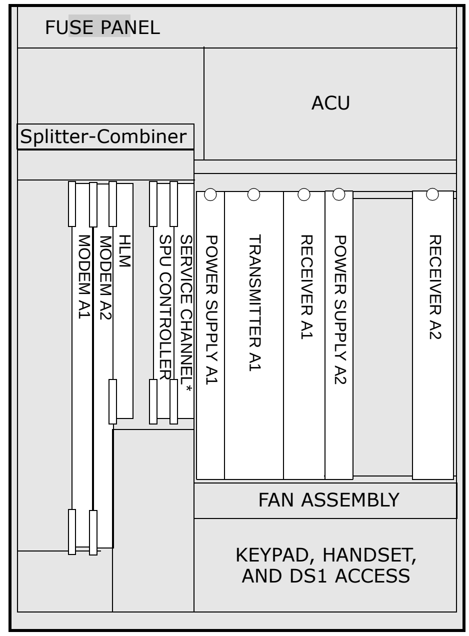
*The Cable Interconnection Bracket is for the 155 Electrical system only. It is not installed in the 155 Optical system.

**Service Channel is optional.

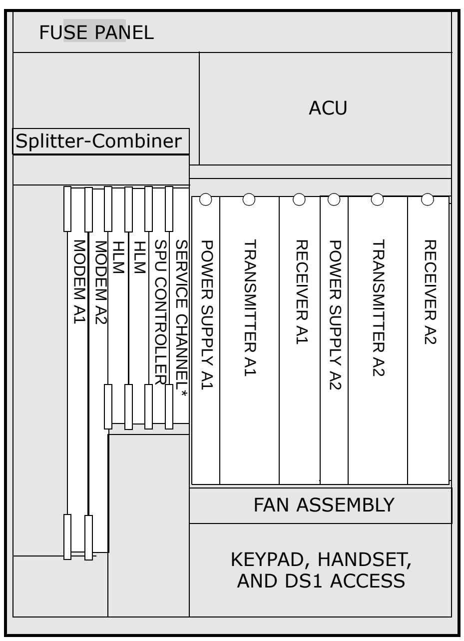
Figure 1-8: High capacity, 4xDS3/3xDS3 terminals



Nonprotected Terminal



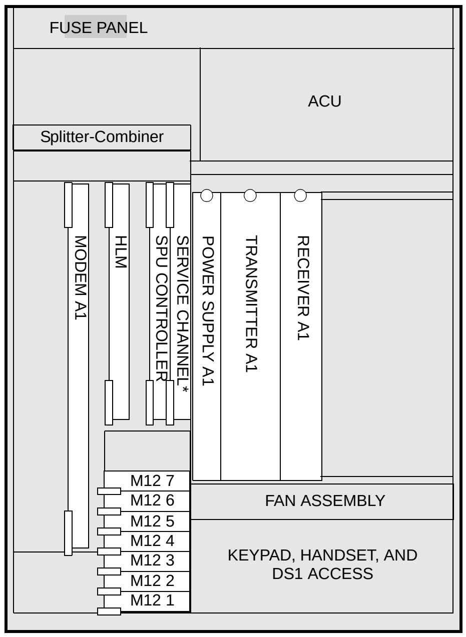
Nonprotected Tx, SD Rx Terminal



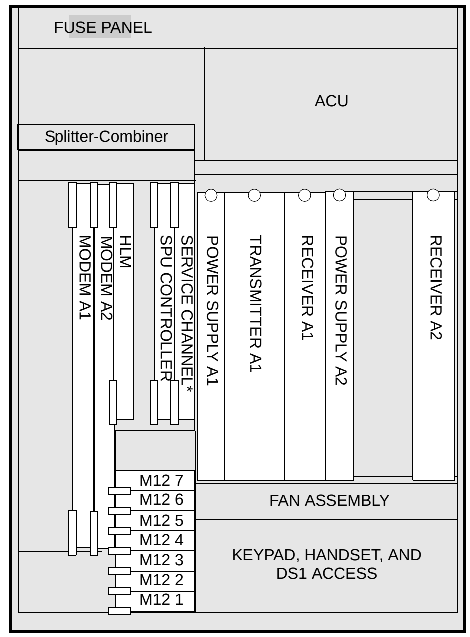
MHSB Terminal
MHSB, SD/FD Terminal

*Service Channel is optional.

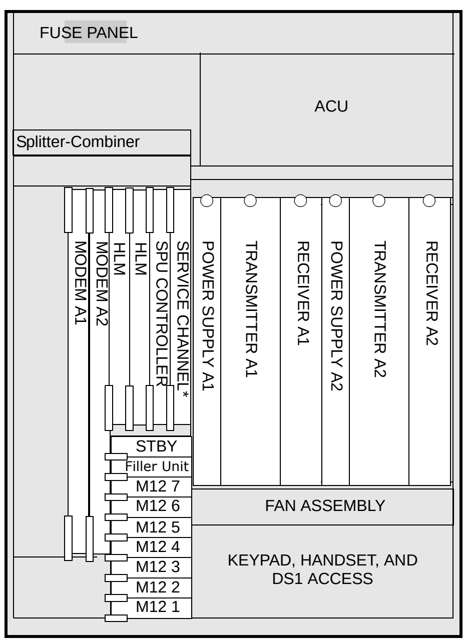
Figure 1-9: High capacity, 3xDS3/2xDS3 + 28 DS1 terminals



Nonprotected Terminal



Nonprotected Tx, SD Rx Terminal



MHSB Terminal
MHSB, SD/FD Terminal

*Service Channel is optional.

For programmable add-drop configurations, M12 Units need to be equipped for dropped T2's only.

Tributary Configuration

Terminal

In a terminal, 28 DS1 circuits are allowed. They are Trib A1 to Trib A28.

Table 1-1: Tributary configuration for a terminal

Slot	M12	Trib
1	M12-1	Trib A1 - A4
2	M12-2	Trib A5 -A8
3	M12-3	Trib A9 - A12
4	M12-4	Trib A13 - A16
5	M12-5	Trib A17 -A20
6	M12-6	Trib A21 - A24
7	M12-7	Trib A25 - A28

Repeater

A repeater configuration can have A (Trib A) and B (Trib B) directions. Trib A goes to the “A” radio, and Trib B goes to the “B” radio. Up to 16 DS1 signals can be transmitted to the “A” radio, and up to 16 DS1 signals can be transmitted to the “B” radio.

Table 1-2: Tributary configuration for a repeater

Slot	M12	Trib
1	M12-1	Trib A1 - A4
2	M12-2	Trib A5 -A8
3	M12-3	Trib A9 - A12
4	M12-4	Trib A13 - A16
5	M12-5	Trib B1 -B4
6	M12-6	Trib B5 -B8
7	M12-7	Trib B9 - B12
8	M12-8	Trib B13 - B16

System Features

Protection Switching

The Constellation Radio can be configured with the following protection system.

- Transmitter Assembly
- Receiver Assembly
- Power Supply
- Modem
- High Level Mux
- M12 Units

The primary set is operating, while the other set is operating in a monitored hot standby (MHSB). When one of the units in the radio shelf fails, the SPU Controller implements an automatic switching algorithm. Switching is nonrevertive; that is, when a failed unit is replaced by a working one, an automatic switching from the standby unit to the working unit does not occur. The exception is the M12 Unit protection, whose nonrevertive or revertive mode can be selected through the Keypad.

All units except the M12 Units are 1+1 protected. M12 Units are 1:N protected.

If one (or more) T1 channel fails on an online M12 Unit, all 4 of those channels are switched to the standby M12 Unit. This switching action causes a momentary disruption of traffic on all 4 of the T1 channels.

The HLM provides errorless switching for the receive paths. Although errorless switching is provided on all MHSB radios, its primary purpose is for space diversity receivers. Switching several times a day is normal for space diversity receivers. Receiver switching is errorless with up to 200 ns of delay between receivers.

RCS Function

Reverse Channel Switch (RCS) is a feature that takes effect when a sync loss occurs at the remote end, or there is a transmitter silent failure in a MHSB configuration. When this happens, a command is sent back to the coordinating radio to switch transmitters as long as the transmitters are not in alarm.

Automatic Transmitter Power Control (ATPC)

ATPC

Full ATPC functionality is a supported feature of Transmitter Assemblies, Model 3 and higher, and has a guaranteed 10 dB range. ATPC is not supported for Model 1 and Model 2 Transmitter Assemblies.

Refer to Appendix C for identifying the model numbers.

ATPC Range

Constellation operates at one of two transmit output power levels: ATPC High and ATPC Low. The levels are set during the calibration procedure to values ranging between 2.5 dB and 10 dB.

- The high power can be set as much as 7.5 dB below the rated power
- The low power can be set as much as 10 dB below the rated power
- The delta between high power and low power calibration settings must be at least 2.5 dB

The radio can be operated at 10 dBm below the rated power by using the keypad to calibrate "ATPC High" at rated power, calibrate "ATPC low" at 10 dB lower than rated power, and then selecting "ATPC disabled low."

Alternatively, the ATPC low setting can be calibrated between 2.5 dB and 10 dB below rated power (ATPC High setting). So, the radio can operate at a value between 2.5 dB and 10 dB below rated power by selecting "ATPC disabled low" through the keypad.

Attenuation pads are required to operate at more than 10 dB below rated power

ATPC Functionality

With the ATPC feature enabled, the Transmitter Assembly operates at a reduced power level output of 10 dB below nominal level during normal operation.

When the RSL (Received Signal Level) at the far-end Receiver drops below a predetermined threshold, a request for increased transmitter power is sent upstream to the Transmitter. For a maximum of 5 minutes, the Transmitter increases the output power to full power by approximately 10 dB.

When a fade condition no longer exists (or 5 minutes have passed), the Transmitter will return to the reduced power level output of 10 dB below nominal level.

ATPC can be enabled or disabled through the Keypad.

Software Updates

The download program stores run-time software in the SPU Controller. This downloading can be done either directly at the local site or remotely from a distant site.

Replaceable Modules

Plug and play enables the user to remove a field-replaceable module from service and then replace (or restore) the module without needing to reprogram the user-configurable settings. All modules in the Signal Processing section can be removed and replaced without turning off the power.

Alarm Reporting

The following alarm system is supported:

- Fault LEDs
- Online LEDs
- Local status LEDs
- External control relay and customer external alarm inputs

Add-Drop Multiplexer Configuration

DS1 Configuration

At a repeater, T1 tributaries may be dropped in groups of 4 T1 lines ($T1_{1-4}$, $T1_{5-8}$, $T1_{9-12}$, and $T1_{13-16}$).

- A direction: M12 slots 1 through 4
- B direction: M12 slots 5 through 8

By using the Keypad command, each dropped T2 group may be assigned to any of the 4 M12 slots.

The protection M12 Unit protects the A and B direction slots.

3DS3/4DS3 Configuration

For back-to-back terminals, one of the DS3 channels in the 3xDS3 unit can be selected for a limited add-drop configuration. In the 4xDS3 unit, DS3 channel 1, 2, or 3 can be selected for a limited add-drop configuration. In this mode, M12 Units are needed only for DS1 signals (in groups of 4) that are dropped or inserted. Up to 16 DS1 signals can be dropped/inserted in each direction. Any DS1 signals that are not dropped are passed to the other terminal via the DS3 cables. DS1 signals may only be passed through in this mode for up to 8 hops before they are terminated.

Network Management and Control

Network Management Interfaces

The Constellation Radio offers versatile open network management with an embedded SNMP agent and compatibility with Harris' NetBoss, StarView, or FarScan network management platforms.

Refer to the following manuals for more information.

- FarScan for Windows
- NetBoss
- StarView Element Management System

User-Friendly Radio Interface

The Constellation also supports a Keypad interface. The Keypad can be used for local (per hop) monitoring of alarms and statuses, and for provisioning the network elements. The Keypad allows the customer to quickly configure a system or diagnose a trouble on a hop.

In place of a Keypad, the customer can connect a terminal (VT100-compatible) or a laptop with terminal emulator software to communicate with the Constellation radio.

CHAPTER

2

SITE PREPARATION

Power Source

DC power source, 20 V to 60 V.

Equipment Rack Location

The equipment rack should be located in a sheltered area that provides proper lighting, ventilation, and access to both the front and back of the Constellation radio.

At least 3 feet of space must be between the equipment, strong magnetic fields, and sources of impulse noise.

Equipment Inspection

Verify that the correct radio system is going to be installed.

- Each Constellation radio has been set up at the factory according to the customer's specifications. To configure a radio for a different application, contact the Harris MCD Technical Assistance Center (TAC). See page xv.
- The Constellation radio is shipped fully assembled and ready to install.

Unpacking Procedure

1. Check all packaging for external damage; report any external damage to the carrier. If damage is noted, a shipping carrier agent should be present for unpacking and inspecting the remaining contents.
2. Open and check each package against the bill of material. If any items are missing, contact Harris MCD’s Customer Support. The Customer Support information is found at the beginning of this manual.
3. Do not remove equipment from antistatic packaging until immediately before installation.
4. Ensure that the connectors are undamaged.
5. Ensure that all plug-in units are firmly seated.
6. Ensure that the cable connections are undamaged and secure.

CHAPTER

3

INSTALLATION AND COMMISSIONING

Introduction

FCC Requirements

The Federal Communications Commission (FCC) requires that records of transmitter measurements be maintained.

Data and Records

The Constellation radio is set up, aligned, and tested at the factory. You will need the following for putting the radio into service.

- Factory/Field Test Data (in the Sales Order Specific Information binder).
- Constellation Routine Maintenance Log form.
  See Chapter 10 for an example of this form.

Precaution

Do not turn on the power to the radio until directed.

Recommended Tools and Test Equipment

Customer-supplied Tools

Table 3-1 lists the customer-supplied tools needed for installation of the Constellation radio.

Table 3-1: Customer-supplied tools

Tools
Antistatic wrist or heel strap
Cable ties and cable-tie installation tool
Basic hand tools
Torque wrench
Cable for powering and grounding the rack

Recommended Test Equipment for Installation and Maintenance

Table 3-2 lists the recommended test equipment required to test the Constellation radio.

Ensure that the test equipment has
- ***the current calibration***
- ***the proper connector(s)***

so that you will get a correct reading from the test equipment.

Table 3-2: Recommended test equipment

Test Equipment	Specification	Model	Function
BER test set	For DS1, DS3, OC3 or electrical 155 Mb testing.	HP 37701 or equivalent	
Digital multimeter	3-1/2 digits Accuracy: 0.3% to ± 60 VDC, 2% from 10 mVAC	Fluke Model 77 or equivalent	To test the battery voltage. To align the antenna.
Frequency counter	Universal frequency counter with 10-digit accuracy and 2160 MHz ability	Agilent 53131A or equivalent	To adjust the frequency of the Transmitter and Receiver.
Power meter	100 kHz to 26.5 GHz ±1% accuracy	Agilent E4418B or equivalent	RF transmitter power output
Power sensor	–25 dBm to +33 dBm (medium and high power heads)	Agilent 8485A (-30 to +20 dBm) Agilent 8481H (-10 to +35 dBm) Agilent 8485D (-20 to -70 dBm) or equivalent	

Circuit Breakers

The values in Table 3-3 are for the Constellation terminal radio only.

Table 3-3: Recommended circuit breaker sizes for Constellation radio terminal only

	6, 7/8 GHz		10/11 GHz	
Configuration	24 V	48 V	24 V	48 V
Fully protected	25 A	15 A	30 A	15 A

Grounding Recommendations

Grounding in accordance with the R56 installation standard is necessary for proper operation of the equipment as well as protection of the personnel and equipment.

- Connect the ground between the radio rack and halo, or ground window of the site.
- Do not connect the ground through any other radio or rack.
- Do not daisy chain the grounds. A surge through a daisy chain ground will go through all the radios.
- The return bus bar should be grounded using 6-AWG wire as a minimum.

Some operators require the same gauge wire for the return buss bar and the battery cables. This may help avoid DC power surges when the on-site generator switches between on or off.

Monitoring Recommendations

It is important that you use high-quality adapters when monitoring power output at the radio monitor port. Inexpensive “screw together” adapters introduce unpredictable amounts of signal loss. Attempting to compensate for this signal loss can result in sync loss and errored seconds events.

Monitoring the Reference Frequency

Harris recommends monitoring the reference frequency during installation, and then at least once a year while the radio is in service.

The specification for the oscillator is +/- 300 Hz. The reference oscillator frequency can be adjusted through the Keypad. If it cannot be adjusted within 300 Hz, the OCXO should be replaced.

Performing routine checks and recording any adjustments can expose a potential crystal problem before there is a failure. Changes in crystal frequency are most likely in the first few months of operation. After three to six months, the crystal should stabilize.

UBER (Uncorrected Bit Error Rate) Measurement

The UBER command can be accessed through the Keypad's hidden Measurement submenu.

UBER is a measurement that shows BER (Bit Error Rate) before FEC (Forward Error Correction) takes place. UBER readings can vary over a wide range, in a normally operating radio, from zero to as high as 5 E10-4 for some modem options. Different modems use different error correcting schemes and as a result, the "normal" UBER range can vary. Even with these high UBER readings the radio will meet or exceed its 10 E-12 error floor performance. The UBER is time-averaged and a reading may reflect a constant error rate or a burst of errors from path activity or radio switching that has been averaged over time.

The causes of UBER may be Path activity, Transmitter IMD (Inter-Modulation Distortion), LO (Local Oscillator) phase noise, or any combination of these. Turning down the transmitter output power to improve the UBER is not necessary or recommended as the radio is designed to operate at the higher transmit power and with FEC. UBER readings can vary from radio to radio due to variations in the previously mentioned parameters; this does not indicate a faulty component but is a normal variation.

The following UBER readings may indicate a problem if they are in excess of:

- 1 E-3 for 4DS-3,
- 1 E -4 for 28T and 16 T high power
- 4E-7 for 8, 16T, 28T and 155 standard power.

If dribbling errors are occurring and UBER readings are greater than those mentioned above, the monitoring of UBER can be a useful troubleshooting tool. If the UBER is reset and the rate remains lower for a period of time and then jumps to a high value, it is an indication of an error burst which could be related to path activity. If the UBER value is constant and high, it may indicate a transmitter that has its output power set too high, or a defective module. In this case, the effect of corrective action can be indicated quickly by observing the UBER reading rather than waiting for hours or days to verify that the dribbling errors have been eliminated.

Summary of the Installation Procedures

Table 3-4 is a summary of the installation procedures.

Table 3-4: Installation procedures

Step	Procedure	For Details, Go To
1	Ensure that the power breaker is off or that the fuse is removed.	
2	Install the Constellation Radio rack as specified in the Sales Order Specific Information (Engineering Work Order).	
3	Ground the radio rack.	page 3-11
4	Open and remove the Constellation doors.	page 3-11
5	Connect the interconnection cables to the Constellation backplane.	page 3-14
6	Connect the Constellation radio to other equipment.	Appendix A
7	Connect the customer-configured alarm wires.	page 3-18
8	Connect the Constellation to the antenna or to a dummy load.	page 3-18
9	Test the office battery voltage.	page 3-21
10	Connect the battery power wires to the Constellation.	page 3-22

Turning on the Radio

Table 3-5: Turn-on procedures

Step	Procedure	For Details, Go To
1	Ensure that the correct fuses are installed in the Fuse Panel.	page 3-24
2	Turn on the power.	page 3-24
3	Turn on the Power Supply switch.	page 3-24
4	Ensure that the antenna port is terminated into a dummy load or the antenna system before turning on the TX switch.	
5	Turn on the TX switch on the Transmitter Assembly.	page 3-24

Do not continue until the radio has warmed up (about 1 hour).

Summary of the Terminal Test

Table 3-6 is a summary of the terminal test procedures.

Table 3-6: Terminal test procedures

Step	Procedure	For Details, Go To
Reference Frequency		
1	At the Transmitter Assembly, measure the reference frequency.	page 3-25
2	Measure the reference frequency at the Receiver Assembly.	page 3-28
Transmitter Power Measurement		
3	Use a Power Meter and the Keypad to verify the RF transmitter power output at the transmit monitor port.	page 3-30
Antenna Alignment		
4	**Ensure that the antenna is terminated into the antenna system (and not to a dummy load).** Align the antenna at the Receiver Assembly.	page 3-35
Loopback Tests		
5	Perform loopback tests (through the Keypad).	page 4-1
BER Tests		
6	Perform BER tests from the Keypad PERFORMANCE > TRIBUTARY	

INSTALLATION AND COMMISSIONING

Summary of the Hop Test

Network Element Address

Obtain a network element address from the network manager.

Verify the configurations listed in Table 3-7 (through the Keypad).

Table 3-7: Hop test procedures

Step	Procedure	For Details, Go To
1	The system configuration through the Keypad.	page 5-1
2	If applicable, the add-drop for a repeater system.	page 5-8
3	Configure the network management (through the Keypad).	page 6-1 page 7-1
4	The tributaries.	page 5-10
5	The relay outputs.	page 5-11
6	The Service Channel.	page 5-12
7	The protection system.	page 5-4 page 5-7
8	Inform the network manager that the Constellation is ready to be put into service.	

Detailed Installation Procedures

Ensure that the power breakers are off or that the fuses are removed.

1. Install the Constellation Radio rack

Install the Constellation radio rack as specified in the Sales Order Specific Information (Engineering Work Order).

2. Ground the radio rack

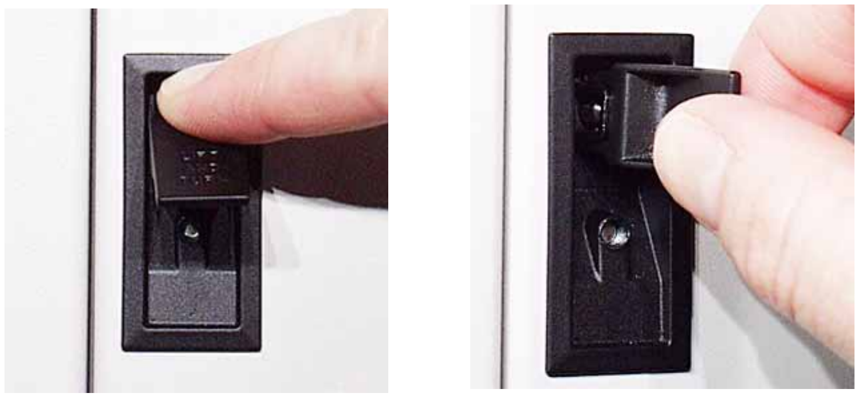
Install one end of the grounding cable to the Constellation Radio rack. Install the other end of the cable to the premises ground system in accordance with local procedures.

3. Open and remove the Constellation doors

a. To open the Constellation doors, lift up the two door latches and turn them clockwise. See Figure 3-1 and Figure 3-2.

Figure 3-1: Constellation Radio, front view

Figure 3-2: Door latch



b. The doors swing open 90 degrees.

c. For radios with straps (Figure 3-3) installed inside the door: Pull the straps (on the left and right sides) to unfasten them.

Figure 3-3: Door straps

d. Lift up the doors to remove them from the card cage.

CAN Connector

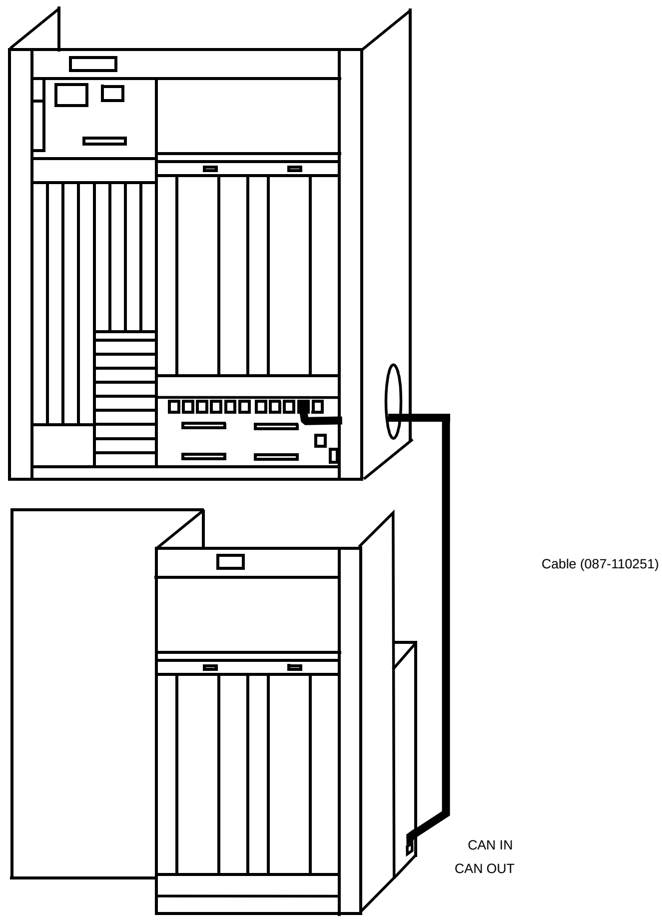
Terminal

Ensure that the RJ-45 connector labeled CAN on the Constellation backplane is terminated.

Repeater

Ensure that a cable (087-110251) is installed between the CAN port on the top shelf and the CAN IN port on the repeater shelf as shown in Figure 3-4.

Figure 3-4: Constellation Radio, repeater configuration



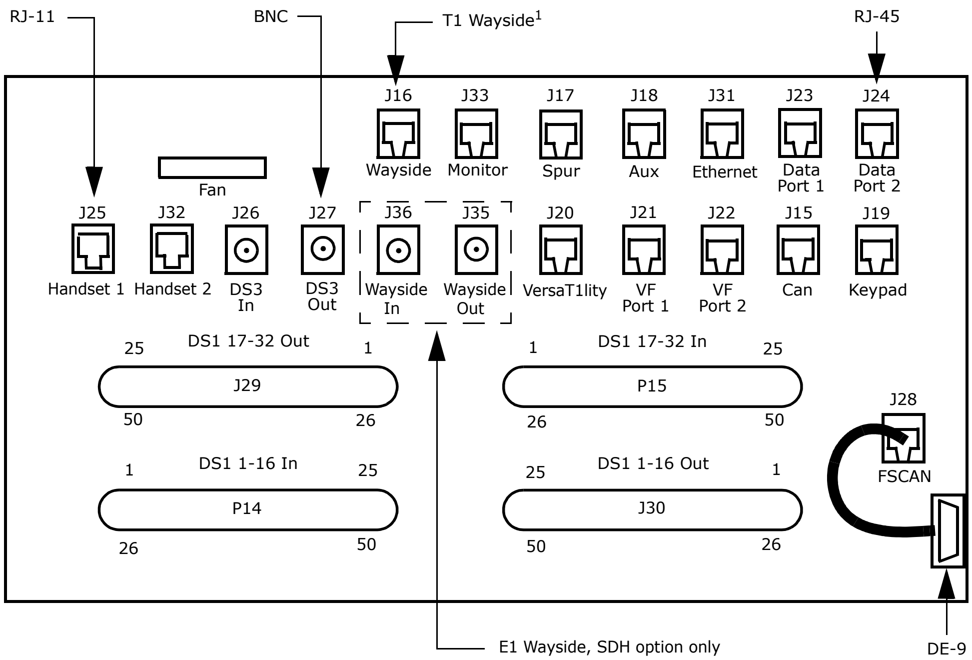
1. Connect the interconnection cables to the Constellation backplane.

Interconnection Cabling

DS1 Configuration

See Figure 3-6 and Table 3-8 for recommended interconnection cabling.

Figure 3-5: Customer access area



Notes:
1. The wayside connection for T1 is not for 1xDS3 or 4xDS3 but only for OC-3, 3xDS3, and 2xDS3 +28xDS1.
2. DS1 In = Input to the radio from the customer's DSX.
3. DS1 Out = Output from the radio to the customer's DSX.

a. You may need to remove the Fan Assembly for easier installation of the cables. See page 11-5 for instructions on how to remove the Fan Assembly.

b. Install the cables through the right port hole of the card cage.

If the Fan Assembly was removed, reinstall the Fan Assembly. See page 11-7 for instructions on how to install the Fan Assembly.

INSTALLATION AND COMMISSIONING

Figure 3-6: Interconnection cabling, DS1 configuration

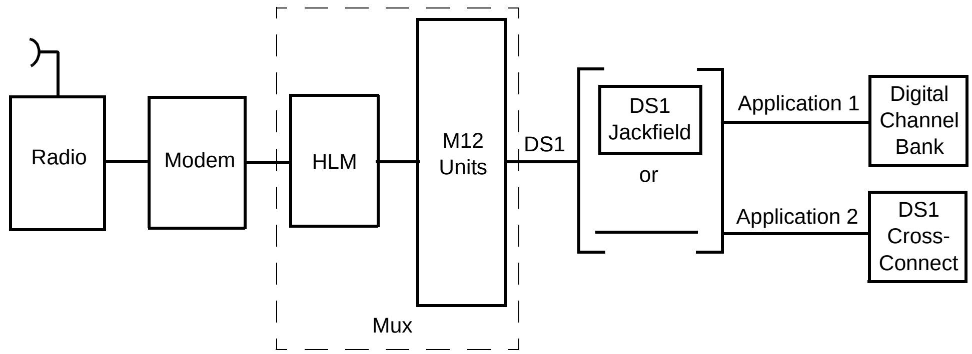


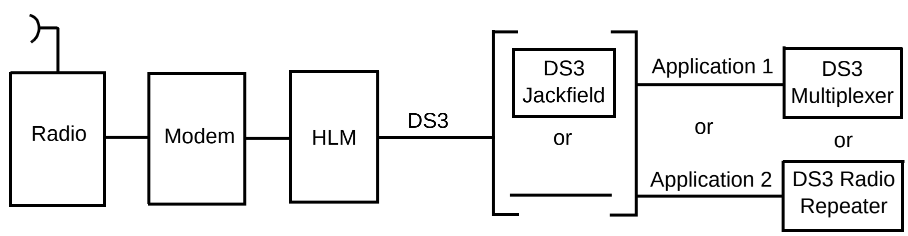
Table 3-8: Interconnection cabling requirements

Application		Cable Length (feet)	Line Attenuation/ Equalization	Specifications
1	Digital channel bank	0 to 1310	Programmed through software	22 AWG, 16-pair, tinned copper, twisted pair, solid, shielded, PVC, equipped with drain wire, 100 ohms
2	DS1 cross-connect	0 to 655		22 AWG, 16-pair, tinned copper, twisted pair, solid, shielded, PVC, equipped with drain wire, 100 ohms

Note: Avaya Communication, 608C cables, or equivalent.

DS3 Configuration

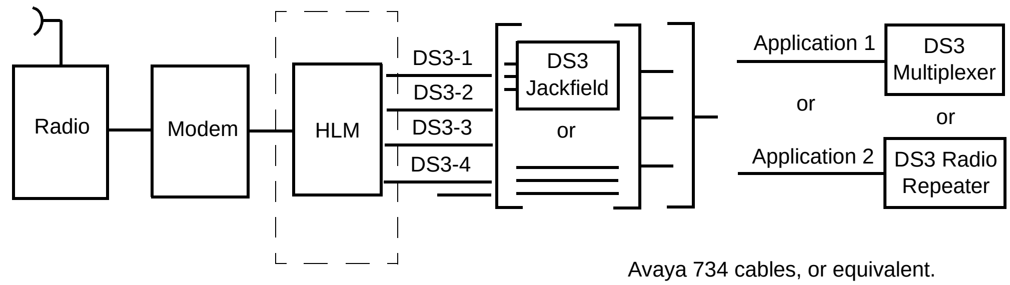
Figure 3-7: Interconnection cabling, DS3 configuration



Avaya 734 cables, or equivalent.

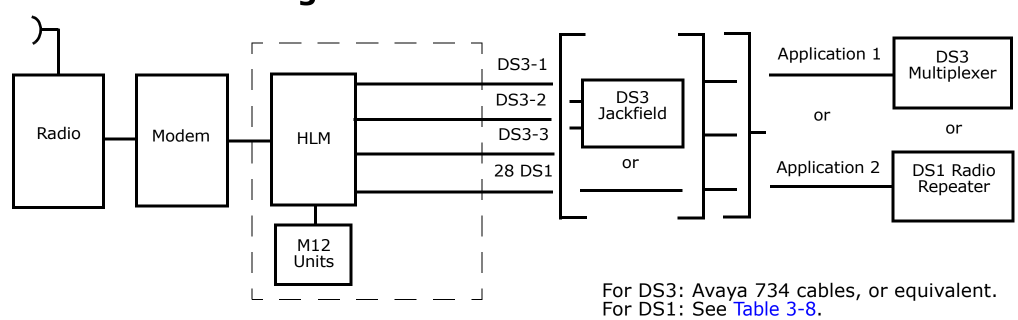
4xDS3 Configuration

Figure 3-8: Interconnection cabling, 4xDS3 configuration



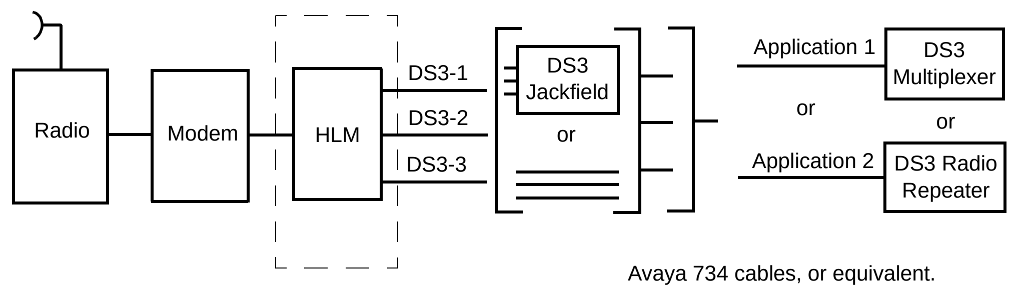
3xDS3 + 28 DS1

Figure 3-9: Interconnection cabling, 3xDS3 + 28 DS1 configuration



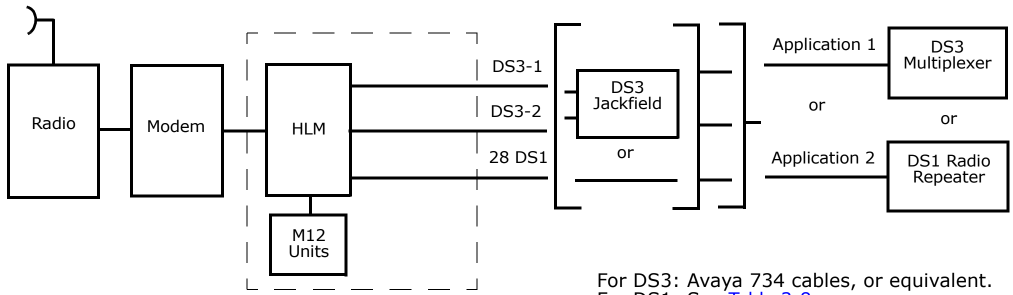
3xDS3 Configuration

Figure 3-10: Interconnection cabling, 3xDS3 configuration



2xDS3 + 28 DS1

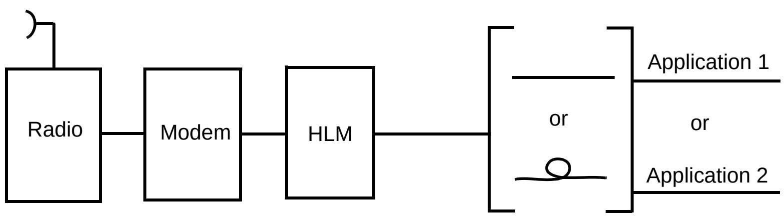
Figure 3-11: Interconnection cabling, 2xDS3 + 28 DS1 configuration



For DS3: Avaya 734 cables, or equivalent.
For DS1: See Table 3-8.

155 Electrical or Optical Configuration

Figure 3-12: Interconnection cabling, 155 Electrical or Optical configuration



For STM1/STS3: Avaya 734 cables, or equivalent.
For OC3: Single-mode or multimode with SC connectors.

1. Connect the Constellation radio to other equipment.

   For connector pinout information, refer to Appendix A.

2. Connect the customer-configured alarm wires.

3. Connect the Constellation Radio to the antenna or to a dummy load.

All Constellation radios, in terminal or repeater (when applicable) configuration, provide 8 alarm inputs and 8 relay outputs. These 8 relays can either provide information about the radio to a non-FarScan NMS, or be used to activate (from FarScan) external devices such as a generator, air conditioning, and so forth (housekeeping). These 8 relays are programmable; the first two relays are predefined at the factory as LOCAL MAJOR and LOCAL MINOR but can be programmed for customer use.

Located at the top left side of the radio (Figure 3-13), this 50-pin D connector (Figure 3-14) is available for customer-configured alarms. The SPU Controller provides 8 opto-isolated alarm inputs. The system provides 8 dry-contact, relay outputs as defined in Table 3-10. Input level of alarm input shall be open or ground. The Service Channel provides the Callout outputs. Table 3-9 lists the relay specifications.

Figure 3-13: Constellation backplane (top left)

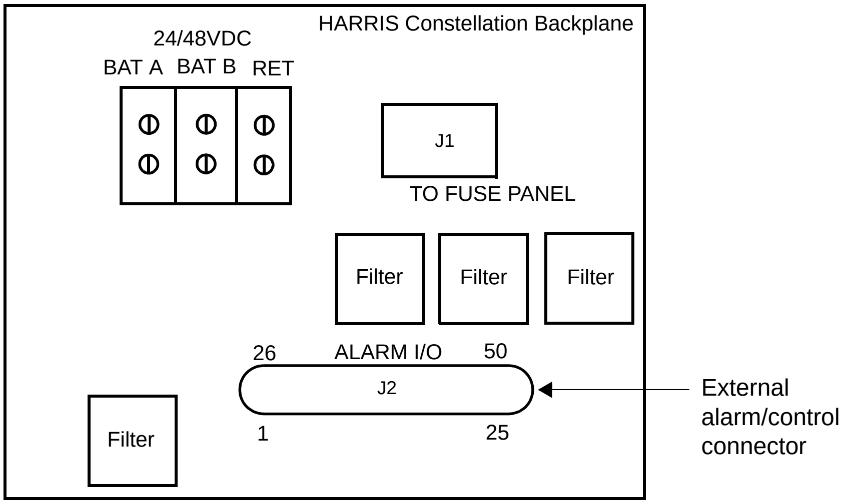


Table 3-9: Relay specifications

Characteristic	Value
Nominal switching capacity (resistive)	2 A, 60 Vdc
Max. switching power (resistive)	60 W
Max. switching voltage	220 Vdc
Max. switching current	2 A
Min. switching capability	10 µA, 10 mV dc

Table 3-10: Relay outputs

Relay	Function	Definition
1 2	Local Major Local Minor	Default relay outputs. Definable through the Keypad.
3 through 8	Customer-definable output	Definable through the Keypad.
Callout	Callout relay for orderwire	Indicates that a call is being received. The customer can use these outputs for additional call-in detection.
FA	Fuse alarm relay	These outputs can be used for remote fuse alarm indication.

Figure 3-14 shows the Alarm I/O pinouts.

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Figure 3-14: Alarm I/O pinouts, (Telco connector)

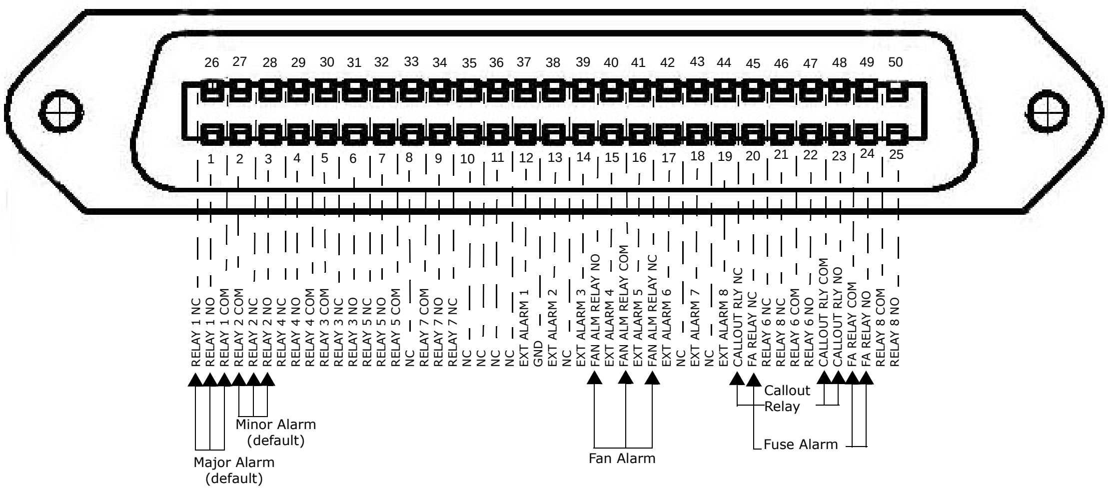


Table 3-11: ACU technical data

Ports			
Antenna port	6 GHz	CMR-137 flange with all tapped mounting holes for No. 6-32 screws.	CPR-137 spacer adapter
	7/8 GHz	CMR-112 flange with all tapped mounting holes for No. 6-32 screws.	CPR-112 spacer adapter
	10/11 GHz	UG39/U flange with all tapped mounting holes for No. 8-32 screws.	CPR-90 spacer adapter
Expansion port	6 GHz	CMR-137 flange with all tapped mounting holes for No. 6-32 screws.	The waveguide termination can be removed to gain access to this port. Optional waveguide pieces to interface to other radios are available upon request.
	7/8 GHz	CMR-112 flange with all tapped mounting holes for No. 6-32 screws.	
	10/11 GHz	UG39/U flange with all tapped mounting holes for No. 8-32 screws.	
Transmit monitor port		SMA female connector. A calibrated monitor port, approximately –30 dB down from the top of rack. The exact number is on the label “Coupling loss from antenna flange”.	
Transmit RF in		SMA female connector.	
Receive RF out		SMA female connector.	

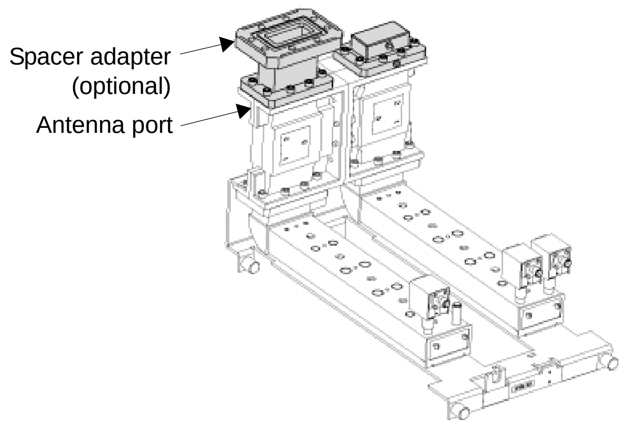
a. Verify that the antenna waveguide is grounded according to recommended or regulatory practice.

b. Determine and prepare the length(s) of flexible waveguide needed to connect the antenna(s) to the radio.

c. Install the waveguide.

d. Remove the Port Cover from the ACU. See Figure 3-15.

Figure 3-15: ACU



e. Install the optional spacer adapter onto the existing antenna port.

f. Connect the antenna waveguide to the ACU flange.

g. Use the flexible waveguide to interface between the radio's waveguide flange and the rigid waveguide. This interface allows flexibility in movement should a seismic disturbance occur.

h. Secure all cable and waveguide assemblies as required.

i. Pressurize the waveguide, and check all waveguide connections for leaks. Tighten the joints as required.

4. Test the office battery voltage.

Use a digital multimeter to test the battery (source) voltage. The battery polarity may be positive or negative with respect to ground.

Source (V)	Accepted Value (V)
24	21 to 28
48	42 to 56

The following table lists the battery noise requirement.

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Office Battery Noise Level (mV, peak to peak)
≤ 50

5. Connect the battery power wires.

Harris recommends a separate fuse or circuit breaker for Battery A and Battery B.

Circuit breaker or fuse, if used, should be turned off or removed prior to connection of power wires.

Power Runs

The appropriate gauge wire should be used for the distance of each power run. Harris recommends the following wire specifications for power runs (Table 3-12).

Table 3-12: Wire specifications for power runs

Power Run	Wire Color	Wire Size (AWG)
Battery A	Red	8
Battery B	White	8
DC return	Black	6
Ground	Green	6

a. Ensure that all the fuses in the fuse panel are in place.

Ensure that the power breaker is off.

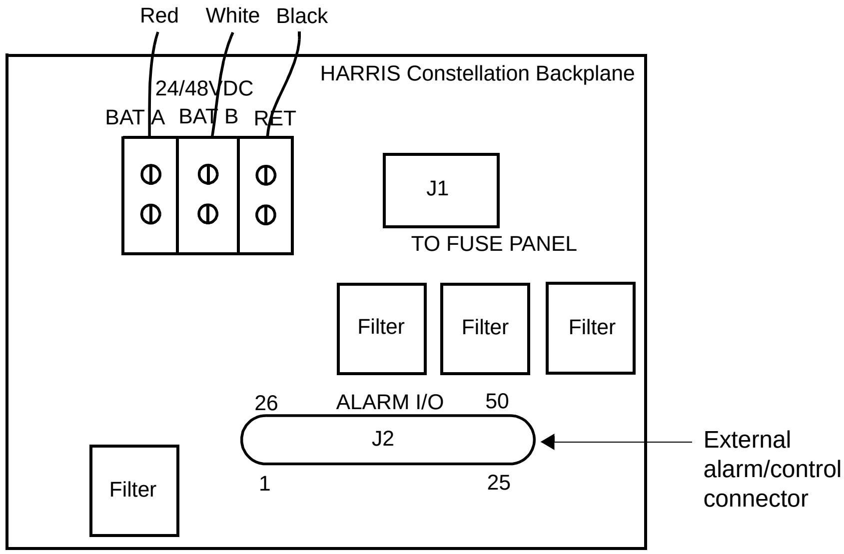
b. Connect the battery power wires.

- If the radio is shipped in a rack, use the drawings in the sales order specific information.
- If the radio is shipped loose, continue with this step.

Terminal

- See Figure 3-16 for wiring specifications.
- See Table 3-12 for recommended wiring sizes.

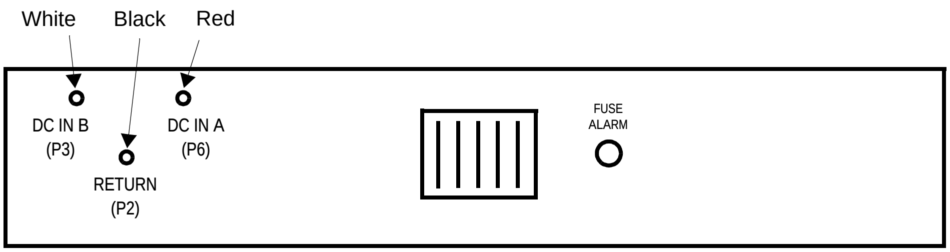
Figure 3-16: Constellation backplane, terminal



Repeater

Connect the wires to the quick disconnect tabs behind the Fuse Panel (Figure 3-17).

Figure 3-17: Fuse Panel, repeater



Detailed Turn-on Procedures

1. Ensure that the correct fuses are installed. One set of fuses rated for 24V can be used in Constellation regardless if there is 24V or 48V DC power.

If the DC operating voltage is changed, equip the fuse values as shown in Table 3-13.

Table 3-13: Fuse Ratings

Fuse	Equipment	Rating (AMP)	
		24V	48V
1	M12	5	3
2	SPU Controller	1/2	1/4
3	Service Channel	1	1/2
4	Modem A1/B2, HLMUX 1	5	3
5	Modem A2/B1, HLMUX 2	5	3
6	RFU PS 1	10	5
7	RFU PS 2	10	5
8	Fan Assembly	2	1
9	N/A		
10	N/A		

2. Ensure that the antenna port is terminated into a dummy load or the antenna system before turning on the TX switch.

3. Turn on the power

Turn on the circuit breaker at the main power distribution panel.

The red LED on each plug-in unit should light momentarily and then go off as the green LED lights. The red LED on the M12 Unit will be illuminated until the initialization process is completed.

4. Turn on the Power Supply switch

On the Power Supply faceplate, push the PWR switch to ON.

5. Turn on the TX switch

On the Transmitter Assembly faceplate, push the TX switch to ON (Figure 3-18, page 3-27).

Do not continue until the radio has warmed up (about 1 hour).

Detailed Terminal Test

Refer to Appendix B for Keypad menu tree.

Transmitter Frequency Measurement & Adjustment

The reason for performing these procedures is to ensure that the Transmitter Assembly is operating on the correct frequency and power level to comply with the license requirements. (Example: FCC Title 47, Part 101.107, 101.111, 101.113, and 101.217.) It also ensures that the residual BER floor and acquisition time remain within specification.

1. Record the operating frequency of the Transmitter from the Keypad hidden menu.

CONFIGURATION > F1 + F3 or Ctrl B > TX FREQ

2. *For 6/7 GHz radios:* Enter 7 digits without the decimal point.
For 10/11 GHz radios: Enter 8 digits without the decimal point. Add zeros (0's) at the end if needed to complete the 8-digit field.

This frequency should match the one written on the Tx filter and the station authorization.

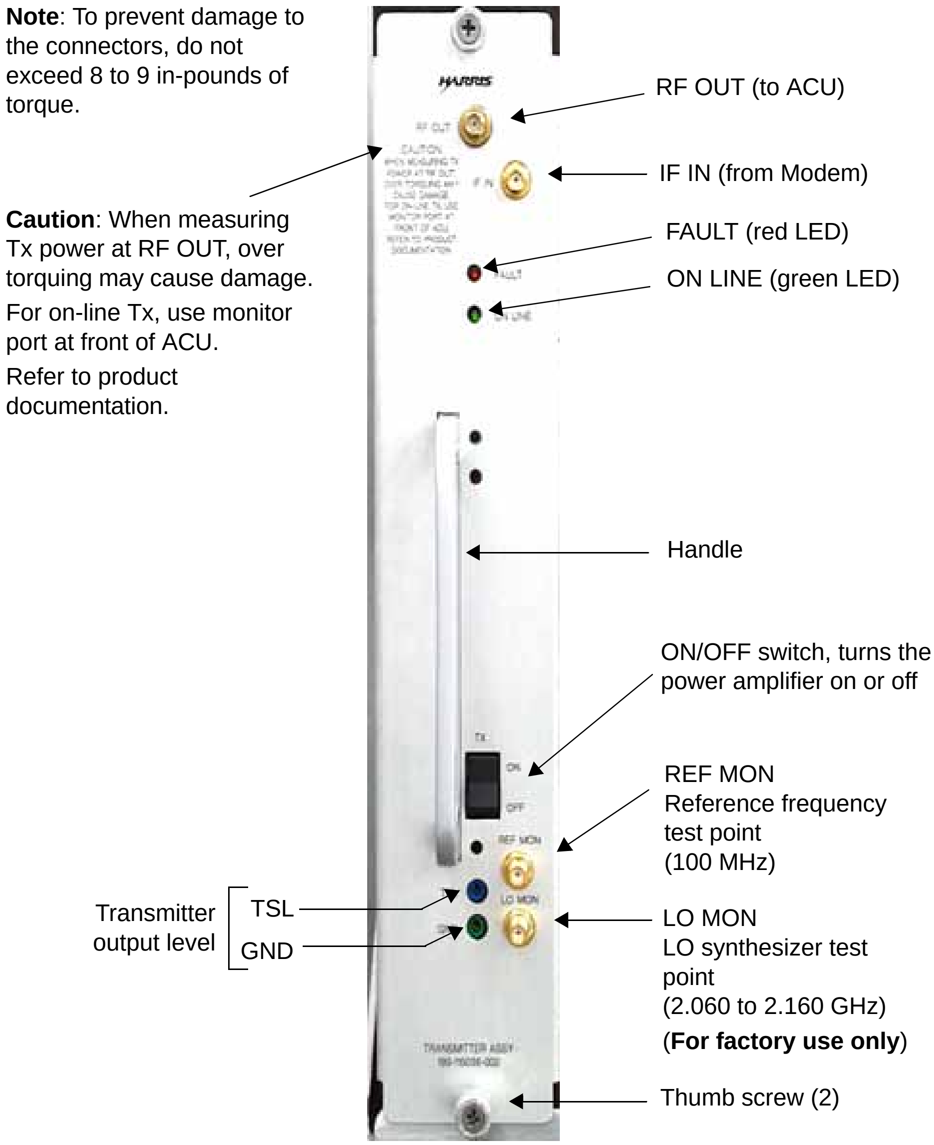
3. Determine from the table in Appendix C which multiplier-filter should be used (or is in use).

The Frequency Counter should be plugged in and powered for at least 30 minutes prior to adjusting the frequency.

4. To measure the 100 MHz oscillator frequency, connect a frequency counter to the REF MON port on the Transmitter Assembly (Figure 3-18).
5. To adjust the oscillator frequency, use Keypad hidden menu command.
6. CONFIGURATION > F1 + F3 or Ctrl B > TX 100MHZ TUNE
7. Adjust the frequency to
   100.000,000 MHz ±(see table)

Year of Operation	Tolerance
Initial adjustment	± 100 Hz
Thereafter	± 300 Hz

Figure 3-18: Transmitter Assembly, front view



Receiver Frequency Measurement & Adjustment

1. Record the operating frequency of the Receiver from the Keypad (hidden menu).

   CONFIGURATION > F1 + F3 or Ctrl B > RX FREQ

   For 6/7 GHz radios: Enter 7 digits without the decimal point.
   For 10/11 GHz radios: Enter 8 digits without the decimal point. Add zeros (0) at the end if needed to complete the 8-digit field.

   This frequency should match the one written on the Rx filter and the station authorization.

2. To measure the 100 MHz oscillator frequency, connect a frequency counter to the REF MON port on the Receiver Assembly (Figure 3-18).

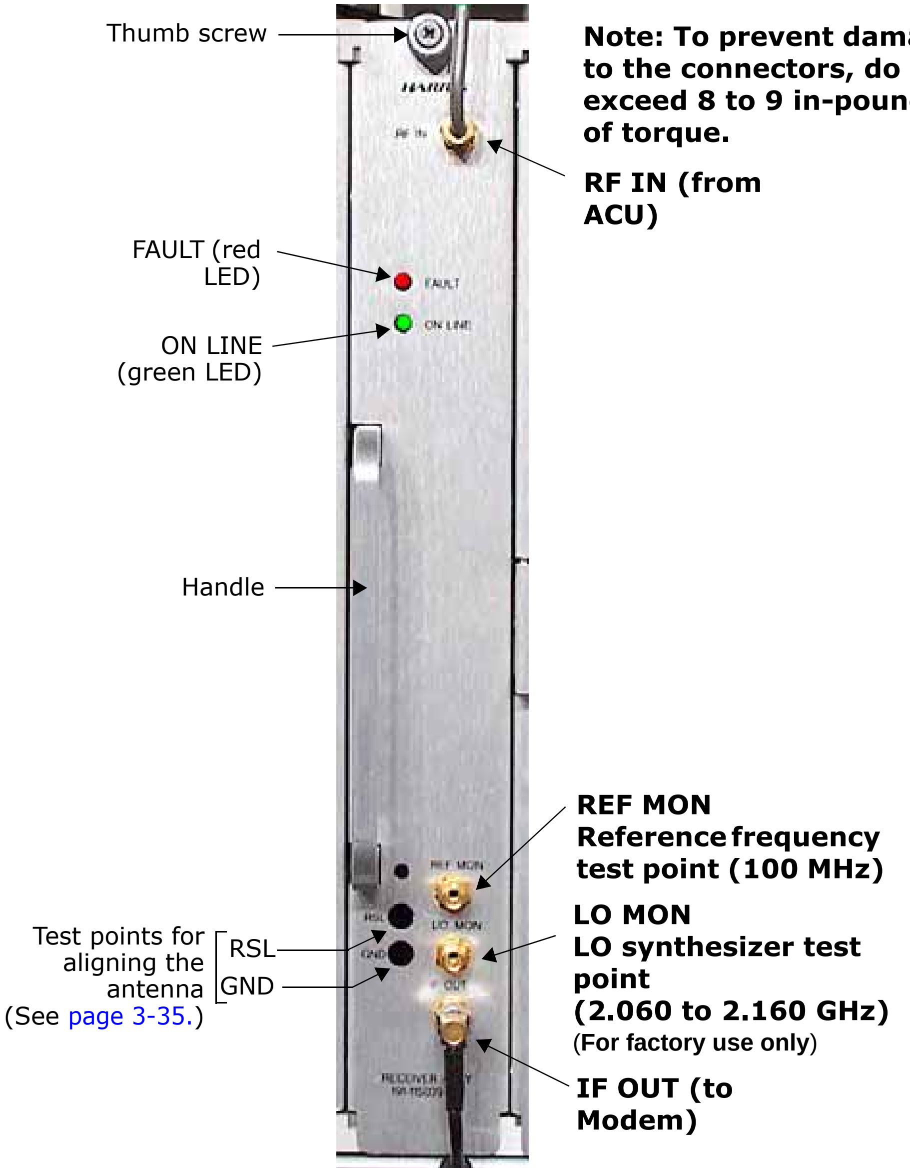
3. To adjust the oscillator frequency, use the Keypad hidden-menu command CONFIGURATION > F1 + F3 or Ctrl B > RX 100MHZ TUNE

4. Adjust the frequency to

   100.000,000 MHz ±(see table)

Year of Operation	Tolerance
Initial adjustment	± 100 Hz
Thereafter	± 300 Hz

Figure 3-19: Receiver Assembly, front view



Transmitter Power Measurement

This procedure for measuring the transmitter power should be followed

- For new installations
- As part of the annual maintenance requirement
- When the Transmitter Assembly is replaced

Note that this is a new procedure and should be followed from now on.

You may observe a low output alarm while you are performing calibration. Ignore the alarm until the calibration has been completed.

Measuring the Power Output of an Off-line Transmitter

If the Transmitter to be measured is off-line, then it must be placed on line.

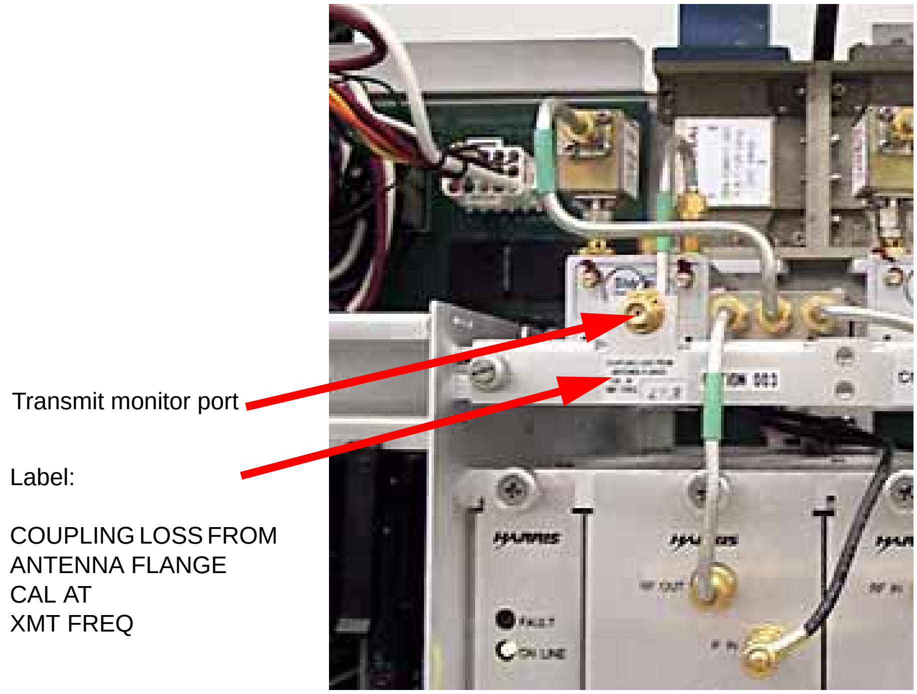
The following procedure interrupts traffic.

a. Lock the Transmitter on line as follows:
   From the Keypad main menu, select
   CONTROL > LOCK/IF LPBK > LOCK MOD/TX > SET

Connecting the Power Meter

a. Connect the power head of the power meter to the transmit monitor port on the ACU. See Figure 3-20.
   The monitor port is labeled “COUPLING LOSS FROM ANTENNA FLANGE CAL AT XMT FREQ __._”.

Figure 3-20: Location of the transmit monitor port



Power Meter Reading

a. The Power Meter reading should equal the value from Table 3-14 or Table 3-15 minus the Coupling Loss on the label.

Power may be set low in some applications. High power settings require a high power option of the transmit assembly.

Table 3-14: Power at antenna flange, NP configuration

TX Freq. (GHz)	Power (dBm)						
	8T	16T		28T/DS3		OC3/3xDS3/4xDS3	
		Std.	High[ab]	Std.	High[ab]	Std.	High[a]
6	29.5	28.5	29.5	29.0	30.5	29.0	31.5/31.0[c]
7/8	27.5	26.5	27.5	27.0	28.5	27.5	30.0
10/11	26.0	24.5	25.5	25.0	26.5	25.0	28.5

a. *High Power requires high power option of the Transmit Assembly.*

b. *High power requires high gain modem option (101-115540-002 for 16T and -003 for 28T).*

c. *The first number is for OC3 & 3xDS3; the second number is for 4xDS3.*

Table 3-15: Power at antenna flange, MHSB configuration

TX Freq. (GHz)	Power (dBm)						
	8T	16T		28T/DS3		OC3/3xDS3/4xDS3	
		Std.	High[ab]	Std.	High[ab]	Std.	High[a]
6	29.1	28.1	29.5	28.6	30.1	28.6	31.1/30.6[c]
7/8	27.1	26.1	27.1	26.6	28.1	27.1	29.6
10/11	25.6	24.1	25.1	24.6	26.1	24.6	28.1

a. *High Power requires high power option of the Transmit Assembly*

b. *High power requires high gain modem option (101-115540-002 for 16T and -003 for 28T).*

c. *The first number is for OC3 & 3xDS3; the second number is for 4xDS3.*

The power at the top of the rack (TOR) = the power meter reading + the coupling loss shown on the monitor port label.

b. If the Power Meter reading does not equal the value calculated from step a, use the Keypad to adjust the RF power out. Refer to the next section for a detailed procedure.

c. If power adjustment is required, go to step a.
If power adjustment is not required, go to step a.

Keypad Procedure for Adjusting the RF Power Out

Note that this procedure requires access to the hidden RF Configuration submenu.

a. Ensure that the Transmitter on line is locked.
From the Keypad main menu, select
CONTROL > LOCK/IF LPBK > LOCK MOD/TX > SET

b. For the high power calibration, access the hidden RF Configuration submenu from the Keypad main menu.
CONFIGURATION > F1 + F3 or Ctrl B > TX PWR CALIB > ADJUST HIGH PWR

c. Use the UP/DOWN keys until the power meter reading + the coupling loss shown on the monitor port label = the value to within ± 0.2 dB of the value in Table 3-14 or Table 3-15.

If desired, the output power may be set to a lower value.
- Model 2 or older may be set as low as 5 dB below the value in Table 3-14 or Table 3-15.
- Model 3 may be set up to 10 dB below the value in Table 3-14 or Table 3-15.

d. Go to **HIGH PWR CALIB**, and enter the value from step c.
Notes:
- Use the F2 key for the decimal point.
- You must enter 3 digits. For example, 30 dBm is entered as 30.0.
- Press **EXEC**.

e. Exit.

f. Go to **ADJUST LOW PWR**.

g. Use the UP/DOWN keys until the value = the power meter reading + the coupling loss shown on the monitor port label.
Notes:
• Tx Assy, Model 2: should be approximately 5 dB below high power
• Tx Assy, Model 3: should be approximately 10 dB below high power
Adjust if necessary.

h. Go to **LOW PWR CALIB**, and enter the value from step g.
Notes:
• Use the F2 key for the decimal point.
• You must enter 3 digits. For example, 30 dBm is entered as 30.0.
• Press **EXEC**.

i. Exit. It will automatically return to high power.

j. Unlock the on-line Transmitter.
From the Keypad main menu, select
CONTROL > LOCK/IF LPBK > LOCK MOD/TX > CLR

Recording the Power Levels

a. Record the power levels along with the date and the name of the person making the measurement in the "Routine Maintenance Log Form" (Chapter 8).

Off-line Transmitter

a. When you have finished taking the measurement, you can either leave the Transmitter on line or return it to the off-line status.

b. The standby Transmitter is now the primary Transmitter.

Switching the traffic back to the previous Transmitter will cause a hit.

If switching of Transmitter Assemblies is desired, it should be done during low-traffic hours.

Aligning the Antenna

1. Align the antenna.

The Keypad reading is not as accurate as using the RSL/GND test points.

a. Connect a multimeter at the RSL/GND test point of the Receiver Assembly.

b. Adjust the orientation of each antenna to maximize the voltage reading.

   The voltage reading is negative and approaches zero as the RSL increases.

   For example:

   At -50 dBm, the meter reading is -5.0 Vdc.

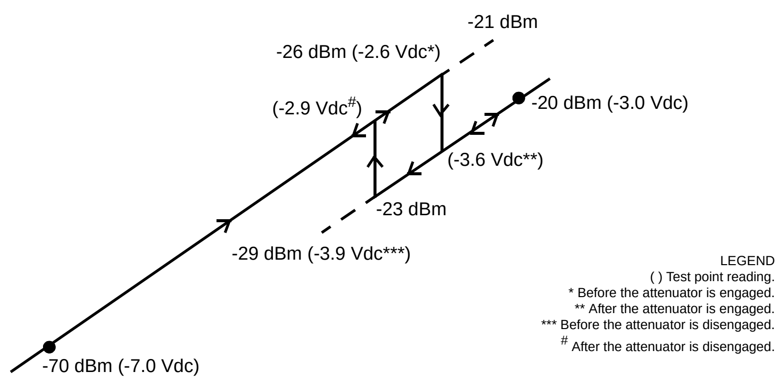
   At -40 dBm, the meter reading is -4.0 Vdc.

   See also Figure 3-21.

RSL Test Point

At -21 dBm or higher, a 10 dB attenuator is engaged, resulting in a 1 volt drop (apparent 10 dB) in the RSL test point reading. The Keypad will display the corrected (unattenuated) value. At nominally -23 dBm, the attenuator is disengaged, and the meter will reflect the unattenuated value. See Figure 3-21.

Figure 3-21: RSL measurement



If the signal level is too high for antenna alignment, the far-end Transmitter could be set to ATPC low power (about 10 dB lower than nominal high power setting). See Keypad menu, Appendix B.

CONFIGURATION > SYSTEM > TX ATPC > DISABLE LOW

If the signal level is still too high, a pad can be temporarily added at the Receiver input.

1. **Perform loopback tests (through the Keypad) (Chapter 4).**
2. **Perform BER tests from the Keypad.**
   PERFORMANCE > TRIBUTARY

CHAPTER

4

LOOPBACK TESTING

Introduction

The following loopback tests can be performed through the Keypad.

- Local electronic IF loopback for fault isolation
- T1 local and remote loopback tests
- DS3 local and remote loopback tests
- OC3 local and remote loopback tests

The following tributary BER test can be performed through the Keypad.

- T1 loopback with a built-in pseudorandom generator/receiver

Precautions

A DS1 or DS3 loopback test disrupts traffic only on that tributary under test.

An IF or OC3 loopback test disrupts traffic.

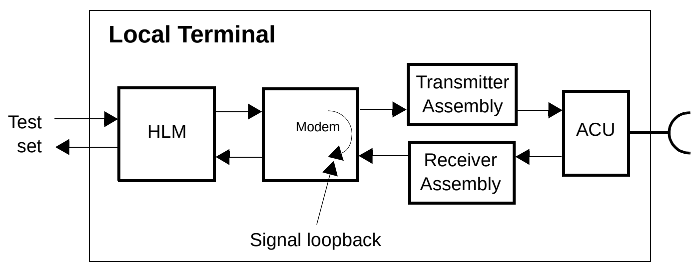
Loopback Procedures

IF Loopback Test

From the Keypad, select

CONTROL > LOCK/IF LPBK > MODEM IF LPBK

Figure 4-1: IF loopback test



DS1 Tributary Loopback Tests

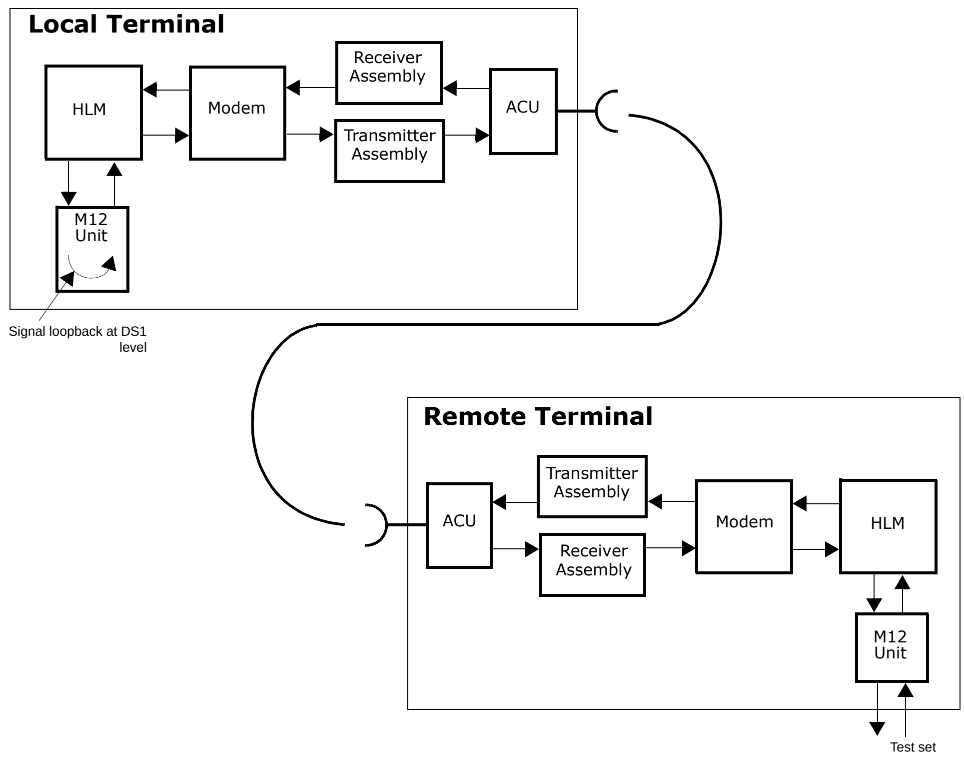
DS1 Tributary Loopback

Customer test equipment is required for this test. This test loops back the signal from the local terminal to the far end. See Figure 4-2.

From the Keypad, select

CONTROL > TRIB LOOPBACK

Figure 4-2: DS1 tributary loopback test



LOOPBACK TESTING

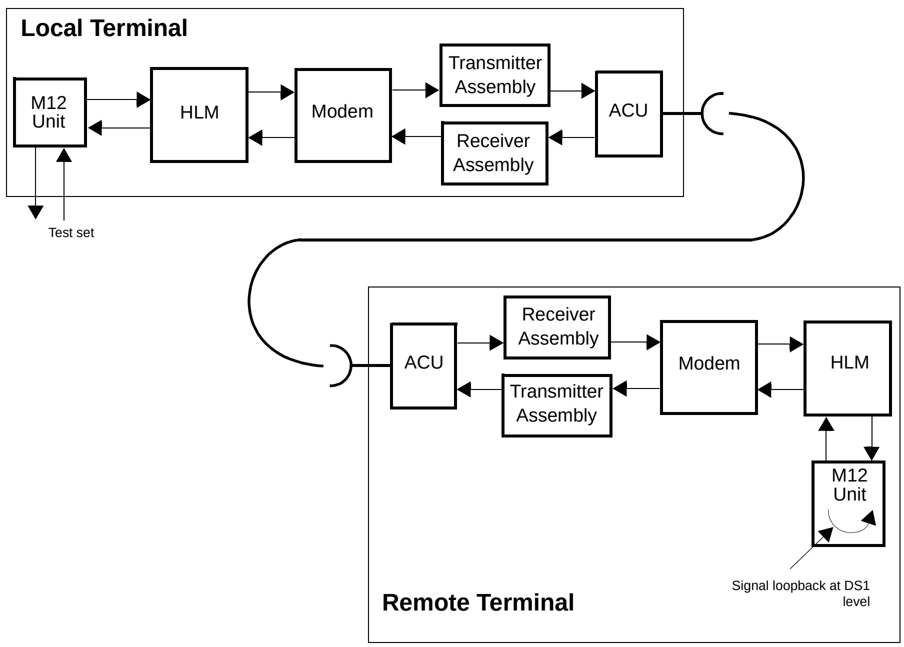
DS1 Tributary Remote Loopback

Customer test equipment is required for this test. This test loops back the signal from the far end to the near end. See Figure 4-3.

From the Keypad, select

CONTROL >TRIB REMOTE LPBK

Figure 4-3: DS1 tributary remote loopback test



OC3 Loopback Tests

OC3 Loopback

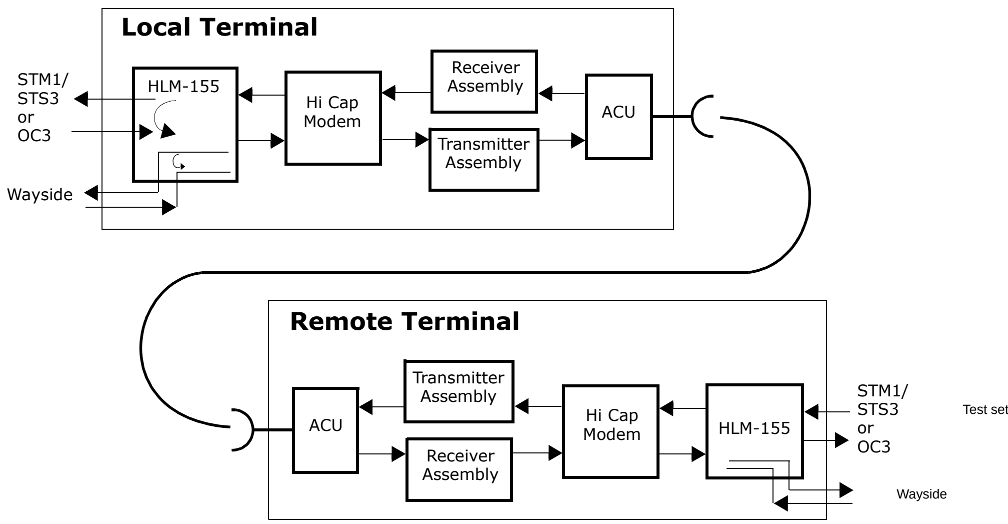
Customer test equipment is required for this test. This test loops back the signal from the local terminal to the far end. See Figure 4-4.

You need to access the hidden Control submenu to conduct the OC3 loopback test.

From the Keypad, select

CONTROL > hidden menu (F1 + F3 or Ctrl B) > OC3 LPBK

Figure 4-4: OC3/STS3 loopback test



HLM-155 Electrical Interface

For HLM-155, Model 1, electrical interface, an input signal is required at the far end for the loopback function to operate.

OC3 Remote Loopback

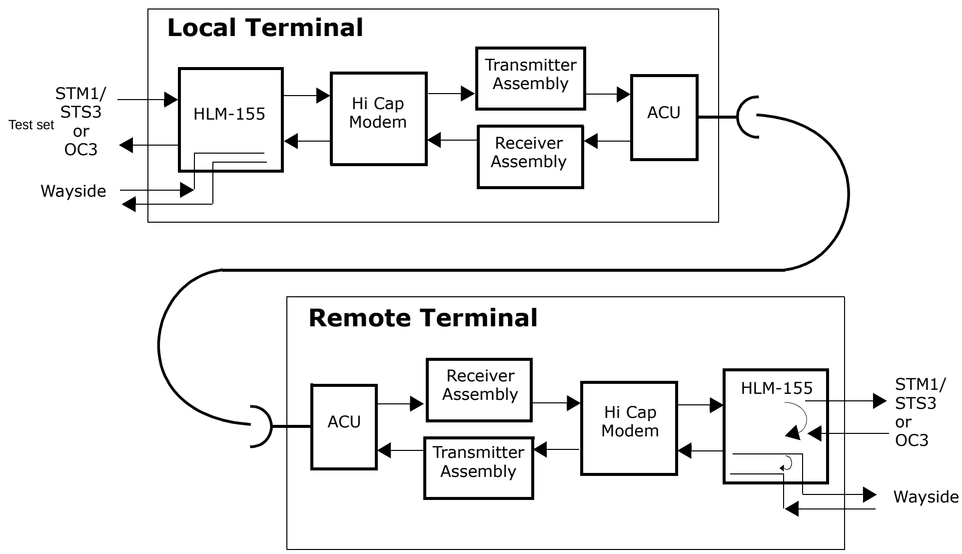
Customer test equipment is required for this test. This test loops back the signal from the far end to the near end. See Figure 4-5.

You need to access the hidden Control submenu to conduct the OC3 loopback test.

From the Keypad, select

CONTROL > hidden menu (F1 + F3 or Ctrl B) > OC3 RMT LPBK

Figure 4-5: OC3 remote loopback test



3DS3/4DS3 Loopback Tests

3DS3/4DS3 Loopback

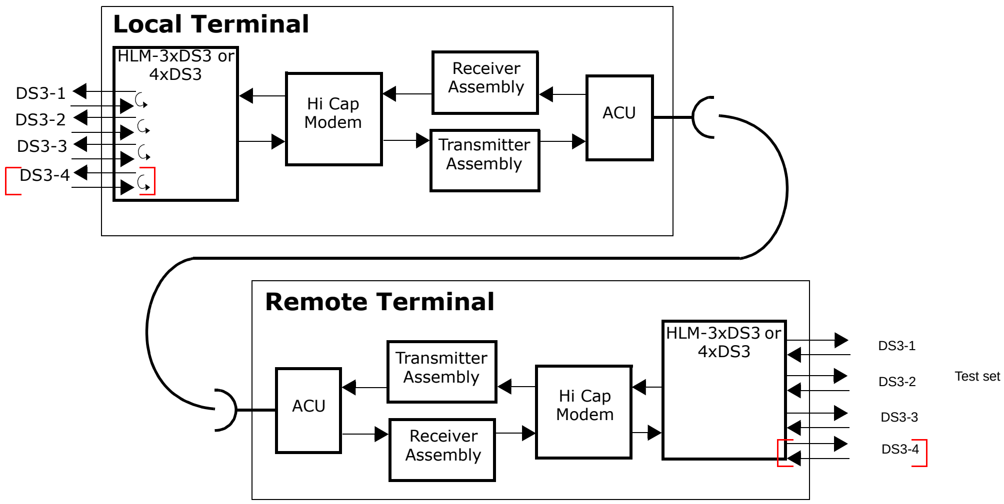
Customer test equipment is required for this test. This test loops back the signal from the near end to the far end. See Figure 4-6.

You need to access the hidden Control submenu to conduct the DS3 loopback test for each channel.

From the Keypad, select

CONTROL > hidden menu (F1 + F3 or Ctrl B) > DS3-x LPBK

Figure 4-6: 3DS3/4DS3 loopback test



3DS3/4DS3 Remote Loopback

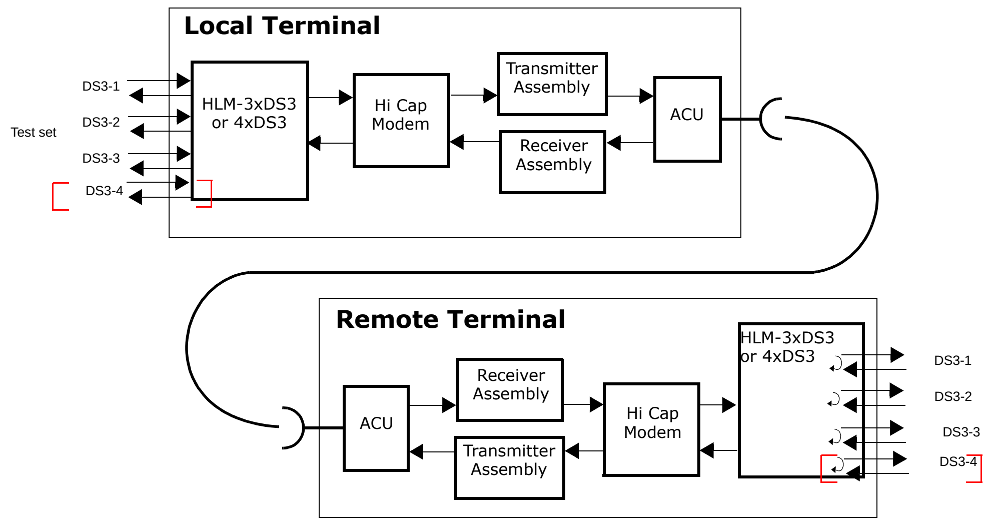
Customer test equipment is required for this test. This test loops back the signal from the far end to the near end. See Figure 4-5.

You need to access the hidden Control submenu to conduct the DS3 loopback test for each channel.

From the Keypad, select

CONTROL > hidden menu (F1 + F3 or Ctrl B) > DS3-x REM LPBK

Figure 4-7: 3DS3/4DS3 remote loopback test



Wayside Loopback Tests

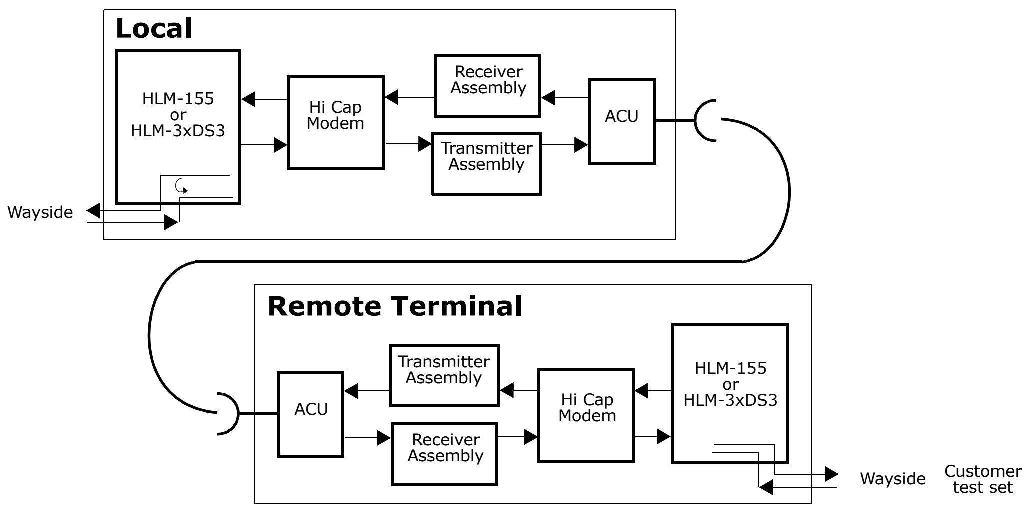
Wayside Loopback

Customer test equipment is required for this test. This test loops back the signal from the near end to the far end. See Figure 4-8.

From the Keypad, select

CONTROL > WAYSIDE LPBK > WAYSIDE LPBK

Figure 4-8: Wayside loopback test



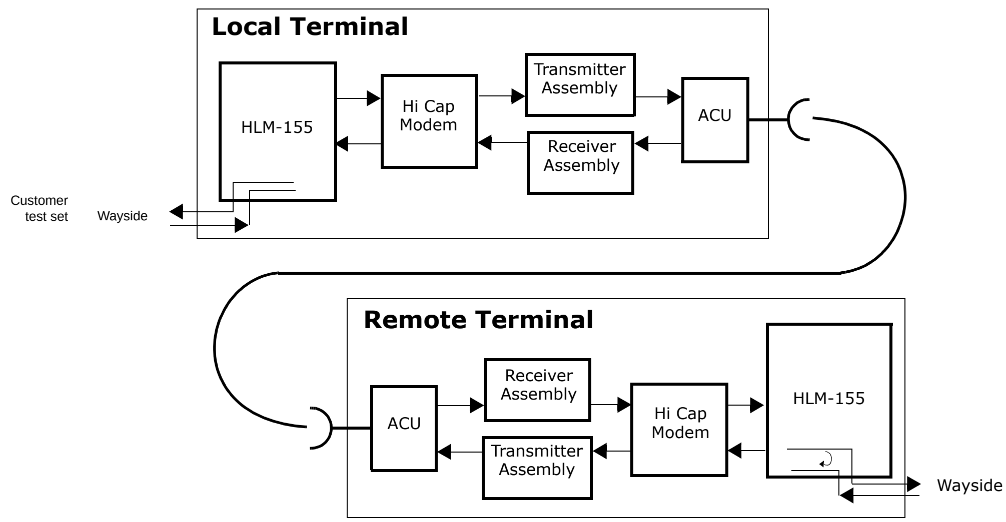
Wayside Remote Loopback

Customer test equipment is required for this test. This test loops back the signal from the far end to the near end. See Figure 4-9.

From the Keypad, select

CONTROL > WAYSIDE LPBK > WAYSIDE RMT LPBK

Figure 4-9: Wayside remote loopback test



Tributary BER Test

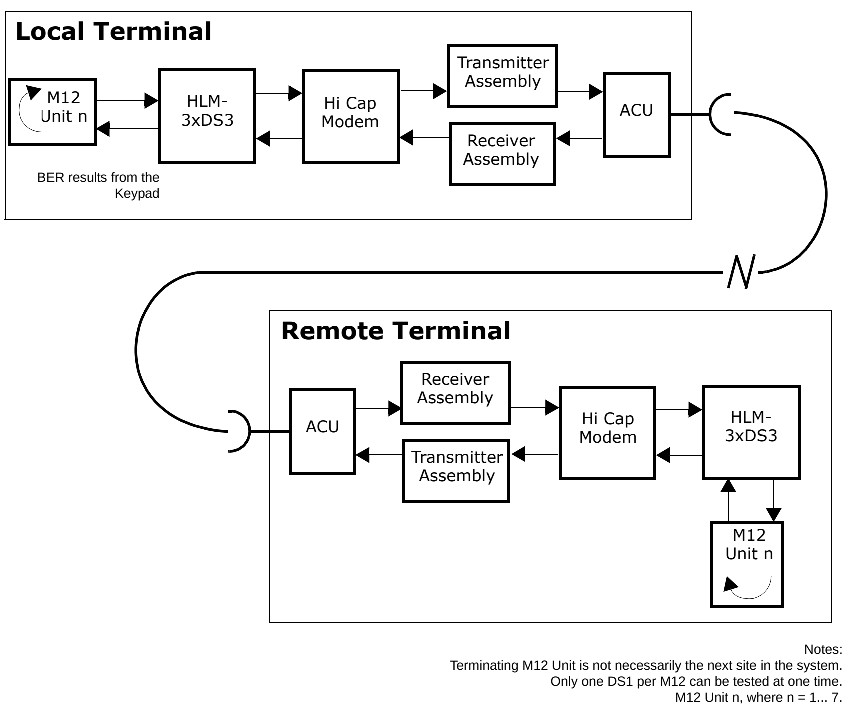
From the Keypad

PERFORMANCE > TRIBUTARY BER

This command causes the far end to give a loopback to the near end. The near end inserts an on-board pseudorandom generator on the transmitter side of the DS1 circuit. A detector on the receiver side of the DS1 circuit gives you the BER and also tells you how long the test has been running.

Figure 4-10 shows a BER testing of a 3xDS3 system with an add-drop configuration.

Figure 4-10: BER testing of a 3xDS3/4xDS3 system with add-drop configuration



LOOPBACK TESTING

CHAPTER

5

CONFIGURING THE CONSTELLATION RADIO

Refer to the Quick Reference Card or Appendix B for Keypad information.

SYSTEM from the CONFIGURATION Submenu

3DS3 (4DS3) CAPACITY USE

For a Constellation Radio with an HLM-3xDS3 unit or HLM-4xDS3, there are three channel configurations from which to select. Select DS3 only, select any DS3 channel to drop to 28 T1, or select any DS3 channel for a partial add-drop (4 T1, 8 T1, 12 T1, or 16 T1).

Only the first three channels of the 4DS3 unit can be selected for add/drop so the 3DS3 submenu is used.

Table 5-1: 3DS3/4DS3 CAPACITY USE

SYSTEM Submenu	Selection	Explanation
3DS3 CAPACITY USE[a]	T3-1, T3-2, T3-3	All three channels use T3 signals (Figure 5-1 and Figure 5-2).
	T2 ADM, T3-2, T3-3	DS3 channel 1 to add-drop T1 signals. Use the ADM submenu to select the M12 Unit(s).
	T3-1, T2 ADM, T3-3	DS3 channel 2 to add-drop T1 signals. Use the ADM submenu to select the M12 Unit(s).
	T3-1, T3-2, T2 ADM	DS3 channel 3 to add-drop T1 signals (Figure 5-3). Use the ADM submenu to select the M12 Unit(s).
	28 T1, T3-2, T3-3	DS3 channel 1 to terminate to 28 T1
	T3-1, 28 T1, T3-3	DS3 channel 2 to terminate to 28 T1.
	T3-1, T3-2, 28 T1	DS3 channel 3 to terminate to 28 T1 (Figure 5-4).

a. The 4DS3 unit uses the 3DS3 Capacity Use submenu.

Figure 5-1: DS3 only

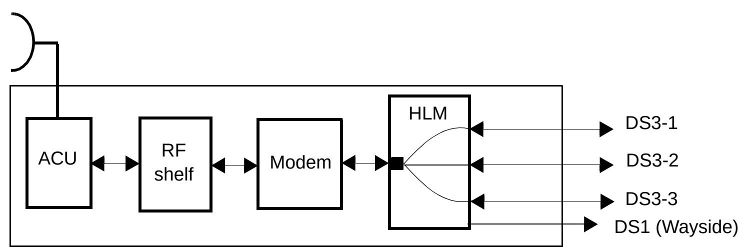


Figure 5-2: DS4 only

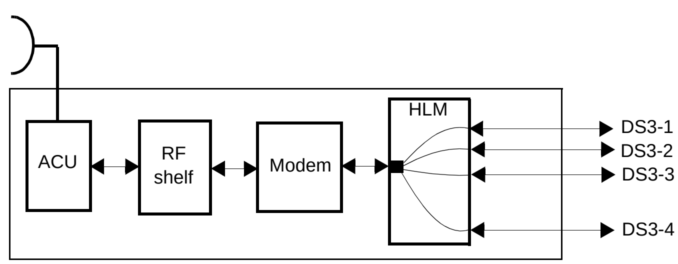


Figure 5-3: Example of DS3 channel with partial add/drop, back-to-back terminals

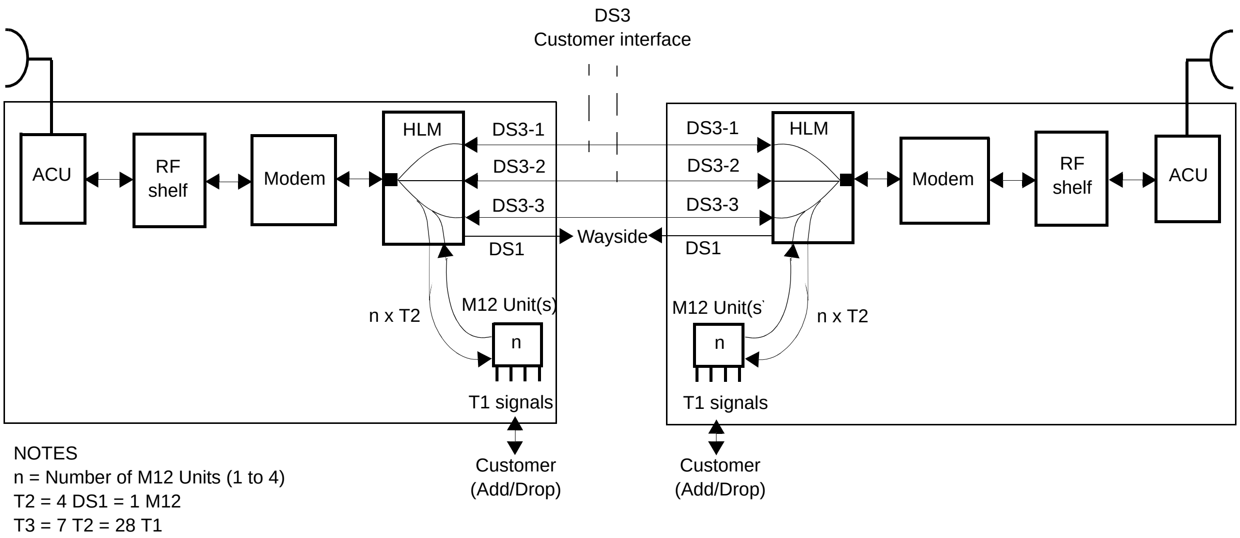
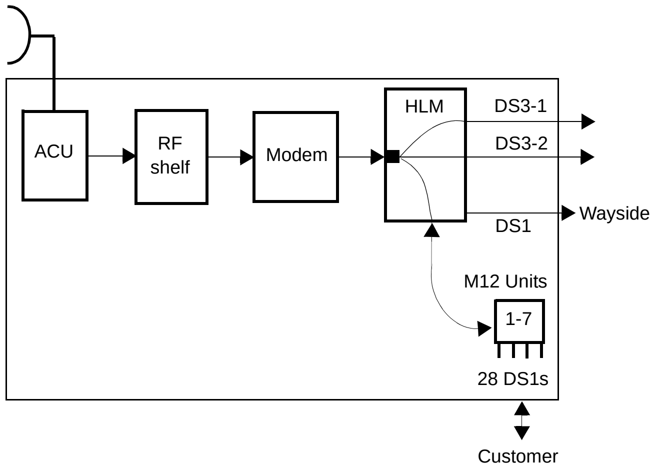


Figure 5-4: Example of dropping a DS3 channel using an integral MUX



USED CAPACITY and PROTECTION

Each M12 Unit can transmit and receive four DS1 signals. Select the number of tributaries you are using. See Table 5-2.

Table 5-2: USED CAPACITY

SYSTEM Submenu	Selection	Explanation
USED CAPACITY	4xTRIB	1 M12 Units equipped
	8xTRIB	2 M12 Units equipped
	12xTRIB	3 M12 Units equipped
	16xTRIB	4 M12 Units equipped
	20xTRIB	5 M12 Units equipped
	24xTRIB	6 M12 Units equipped
	28xTRIB	7 M12 Units equipped
PROTECTION	UNPROT	Nonprotected radio
	UNPR TX	Nonprotected Tx, space diversity Rx radio
	MHSB	Monitored Hot Standby
	FREQ DIV	Frequency diversity Tx and Rx
	RX & M12	Protects the receiver and the M12 cards
	M12 ONLY	Protects only the M12 cards

RCS DELAY

The Reverse Channel Switch (RCS) delay time can be selected in

CONFIGURATION > SYSTEM > RCS DELAY.

This sets the delay time after a remote sync loss alarm before a transmit switch occurs.

SYNCHRONIZATION MX

This section applies to low and medium capacity radios only. Refer to page 1-7 for an explanation of low/medium capacity radios.

In a repeater configuration, the HLM must be placed in either

- THRU TIMED or
- SOURCE timed.

THRU TIMED

In general, the HLM is placed in **THRU TIMED**. The exceptions are explained in the "SOURCE timed" section.

From the Keypad menu, select

CONFIGURATION > SYSTEM > SYNCHRONIZATION MX > THRU TIMED

SOURCE Timed

Select Source timed in the following cases.

- In a repeater system where the Modem units are not the same (that is, one is 115072 and the other is 115430), ensure that the system synchronization is set to **SOURCE** timed.
- In a loop system, when the HLM is at a master site, the HLM must be set to **SOURCE** timed.
- Terminal configuration.

From the Keypad menu, select

CONFIGURATION > SYSTEM > SYNCHRONIZATION MX > SOURCE

If the HLM is set for SOURCE timed, select enable local off hook for the Service Channel.

CONFIGURATION > SERVICE CHANNEL > LOCAL OFF HOOK > ENABLE

STUFFING MODE (DS3 MODE)

This mode is not affected if a channel is using only DS3 signals in the system.

In an add-drop system, the M13 mode should be selected in general. When the multiplexer is adding all 7 T2 signals into a T3 channel, both M13 and C-bit parity (for OEM equipment) modes are available.

Table 5-3: Stuffing Mode

SYSTEM Submenu	Selection	Explanation
STUFFING MODE	M13	The general mode.
	C-BIT PARITY	Do not use in add-drop modes.

ATPC High/Low Configuration

Constellation operates at one of two TX output power levels: ATPC High and ATPC Low. These levels are set during calibration by using the keypad.

The high power setting can be as much as 7.5 dBm below the rated power during calibration. So, the power can be reduced by calibrating ATPC High at a value that is no more than 7.5 dBm below the rated power.

The radio can also be set to 10 dBm below the rated power by calibrating ATPC High at rated power, calibrating ATPC Low at 10 dB lower than rated power, then selecting “ATPC disabled low” to operate 10 dB below rated power.

If necessary, the ATPC Low setting can be calibrated between 2.5 dB and 10 dB below rated power by selecting “ATPC disabled low.”

Pads are required to operate at more than 10 dB below rated power.

Table 5-4: ATPC Keypad Selection

SYSTEM Submenu	Selection	Explanation
TX ATPC	DISABLE HIGH	Disable ATPC; set Tx at High power.
	DISABLE LOW	Disable ATPC; set Tx at Low power.
	ENABLE	Enable ATPC.

M12 PROTECTION, SVC, FAN, PATH ALARMS MENU, AND CONFIG ALARM

Table 5-5: M12 PROTECTION, SVC, FAN, PATH ALARMS MENU, AND CONFIG ALARM

SYSTEM Submenu	Selection	Explanation
TX ATPC	DISABLE HIGH	Disable ATPC; set Tx at High power.
	DISABLE LOW	Disable ATPC; set Tx at Low power.
	ENABLE	Enable ATPC.
M12 PROTECTION	NON REV	Nonrevertive. When this option is selected, an automatic switching from the standby M12 Unit to the working unit does not occur whenever a failed unit is replaced by a working one.
	REVERTIVE	When this option is selected, an automatic switching from the standby M12 Unit to the working unit occurs whenever a failed unit is replaced by a working one.
SVC OPTION	INSTALL	Choose this command to put the Service Channel into service.
	UNINSTALL	Choose this command to put the Service Channel out of service.
FAN OPTION	INSTALL	Choose this command for new installation of the radio.
	UNINSTAL	Choose this command to put the Fan out of service.

Table 5-5: M12 PROTECTION, SVC, FAN, PATH ALARMS MENU, AND CONFIG ALARM

SYSTEM Submenu	Selection	Explanation
PATH A, B ALARMS MENU	SHOW	Displays the A and B alarms menu
	HIDE	If you choose HIDE, the RSL LOW and SIGNAL DEGRADED alarms will not be displayed.
CONFIG ALARM	CLR/SET	This item does not display for new installation. This alarm displays only if there is a configuration alarm.

ADM from the CONFIGURATION Submenu

Configuring the Add-Drop Multiplexer (ADM) in a Repeater

The HLM multiplexes and demultiplexes anywhere from one T2 up to four T2 signals in the A and B directions. The M12 Unit multiplexes and demultiplexes four T1 signals into and out of a T2.

M12-1 to M12-4 Units are for direction A.
M12-5 to M12-8 Units are for direction B.

For each M12 Unit pair, select:

- which T2 to ADD/DROP.
  - None
  - T2-1
  - T2-2
  - T2-3
  - T2-4
  - T2-5
  - T2-6
  - T2-7
- which direction to DROP AND CONTINUE.
  - DROP & CONTINUE

    Traffic can be dropped from both A and B at the same time.
  - DROP A
  - DROP B

Table 5-6: ADM for Low/Medium capacity radios

ADM Submenu	Selection	Explanation
M12-1/5 T2 ADD/DRP	None T2-1... 7	Do not drop any T2 signals into these M12 Units T2 to drop into M12.
M12-1/5 DROP & CONT	Drop A Drop B Drop&Cont	Drop T2 on Side A only. Drop T2 on Side B only. Drop T2 on both A and B sides.

3xDS3/4xDS3 Terminal

If you selected a T2 ADM for one of the channels, you must configure each of the M12 Units listed below.

- M12-1 T2 ADD/DRP
- M12-2 T2 ADD/DRP
- M12-3 T2 ADD/DRP
- M12-4 T2 ADD/DRP

Table 5-7: ADM for high capacity radios

ADM Submenu	Selection	Explanation
M12-1 T2 ADD/DRP	None T2-1... 7	Do not drop any T2 signals into these M12 Units T2 to drop into M12.

TRIBUTARIES from the CONFIGURATION Submenu

Table 5-8: TRIBUTARIES Submenu

TRIBUTARIES Submenu	Selection	Explanation
ENABLE	DS-1, 2, 3, 4 TRIBUTARY A1 TO 28 TRIBUTARY B1 TO 16 WAYSIDE	Choose ENABLE or DISABLE for each tributary. This command only masks the alarm of the disabled tributary.
CODE	TRIBUTARY A1 TO 28 CODE TRIBUTARY B1 TO 16 CODE	Select the appropriate line code for each tributary used. AMI or B8ZS, HDB3
	WAYSIDE CODE WAYSIDE CODE	AMI or B8ZS AMI or B8ZS, HDB3
EQUALIZER		This item is compensation for cable length between customer’s equipment and the radio equipment. It is applicable to DS signals.

Table 5-8: TRIBUTARIES Submenu

TRIBUTARIES Submenu	Selection	Explanation
	DS3 EQUALIZER	For a DS3 signal.
	DS3-1, 2, 3, 4 EQUALIZER	For 4xDS3 & 3xDS3 signals: for each T3 tributary, select the range in feet.
	TRIB EQUALIZER	Select the appropriate range in feet for each tributary. For an E1 signal: select E1 for each tributary. Range in feet is not available for E1.
	WAYSIDE EQUALIZER	For a DS1 signal, select the appropriate range in feet.
	WAYSIDE EQUALIZER	For an E1 signal, select E1 UNBALANCED or E1 BALANCED.

RELAYS from the CONFIGURATION Submenu

- There are a list of
  - 8 relay outputs
  - 17 alarm configurations
- Defaults
  - For **RELAY 1**, **MAJOR ALARM** is the default.
  - For **RELAY 2**, **MINOR ALARM** is the default.

Table 5-9: RELAYS Submenu

RELAYS Submenu	Selection	Explanation
RELAY 1 TO RELAY 8 INPUT	Manual Control (external site control) Major Alarm Minor Alarm Input LOS Sync Loss A Sync Loss B Errored Seconds A Errored Seconds B Signal Degradation A1 Signal Degradation A2 Signal Degradation B1 Signal Degradation B2 On Line Mod/Tx A On Line Mod/Tx B On Line Rx A On Line Rx B On Line HLM	Select the alarm defined for the **Relay** number.

Configuring the SERVICE CHANNEL

CONFIGURATION Submenu

Table 5-10: SERVICE CHANNEL submenu

SERVICE CHANNEL Submenu	Selection	Explanation
ADDRESS	000-999	Must be three digits. This is a unique address for the Service Channel.
MODE	LINEAR	For a linear system.

Table 5-10: SERVICE CHANNEL submenu (continued)

SERVICE CHANNEL Submenu	Selection	Explanation
The system automatically selects Terminal or Repeater mode.	LPMASTER or LP SLAVE	For a loop system: Select either LP MASTER or LP SLAVE. Only one MASTER per loop can be selected, but there must be one
VF PORT 1 LEVEL (to set the required VF level)	0 dBm 7 dBm -16 dBm	For both transmit and receive directions. For receive direction. For transmit direction.
VF PORT 2 LEVEL (to set the required VF level)	-16 dBm 7 dBm 0 dBm	For receive direction. For transmit direction. For both transmit and receive directions.
DATA BRIDGE	ISOLATE BRIDGE	Provides full duplex in a port-to-port application. Provides half-duplex communication.
LOCAL OFF HOOK	ENABLE	If external VF signal is applied to a VF port or If it is a master site or If the HLM is set for SOURCE TIME
EXTERNAL PILOT (for loop systems only)	ENABLE DISABLE	When two slave terminals are back-to-back. When a • master terminal and a slave terminal are back-to-back or • system is a repeater
DATA PORT BAUD	SAMPLE 9,600 / 19,200 / 38,400	Data rates up to 4,800 bit/s can be used with no restriction on the size of the data byte. For asynchronous start-stop, with the data byte set to 8 bits.
DATA PORT PARITY	ENABLE	To send the parity bit through the system. The system does not monitor the parity bit.

For more information on MODE, LOCAL OFF HOOK, and EXTERNAL PILOT, refer to the Systems Application Information (SAI) manual.

CONTROL Submenu

1. If it is required to mute the VF and data in the A direction, from the main menu:
2. Select **CONTROL > SERVICE CHANNEL > DATA/VF A > MUTE**.

   Notes:
   - Default is ON.
   - It is important not to connect two slave terminals with their external pilot enabled if each terminal is part of a separate loop.
   - At no time should a master site have its external pilot enabled; the Service Channel will not work properly.

Network Management

For network management configuration, refer to Chapter 6 and Chapter 7.

CHAPTER

6

IP COMMUNICATION STACK AND IP APPLICATIONS

TCP/IP-to-Netcom Connectivity

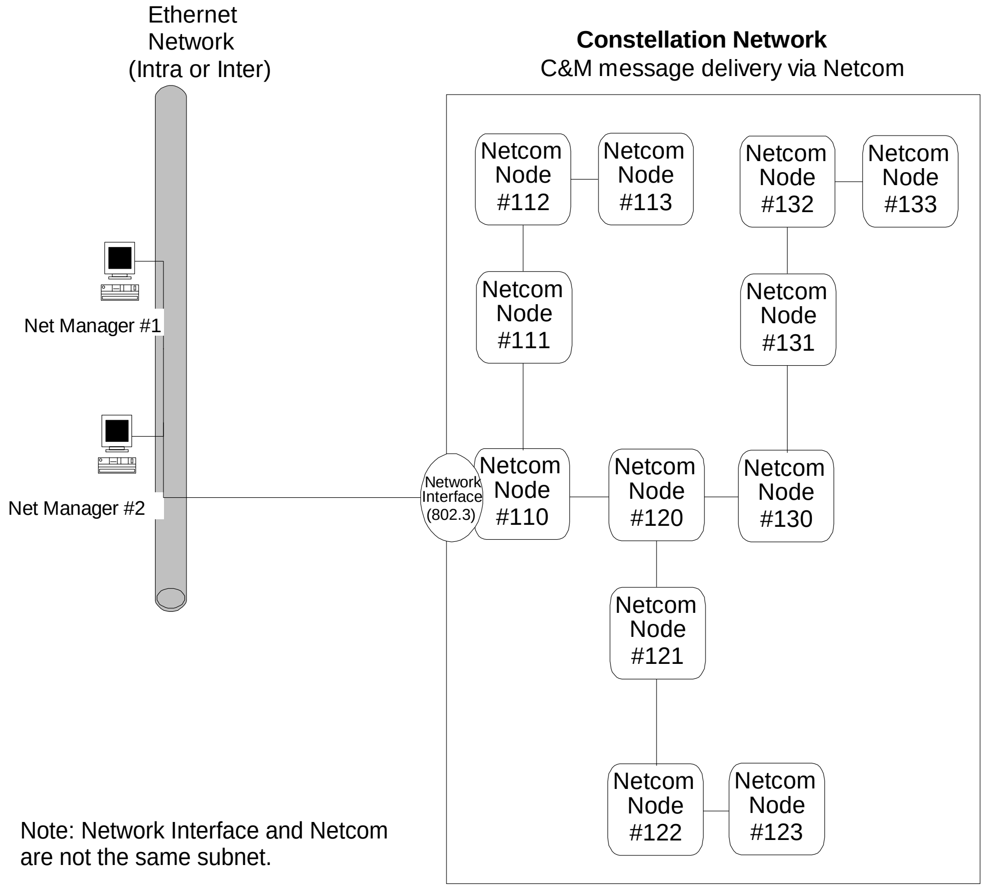
Figure 6-1 shows one example of a TCP/IP-to-Netcom connectivity for the Constellation radio.

A Network Manager is to be connected to the Netcom Network by:

- Direct–LAN

Net Manager 1 and Net Manager 2 may or may not be on the same subnet, and may or may not have connectivity to each other.

Figure 6-1: Constellation TCP/IP-to-Netcom connectivity



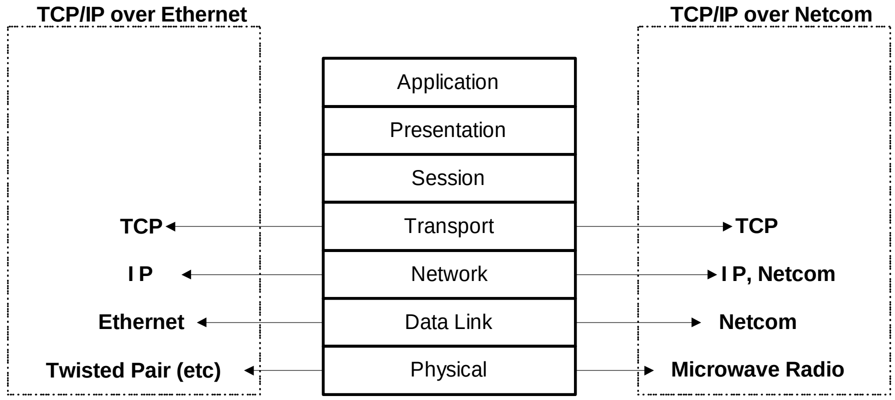
Protocol Layers

To provide TCP/IP service within the Constellation Network, the TCP/IP suite requires a physical and a data link layer assistance. TCP/IP over Ethernet is configured with Ethernet in the data link layer and a twisted-pair cable in the physical layer.

In Harris' TCP/IP over Netcom architecture, the microwave radio replaces the twisted-pair cable and Netcom replaces Ethernet.

Figure 6-2 is a comparison of the two protocol layer schemes.

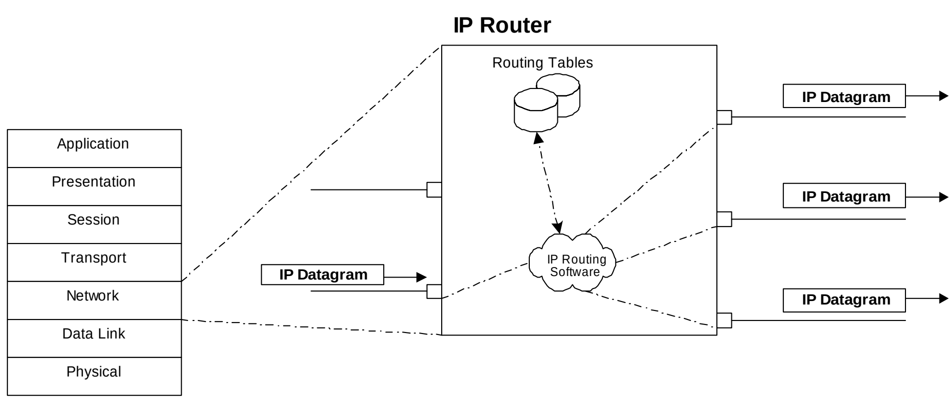
Figure 6-2: Protocol layers



IP Routing

Standard IP routing is accomplished through the use of the IP routing table. See Figure 6-3.

Figure 6-3: IP routing



This scheme is true of IP routing using static routing tables and of IP routing using dynamic routing tables. Static routing requires operator assistance to build and maintain the routing tables. Dynamic routing requires the implementation of a routing protocol (that is, RIP) to query the network and to update the routing tables. Both dynamic routing and static routing can be used.

Constellation supports both RIP 1 and RIP 2 dynamic routing tables.

Community ID

Two communities are defined. These Community IDs are not user-configurable.

- "public"

  Community with full access to the MIB objects (read-write)

- "private"

  Community with read-only access to the MIB objects (read-only)

Network Management Submenu

CONFIGURATION Menu

Use the **Configuration** menu on the Keypad to gain access to the following **Network Management** submenu.

- NE ADDRESS
- IP ROUTING
  - AUX PORT CONFIG
  - NETCOM INTERFACE
  - ETHERNET INTERFACE
  - RIP
- NETCOM OVER ETHERNET
- SNMP
- COMM PORT SETTINGS
- REBOOT SYSTEM

NE ADDRESS

Table 6-1: NE ADDRESS

NETWORK MANAGEMENT Submenu	Selection	Explanation
NE ADDRESS	001 to 999	This is a 3-digit number.

IP ROUTING

The IP Routing submenu contains IP configuration and routing information.

For a detailed explanation on IP routing, refer to page 6-3.

Aux Port Configuration

The Aux port is configurable to support two different protocols.

Table 6-2: AUX PORT CONFIG

IP ROUTING Submenu	Selection	Explanation
AUX PORT CONFIG	Netcom	Proprietary protocol used to interconnect two Constellation radios.
	Ethernet	To connect on a LAN.
	None	No connection.

Netcom IP Interface

Table 6-3: Netcom IP interface

IP ROUTING Submenu	Selection	Explanation
NETCOM IP INTERFACE	DISABLE/ENABLE	Disable/Enable the IP interface over Netcom
NETCOM IP ADDRESS	xxx.xxx.xxx.xxx	IP address of the Netcom interface.
NETCOM IP MASK	xxx.xxx.xxx.xxx	IP mask of the Netcom interface.

Ethernet IP Interface

Table 6-4: Ethernet IP interface

IP ROUTING Submenu	Selection	Explanation
ETHERNET IP INTERFACE	DISABLE/ENABLE	Disable/Enable the IP interface over Ethernet.
ETHERNET IP ADDRESS	xxx.xxx.xxx.xxx	IP address of the Ethernet interface.
ETHERNET IP MASK	xxx.xxx.xxx.xxx	IP mask of the Ethernet interface.

Routing for Internet Protocol (RIP)

The RIP command changes the mode of operation of the RIP.

Table 6-5: RIP

IP ROUTING Submenu	Selection	Explanation
RIP	DISABLE	RIP protocol is disabled.
	Ver 1	RIP protocol is in the RIP1 compatible mode. This mode should be used if other customer's equipment support only RIP1 protocol.
	Ver 2	RIP protocol is in the RIP2 mode. This is the normal mode. You should select this mode if you do not have a real need for another mode. This is also the default mode.
	Ver 1 & 2	RIP protocol is in the combined RIP1 and RIP2 mode. In this mode, the RIP sends and receives packets in both RIP1 and RIP2 formats. This mode should be selected *only* on the gateway radio when the OEM equipment connected to the Ethernet port supports RIP1 only, while the rest of the network, including all the Harris radios, are in the RIP2 mode.

Table 6-5: RIP (continued)

IP ROUTING Submenu	Selection	Explanation
RIP ON NETCOM IF	DISABLE/ ENABLE	The default value is Enable. This command enables/disables the RIP protocol on the Netcom IP interface. Select Enable unless you would like to isolate this radio from the rest of the Harris radios on the network, RIP-wise. Those who do not clearly understand how the RIP functions should not try to change this parameter.
RIP ON ETHERNET IF	DISABLE/ ENABLE	The default value is Enable. This command enables/disables the RIP protocol on the Ethernet IP interface. Select Enable unless you would like to isolate the OEM equipment connected to the Ethernet port from the Harris radios on the network, RIP-wise. Those who do not clearly understand how the RIP functions should not try to change this parameter.

Static Routing Tables

Seven static routing tables can be added/removed from/to the RIP tables. Table 6-6 is an explanation for routing table 1.

Table 6-6: Ethernet IP interface

IP ROUTING Submenu	Selection	Explanation
IP Route 1 Address	xxx.xxx.xxx.xxx	IP address of the subnetwork to be reached
IP Route Mask 1	xxx.xxx.xxx.xxx	IP mask of the subnetwork to be reached
Next IP Router 1	xxx.xxx.xxx.xxx	Router to which the IP packet to be sent in order to reach “IP Router 1 Address”

The address 255.255.255.255 disables the static entry.

REBOOT SYSTEM

IP parameter changes must be set by rebooting the SPU Controller. Choose the REBOOT SYSTEM command (page B-10) from the Keypad menu.

Table 6-7: REBOOT SYSTEM

NETWORK MANAGEMEN T Submenu	Selection	Explanation
REBOOT SYSTEM	YES	Reboots the SPU Controller. This procedure is not traffic-affecting.

SNMP Agent Configuration

The Constellation SNMP is compliant with SNMP V1 (RFC 1157).

Management Information Base (MIB)

To access the Constellation MIB, go to the Harris Premier Customer Site:

https://premier.harris.com/microwave/

or call the Technical Assistance Center (page xv).

Allowed NMS

To poll the agent, the manager is registered as an “allowed manager”. Using their IP addresses, up to 10 managers can be registered at a time.

A request from an NMS that is not allowed is denied.

SNMP Managers

Two tables are defined. SNMP Managers table and Trap Destinations table. A manager can be specified in both tables or in either one of them.

Allowed SNMP managers are defined through the Keypad.

Table 6-8: Manager IP address

SNMP Submenu	Selection	Explanation
MANAGER 1 IP ADDR	xxx.xxx.xxx.xxx	The managers specified in this table will be allowed to send an SNMP GET or SET request to the equipment.
to		
MANAGER 10 IP ADDR	xxx.xxx.xxx.xxx	

The address 255.255.255.255 indicates that this instance of manager is not used.

Trap Destinations

Trap Destinations are defined through the Keypad.

Table 6-9: Trap destination address

SNMP Submenu	Selection	Explanation
TRAP DEST 1 IP ADDR	xxx.xxx.xxx.xxx	The managers specified in this table will receive traps from the equipment.
to		
TRAP DEST 10 IP ADDR	xxx.xxx.xxx.xxx	

The address 255.255.255.255 indicates that this instance of manager is not used; therefore, no trap will be sent to this address.

Trap Management

Traps are sent to all the managers listed in the Trap Destination table. The trap mechanism is user-configurable through the Keypad.

Table 6-10: Trap management

SNMP Submenu	Selection	Explanation
TRAP TIMEOUT (SEC)	xxx	The time between resending the same trap message (= 0 if the Trap Repeat is 0) Default: 10 seconds
TRAP REPEAT	xxx	The number of the same trap message sent if the network manager does not poll the system (acknowledge)
TRAP COMMUNITY	Constellation	Community name of a trap
Disable Traps		Trap messages can be disabled or enabled. All trap messages can be disabled as a group, or each trap message can be configured individually. See page B-11.

Table 6-11: Disable Traps

DISABLE TRAPS Submenu	Selection	Explanation
ALL TRAPS	DISABLE ALL	All trap messages can be disabled as a group, or.
	CFG Individually	each trap message can be configured individually.
36 traps messages See page B-11.	Enable/Disable	Each trap message can be disabled or enabled individually.

CHAPTER

7

SNMP-BASED NETWORK MANAGEMENT

Introduction

The Constellation radio has an embedded SNMP agent on board. It also has a 10BASE-T Ethernet interface. This makes it easy to connect Constellation to NetBoss, StarView or any other SNMP-based network management system.

Constellation is typically configured using the keypad. It can also be configured using serial connection and a hyperterminal connection from a PC or laptop.

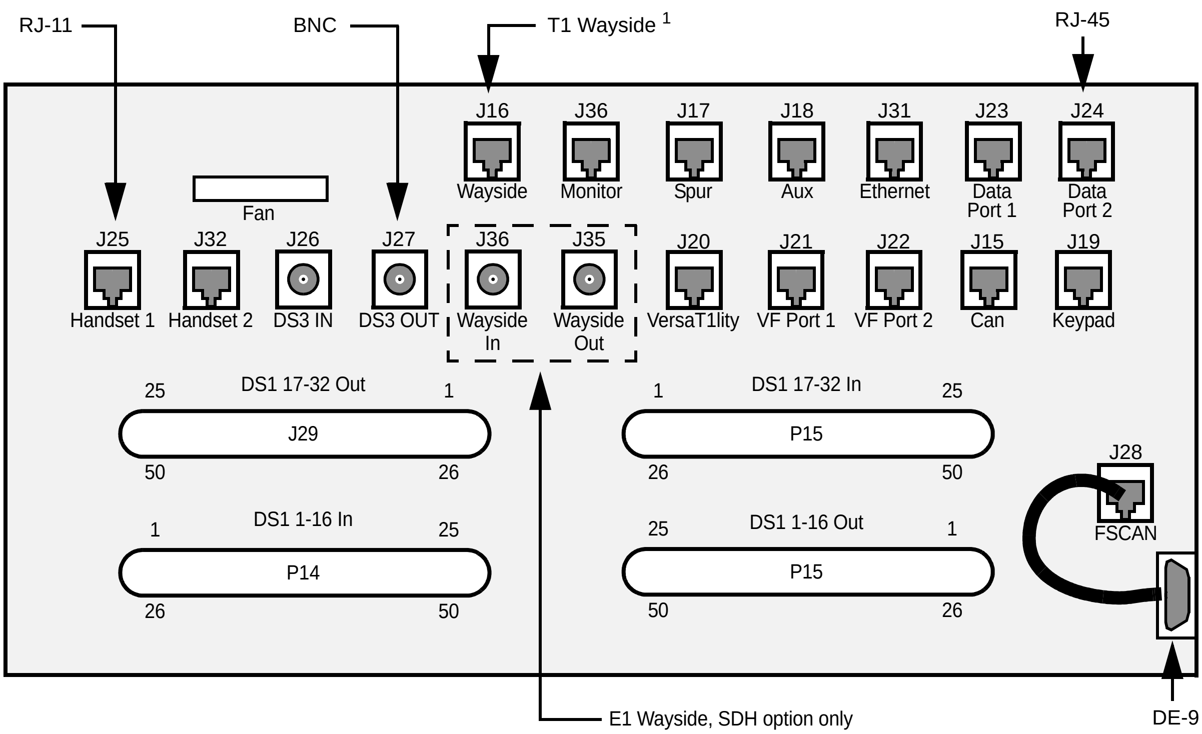
Constellation should have the latest software installed and running before completing the following.

Constellation Port Descriptions

The ports on the customer access area of the Constellation backplane are shown in Figure 7-1. The tables on the following pages describe the connector type and function.

For the purpose of this document, we will focus on the Ethernet port (J31).

Figure 7-1: Constellation Customer Access Area



In addition to the physical circuits available on the backplane, there is a virtual Netcom circuit. The Netcom air interface transports and routes IP traffic within the overhead bits (microwave). Physical interconnection is through the Ethernet port on the radio. This, along with user configuration, enables the interface to transport traffic. Configuration examples are given on page 7-6 (standard) and page 7-9 (advanced).

The AUX and ETHERNET ports cannot be used at the same time.

Table 7-1: Orderwire Interconnection

Port	Connector Type	Radio Equipment	Port	Connector Type	Signal
VF PORT 1	RJ-45	DVSII	VF1	50-pin Female	4W VF (600 &)
			VF2	50-pin Female	
		MegaStar	VF1B	DB-25 Female	
			VF2A	DB-25 Female	
			VF2B		
		MicroStar L	4W VF	RJ-45	
		MicroStar L (16 E1)		DB-9 Female	
		MicroStar M (1 RMS IDU)		DB-37 Female	
		MicroStar M/H (3 RMS IDU)		DB-9 Female	
VF PORT 2	RJ-45	DVSII	VF1	50-pin Female	4W VF (600 &)
			VF1 AUX		
			VF2	50-pin Female	
			VF2 AUX		
		MegaStar	VF1A	DB-25 Female	
			VF1B		
			VF2A	DB-25 Female	
		MicroStar L	4W VF	RJ-45	
		MicroStar L (16 E1)		DB-9 Female	
		MicroStar M (1 RMS IDU)		DB-37 Female	
		MicroStar M/H (3 RMS IDU)		DB-9 Female	

Table 7-1: Orderwire Interconnection (continued)

Port	Connector Type	Radio Equipment	Port	Connector Type	Signal
DATA PORT 1 & 2	RJ-45	DVSII	DATA1	50-pin Female	RS-232
			DATA2		
			DATA3		
			DATA4		
		MegaStar	DATA1	DB-15 Female	
			DATA2		
		MicroStar L/M/H	DATA	DB-9 Female	

Table 7-2: SCAN Equipment Interconnection

Port	Connector Type	Radio Equipment	Port	Connector Type	Signal
AUX	RJ-45	Constellation	AUX	RJ-45	RS-422
SPUR			SPUR		
VERSAT1LITY	RJ-45	CAU	COMM1	DB-9 Female	RS-232 or RS-423
			COMM2		
			COMM3		
			RTU		
		DVA	COMM1	DB-9 Female	RS-232 or RS-423
			COMM2		RS-232 or RS-423
			COMM3		RS-423
			COMM4		RS-423
			COMM5		RS-423
		DVM/DVL/ DVT	INT CTL EXT B	DB-25 Female	RS-423
		GlobeStar	RTU	DB-9 Female	RS-232 or RS-423
		MegaStar	AUX	DB-9 Female	RS-232 or RS-423
			SPUR		
		MicroStar L/M/H	RTU	DB-9 Female	RS-232 or RS-423

Table 7-2: SCAN Equipment Interconnection (continued)

Port	Connector Type	Radio Equipment	Port	Connector Type	Signal
Monitor	RJ-45	CAU	COMM1	DB-9 Female	RS-232
			COMM2		
			COMM3		
			RTU		
		DVA	COMM1	DB-9 Female	RS-232
			COMM2		
		GlobeStar	RTU	DB-9 Female	RS-232
		MegaStar	AUX	DB-9 Female	RS-232
			SPUR		
		MicroStar L/M/H	RTU	DB-9 Female	RS-232
FSCAN	RJ-45	FarScan PC	COMM	DB-9 Male	RS-232
		HNM UNIX Station	COMM	DB-25 Female	RS-232
ETHERNET	RJ-45	StarView PC	LAN	RJ-45	10BASE-T
		Constellation	Ethernet		
		Galaxy AIU	LAN		
		MicroStar Type II	Ethernet		

SNMP Connectivity Requirements

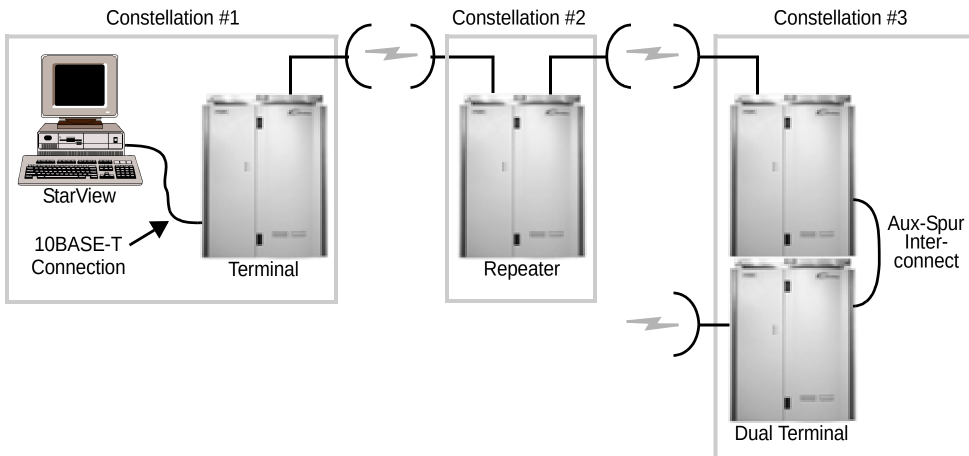
Some conditions must be met to set up the Constellation radio for SNMP connectivity:

- A minimum of two subnets is required.
- If StarView or any SNMP management station is connected directly to the Constellation Ethernet port, a 10BASE-T straight cable is required.
- An additional subnet is required for every enabled Ethernet port on a remote radio. This is so accurate and reliable routing across the Ethernet and Netcom interface can occur.
- Repeaters only require one IP address.
- For every site where the radio's Ethernet port is enabled, the AUX port must also be set to Ethernet.
- It is advisable to always enable RIP II on the radio.
- A reboot of the SPU shelf is required after any change to IP connectivity information to enable the changes (non-traffic-affecting).
- Dual terminals require one IP address for each terminal.
- RIP II updates take a minimum of five minutes to broadcast updates. Allow enough time for changes to broadcast across your network.
- If a router between the StarView PC and first radio is required, you may need to enter static routes on the StarView PC to reach all Ethernet subnets contained within the radio network.

Standard Configuration

A standard configuration refers to a network where the only radio with the Ethernet port enabled is the radio connected to StarView. Figure 7-2 shows an example of a small network consisting of three sites: terminal, repeater and dual terminal.

Figure 7-2: Standard Configuration Example



This example is a very basic LAN setup, where no IP connections are dropped at the remote sites. StarView has a straight Ethernet connection into the radio.

Based on Figure 7-2, the following assumptions are made:

- Only two subnets are needed because no IP segments will be dropped at remote sites.
- Private class C IP (192.168.1.0 and 192.168.2.0) is used.
- StarView PC: 192.168.1.1
- Constellation #1 Ethernet IP: 192.168.1.2
- Constellation #1 Netcom IP: 192.168.2.1
- Constellation #2 Netcom IP: 192.168.2.2
- Constellation #3 (top terminal) Netcom IP: 192.168.2.3
- Constellation #4 (bottom terminal) Netcom IP: 192.168.2.4

All IP configurations are found in the following keypad menu:
`Configuration > Network Management`

Table 7-3: Standard Configuration

Setting	Constellation #1	Constellation #2	Constellation #3 (top)	Constellation #3 (bottom)
Keypad: ... `Network Management > IP Routing`				
AUX Port Config	Ethernet	Netcom	Netcom	Netcom
Netcom Interface	Enabled	Enabled	Enabled	Enabled
Netcom IP Address	192.168.2.1	192.168.2.2	192.168.2.3	192.168.2.4
Netcom Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0	255.255.255.0
Ethernet Interface	Enabled	Disabled	Disabled	Disabled
Ethernet IP Address	192.168.1.2	255.255.255.255 (default)	255.255.255.255 (default)	255.255.255.255 (default)
Ethernet Subnet Mask	255.255.255.0	255.255.255.255	255.255.255.255	255.255.255.255
IP Route 1...10				
IP Route Mask 1...10				
Next IP Router 1...10				
RIP	RIP II	RIP II	RIP II	RIP II
RIP on Netcom IF	Enabled	Enabled	Enabled	Enabled
RIP on Ethernet IF	Enabled	Enabled	Enabled	Enabled
Keypad: ... `IP Routing > SNMP > SNMP Managers`				
Manager 1IP Address	192.168.1.1	192.168.1.1	192.168.1.1	192.168.1.1
Manager 2…10 IP Address	255.255.255.255	255.255.255.255	255.255.255.255	255.255.255.255
Keypad: ... `IP Routing > SNMP > Trap Destination`				
Trap Destination 1	192.168.1.1	192.168.1.1	192.168.1.1	192.168.1.1
Trap Destination 2…10	255.255.255.255	255.255.255.255	255.255.255.255	255.255.255.255

Increment the value by one for each new radio to make management of the address space less confusing. For example, if the Netcom IP address for Constellation #2 is 192.168.2.2, the address for Constellation #3 would be 192.168.2.3.

A static route also needs to be entered in StarView. This is because the radios' Netcom interfaces are not in the same subnet as the PC. Without this setup, the IP packet traveling from StarView to the radio would not know where to go. This step is typically only required when there is additional network hardware (such as a router) between the StarView PC and the first radio. Refer to the static route example on page 7-8.

You will need to re-issue the static route command every time the PC reboots.

Static Route Example

From the command prompt on the StarView PC, make the following changes:

```
route add 192.168.2.0 mask 255.255.255.0 192.168.1.2
```

Netcom subnet (192.168.2.0)

First radio Ethernet IP (192.168.1.2)

If there is additional network hardware (such as a router) between the StarView PC and the first radio, a static route may also need to be entered in Constellation #1. This is because the StarView would not be on the same subnet as the Constellation #1 Ethernet interface. Without this setup, the IP packet traveling from Constellation #1 to StarView would not know where to go.

Static Route Example

Keypad: . . . IP Routing -> IP Route 1 192.168.1.0

Keypad: . . . IP Routing -> IP Route Mask 1 255.255.255.0

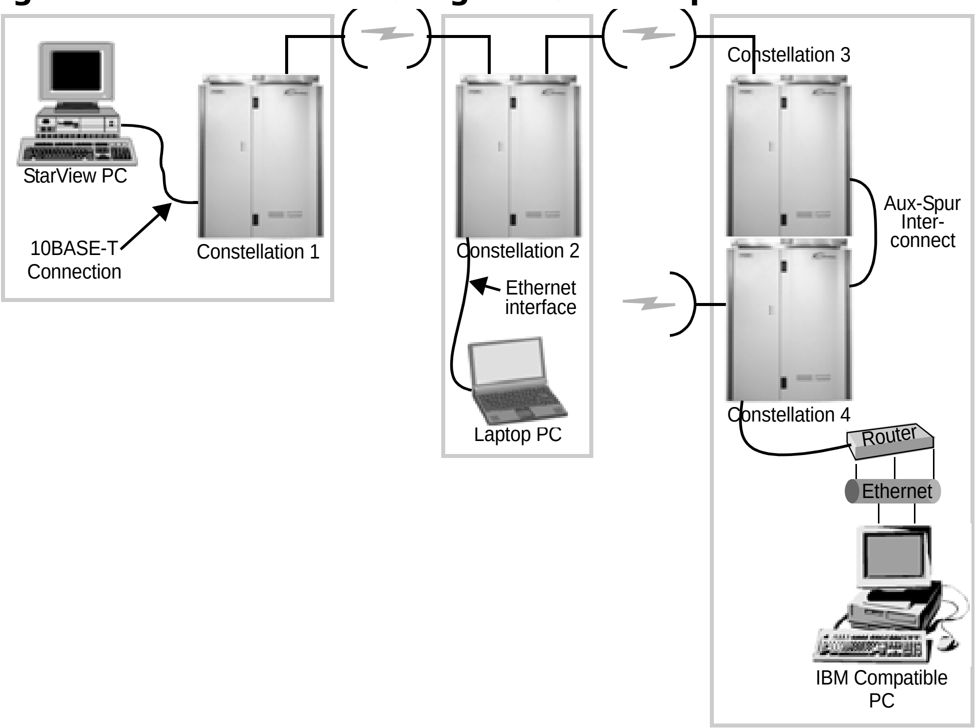
Keypad: . . . IP Routing -> Next IP Router 1 192.168.2.230

192.168.2.230 is IP address of an interface of the additional router connected to Ethernet interface of Constellation #1

Advanced Configuration

An advanced configuration applies to any configuration where Ethernet connections are dropped at remote radio sites. An example of this is shown in Figure 7-3.

Figure 7-3: Advanced Configuration Example



SNMP-BASED NETWORK MANAGEMENT

Based on Figure 7-3, the following assumptions are made:

- Four subnets are needed (one for each Ethernet subnet at each remote site, and one for Netcom).
- Private class C IP (192.168.1-4.0) is used.
- StarView PC: 192.168.1.1
- Constellation #1 Ethernet IP: 192.168.1.2
- Constellation #1 Netcom IP: 192.168.2.1
- Constellation #2 Netcom IP: 192.168.2.2
- Constellation #3 (top) Netcom IP: 192.168.2.3
- Constellation #3 (bottom) Netcom IP: 192.168.2.4
- Constellation #2 Ethernet IP: 192.168.3.1
- Constellation #3 (bottom) Ethernet IP: 192.168.4.1

An advanced configuration would have the following (differences between standard and advanced are in **bold** text):

All IP configurations are found in the following keypad menu:

`Configuration > Network Management`

Table 7-4: Advanced Configuration

Setting	Constellation #1	Constellation #2	Constellation #3 (top)	Constellation #3 (bottom)
Keypad: `... Network Management > IP Routing`				
AUX Port Config	Ethernet	Ethernet	Netcom	Ethernet
Netcom Interface	Enabled	Enabled	Enabled	Enabled
Netcom IP Address	192.168.2.1	192.168.2.2	192.168.2.3	192.168.2.4
Netcom Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0	255.255.255.0
Ethernet Interface	Enabled	**Enabled**	Disabled	**Enabled**
Ethernet IP Address	192.168.1.2	**192.168.3.1**	255.255.255.255 (default)	**192.168.4.1**
Ethernet Subnet Mask	255.255.255.0	**255.255.255.0**	255.255.255.255	**255.255.255.0**
IP Route 1...10				
IP Route Mask 1...10				

Table 7-4: Advanced Configuration

Next IP Router 1...10				
RIP	RIP II	RIP II	RIP II	RIP II
RIP on Netcom IF	Enabled	Enabled	Enabled	Enabled
RIP on Ethernet IF	Enabled	Enabled	Enabled	Enabled
Keypad: `... IP Routing > SNMP > SNMP Managers`				
Manager 1IP Address	192.168.1.1	192.168.1.1	192.168.1.1	192.168.1.1
Manager 2…10 IP Address	255.255.255.255	255.255.255.255	255.255.255.255	255.255.255.255
Keypad: `... IP Routing > SNMP > Trap Destination`				
Trap Destination 1	192.168.1.1	192.168.1.1	192.168.1.1	192.168.1.1
Trap Destination 2…10	255.255.255.255	255.255.255.255	255.255.255.255	255.255.255.255

SNMP-BASED NETWORK MANAGEMENT

The only difference in the two examples is that the AUX port needs to be set to Ethernet when dropping Ethernet connections.

The above is a very basic setup. If other networking elements, such as routers and corporate LAN/WAN, are introduced, additional configuration is required. An example of this could be using static routes on the radios to reach far subnets (if these subnets are not broadcast in RIP II in the radio network).

When to Use Static Routes Versus RIP II

Static routes tell the IP packet traveling in the Netcom Air interface where to go. They eliminate the need for RIP II. (Refer to Table 6-5.)

If everything is set up with RIP II, use RIP II instead of static routing. However, some routers connected to the ethernet port may not support RIP II. In that case, static routes should be used.

For static routing, the following configuration changes need to be made:

- IP Route 1...10: IP Address or Subnet where the target device lives.
- IP Route Mask 1...10: Subnet where the target device lives.
- Next IP Router 1...10: This is the node that routes the IP packet. This needs to be an IP address (no subnet broadcast addresses), and is required to be on the same subnet where the device performing the routing is located.

Table 7-5 shows the static routing changes to the advanced configuration. All changes compared to the advanced configuration using RIP II are shown in **bold** text.

Table 7-5: Static Routing Changes (Advanced Configuration)

Setting	Constellation #1	Constellation #2	Constellation #3 (top)	Constellation #3 (bottom)
Keypad: `... Network Management > IP Routing`				
AUX Port Config	Ethernet	Ethernet	Netcom	Ethernet
Netcom Interface	Enabled	Enabled	Enabled	Enabled
Netcom IP Address	192.168.2.1	192.168.2.2	192.168.2.3	192.168.2.4
Netcom Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0	255.255.255.0
Ethernet Interface	Enabled	Enabled	Disabled	Enabled
Ethernet IP Address	192.168.1.2	192.168.3.1	255.255.255.255 (default)	192.168.4.1
Ethernet Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.255	255.255.255.0
IP Route 1	**192.168.3.0 (Constellation #2)**	**192.168.1.0 (Constellation #1)**	**192.168.3.0 (Constellation #2)**	**192.168.1.0 (Constellation #1)**
IP Route Mask 1	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**
Next IP Router 1	**192.168.2.2 (#2 Netcom IP)**	**192.168.2.1 (#1 Netcom IP)**	**192.168.2.2 (#2 Netcom IP)**	**192.168.2.1 (#1 Netcom IP)**
IP Route 2	**192.168.4.0 (Constellation #3 bottom)**	**192.168.4.0 (Constellation #3 bottom)**	**192.168.1.0 (Constellation #1)**	**192.168.3.0 (Constellation #2)**
IP Route Mask 2	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**	**255.255.255.0**
Next IP Router 2	**192.168.2.4 (#3 bottom Netcom IP)**	**192.168.2.4 (#3 bottom Netcom IP)**	**192.168.2.1 (#1 Netcom IP)**	**192.168.2.2 (#2 Netcom IP)**
IP Route 3	**255.255.255.255**	**255.255.255.255**	**192.168.4.0 (Constellation #3 bottom)**	**255.255.255.255**
IP Route Mask 3	**255.255.255.255**	**255.255.255.255**	**255.255.255.0**	**255.255.255.255**
Next IP Router 3	**255.255.255.255**	**255.255.255.255**	**192.168.2.4 (#3 bottom Netcom IP)**	**255.255.255.255**
RIP	**DISABLED**	**DISABLED**	**DISABLED**	**DISABLED**
RIP on Netcom IF	Enabled	Enabled	Enabled	Enabled
RIP on Ethernet IF	Enabled	Enabled	Enabled	Enabled

Table 7-5: Static Routing Changes (Advanced Configuration)

Keypad: ... IP Routing > SNMP > SNMP Managers				
Manager 1IP Address	192.168.1.1	192.168.1.1	192.168.1.1	192.168.1.1
Manager 2...10 IP	255.255.255.255	255.255.255.255	255.255.255.255	255.255.255.255
Keypad: ... IP Routing > SNMP > Trap Destination				
Trap Destination 1	192.168.1.1	192.168.1.1	192.168.1.1	192.168.1.1
Trap Destination 2...10 IP	255.255.255.255	255.255.255.255	255.255.255.255	255.255.255.255

You may also need to add a static route on the StarView PC if no other routing facilities are in place (such as a router). See page 7-6 for an example.

CHAPTER

8

ROUTINE MAINTENANCE

Routine Observances

Routine observances of the Constellation Radio include the following:

- Look at the LED indicators on the faceplates to ensure that they are all green.

  On protected systems, only the on-line units have the green LEDs lighted.

- Use the Keypad to do routine maintenance tests to ensure that the radio is performing properly.

FCC Requirements

The Federal Communications Commission (FCC) requires that records of transmitter measurements be maintained.

The following measurements should be taken at least once a year and recorded in a Maintenance Log (see for an example of a Maintenance Log form).

- Transmitter Assembly
  - Reference frequency
  - Power output (at the ACU transmit monitor port) (page 8-5)

Monitoring Recommendations

It is important that you use high-quality adapters when monitoring power output at the radio monitor port. Inexpensive "screw together" adapters introduce unpredictable amounts of signal loss. Attempting to compensate for this signal loss can result in sync loss and errored seconds events.

Monitoring the Reference Frequency

Harris recommends monitoring the reference frequency during installation, and then at least once a year while the radio is in service.

The specification for the oscillator is +/- 300 Hz. The reference oscillator frequency can be adjusted through the Keypad. If it cannot be adjusted within 300 Hz, the OCXO should be replaced.

Performing routine checks and recording any adjustments can expose a potential crystal problem before there is a failure. Changes in crystal frequency are most likely in the first few months of operation. After three to six months, the crystal should stabilize.

UBER Measurement

UBER (uncorrected bit error ratio) is a measurement that shows BER before FEC takes place. UBER command can be accessed through the Keypad's hidden Measurement submenu.

Transmitter Frequency Measurement

The reason for performing these procedures is to ensure that the Transmitter Assembly is operating on the correct frequency and power level to comply with the license requirements. (Example: FCC Title 47, Part 101.107, 101.111, 101.113, and 101.217.) It also ensures that the residual BER floor and acquisition time remain within specification.

1. Record the operating frequency of the Transmitter from the Keypad (hidden menu).

   CONFIGURATION > F1 + F3 or Ctrl B > TX FREQ

2. This frequency should match the one written on the Tx filter and the station authorization.

3. Determine from the table in Appendix C, which multiplier-filter should be used (or is in use).

   The Transmitter Assembly should be plugged into the rack and powered for at least 30 minutes prior to adjusting the frequency. The position of the TX On/OFF switch does not affect the measurement. The power supply should be ON.

   The Frequency Counter should be plugged in and powered for at least 30 minutes prior to adjusting the frequency.

4. Connect a frequency counter to the REF MON port on the Transmitter Assembly (Figure 8-1).

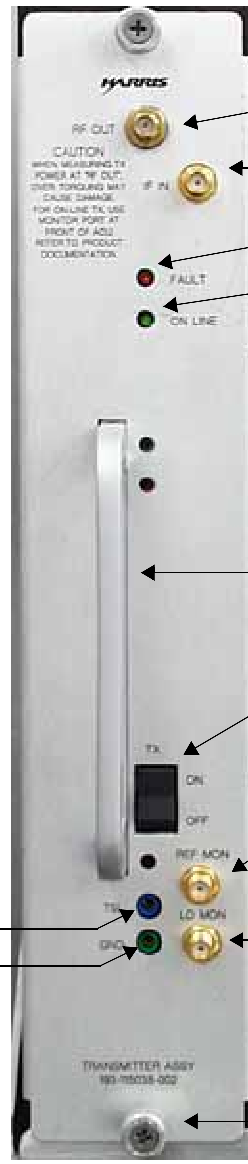
5. To adjust the frequency, use the hidden Keypad command

   CONFIGURATION > F1 + F3 or Ctrl B > TX 100MHZ TUNE

6. Adjust the frequency to
100.000,000 MHz ±(see table)

Year of Operation	Tolerance
Initial adjustment	± 100 Hz
Thereafter	± 300 Hz

Figure 8-1: Transmitter Assembly, front view



Transmitter Power Measurement

This procedure for measuring the transmitter power should be followed

- For new installations
- As part of the annual maintenance requirement
- When the Transmitter Assembly is replaced

Note that this is a new procedure and should be followed from now on.

You may observe a low output alarm while you are performing calibration. Ignore the alarm until the calibration has been completed.

Measuring the Power Output of an Off-line Transmitter

If the Transmitter to be measured is off-line, then it must be placed on line.

The following procedure interrupts traffic.

1. Switch the Transmitter on line as follows:
From the Keypad main menu, select
CONTROL > LOCK/IF LPBK > SWITCH MOD/TX (A or B) > EXEC
The new transmitter's green LED should be lit after an audible click of the ACU's coax relay.

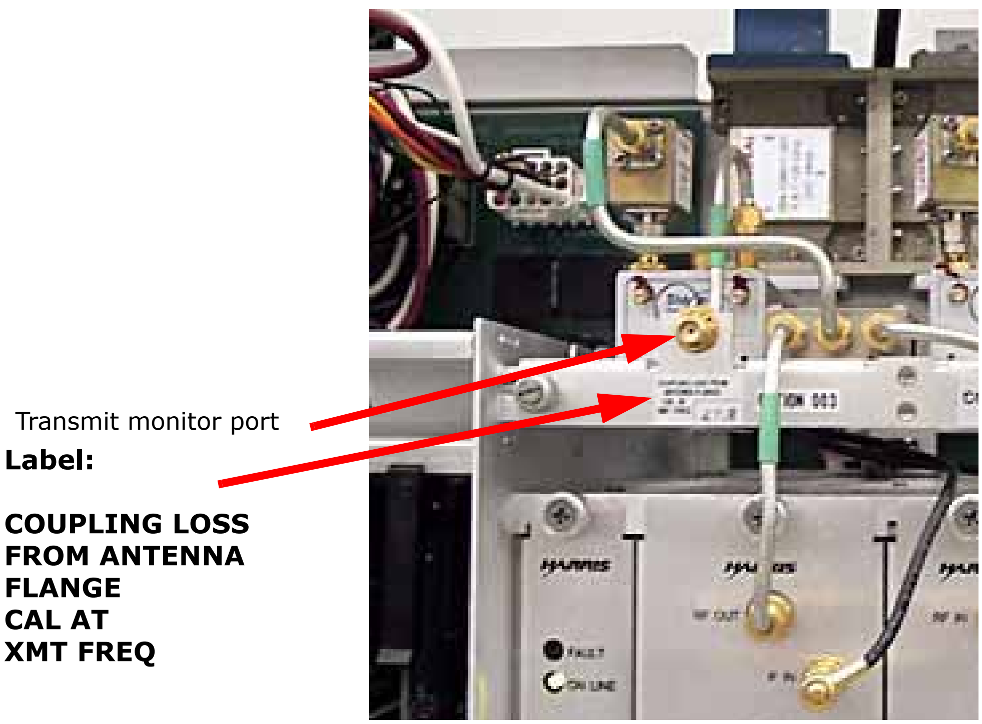
If the radio switches back to the original transmitter that was online (see RCS switch alarm on page B-9), check that the correct option of Transmitter and Multiplier/Filter is being installed. Contact Harris Technical Support for futher assistance.

Connecting the Power Meter

2. Connect the power head of the power meter to the transmit monitor port on the ACU. See Figure 8-2.

   The monitor port is labeled “COUPLING LOSS FROM ANTENNA FLANGE CAL AT XMT FREQ __._”.

Figure 8-2: Location of the transmit monitor port



Power Meter Reading

3. The Power Meter reading should equal the value from Table 8-1 or Table 8-2 minus the Coupling Loss on the label. You also may refer to the original factory test data that was supplied with the radio for the power at the Transmit monitor port.

Power may be set low in some applications.

Table 8-1: Power at antenna flange, NP configuration

TX Freq. (GHz)	Power (dBm)						
	8T	16T		28T/DS3		OC3/3xDS3/4xDS3	
		Std.	High[ab]	Std.	High[ab]	Std.	High[a]
6	29.5	28.5	29.5	29.0	30.5	29.0	31.5/31.0[c]
7/8	27.5	26.5	27.5	27.0	28.5	27.5	30.0
10/11	26.0	24.5	25.5	25.0	26.5	25.0	28.5

a. High Power requires high power option of the Transmit Assembly

b. High power requires high gain modem option (101-115540-002 for 16T and -003 for 28T).

c. The first number is for OC3 & 3xDS3; the second number is for 4xDS3.

Table 8-2: Power at antenna flange, MHSB configuration

TX Freq. (GHz)	Power (dBm)						
	8T	16T		28T/DS3		OC3/3xDS3/4xDS3	
		Std.	High[ab]	Std.	High[ab]	Std.	High[a]
6	29.1	28.1	29.5	28.6	30.1	28.6	31.1/30.6[c]
7/8	27.1	26.1	27.1	26.6	28.1	27.1	29.6
10/11	25.6	24.1	25.1	24.6	26.1	24.6	28.1

a. High Power requires high power option of the Transmit Assembly

b. High power requires high gain modem option (101-115540-002 for 16T and -003 for 28T).

c. The first number is for OC3 & 3xDS3; the second number is for 4xDS3.

The power at the top of the rack (TOR) = the power meter reading + the coupling loss shown on the monitor port label.

4. If the Power Meter reading does not equal the value calculated from step 3, use the Keypad to adjust the RF power out. Refer to the next section for a detailed procedure.

5. If power adjustment is required, go to step 6.
If power adjustment is not required, go to step 19.

Keypad Procedure for Adjusting the RF Power Out

This procedure requires access to the hidden RF Configuration submenu.

6. Ensure that the Transmitter on line is locked.

   From the Keypad main menu, select

   CONTROL > LOCK/IF LPBK > LOCK MOD/TX > SET

7. For the high power calibration, access the hidden RF Configuration submenu from the Keypad main menu.

   CONFIGURATION > F1 + F3 or Ctrl B > TX PWR CALIB > ADJUST HIGH PWR

8. Use the UP/DOWN keys until the power meter reading + the coupling loss shown on the monitor port label = the value to within ± 0.2 dB of the value in Table 8-1 or Table 8-2.

If desired, the output power may be set to a lower value.
- Model 2 or older may be set as low as 5 dB below the value in Table 8-1 or Table 8-2.
- Model 3 may be set up to 10 dB below the value in Table 8-1 or Table 8-2.

9. Use the UP/DOWN keys until the value = the power meter reading + the coupling loss shown on the monitor port label.

10. Go to **HIGH PWR CALIB**, and enter the value from step 9.

Notes:

• Use the F2 key for the decimal point.

• You must enter 3 digits. For example, 30 dBm is entered as 30.0.

11. Press the **EXEC** key.

12. Exit.

13. Go to **ADJUST LOW PWR**.

14. Use the UP/DOWN keys until the value = the power meter reading + the coupling loss shown on the monitor port label.

• Tx Assy, Model 2: should be approximately 5 dB below high power
• Tx Assy, Model 3: should be approximately 10 dB below high power

Adjust if necessary.

15. Go to **LOW PWR CALIB**, and enter the value from step 14.

Notes:

• Use the F2 key for the decimal point.

• You must enter 3 digits. For example, 30 dBm is entered as 30.0.

16. Press the **EXEC** key.

17. Exit. It will automatically return to high power.

18. Unlock the on-line Transmitter.

From the Keypad main menu, select

CONTROL > LOCK/IF LPBK > LOCK MOD/TX > CLR

Recording the Power Levels

19. Record the power levels along with the date and the name of the person making the measurement in the "Routine Maintenance Log Form" (see the end of this chapter).

Off-line Transmitter

20. When you have finished taking the measurement, you can either leave the Transmitter on line or return it to the off-line status.

21. The standby Transmitter is now the primary Transmitter.

Switching the traffic back to the previous Transmitter will cause a hit.

If switching of Transmitter Assemblies is desired, it should be done during low-traffic hours.

Receiver Frequency Measurement

1. Record the operating frequency of the Receiver from the Keypad (hidden menu).

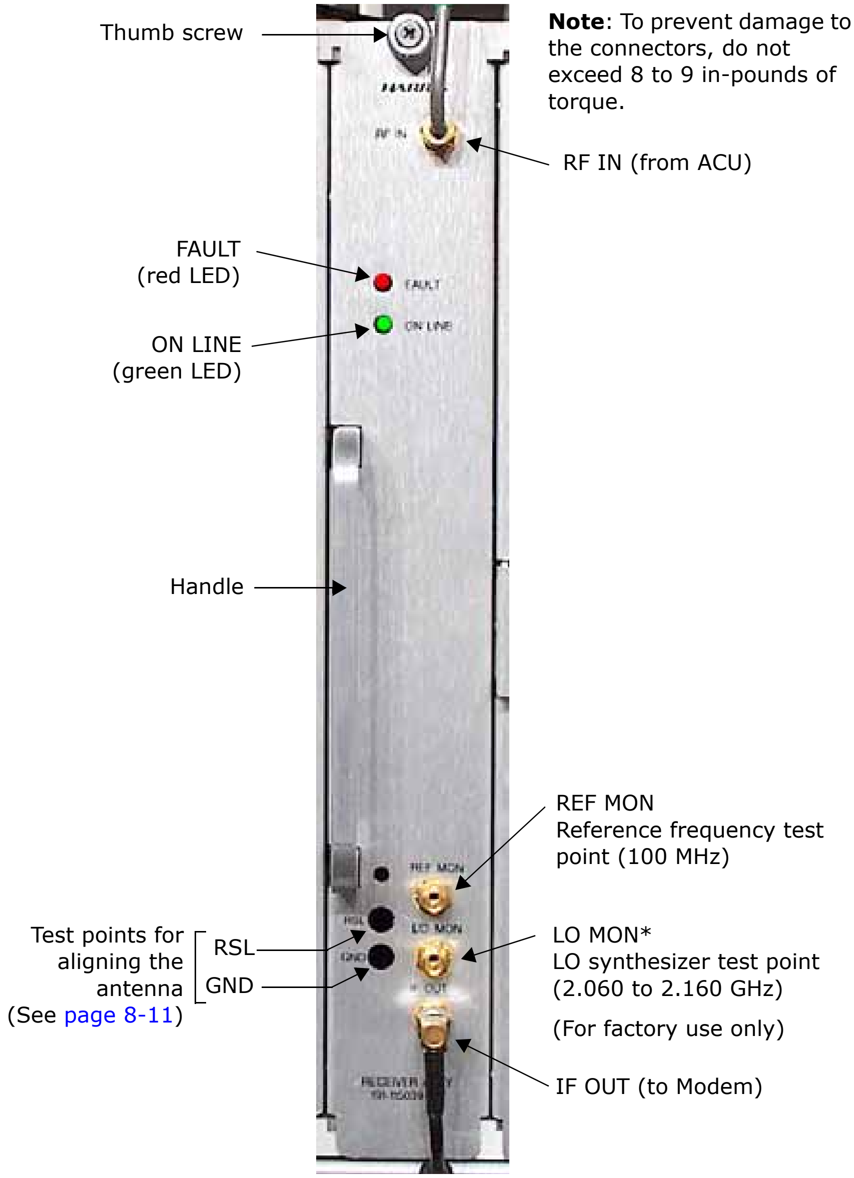
   CONFIGURATION > F1 + F3 or Ctrl B > RX FREQ

   For 6/7 GHz radios: Enter 7 digits without the decimal point.
   For 10/11 GHz radios: Enter 8 digits without the decimal point. Add zeros (0) at the end if needed to complete the 8-digit field.

   This frequency should match the one written on the Rx filter and the station authorization.

2. To measure the 100 MHz oscillator frequency, connect a frequency counter to the REF MON port on the Receiver Assembly (Figure 8-1).

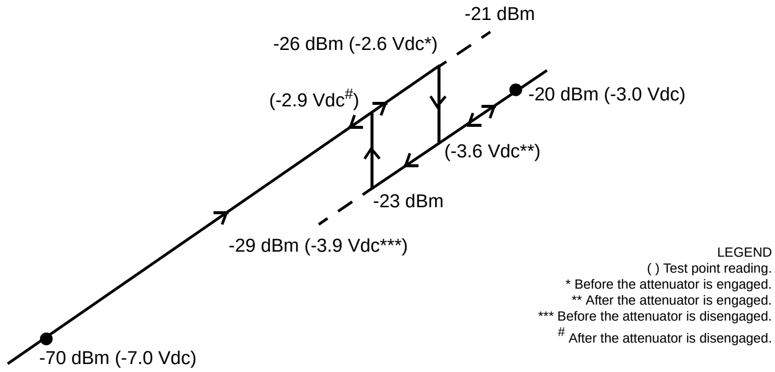
Figure 8-3: Receiver Assembly, front view



RSL Test Point

At -21 dBm or higher, a 10 dB attenuator is engaged, resulting in a 1 volt drop (apparent 10 dB) in the RSL test point reading. The Keypad will display the corrected (unattenuated) value. At nominally -23 dBm, the attenuator is disengaged, and the meter will reflect the unattenuated value. See Figure 8-4.

Figure 8-4: RSL measurement



If the signal level is too high for antenna alignment, the far-end Transmitter could be set to ATPC low power (about 10 dB lower than nominal high power setting). See Keypad menu, Appendix B.

CONFIGURATION > SYSTEM > TX ATPC > DISABLE LOW

If the signal level is still too high, a pad can be temporarily added at the Receiver input.

Routine Maintenance Log Form

Constellation Radio **MCD Rack No. ________**

Radio Site No.______________ Location _________________________________ Coordinating Site _______________________________________

Assembly	What to Measure	Faceplate Test Point	Unit	First Installation		1 Year after Installation		2 Years after Installation		3 Years after Installation		4 Years after Installation		5 Years after Installation	
				Initial Value	Date & Name	Value	Date & Name	Value	Date & Name	Value	Date & Name	Value	Date & Name	Value	Date & Name
Transmitter	Reference frequency	REF MON SMA connector (100 MHz)	A1												
			A2												
			B1												
			B2												
	Power output	ACU transmit monitor port	A1												
			A2												
			B1												
			B2												
	Power output	Keypad	A1												
			A2												
			B1												
			B2												

NOTE

Refer to Chapter 8 for procedures.

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ROUTINE MAINTENANCE

Assembly	What to Measure	Faceplate Test Point	Unit	First Installation		1 Year after Installation		2 Years after Installation		3 Years after Installation		4 Years after Installation		5 Years after Installation	
				Initial Value	Date & Name	Value	Date & Name	Value	Date & Name	Value	Date & Name	Value	Date & Name	Value	Date & Name
Receiver	Reference frequency	REF MON SMA connector (100 MHz)	A1												
			A2												
			B1												
			B2												
	Received Signal Level	Take the reading from the Keypad	A1												
			A2												
			B1												
			B2												

NOTES:

1. **Measurements at the Receiver Assembly are not required by the FCC. This page is for customer's information only.**
2. **Refer to Chapter 8 for procedures.**

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CHAPTER

9

SYSTEM SOFTWARE UPGRADES

Obtaining New Software

New software is available from the Harris Premier Customer Site:

https://premier.harris.com/microwave/

or call the Technical Assistance Center (page xv).

Be sure to read the software release note before downloading the software into the Constellation radio.

Downloading New Software

If you have Farscan or Starview connected, it is recommended that you stop Farscan or Starview before downloading the software. Otherwise, the download is very slow and occasionally the program crashes.

After you have downloaded the new software, check the following Configuration settings to ensure that the configurations are still correct.

- CONFIGURATION > TRIBUTARIES > ENABLE
- CONFIGURATION > TRIBUTARIES > CODE
- For a repeater system: CONFIGURATION > ADM

Introduction

You will need the file with the latest Constellation System Software that contains the Download Utility v3.02 (Swdl.exe) or later.

There are two downloading procedures for equipment connected in a contiguous network. See Figure 9-1.

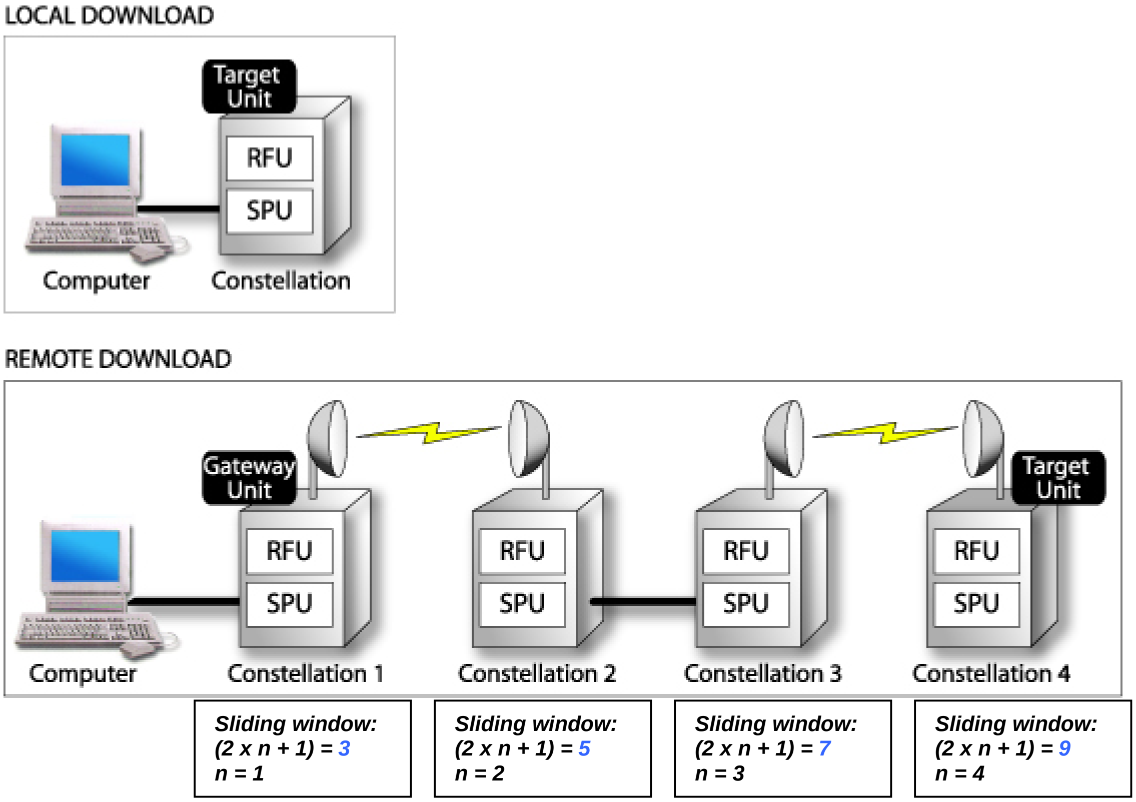
- **Local Download**

Your PC is connected directly to the target radio you are downloading the system software to.

- **Remote Download**

Your PC is connected to any other Constellation radio on the network (**gateway** unit) and that the **gateway** unit can communicate with the target unit.

Figure 9-1: Local and remote download connections



Requirements

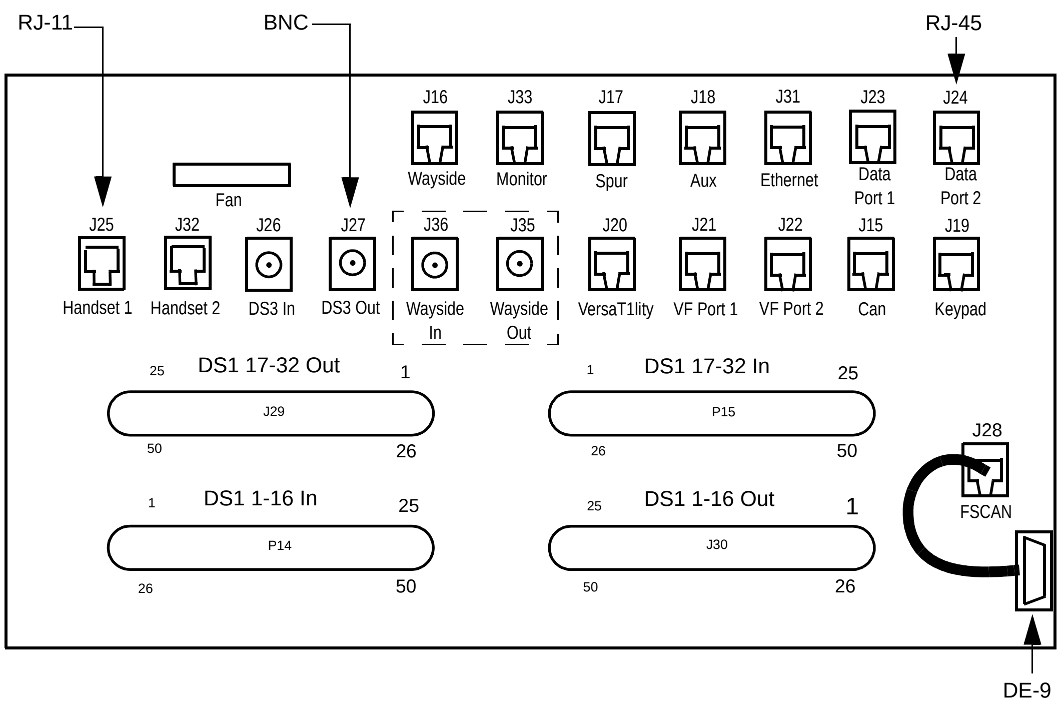
- IBM PC-compatible desktop or laptop computer
- Windows 95, 98, ME NT or 2000 operating system with adequate resources
- Null cable for connecting the PC to the Constellation radio
  - DE-9 to DE-9 cable (crossover cable)
  - DE-9 to RJ-45 cable

See Appendix A for pinout specifications.

Preparing for Download

1. Connect an appropriate null modem cable from the COM1 port of a PC to an appropriate port in the customer access area (Figure 9-2) of the Constellation radio.
   - FSCAN (FarScan) port (DE-9) or
   - MONITOR port (RJ-45) (J33) or
   - VERSATILITY port (RJ-45) (J20).

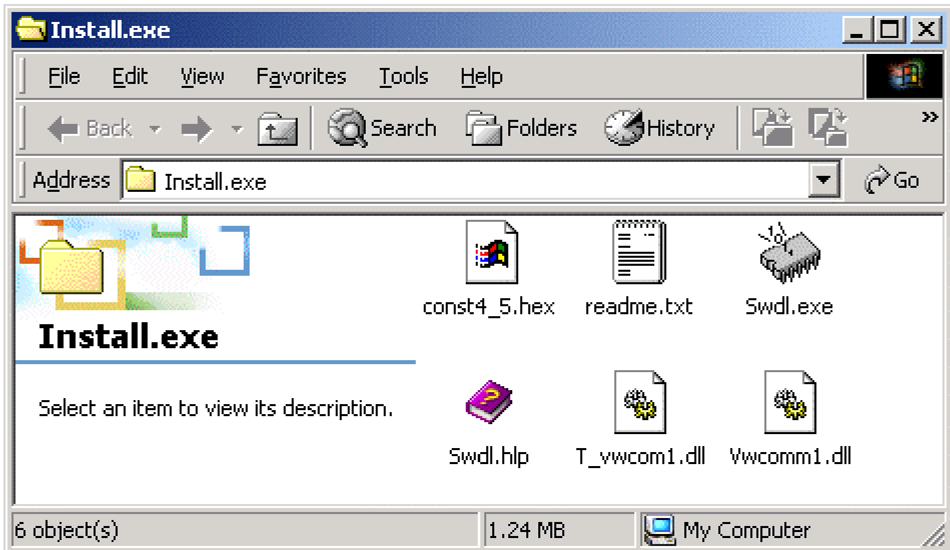
Figure 9-2: Customer access area



Ensure that no other applications are running on the PC with the selected COM port, such as PDA Hot Sync, Laplink, and so forth.

2. Insert the software upgrade disk into the disk drive.
3. Double-click the Harris file named **Install.exe** to unzip it to a folder location that you can easily recall.
4. Open the folder where the files were unzipped. The following is displayed.

Figure 9-3: Unzipped files



Note: The const*_*.hex file number may differ from the example shown in Figure 9-3.

5. The following explains how to download the software into the SPU Controller.

- **readme.txt** file
- "Local and Remote Download" section, page 9-6.

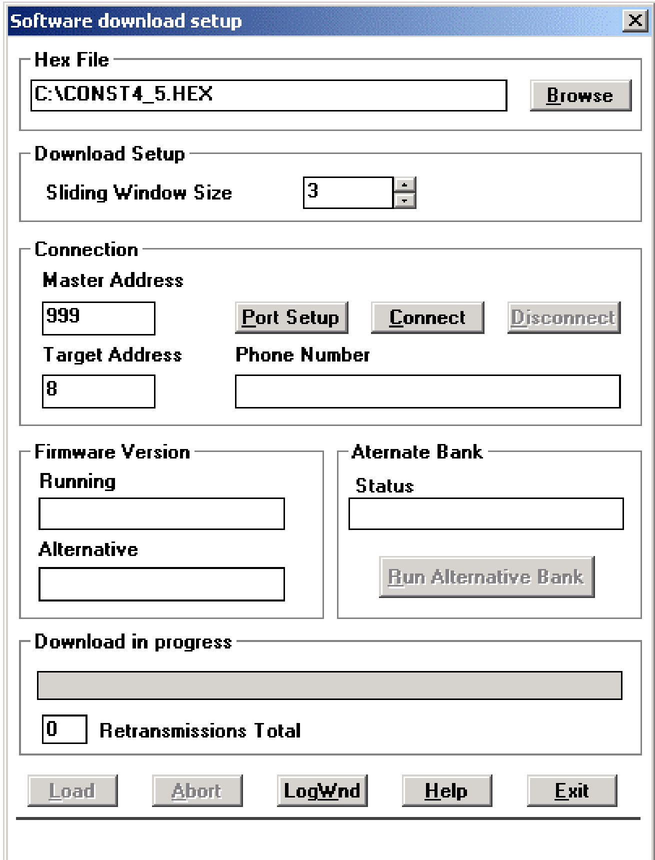
Local and Remote Download

1. Ensure that the radio is turned on.

All alarms on the target radio must be cleared before continuing with the download.

2. Double-click the **Swdl.exe** file to launch the Download Utility application. See Figure 9-3.
3. The **Software download setup** dialog box is displayed.

Figure 9-4: Software download setup dialog box



a. **Hex File**

Use the **Browse** button to locate the **Const*_*.hex** (Const5_5.hex) file. This file is located in the folder where you unzipped the Install.exe file.

b. Download Setup, Sliding Window Size

The size depends on the position of the radio in the network. See Figure 9-1 for the formula.

- Local Download: 3.
- Remote Download: The size = 2 x n + 1, where n = links away from the local site.

c. Connection

Master Address: The Master Address must be different from any FarScan/NE addresses present in the network you are downloading into.

Target Address: The target address is the FarScan or NE address of the radio where the software will be downloaded.

Configure Communication Parameters

1. From the Keypad menu tree of the Constellation radio, choose

CONFIGURATION > **NETWORK MANAGEMENT** > **COMM PORT SETTINGS**

FARSCAN BAUD: 57600

FARSCAN PARITY: NONE

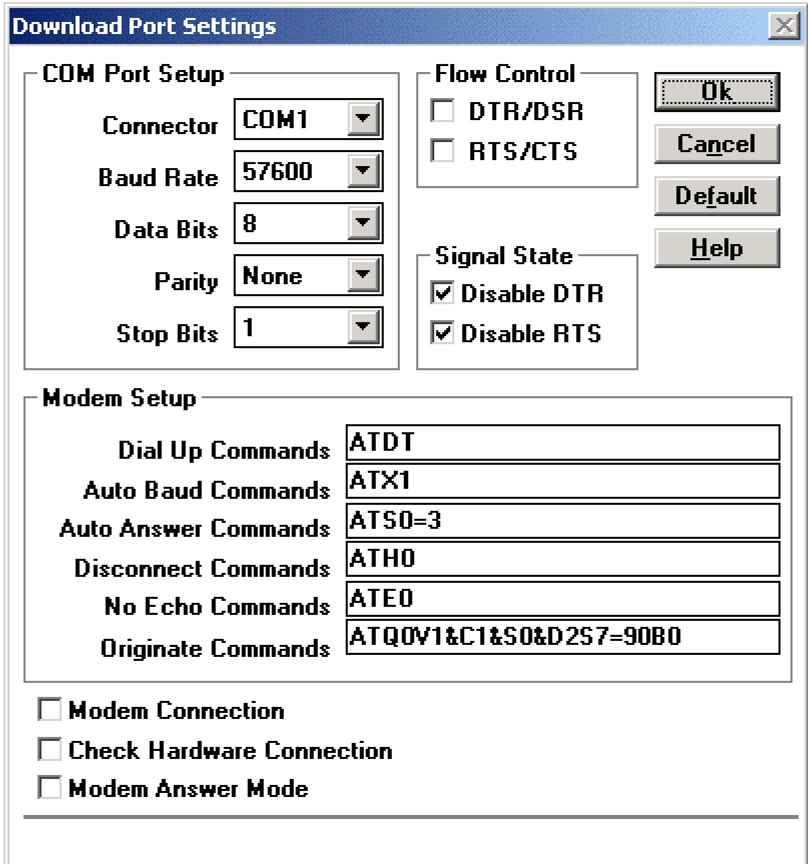
Or Monitor or Versatility settings, if that port is used instead.

2. Exit the Keypad menu tree, and choose **Port Setup** from the Software download setup dialog box. See Figure 9-4.

3. The **Download Port Settings** dialog box appears.

SYSTEM SOFTWARE UPGRADES

Figure 9-5: Download Port Settings dialog box



a. In the **COM Port Setup**, choose:
   Baud Rate: 57600
   Parity: None

b. At the bottom of the **Download Port Settings** dialog box, clear the following three boxes.
   Modem Connection
   Check Hardware Connection
   Modem Answer Mode

c. Click **Ok**.

Connecting the Computer

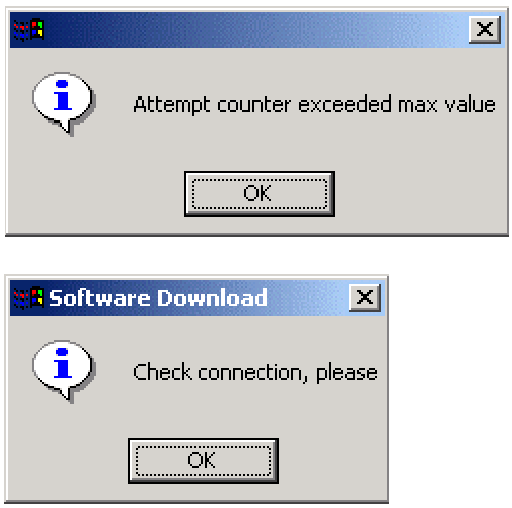
1. In the **Software download setup** dialog box (Figure 9-4), click the **Connect** button.

   This step connects the computer to the equipment.

   The current running software version is displayed in the **Firmware Version**, **Running** box.

2. If the connection is not established between the computer and the radio, the following messages appear.

Figure 9-6: PC-radio connection failed messages



3. Check your connections, and try again.

Downloading the Software

1. In the **Software download setup** dialog box (Figure 9-4), click the **Load** button to start the Constellation software download.

2. The progress indicator appears.

   a. The **Alternate Bank Status** shows “Erasing flash”.

   b. After 10 seconds, the Status shows “In download”, and the progress indicator displays the progression of the download.

   c. At the end of the download, the downloaded software version is displayed in the **Alternative** box.

The recommendation is to run the recently loaded software during a scheduled maintenance window.

3. Now you have two options.
   - Running the new software at a later time
   - Running the new software now

Running the New Software at a Later Time

a. Do not click the **Run Alternative Bank.**

b. Close the software download utility program.

c. When you are ready to run the new software
   Use the Keypad menu tree:
   CONTROL > ALTERNATE S/W > RUN ALTERNATE S/W > EXEC
   A **SYSTEM IS REBOOTING** alarm appears on your radio and Keypad. This is normal.

d. Wait at least 2 minutes for the SPU Controller to reboot.

e. Check the Keypad to see if the rebooting alarm has cleared.

f. To check the new version on the Keypad:
   STATUS > INVENTORY > CONTROLLER
   displays the new version.

Running the New Software Now

Click the **Run Alternative Bank** button in the **Software download setup** dialog box (Figure 9-4).

The SPU Controller resets and reboots with the new software. A **SYSTEM IS REBOOTING** alarm appears on your radio and Keypad. This is normal.

g. Wait at least 2 minutes for the SPU Controller to reboot.

h. Check the Keypad to see if the rebooting alarm has cleared.

i. Click the **Connect** button in the **Software download setup** dialog box (Figure 9-4). The Firmware Version, Running box should show the new version.

Rebooting Software

While the system is in an alarm state, do not:
Reboot
Switch to alternate software
Download new software
Unplug the SPU Controller

Reboot

Reboot can be done by

- Removing and inserting the SPU Controller or
- Using the Keypad

Alternate Bank

The new software is downloaded into an alternate bank. When the radio is switched to the alternate bank and if the new software causes a failure within 2 minutes, then the watchdog triggers a reset line and reboots. This algorithm switches the radio back to the known good software version.

This procedure is a precaution in case the software from the alternate bank is not stable. See the following example.

Example

1. Running Version 6.0
   Alternate Version 6.5
2. Switch to Alternate Version 6.5.
3. The SPU Controller boots in Version 6.5. Version 6.0 stays the primary software for 2 minutes.

   If the SPU Controller is rebooted in less than 2 minutes, it switches back to Version 6.0.
4. After Version 6.5 runs successfully for 2 minutes, it becomes the primary software, and Version 6.0 becomes the alternate software.

CHAPTER

10

TROUBLESHOOTING GUIDELINES

Introduction

You must upgrade the Constellation to Version 4.5 or later.

- To check the version, from the Keypad: STATUS > INVENTORY > CONTROLLER > S/W VER.
- For software upgrade information, check the Harris Premier Web site.
- For downloading procedures, refer to Chapter 9.

Harris Premier Customer Web Site

https://premier.harris.com/microwave/

The Premier Customer Web Site contains

- Customer Service Bulletins
- the latest software information
- the latest publications

Things to Do First

- Verify that the rack and all interfacing equipment grounding meets site specifications. (Office and earth ground.)
- Verify that all SMA connectors are properly in place and secured with the proper torque (8 to 9 inch-pounds).
- Verify that all other connectors are properly seated and secured.
- Check for proper configuration and connection of DS1/DS3 interface (enable/disable, line build-out and line coding).
- Verify module options with the Sales Order Specific Information. This is important if performing radio capacity changes.

Verify that the test equipment is in calibration.

- With a test equipment, verify that the power output at the monitor port is correct in accordance with the Sales Order documents.
- Verify that the 100 MHz oscillator is within tolerance ± 300 Hz at the REF MON port.

Do not turn up transmit power to accommodate the far-end received signal level.

Overdriving the Power Amplifier will cause high CBER and UBER at the far-end Receivers.

Diagnosing Alarm Messages

Check to ensure that the radio configuration is correct before proceeding with troubleshooting.

Although an alarm state is indicated on the card, the fault may lie further up the signal path. Before troubleshooting the alarmed card, keep checking the next card up the signal path until you have isolated the origin of the fault.

Figure 10-1 is a block diagram of the signal path. The arrows above the alarmed card indicates that the fault may lie in the card or in the card further up the signal path.

Simultaneous Replacement of Modules

Do not replace two or more of the following modules simultaneously.

- SPU Controller
- Transmitter Assembly A1
- Power Supply A1

Change one module, wait until the system reboots, and then change another module and reboot.

LED Indicators

The Keypad should be used to obtain a more detailed information on the alarms.

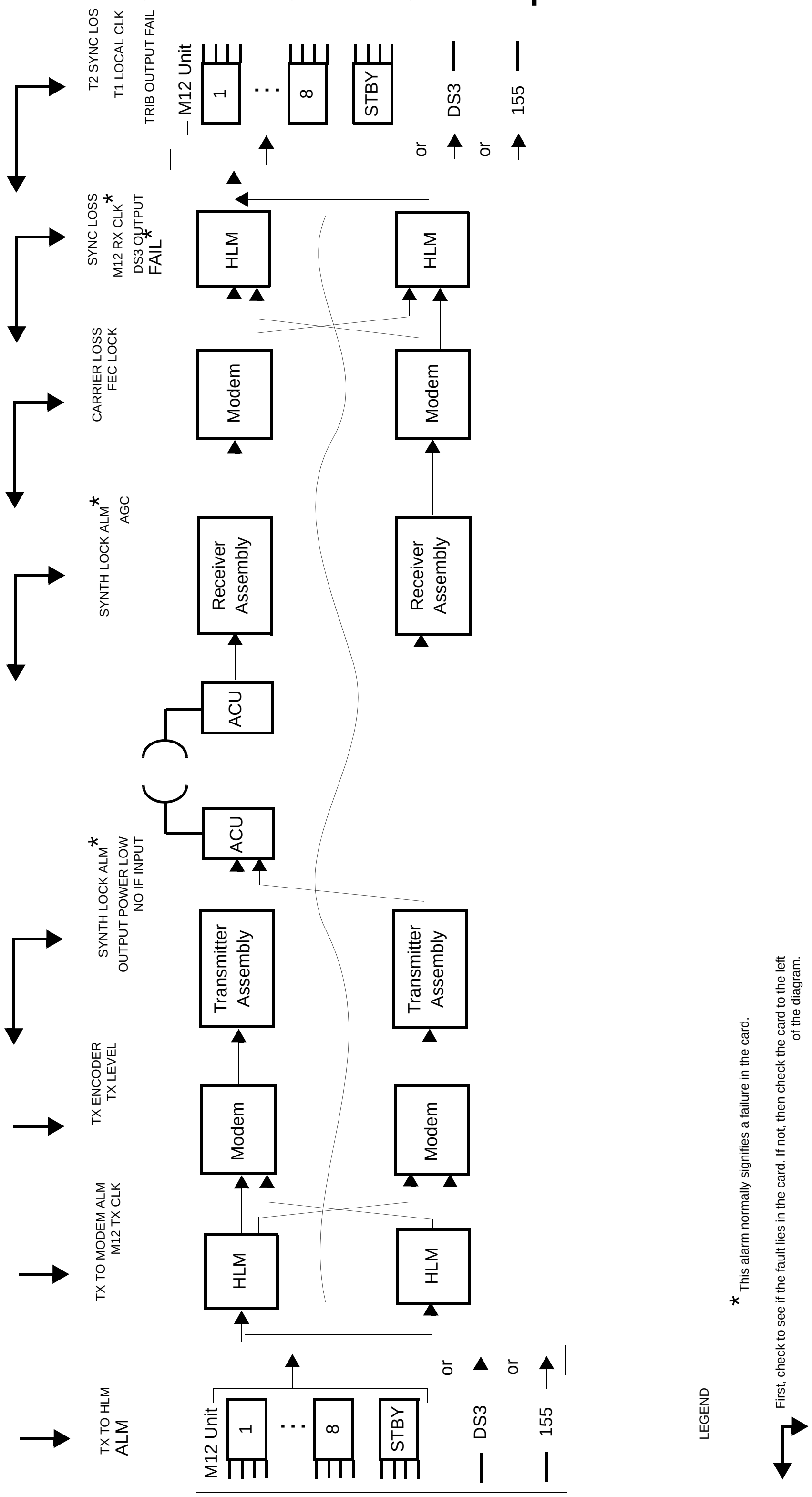
Table 10-1: LED indicators

Module	Label	Color	If the LED Is On
Fan Assembly	FAULT	Red	In a protected configuration, at least one of the fans is not working.
Fuse Panel	FUSE ALARM	Red	Indicates a fuse has blown.
High Level Mux	FAULT ON-LINE	Red Green	Board failure or input signal failure. Carrying traffic.
M12 Unit	FAULT ON-LINE	Red Green	Board failure or output level is low. Carrying traffic.
Modem	FAULT	Red	Indicates any of 4 Modem Tx alarms: • Tx side 1 activity • Tx side 2 activity • Tx FIFO overflow • Tx IF level alarm or Indicates any of 3 Modem Rx alarms: • Carrier recovery • R-S frame • Rx FIFO overflow
	ON-LINE	Green	Indicates that the Modem Tx, Modem Rx, or both are on line. In a monitored hot standby, both Modems can have the green LEDs on. Selection is controlled by the SPU Controller.
Power Supply	FAULT	Red	Indicates an over-voltage alarm or that one or more outputs have failed.
	ON-LINE	Green	Converter is on and is operating (either the Tx or the Rx is online.
Receiver Assembly	FAULT ON-LINE	Red Green	Board failure or input signal failure. Carrying traffic.
Service Channel	FAULT	Red	Indicates a board failure or inability to synchronize with the far-end Service Channel.
	ON-LINE	Green	If power is on, this LED is always lighted.

Table 10-1: LED indicators (continued)

Module	Label	Color	If the LED Is On
SPU Controller	MAJOR	Red	Indicates a loss of traffic (either receive or transmit direction).
	MINOR	Red	Indicates a non-traffic-affecting alarm or control has been applied.
	STATUS	Yellow	Indicates a loss of input signal from a customer.
	ACTIVE	Green	Normal condition.
	TX	Green	Blinks whenever a packet of Ethernet signal is being transmitted.
	RX	Green	Blinks whenever a packet of Ethernet signal is being received.
Transmitter Assembly	FAULT	Red	Indicates board failure or an input signal failure
	ON-LINE	Green	Carrying traffic.

Figure 10-1: Constellation Radio alarm path



Glossary of Alarms

Message	Explanation	Course of Action/Possible Causes
+10.5 V PA	Power Supply voltage output for the Transmitter power amplifier is beyond the ± 5% to 7% tolerance.	This alarm is asserted momentarily if the TX synthesizer unlocks. Otherwise, it is an indication of power supply failure.
+10.5 V	Power Supply voltage output for the Receiver is beyond the ± 5% to 7% tolerance.	An indication of power supply failure.
±12V	Power Supply voltage output for the Transmitter and Receiver is beyond the ± 5% to 7% tolerance.	An indication of power supply failure.
+5V	Power Supply voltage output for the Transmitter and Receiver is beyond the ± 5% to 7% tolerance.	An indication of power supply failure.
AGC	RF signal into the Receiver is too low.	Check the following: RX frequency setting RX module far-end TX level antenna alignment multiplier/picket filter.
AIS INPUT (DS3) AIS INPUT (Tributary A1-A28, B1-B16)	AIS signal present at DS3 input. AIS signal present at DS1 input.	Indication of input signal status.
AIS RECEIVED (DS3)	Coordinating DS3 interface not receiving valid input signal.	Check far-end DS3 input.
AIS RECEIVED (Tributary A1-A28, B1-B16)	Coordinating HLM is not receiving valid signal from M12 Unit, or far-end DS1xx input is lost.	Check far-end M12 Unit and DS1 inputs.
ALIGNMENT A, B	HLM unable to bit-align receiver delay difference. Alarm may be path activity related.	If alarm does not clear by itself, contact TAC (page 12-7) for troubleshooting instruction.
BIPOLAR VIOLATION	Input signal in violation of bipolar requirements.	Use the Keypad to verify the signal coding. CONFIGURATION > TRIBUTARIES > CODE > TRIBUTARY X CODE
CARD(S) NOT UPDATED	One or more spare cards just installed require an updated card software.	Contact TAC (page 12-7) for instructions to update the card software. **Updating the card software may cause traffic outage.**

TROUBLESHOOTING GUIDELINES

Message	Explanation	Course of Action/Possible Causes
CARRIER LOSS CARRIER LOSS A, B	Modem cannot lock on signal.	Fault may be in the Rx, path, far-end Tx, far-end Modem, near-end Modem (least likely).
CONFIG ALM (configuration alarm)	Caused if 2 or more of the following modules are changed simultaneously: Power Supply A1 Transmitter Assembly A1 SPU Controller	Use the Keypad to check the configuration of the radio. If all of the configuration are correct, clear the alarm. If not, reconfigure the radio.
Clearing the CONFIG ALM can drop traffic.		
DEMOD	The HLM is not receiving proper signals from the Modem.	Replace the Modem.
DS3-1, 2, 3, 4 BPV	Input signal in violation of bipolar requirements at designated channel.	Use the Keypad to verify the signal coding. CONFIGURATION > TRIBUTARIES > CODE > TRIBUTARY X CODE
DS3-1, 2, 3, 4 INPUT LOS	No T3 signal present at designated DS3 input.	Check DS3 input signals.
DS3-1, 2, 3, 4 LOOPBACK	The signal on the channel is in loopback mode locally.	Clear the loopback from local radio. CONTROL > TRIB LOOPBACK > DS3 LPBK > CLR
DS3-1, 2, 3, 4 LPBK BY REMOT	The signal on the channel is looped back on HLM towards the Modem. This signal was sent by remote radio.	Clear loopback by remote from remote radio.
DS3-1, 2, 3, 4 OUTPUT FAIL	No DS3 output signal or signal level too low (-3 dB) from the designated DS3 channel.	Incorrect output load; failed HLM/
DS3-1, 2, 3, 4 REMOTE LPBK	Loopback test of the channel from the far end.	Clear remote loopback from local radio. CONTROL > TRIB LOOPBACK > DS3 LPBK > CLR
DS3 LPBK	T3 signal is looped back on HLM towards the Modem.	Clear the loopback from local radio. CONTROL > TRIB LOOPBACK > DS3 LPBK > CLR
EXTERNAL ALARM (1-8)	Alarm input is at logic low or ground.	These are customer’s own alarms.

Message	Explanation	Course of Action/Possible Causes
FAN ALARM (A1, A2) FAN ALARM (B1, B2)	Fan is not operating: a blown fuse defective part	If Keypad displays Fan Alarm but the red LED on the Fan is not lighted, try replacing the fuse. If the Fan still does not operate, the cause may be a defective Fan. If Keypad does not display Fan Alarm, the cause may be a defective Transmitter. Note: The Fan alarm is not reported from the expansion shelf in a repeater.
FEC LOCK FEC LOCK A, B	Reed-Solomon FEC decoding is out of lock in the Modem.	Fault may be receive path, far-end Transmitter, or far-end Modem.
FUSE ALARM	Blown fuse in Fuse Panel A.	Replace the blown fuse. Note: The Fuse alarm is not reported from the expansion shelf in a repeater.
HLM-1, 2 ABSENT	HLM card unplugged or not installed per configuration. Defective HLM.	Is the HLM is plugged in? If yes, replace the defective HLM. See Chapter 11.
INPUT LOS (DS3) INPUT LOS (Tributary A1-A28, B1-B16)	No signal present at DS3 input. No signal present at DS1 input.	Check input.
LOCAL CLOCK	On the 3xDS3 unit, one of the three onboard oscillator has failed.	Replace High Level Mux.
LOCK HLM 1, 2	HLM 1 or 2 is locked on line.	From the Keypad: CONTROL > LOCK/IF LPBK > LOCK HLM > CLR
LOCK DEMOD / RX A1, A2 LOCK DEMOD / RX B1, B2	Traffic is locked onto Receiver Assy An. Traffic is locked onto Receiver Assy Bn.	From the Keypad: CONTROL > LOCK/IF LPBK > LOCK DMOD/RX > CLR
LOCK MOD / TX A1, A2 LOCK MOD / TX B1, B2	Traffic is locked onto Transmitter Assembly An. Traffic is locked onto Transmitter Assembly Bn.	From the Keypad: CONTROL > LOCK/IF LPBK > LOCK MOD/TX > CLR
LOSS OF -12V	Transmitter has failed. Trouble in the Power Supply.	Replace the Transmitter. See Chapter 11.

Message	Explanation	Course of Action/Possible Causes
M12-1...M12-8 ABSENT	M12 Unit is unplugged. The M12 slot is different from the configuration when the system was first turned on. Defective M12 Unit.	Is the M12 Unit plugged in? Check the configuration with the Keypad. Replace the defective M12 Unit. See Chapter 11.
M12-1...M12-8 RX CLK	M12-1...M12-8 Unit is not receiving CLK from HLM.	Probable cause is a faulty HLM.
M12-1...M12-8 TX CLK	M12 Unit is not receiving TX CLK from HLM.	Probable cause is a faulty HLM.
M12 FILLER MISSING	Filler Unit is missing from unused M12 slot.	Install a Filler Unit in the missing slot.
M12 STBY ABSENT	M12 Unit is unplugged from the M12 Standby slot. M12 Unit is not equipped per configuration. Defective M12 card.	Is the M12 Unit plugged in? Install an M12 Unit. Replace the M12 Unit. See Chapter 11.
M12-STBY RX CLK	HLM is not receiving CLK from M12-Standby Unit.	Replace the M12 Unit in the M12 Standby slot.
M12-STBY TX CLK	M12 Standby Unit is not receiving TX CLK from HLM.	Replace the High Level Mux with the red (Fault) LED lighted.
M13 SYNC LOSS	Loss of frame for selected DS3 to be demuxed.	Check far-end High Level Mux and configuration.
MANUAL MUTE	TX power switch on the Transmitter Assembly is OFF.	On the Transmitter Assembly faceplate, press the Tx switch to the ON position.
MODEM ABSENT (A1, A2 / B1, B2)	Modem card unplugged. Modem not installed per configuration. Defective Modem.	Is the Modem plugged in? Install Modem. Replace the Modem. See Chapter 11.
MODEM A, B IF LPBK	Modem A or B in loopback mode (local command only).	Cancel the IF loopback test.
NO ETHERNET ADDRESS	Address not assigned; a unique address should be assigned.	Assign an address; return SPU Controller to Harris.
NO IF INPUT	Loss of signal from the Modem to the Transmitter.	Check the cable connecting the Modem to the Transmitter. If the cable is okay, replace the Modem.
OC3 INPUT LOS	No signal present at transceiver of HLM-155.	Check the input signal from the external equipment.

Message	Explanation	Course of Action/Possible Causes
OC3 LPBK	The OC3 signal is in loopback mode locally.	Clear the loopback test from the local radio. CONTROL > hidden menu
OC3 LPBK BY REMOTE	The OC3 signal is looped back on HLM towards the Modem.	Clear loopback by remote test from the remote radio.
OC3 REMOTE LPBK	OC3 signal loopback test from the far end.	Clear remote loopback test from the local radio. CONTROL > hidden menu
OC3 RX LOF	Loss of frame into HLM-155 from Hi Cap Modem.	Check Modem alarms.
OC3 TX LOF	Loss of frame into HLM-155 from customer.	Check input signal from external equipment.
ONLINE ALIGNMENT A, B	HLM unable to bit-align receiver delay difference. Rx switching will not be errorless.	Check Modem alarms.
OUTPUT FAIL (DS3, Tributary, Wayside)	No output signal or signal level too low (-3 dB).	Check for improper line termination. Replace High Level Mux.
OUTPUT POWER LOW	RF output level from the Transmitter Assembly is at least 3 dB low.	Check configuration. Could be a bad multiplier/picket filter. Replace Transmitter.
PROTECT M12-1... M12-8	Designated M12 Unit is protected by a standby M12 Unit.	Check M12 Unit. Replace the Unit if needed.
PS ABSENT (A1, A2 / B1, B2)	Power Supply unplugged. Power Supply not installed per configuration. Defective Power Supply.	Is the Power Supply plugged in? Install Power Supply card. Replace the Power Supply. See Chapter 11.
REMOTE SYNC LOSS A, B	Coordinating loss of framing at the far end.	Start the troubleshooting of the far-end radio.
RSL LOW A1,A2 / B1,B2	RF level into Receiver Assembly < 10 dB above system threshold.	Check the following: Receiver frequency setting Receiver Assembly far-end Transmitter level antenna alignment multiplier/picket filter

Message	Explanation	Course of Action/Possible Causes
RX ABSENT (A1, A2 / B1, B2)	Receiver Assembly unplugged or not installed per configuration. Power Supply turned off. Defective Receiver Assembly.	Ensure that the Receiver Assembly is plugged into the backplane. If all 3 RF cards show absent alarms, the trouble is most likely to be in the Power Supply. Replace the PS card. Before turning on the PS, turn off the Tx. Replace the Receiver Assembly. See Chapter 11.
RX DECODER	Modem decoder is in alarm state.	Fault may be in The Receiver The path Far-end Transmitter Far-end Modem Near-end Modem (least likely).
RX LOSS OF FRAME	Local loss of framing of incoming signal.	Fault may be in The Receiver The path Far-end Transmitter Far-end Modem Near-end Modem (least likely).
SIGNAL DEGRADED A, B (TRAFFIC A, B) (PATH A, B)	Signal quality after equalization is degraded. System RSL or BER may be close to threshold.	Fault may be receive path or far-end Transmitter.
SVC ABSENT	Service Channel unplugged or missing.	Ensure that the Service Channel is plugged into the backplane. From the Keypad, CONFIGURATION > SYSTEM > SVC OPTION > INSTALL puts the Service Channel into service.
SYNC LOSS A, B (HLM-1, 2) SYNC LOSS A, B (SVC)	HLM unable to synchronize to Rx signal. Not receiving Service Channel frame from coordinate Service Channel.	Check Modem alarms.

Message	Explanation	Course of Action/Possible Causes
SYNTH LOCK (RX-A1, A2 / B1, B2)	2 GHz synthesizer in the Receiver Assembly is out of lock. Frequency is different from the assigned frequency.	You must enter exactly 7 digits for the frequency, but for 11 GHz systems, you must enter 8 digits. If the frequency is set correctly, either the Rx or the PS may be faulty.
SYNTH LOCK (TX-A1, A2 / B1, B2)	2 GHz synthesizer in the Transmitter Assembly is out of lock. Frequency is different from the assigned frequency.	You must enter exactly 7 digits for the frequency, but for 11 GHz systems, you must enter 8 digits. If the frequency is set correctly, either the Tx or the PS may be faulty.
SYSTEM IS REBOOTING	System is rebooting.	Do not unplug the SPU Controller. Do not reboot the SPU Controller. Do not download new software. Do not switch software version.
T1 LOCAL CLK	T1 CLK failure on M12 Unit.	Replace the M12 Unit.
T2 SYNC LOSS	M12 Unit cannot frame up to incoming signal.	Check High Level Mux alarms. If okay, check far-end M12 Unit.
TRIB 1...4 OUTPUT FAIL	Output signal failure or signal level below alarm threshold.	Check line termination. If okay, replace M12 Unit.
TRIB LPBK (A1...A28, B1...B16)	One or several T1 signals are looped back toward the HLM.	Clear by Keypad command: CONTROL > TRIB LOOPBACK > TRIB LPBK > CLR.
TRIB LPBK BY REMOT	One or several T1 signals are looped back toward the HLM. This signal was sent by remote radio.	Clear loopback at remote site.
TRIB REMOTE LPBK (A1...A28, B1...B16)	Coordinating one or several T1 signals are looped back toward the HLM.	Clear by Keypad command: CONTROL > TRIB REMOTE LPBK > TRIB RMT LPBK > CLR.
TX-A, B, ATPC BOOST	Boost request from coordinating Receiver.	Path or far-end Transmitter.
TX ABSENT (A1, A2 / B1, B2)	Transmitter Assembly unplugged or not installed per configuration. Power Supply turned off or defective. Defective Transmitter Assembly.	Before plugging in the Tx, turn off the Tx switch. If all 3 RF cards show absent alarms, the trouble is most likely to be in the Power Supply. Replace the PS card. Before turning on the PS, turn off the Tx. Replace the Tx Assy. You must reset the output power. See Chapter 11.

TROUBLESHOOTING GUIDELINES

Message	Explanation	Course of Action/Possible Causes
TX ENCODER	Modem FEC circuitry unlocked. Possible cause: bad Modem.	Replace Modem. See Chapter 11.
TX LEVEL	IF signal output from the Modem is 3 dB low.	Replace Modem. See Chapter 11.
TX LOSS OF FRAME (HLM)	Loss of frame into HLM from customer.	Check input signal.
TX TO HLM-1, 2 ALM	Tx signal from M12 Unit to HLM-1, 2 is not being received.	Replace the M12 Unit.
TX TO MODEM (A1, A2 / B1, B2)	Modem (A1, A2 / B1, B2) is not receiving CLK from HLM.	Replace HLM. See Chapter 11.
WRONG RX OPTION	The capacity of the RF receiver does not match the capacity of the MUX.	Replace the RF receiver or MUX. If you have a 3DS3 MUX or higher capacity, then you must have a high capacity RF (either the 011- or the 111- options).
WRONG TX OPTION	The capacity of the RF transmitter does not match the capacity of the MUX.	Replace the RF transmitter or MUX. If you have a 3DS3 MUX or higher capacity, then you must have a high capacity RF (either the 011- or the 111- options).
WS BIPOLAR VIOLATION	Wayside bipolar violation.	
WS INPUT LOS	No signal present at the Wayside input.	Check the input signal from the external equipment.
WS LOOPBACK	Wayside signal in loopback mode locally.	Clear loopback test. Keypad command: CONTROL > WAYSIDE LPBK > WAYSIDE LPBK > CLR
WS LPBK BY REMOTE	Wayside signals are looped back toward the HLM.	Clear loopback by remote from remote radio.
WS OUTPUT FAIL	No output signal or signal level too low.	Check the termination. If it is okay, replace the High Level Mux.
WS REMOTE LPBK	Wayside signal loopback test from the far end.	Clear remote loopback from local radio. Keypad command: CONTROL > WAYSIDE LPBK > WAYSIDE RMT LPBK > CLR
WS RX LOF	Loss of frame of outgoing signal from the High Level Mux.	Check the Modem alarms. If okay, check far-end High Level Mux.

CHAPTER

11

FIELD-REPLACEABLE UNITS

Precautions

Electric Parts

Wear a grounded antistatic wrist strap or heel strap prior to opening electrostatic discharge (ESD) protective packaging and while handling any unprotected electric parts.

Avoid touching the edge connectors with your fingers.

Laser and Optical Connectors

Do not look into optical connectors. Invisible laser light emitted from optical sources can cause permanent eye injury.

Do not touch the optical connector face with your fingers.

Simultaneous Replacement of Modules

Do not replace two or more of the following modules simultaneously.

- SPU Controller
- Transmitter Assembly A1
- Power Supply A1

Change one module, wait until the system reboots, and then change another module and reboot.

"Card(s) Not Updated" Minor Alarm

Installing a replacement card may result in "Card(s) Not Updated" minor alarm if the replacement card has an outdated software version. Refer to Chapter 10, "Glossary of Alarms", page 10-7, for corrective action.

Tools and Test Equipment

Tools
Antistatic wrist and/or heel strap
SMA wrench (5/16 inch)
SMA torque wrench (8 in-lb)
Small hand tools
(Optional) GPO Install/Removal Tool Part # A095-A99-01 (Corning Gilbert) Available from East Coast Microwave http://www.ecmstockroom.com/

Test Equipment	Used for
Power meter	Transmitter Assembly replacement
Frequency counter	Transmitter Assembly or Receiver Assembly replacement
Cable, SMA-SMA connectors, 3 to 6 feet (approx.)	Frequency counter
Digital voltmeter	Measuring DC voltages

General Procedures

- If applicable, inform the network administrator of your plan.
- Place any defective unit in an antistatic bag, and return the unit to Harris MCD.

Drawings with the following highlighted:

- Radio Frequency Section
- Signal Processing Section

Opening and Removing the Constellation Doors

1. To open the Constellation doors, lift up the two door latches and turn them clockwise. See Figure 11-1.

Figure 11-1: Constellation Radio, front view

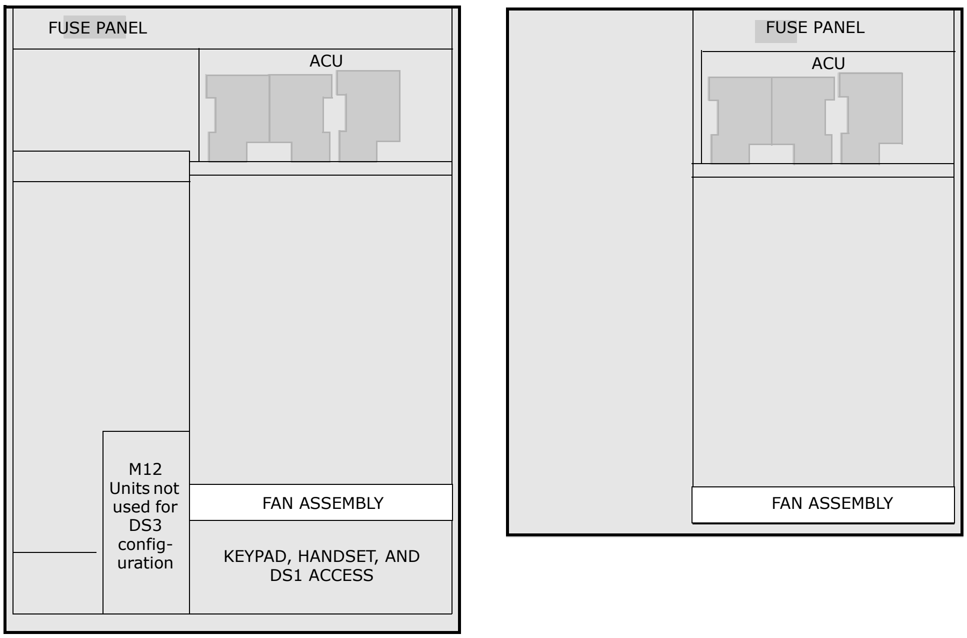
2. The doors swing open 90 degrees.
3. For radios with straps (Figure 11-2) installed inside the door: Pull the straps (on the left and right sides) to unfasten them.

Figure 11-2: Door straps

4. Lift up the doors to remove them from the card cage.

Fan Assembly

Figure 11-3: The Constellation Radio (with doors removed), repeater



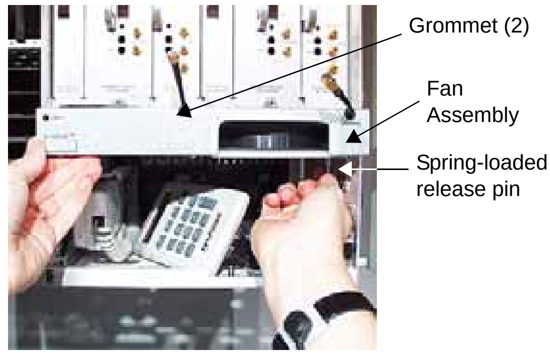
If the Constellation radio is in service, the Fan Assembly must be operating within 10 minutes of removal and installation.

Removing the Fan Assembly

1. For a terminal, remove the Keypad and place it temporarily out of the way. See Figure 11-4.

Figure 11-4: Removing the Keypad

(a)



(b)

Figure 11-5: Spring-loaded pin

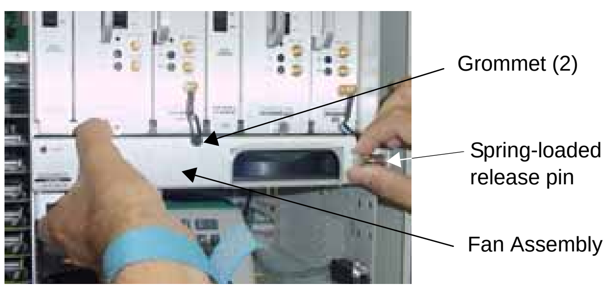
Locked position

Unlocked position

2. The spring-loaded release pin is located on the right-hand side either below the Fan assembly or in front of the front panel. See Figure 11-4 (b) or Figure 11-6.

With your right hand, pull out the spring-loaded release pin, and rotate it a quarter-turn to lock the pin. See Figure 11-5.

Figure 11-6: Fan Assembly with pin on right-hand side



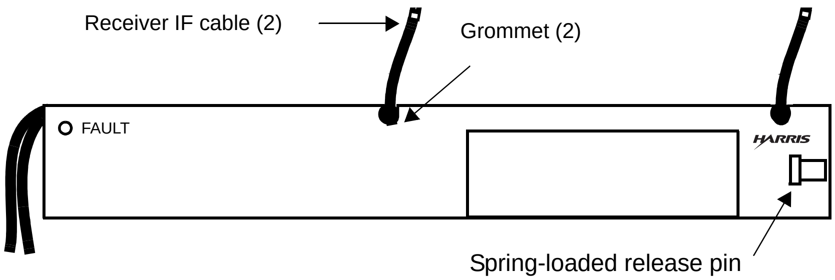
3. Pull the grommets away from the Fan Assembly.

4. Press the IF cables up and away from the Fan Assembly, and carefully pull out the Fan Assembly.

Installing the Fan Assembly

1. Rotate the spring-loaded pin a quarter of a turn to unlock it.
2. Place the receiver IF cable(s) behind the fan faceplate and out the notched edge(s) as shown in Figure 11-7.

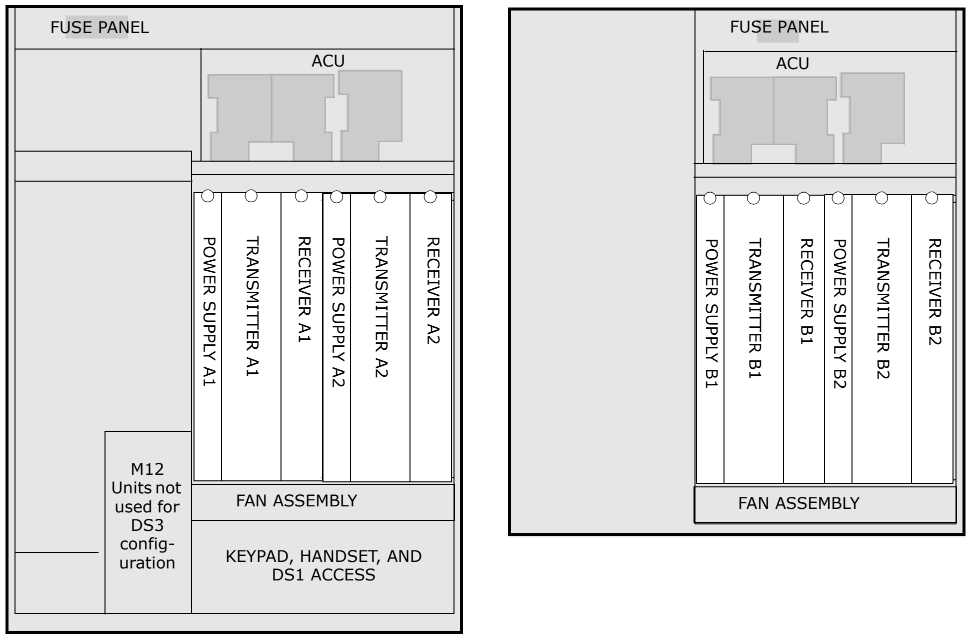
Figure 11-7: Fan Assembly



3. Carefully slide the Fan Assembly in without pinching the IF cables.
4. The Fan Assembly is properly installed when the release pin pops in.
5. Place the grommets against the Fan Assembly.
6. For a terminal, return the Keypad to its former place.

Radio Frequency Section

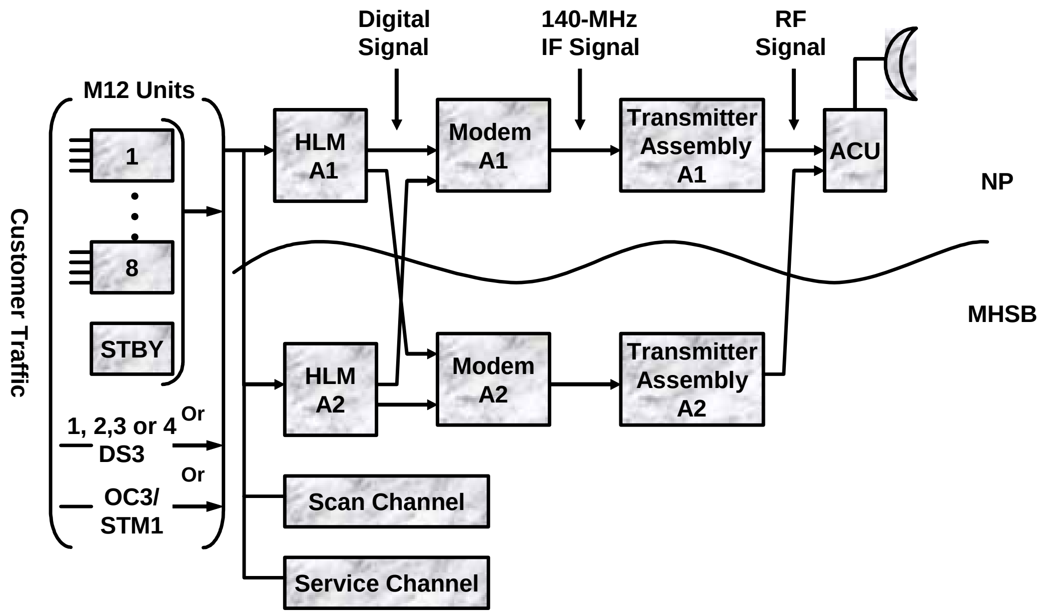
Figure 11-8: Radio Frequency section, repeater



Overview of the Transmit Direction

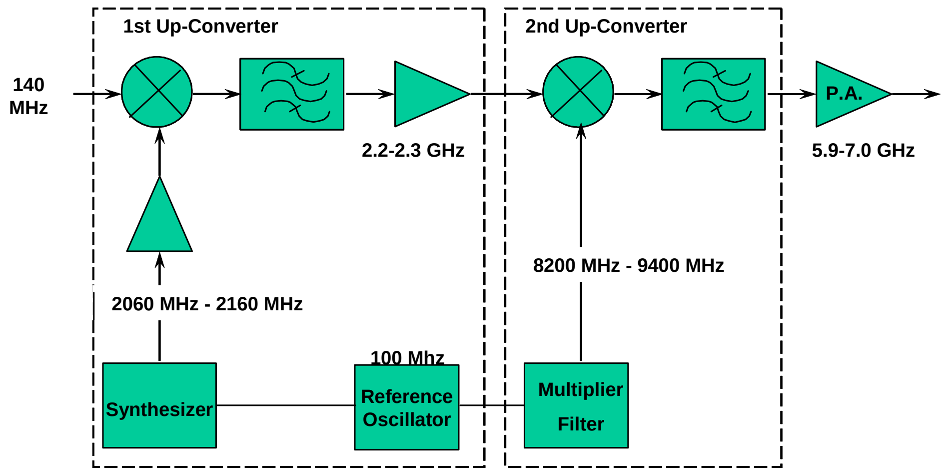
In the transmit direction, each M12 Unit receives the four DS1 signals from the customer and multiplexes the signals into a T2 signal. The T2 siganls are sent to the High Level Mux (HLM) where they are multiplexed together along with the service and SCAN channels. DS3, OC3, and STM1 signals are received directly by the HLM. This high-level digital signal is sent to the Modem where it modulates the siganl into a 140 MHz IF carrier wave.

Figure 11-9: Transmit Direction



The Tranmitter Asembly recieves the 140 MHz IF signal and then upconverts, filters, and amplifies the signal. The ACU filters the Tx signal and routes it to the antenna.

Figure 11-10:Transmit Path



Transmitter Assembly

The Transmitter Assembly provides all functions required to upconvert the 140 MHz IF signal from the Modem to the RF microwave output frequency at the required power output. A High Gain option is also available. Refer to Chapter 4 of the *Systems Application Manual* for RF performance numbers.

The power amplifier contains a power detector for levels, and monitors the amplified signal. This signal is then set to the IF card's automatic level control (ALC) circuit, which in turn drives a voltage variable attenuator to control the power output of the transmitter assembly.

Control of the PA detector reference voltage directly controls the PA power. An Automatic Level Control (ALC) circuit maintains power output at one of two preset levels, which ase selected by an Automatic Transmitter Power Control (ATPC) circuit. When the ATPC feature is active, the Power Amplifier can provide 10 dB of boost to the transmitter output power when there is a request from the far end receiver.

The transmitter is built from 6 LRUs (Line Replaceable Unit)

- Transmitter Base assembly
- 2nd Up-Converter/Driver
- Power Amplifier
- Tx IF Filter
- Tx Reference Crystal Oscialltor
- Tx Multiplier/Filter

Table 11-1: Transmitter Assembly Options (19x-115038-xxx)

Tx Option[a]	Frequency	Transmitter Used For
-001	5850 to 6950	Medium Capacity 8/16/28xDS1 and 1xDS3 radios
-011	5850 to 6950	High Capacity 155 and 180 Mbps radios (can also be used in place of Model 192/193 Tx in medium capacity radios with system software 6.3 or higher)
-111	5850 to 6950	High System Gain: 16xDS1, 28xDS1, 1xDS3, 155 Mbps and 180 Mbps radios. Can be used as a spare for -00x, -01x. (For 16xDS1, 28xDS1 & 1xDS3, a high gain modem is required).
-002	10550 to 11700	Medium Capacity 8/16/28xDS1 and 1xDS3 radios
-012	10550 to 11700	High Capacity 155 and 180 Mbps radios can also be used in place of Model 192/193 Tx in medium capacity radios with system software 6.3 or higher)
-112	10550 to 11700	High System Gain: 16xDS1, 28xDS1, 1xDS3, 155 Mbps and 180 Mbps radios. Can be used as a spare for -00x, -01x. (For 16xDS1, 28xDS1 & 1xDS3, a high gain modem is required).
-003	7100 to 8500	Medium Capacity 8/16/28xDS1 and 1xDS3 radios
-013	7100 to 8500	High Capacity 155 and 180 Mbps radios can also be used in place of Model 192/193 Tx in medium capacity radios with system software 6.3 or higher)
-113	7100 to 8500	High System Gain: 16xDS1, 28xDS1, 1xDS3, 155 Mbps and 180 Mbps radios. Can be used as a spare for -00x, -01x. (For 16xDS1, 28xDS1 & 1xDS3, a high gain modem is required).

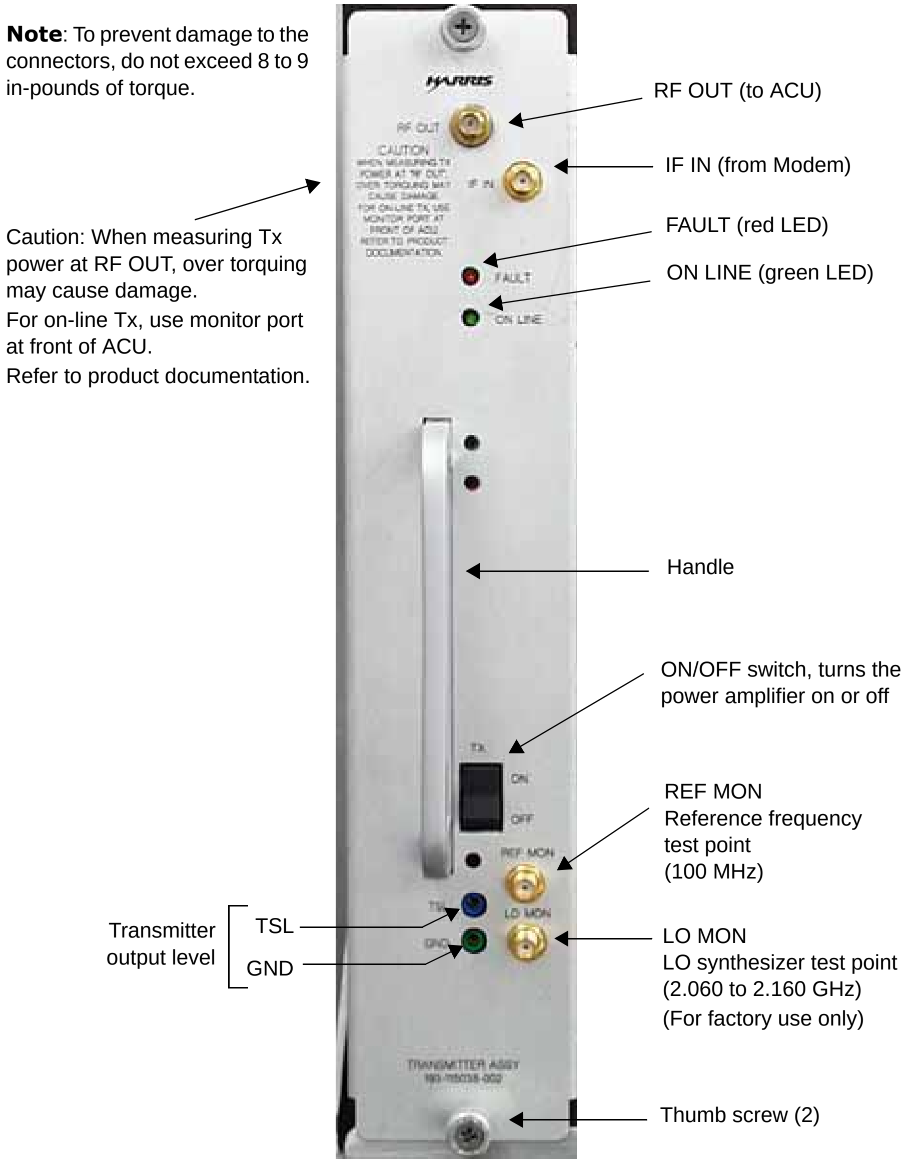
a. *See Table C-1 for compatibility.*

FIELD-REPLACEABLE UNITS

Field replaceable subassemblies on the transmitter assembly (Figure 11-11):

- Multiplier Filter 10x-115232-0xx (see Table C-4 for options)
- OCXO 786-020590-053

Figure 11-11:Transmitter Assembly, front view



Preparing to Replace the Transmitter Assembly

1. Obtain a spare Transmitter Assembly.

2. Ensure that the correct option of the Multiplier-Filter is installed onto the Transmitter Assembly.

See Appendix C for a table of options.

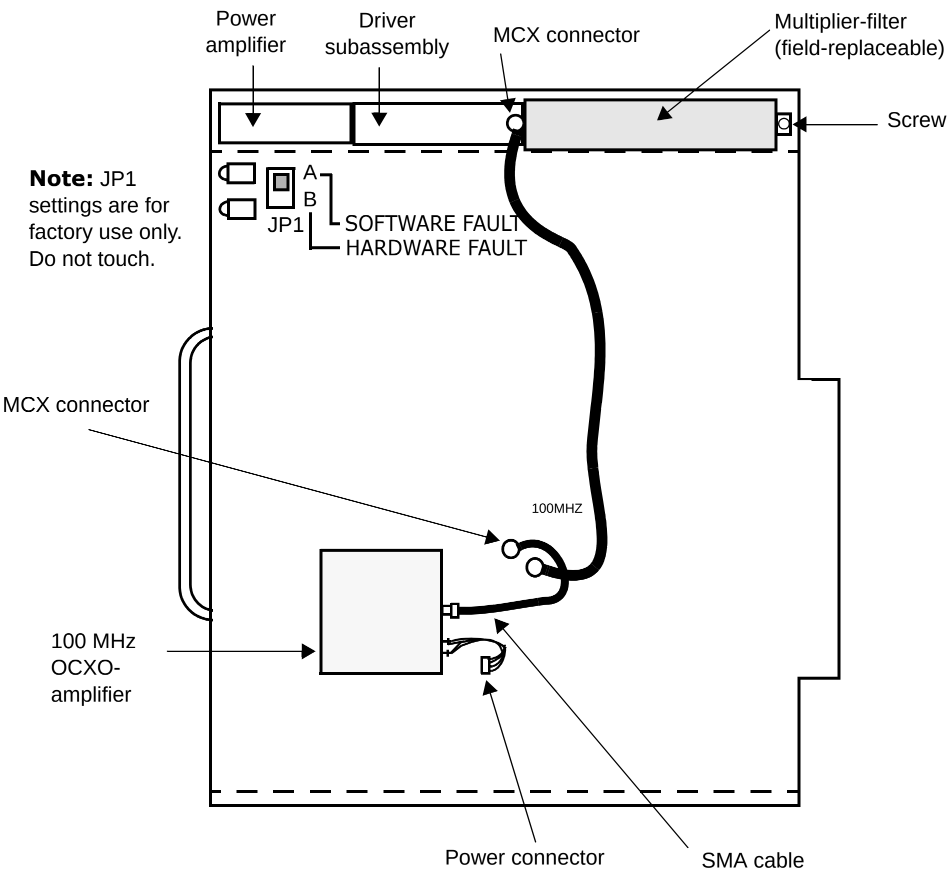
3. For procedure to replace a Multiplier-Filter, go to page 11-13.

4. For procedure to replace a Transmitter Assembly, go to page 11-15.

Removing and Installing the Multiplier-Filter

1. Unplug the MCX connector. See Figure 11-12.

Figure 11-12:Transmitter Assembly, component side



2. Unfasten the screw on the right-hand side of the Multiplier-Filter.

3. Unplug the Multiplier-Filter from the Driver Amplifier by pulling the Multiplier-Filter to the right.

Ensure that the Multiplier-Filter you are installing is the correct option.

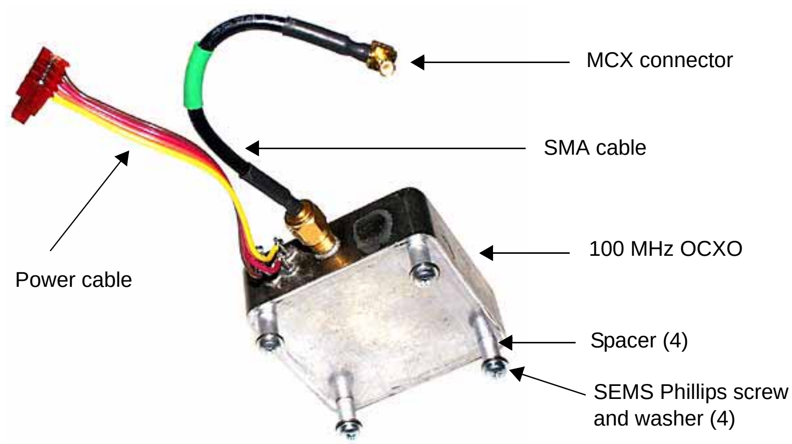
4. Reverse the previous three steps to install the Multiplier-Filter onto the Transmitter Assembly.

FIELD-REPLACEABLE UNITS

Removing and Installing the 100 MHz OCXO

1. Place the Transmitter Assembly on a flat surface.
2. Disconnect the MCX connector (J4) by carefully pulling it up straight from the printed circuit board. The connector is designated **100MHz** on the board. See Figure 11-12.
3. Disconnect the power connector from the printed circuit board.
4. Carefully pull out the 100 MHz OCXO from the Transmitter Assembly, taking care not to remove the grommets from the printed circuit board.
5. Remove the SMA cable from the OCXO you have just removed. See Figure 11-13.

Figure 11-13:100 MHz OCXO



6. Remove and retain the 4 SEMS Phillips screws, washers, and spacers from the bottom of the OCXO.
7. Obtain a new 100 MHz OCXO.
8. Install the 4 spacers with the SEMS Phillips screws and washers you removed in step 6 onto the bottom of the new OCXO.
9. Connect the SMA cable you removed in step 5 onto the 100 MHz OCXO. Do not tighten.
10. Install the new OCXO onto the Transmitter Assembly, ensuring the grommets remain in place.
11. Plug the power connector onto the printed circuit board.
12. Carefully plug the MCX connector into the receptacle designated **100MHZ**.
13. Use a torque wrench to tighten (8-9 inch-pounds) the SMA connector you installed in step 9.
14. For Transmitter Assembly installation procedures, go to page 11-16.

Removing the Transmitter Assembly

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 3.

In a nonprotected configuration, removing the Transmitter Assembly is a service-affecting procedure.

1. Use the Keypad command to **lock traffic** onto the standby Transmitter and Receiver Assemblies. This step causes a minor alarm.

   CONTROL > LOCK/IF LPBK > LOCK MOD/TX, SET
   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, SET

   Since switching of Transmitter Assembly is not errorless, this procedure momentarily affects customer traffic.

2. Verify that the standby Transmitter and Receiver Assemblies are locked and passing traffic.
3. On the Transmitter Assembly you are removing, press the TX switch to the OFF position to turn off the power amplifier.
4. On the corresponding Power Supply, press the PWR switch to the OFF position to turn off the power supply.
5. Disconnect the two cables on the Transmitter Assembly.
   - The cable connected to the IF IN SMA connector
   - The cable connected to the ACU
6. Unfasten the 2 captive thumbscrews.
7. Carefully pull out the Transmitter Assembly from the shelf.

Installing the Transmitter Assembly

Before plugging the spare Transmitter Assembly into the Constellation card cage, the correct option of the Multiplier-Filter must be installed onto the board.

See page 11-13 for "Removing and Installing the Multiplier-Filter".

1. Check the part number of the Transmitter Assembly to ensure that the correct unit is being installed.
2. Ensure that the
   - TX switch on the Transmitter Assembly faceplate is in the OFF position.
   - PWR switch on the Power Supply is in the OFF position.
3. Carefully slide the Transmitter Assembly into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the 2 thumbscrews to fasten the unit to the shelf.
5. On the faceplate, reconnect the cables onto the SMA connector.
   - IF IN (from the Modem)
   - RF OUT (to the ACU)
6. Use a torque wrench to tighten the connector (8 to 9 in-lb).

Transmitter Turn-on Procedure

Table 11-2: Required test equipment

Test Equipment	Model
Universal Frequency Counter with 10-digit accuracy	Agilent 53131A or equivalent
Power meter with power sensor	Agilent E4418B and 8485A or equivalent

1. On the Transmitter Assembly, press the TX switch to the ON position.
2. On the Power Supply, press the PWR switch to the ON position to turn on the power supply.

Go to page 8-3 and follow the steps under Transmitter Frequency Measurement and Transmitter Power Measurement.

MHSB System

1. Use the Keypad command to take the switched unit out of **lock** status.
   CONTROL > LOCK/IF LPBK > LOCK MOD/TX, CLR
   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, CLR
2. The standby RF units are now the primary RF units.

> ***Switching the traffic back to the previous RF units will cause a hit.***

3. If switching of RF units is desired, it should be done during low-traffic hours.

Overview of the Receive Direction

The ACU receives the RF signal from the antenna port and filters the signal before routing it to the Receiver Assembly in the RF section of the card cage. The Receiver Assembly amplifies and down-converts the received signal into a 140 MHz IF signal.

The Modem demodulates the 140 MHz IF signal into a high-level digital signal and sends it to the HLM. The HLM demultiplexes the signal from the Modem into multiple T2 signals for the M12 Units DS3, OC3 and STM1 signals recovered are sent to the customer interface. The M12 Unit demultiplexes the signals into four DS1 signals for transmission to the customer.

Figure 11-14:Receive Direction

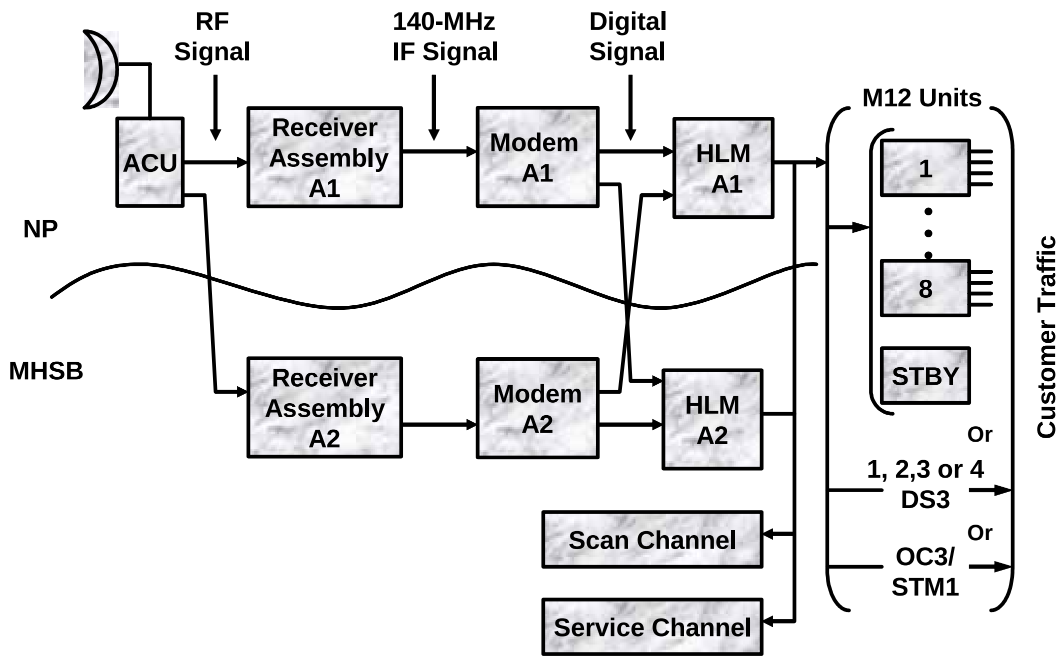
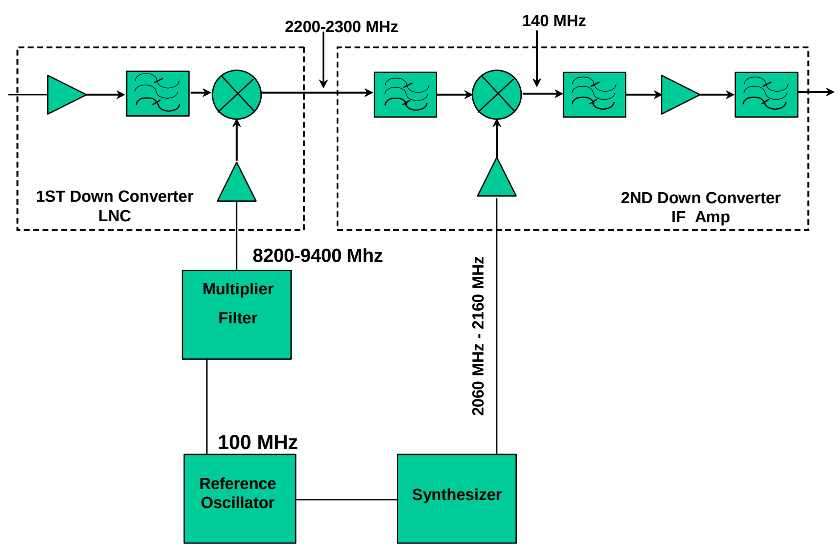


Figure 11-15:Receiver Path



Receiver Assembly

The Receiver Assembly amplifies and down-converts a microwave received signal from the ACU's receive filter through a dual conversion system. The Input to the receiver is down-converted to a 2 GHz signal, which is then down-converted a second time to a 140 MHz IF output signal, which is sent to the Modem.

The receiver Automatic Gain Control (AGC) compensates for variations in the receive signal strength so as to supply the modem with a constant signal level. Variations in the receive signal strength is the result of path fading due to atmospheric conditions.

The 140 MHz IF signal is split and fed to an AGC amplifier chain and SLVA for level detection. The AGC amplifier chain provides > 65 dB of Dynamic range (-80 to -15 dBm TOR) and is configured as three separate modules. The AGC ouput is designed to provide a leveld output of -10 dBm. The SLVA provides accurate linear (volt) power detection. The analog RSL level also is buffered and brought out to the front panel test jacks for use during antenna alignment (approximately -100mV/dBm).

Table 11-3: Reciever Assembly Options (19x-115039-xxx)

Option[a]	Frequency	Receiver Used For
-001	5850 to 6950	Medium Capacity 8/16/28xDS1 and 1xDS3 radios
-011	5850 to 6950	High Capacity 155 and 180 Mbps radios (can also be used in place of Model 192/193 Tx in medium capacity radios with system software 6.3 or higher). For interchangeability, correct IF filter (3.75/5.0 or 10 MHz) on Rx is required.
-002	10550 to 11700	Medium Capacity 8/16/28xDS1 and 1xDS3 radios
-012	10550 to 11700	High Capacity 155 and 180 Mbps radios can also be used in place of Model 192/193 Tx in medium capacity radios with system software 6.3 or higher). For interchangeability, correct IF filter (3.75/5.0 or 10 MHz) on Rx is required.
-003	7100 to 8500	Medium Capacity 8/16/28xDS1 and 1xDS3 radios
-013	7100 to 8500	High Capacity 155 and 180 Mbps radios can also be used in place of Model 192/193 Tx in medium capacity radios with system software 6.3 or higher). For interchangeability, correct IF filter (3.75/5.0 or 10 MHz) on Rx is required.

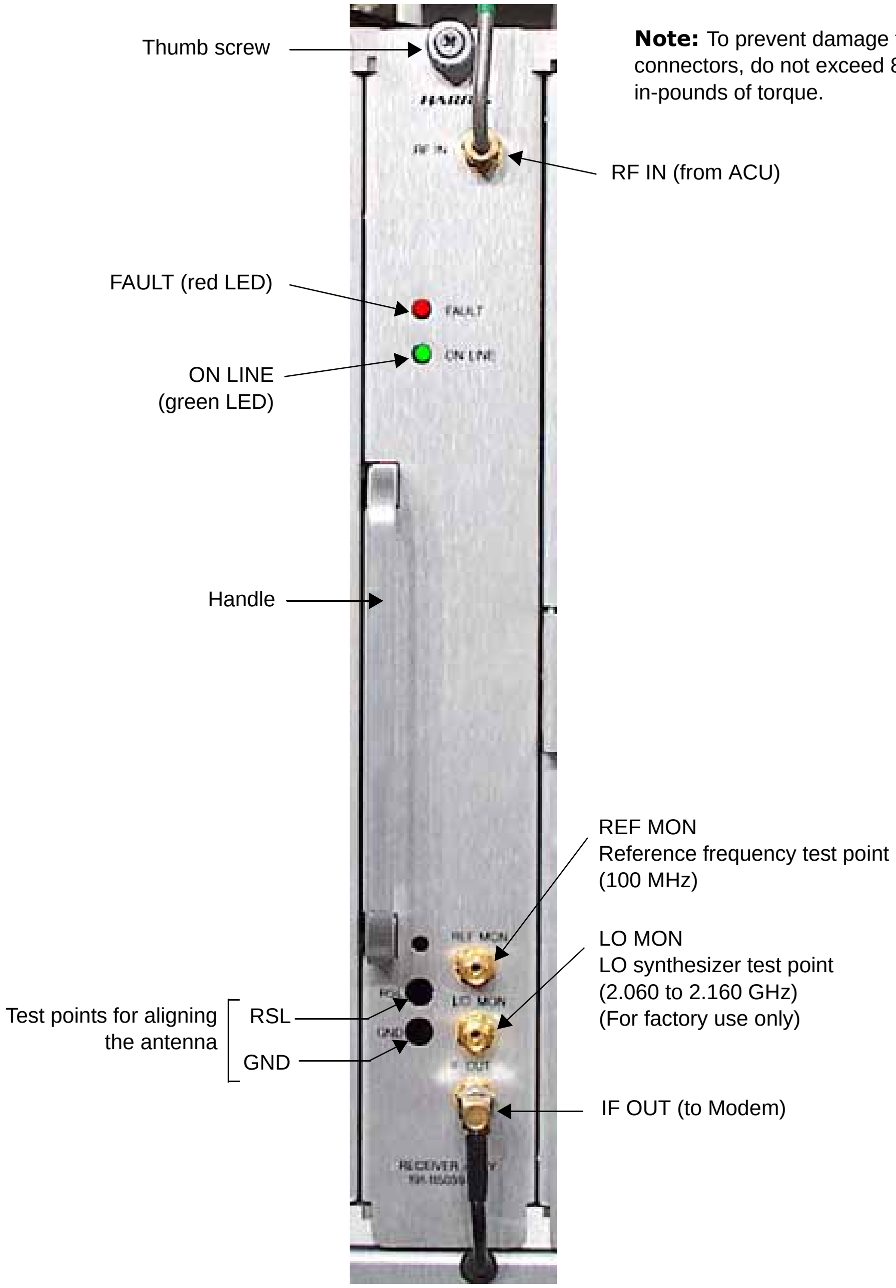
a. See Table C-2 for compatibility.

FIELD-REPLACEABLE UNITS

Field replaceable subassemblies on the receiver assembly (Figure 11-16):

- Multiplier Filter 10x-115232-0xx (see Table C-4 for options)
- IF Filter 10x-115254-00x (see Table C-3 for options and compatibility)
- OCXO 786-020590-053

Figure 11-16:Receiver Assembly, front view



Note: To prevent damage to the connectors, do not exceed 8 to 9 in-pounds of torque.

Preparing to Replace the Receiver Assembly

1. Obtain a spare Receiver Assembly.

2. Ensure that the correct option of the Multiplier-Filter is installed onto the Receiver Assembly.

See Appendix C for a table of options.

3. For procedure to replace a Multiplier-Filter, go to page 11-21.

4. Ensure that the correct option of the IF filter is installed onto the Receiver Assembly.

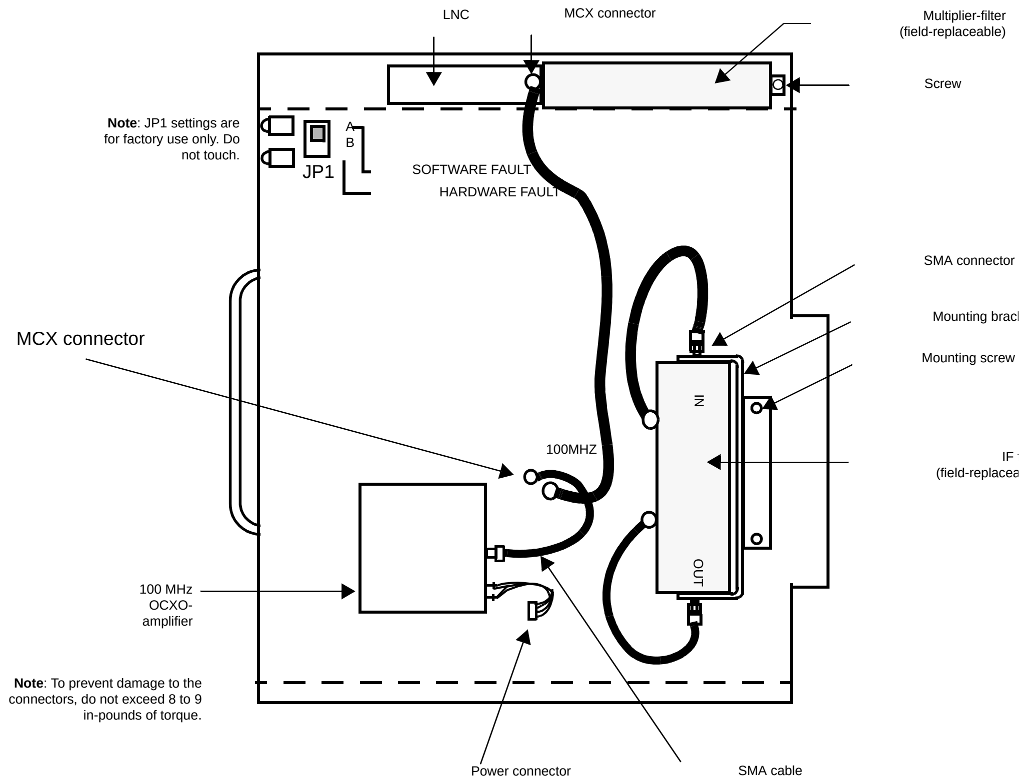
Refer to page 11-22.

5. For procedure to replace a Receiver Assembly, go to page 11-24.

Removing and Installing the Multiplier-Filter

1. Unplug the MCX connector. See Figure 11-17.

Figure 11-17:Receiver Assembly, component side



2. Unfasten the screw on the right-hand side of the Multiplier-Filter.

FIELD-REPLACEABLE UNITS

3. Unplug the Multiplier-Filter from the LNC by pulling the Multiplier-Filter to the right.

Ensure that the Multiplier-Filter you are installing is the correct option.

4. Reverse the previous three steps to install the Multiplier-Filter onto the Receiver Assembly.

Removing and Installing the IF Filter

Option	Bandwidth (MHz)
-001	5.0
-002	10.0
-003	14.0
-004	30.0

1. Gently unscrew the SMA connectors. See Figure 11-17.
2. Carefully move the cables out of the way.
3. Loosen the mounting screws to remove the mounting bracket and IF Filter from the board.
4. Loosen the SMA nuts on the connector to remove the IF Filter from the mounting bracket.
5. Insert the replacement IF Filter into the mounting bracket.

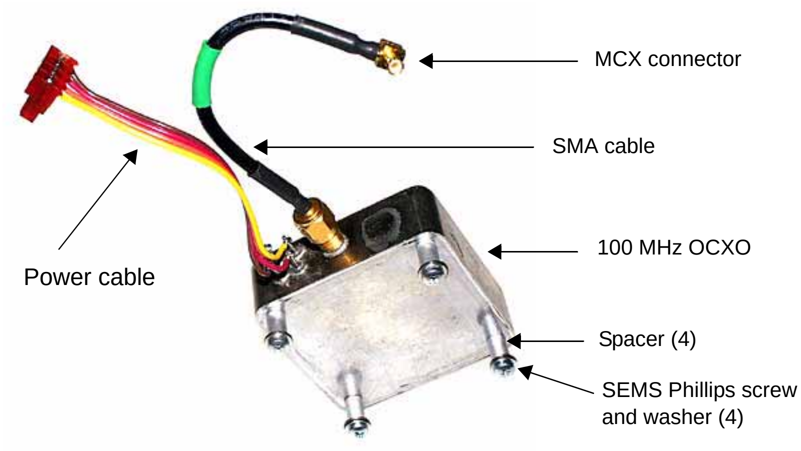
   If IN and OUT are marked on the IF Filter, ensure that the side marked IN is in the top position as shown in Figure 11-17.
6. Reverse the first four steps to install the IF Filter onto the board.

To prevent damage to the connectors, do not exceed 8 to 9 in-pounds of torque.

Removing and Installing the 100 MHz OCXO

1. Place the Receiver Assembly on a flat surface.
2. Disconnect the MCX connector by carefully pulling it up straight from the printed circuit board. The connector is designated **100MHZ** on the board. See Figure 11-17.
3. Disconnect the power connector from the printed circuit board.
4. Carefully pull out the 100 MHz OCXO from the Receiver Assembly, taking care not to remove the grommets from the printed circuit board.
5. Remove the SMA cable from the OCXO you have just removed. See Figure 11-18.

Figure 11-18:100 MHz OCXO



6. Remove and retain the 4 SEMS Phillips screws, washers, and spacers from the bottom of the OCXO.
7. Obtain a new 100 MHz OCXO.
8. Install the 4 spacers with the SEMS Phillips screws and washers you removed in step 6 onto the bottom of the new OCXO.
9. Connect the SMA cable you removed in step 5 onto the 100 MHz OCXO. Do not tighten.
10. Install the new OCXO onto the Receiver Assembly, ensuring the grommets remain in place.
11. Plug the power connector onto the Receiver printed circuit board.
12. Carefully plug the MCX connector into the receptacle designated **100MHZ**.
13. Use a torque wrench to tighten (8-9 inch-pounds) the SMA connector you installed in step 9.
14. For Receiver Assembly installation procedures, go to page 11-25.

Removing the Receiver Assembly

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

In a nonprotected configuration, removing the Receiver Assembly is a service-affecting procedure.

1. Use the Keypad command to **lock traffic** onto the Receiver Assembly that is *not* being removed. This step causes a minor alarm.

   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, SET

   In a normal operation, switching of Receiver Assembly is an errorless function.

2. Disconnect the cable to the IF OUT SMA connector.
3. Loosen the SMA connector of the cable connected to the ACU.
4. Disconnect the cable connected to RF IN, and rotate it out of the way.
5. Unfasten the captive thumbscrew.
6. Carefully pull out the Receiver Assembly from the shelf.

Before plugging the spare Receiver Assembly into the Constellation card cage, the correct option of the Multiplier-Filter and the IF Filter must be installed onto the board.

Installing the Receiver Assembly

1. Check the part number of the Receiver Assembly to ensure that the correct unit is being installed.
2. Carefully slide the Receiver Assembly into the designated slot in the shelf until the unit plugs into the backplane.
3. Use the thumbscrew to fasten the unit to the shelf.
4. On the faceplate, reconnect the cables onto the SMA connectors.
   - RF IN (from the ACU)
   - IF OUT (to the Modem)
5. Use a torque wrench to tighten the connectors (8 to 9 in-lb).
6. For the testing procedure, refer to page 8-10 and follow the steps under Receiver Frequency Measurement.

MHSB System

1. Use the Keypad command to take the switched unit out of **lock** status.
   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, CLR
2. The standby Receiver Assembly is now the primary Receiver Assembly.

Power Supply

The Power Supply provides power to one Transmitter Assembly and one Receiver Assembly in the RFU shelf. One Power Supply is required for a nonprotected radio system. Two units are required for a Monitored Hot Standby (MHSB) system.

The Power Supply operates from a 22 to 60 Vdc input power source and provides five voltage outputs. This unit receives 24 volts or 48 volts from the power source via the Fuse Panel.

The part number for the Power Supply is **103-115046-001**.

Power Supply Failure

When the Power Supply fails, the Transmitter and the Receiver Assemblies associated with the Power Supply cannot carry traffic. In a MHSB system, the system automatically switches traffic to the standby units.

Figure 11-19:Power Supply, front view

Removing the Power Supply

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

1. Use the Keypad commands to **lock traffic** onto the standby Transmitter and Receiver. This step causes a minor alarm.

   CONTROL > LOCK/IF LPBK > LOCK MOD/TX, SET

   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, SET

2. On the Transmitter Assembly, press the TX switch to the OFF position to turn off the power amplifier.
3. Press the PWR switch to the OFF position to turn off the power supply.
4. Unfasten the captive thumbscrew.
5. Carefully pull out the Power Supply from the shelf.

Installing the Power Supply

1. Check the part number of the Power Supply to ensure that the correct unit (or a newer unit) is being installed.
2. Ensure that the PWR switch on the Power Supply faceplate is in the OFF position.
3. Carefully slide the Power Supply into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the thumbscrew to fasten the unit to the shelf.
5. Press the PWR switch to ON.
6. On the Transmitter Assembly, press the TX switch to the ON position to turn on the power amplifier.

MHSB System

1. Use the Keypad command to take the standby units out of **lock** status.

   CONTROL > LOCK/IF LPBK > LOCK MOD/TX, CLR

   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, CLR

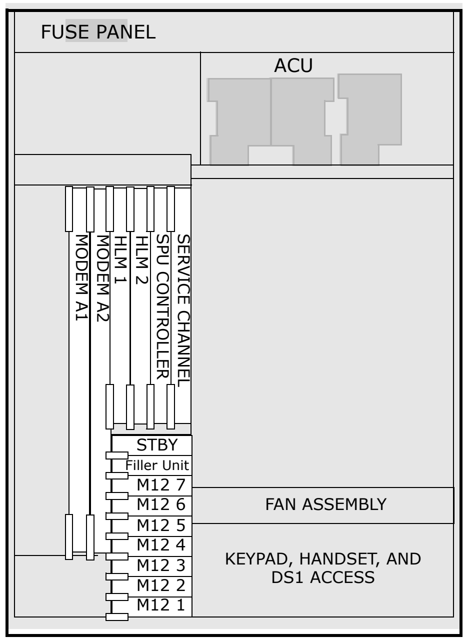
2. The standby RF units are now the primary RF units.

Switching the traffic back to the previous RF units will cause a hit; that is, switching of the Transmitter Assemblies will cause a hit.

3. If switching of RF units is desired, it should be done during low-traffic hours.

Signal Processing Section

Figure 11-20:Signal Processing section



SPU Controller

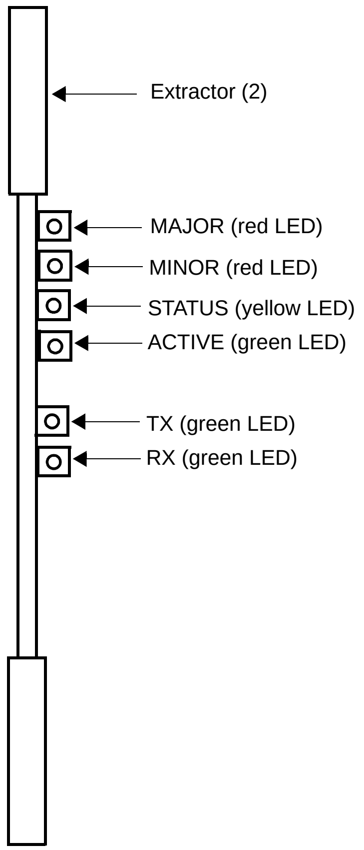
The SPU Controller provides a communication interface between various serial-protocol components in the system. It is the communications junction for the Constellation radio system. It controls all communications to and from other cards in the shelves via the CAN bus.

The SPU Controller also provides:

- Protection switching
- Provisioning
- Remote and local alarm display

The part number for the SPU Controller is **102-115075-001**.

Figure 11-21:SPU Controller, front view



Removing the SPU Controller

Removal of the SPU Controller produces loss of:

- All of the hardware protection mechanisms
- All high-level SCAN protocol features
- Spur and Aux SCAN channels

This is not a service-affecting procedure.

Before removing the SPU Controller, ensure that the system is carrying traffic in the unlocked mode.

1. Use the 2 extractor tabs to unlock the SPU Controller from the shelf.
2. Carefully pull out the Service Channel from the shelf.

Installing the SPU Controller

1. Check the part number of the SPU Controller to ensure that the correct unit is being installed.
2. Ensure that the 2 extractors are in the unlocked position.
3. Carefully slide the SPU Controller into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the 2 extractor tabs to lock the unit into place.

Service Channel (Optional)

The Constellation Service Channel is a one-data, one-voice system. It is capable of operating as a repeater or terminal in a linear system or of providing protection in loop systems. It provides ringing to telephone sets, along with an on-board alarm when the Service Channel is called.

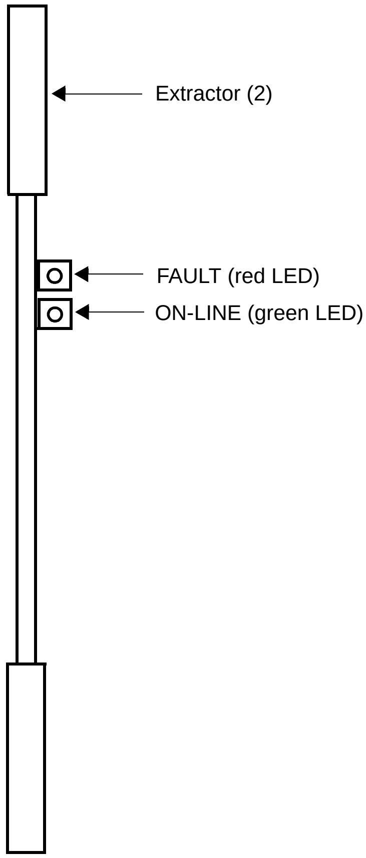
The Service Channel has two customer 4-wire, 600-ohm VF ports with two selectable VF levels to choose from. Both ports have the 0 dBm level for both transmit and receive directions. However, Port 1 can be selected to have -16 dBm for the transmit direction and +7 dBm for the receive direction while Port 2 can be selected to have +7 dBm for the transmit and -16 dBm for the receive direction. Both ports are bridged together.

Two customer RS-232 data ports can be selected to be bridged together providing half-duplex communication or selected to be isolated providing full duplex ina port-to-port application. They can also be selected to three different baud rates or to sample the data. When a baud rate is set, the data must begin with a start bit, have eight data bits, and end with one or two stop bits. A parity bit can be added at the end of the data bits when the parity option is set. The Serivce Channel does not monitor the parity bit. When the port is set to sample the data, the data rate can range from DC to 4800 b/s.

Each Service Channel is assigned a 3-digit site address that allows individual calling via the dual-tone multifrequency (DTMF) telephone set. This feature is compatible with earlier service channels (DVS-II, MegaStar).

The part number for the Service Channel is **101-115076-001**.

Figure 11-22:Service Channel, front view



Removing the Service Channel

Removing the Service Channel will affect any data or VF information that the Service Channel is carrying.

1. To prevent the system from reporting a minor alarm, from the Keypad main menu, select

   CONFIGURATION > **SYSTEM** > **SVC OPTION** > **UNINSTALL**
2. Use the 2 extractor tabs to unlock the Service Channel from the shelf.
3. Carefully pull out the Service Channel from the shelf.

Installing the Service Channel

1. Check the part number of the Service Channel to ensure that the correct unit is being installed.
2. Ensure that the 2 extractors are in the unlocked position.
3. Carefully slide the Service Channel into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the 2 extractor tabs to lock the unit into place.
5. From the Keypad main menu, select

   CONFIGURATION > SYSTEM > SVC OPTION > INSTALL

   to put the Service Channel into service.

Loop System

The Service Channel is designed to operatie in a loop system to provide the necessary switching and muting of data. When the Service Channels are set up in a loop system, the following should be observed: One Service Channel must be set up as a master with all the others set up as slaves. For the external pilot:

1. The external pilot must be enabled if two Service Channels are set up as slaves, and they are:

   a. In a Constellation terminal,

   b. In the same loop, and

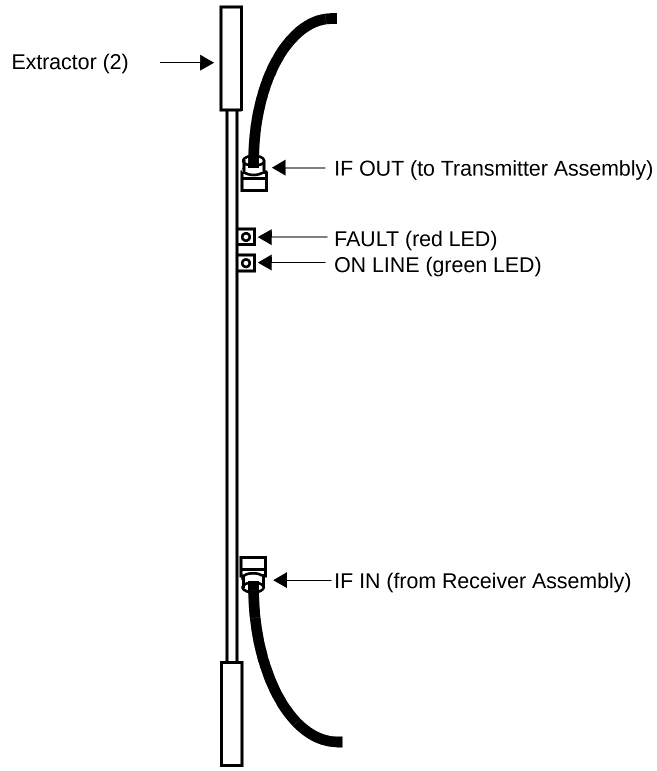
   c. At the same system site.

   This setting allows the pilot siganl to pass between the Service Channels through the VF cable.
2. The external pilot must be disabled at all other times not described in number 1.

The Service Channel terminal and repeater mode is set to the same terminal and repeater settings as the Constellation shelf. If the Constellation shelf is set to terminal, then the Service Channel is also set to terminal. The same is true for repeater mode.

Modem

Figure 11-23:Modem, front view



Medium Capacity

The Modem provides the necessary signal processing to modulate high speed serial data into a 140 MHz IF signal using a QAM scheme, and to demodulate the 140 MHz IF signal back to a serial data stream. For capacity upgrades, the same card can be field updated using a kit available from Harris without having to purchase a new card.

Table 11-4: Modem (“Cable”) Options (101-115430-00x)

Option[a]	Capacity	Modulation (QAM)
-001	8DS1	32
-002	16DS1	128
-003	28DS1/1DS3	64

a. See Table C-5 for compatibility.

FIELD-REPLACEABLE UNITS

Table 11-5: Modem ("Legacy") Options (101-115072-00x)

Option[a]	Capacity	Modulation (QAM)
-001	8DS1	32
-002	16DS1	128
-003	28DS1/1DS3	64

a. See Table C-5 for compatibility.

The legacy modem is no longer shipped and has been replaced by the cable modem. The legacy modem and cable modem are not mid-air meet compatible. A "like" modem must face a "like" modem across a HOP. Therefore, a "near end" legacy modem cannot face a "far end" cable modem and vice versa. The legacy and cable modems are compatible end-to-end in a multi-hop system. A multi-hop system can use both cable and legacy modems as long as "like" modems face "like" modems across any HOP in the system. Cable modems can be used in all Constellation radios previously shipped.

High Gain Medium Capacity

The High Gain Modem is used in conjunction with the High Gain Transmitter to provide a high system gain option for 16xDS1, 28xDS1 and 1xDS3 radios. The modem provides the necessary signal processing to modulate data into a 140 MHz QAM signal and to demodulate the 140 MHz QAM signal back to a data stream. It also provides appropriate error-correcting schemes, such as Reed-Solomon FEC and TCM (trelliscoded modulation). See Chapter 4 in the *Systems Application Manual* for RF performance numbers.

Table 11-6: High Gain Modem Options (101-115540-00x)

Option	Capacity	Modulation (QAM)
-002	16DS1	128
-003	28DS1/1DS3	64

High Capacity

The High Capacity Modem provides the necessary signal processing to modulate 155 or 180 Mbit/s data into a 140 MHz QAM signal and to demodulate the 140 MHz QAM signal back to a data stream. It also provides appropriate error-correcting schemes, such as Reed-Solomon FEC and TCM (trelliscoded modulation).

Table 11-7: High Capacity Modem Options (101-115540-00x)

Option	Capacity	Modulation (QAM)
-001	OC3, 3DS3, 2DS3+28DS1	128
-004	4DS3, 3DS3+28DS1	256

Removing the Modem

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

In a nonprotected configuration, removing the Modem is a service-affecting procedure.

1. Use the Keypad command to **lock traffic** on to the Modem that is *not* being removed. This procedure causes a minor alarm.

   CONTROL > LOCK/IF LPBK > LOCK MOD/TX, SET

   CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, SET

2. On a repeater system:

   On the off-line Power Supply faceplate, turn the PWR switch OFF.

3. Disconnect the cable to the IF OUT SMA connector.
4. Disconnect the cable connected to IF IN SMA connector.
5. Use the 2 extractor tabs to unlock the Modem from the shelf.
6. Carefully pull out the Modem from the shelf.

Installing the Modem

1. Check the part number of the Modem to ensure that the correct unit is being installed.
2. Ensure that the 2 extractors are in the unlocked position.
3. Carefully slide the Modem into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the 2 extractor tabs to lock the unit into place.
5. Reconnect the cables at
   - IF OUT
   - IF IN
6. Use a torque wrench to tighten the connectors (8 to 9 in-lb).
7. On a repeater system:

   On the Power Supply faceplate, turn the PWR switch ON.

Repeater System

In a repeater system where the Modem units are not the same (that is, one is a Modem and the other is a Cable Modem), ensure that the system synchronization is set to **SOURCE** timed.

From the Keypad menu, select

SYSTEM > SYNCHRONIZATION MX > SOURCE

MHSB System

Use the Keypad command to take the switched unit out of **lock** status.

CONTROL > LOCK/IF LPBK > LOCK MOD/TX, CLR

CONTROL > LOCK/IF LPBK > LOCK DMOD/RX, CLR

High Level Mux

The HLM multiplexes and demultiplexes the T2 signals into and out of a T3 for seven T2s or a pseudo-T3 (T2x) for less than seven T2s[1]. The HLM adds two 131 Kbps radio overhead cahnnels (Service and Scan) to the T3 or T2x frame. The HLM provides errorless switching between the Modems for receive protection.

The HLM combines several 6.312 Mbit/sT2 signals from the M12 Units into a single high-level signal (T3, T2x). The HLM also demultiplexes the high-level signal (T3, T2x) into several 6.312 Mbit/s T2 signals. A T3 version of this unit accepts a DS3 signal. The DS3 signal is converted to a T3 signal. This T3 sync unit then synchronizes with the T3 frame bits.

The HLM card provides different options supporting capacities from 8xDS1 to 28xDS1 for Terminal and Repeaters and DS3 for Terminals.

Table 11-8: High Level Mux Options (10x-115071-00x)

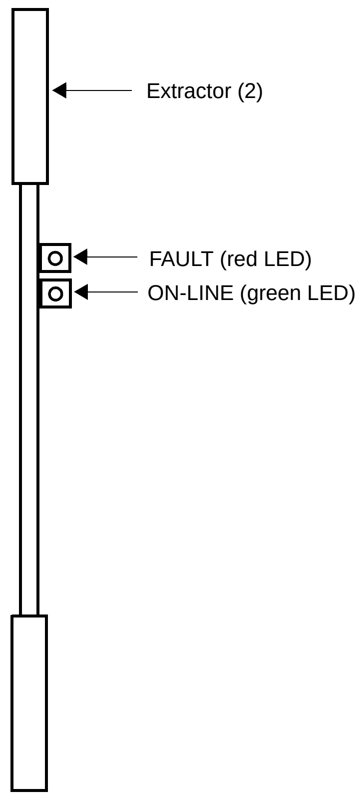
Option[a]	Capacity	Description
-001	8DS1	Terminal
-002	8DS1	Repeater
-003	16DS1	Terminal
-004	16DS1	Repeater
-005	28DS1	Terminal
-006	28DS1	Repeater
-007	DS3	Terminal

a. See Table C-6 for compatibility.

FIELD-REPLACEABLE UNITS

1. x=the number of T2 channels. T2=6.312 MHz data channel. T3=44.736 MHz data channel.

Figure 11-24:High Level Mux, front view



Removing the High Level Mux (HLM)

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

In a nonprotected configuration, removing the HLM is a service-affecting procedure.

1. Use the Keypad command to **lock traffic** on to the HLM that is *not* being removed. This step causes a minor alarm.

   CONTROL > LOCK/IF LPBK > LOCK HLM, SET

2. Use the 2 extractor tabs to unlock the HLM from the shelf.
3. Carefully pull out the HLM from the shelf.

Installing the HLM

1. Check the part number of the HLM to ensure that the correct unit is being installed.
2. Ensure that the 2 extractors are in the unlocked position.
3. Carefully slide the HLM into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the 2 extractor tabs to lock the unit into place.

Repeater System

- In a repeater system where the Modem units are not the same (that is, one is 115072 and the other is 115430), ensure that the system synchronization is set to **SOURCE** timed.
- In a loop system, when the HLM is at a master site, the HLM must be set to **SOURCE** timed.

From the Keypad menu, select

CONFIGURATION > SYSTEM > SYNCHRONIZATION MX > SOURCE

MHSB System

Use the Keypad command to take the switched unit out of **lock** status.

CONTROL > LOCK/IF LPBK > LOCK HLM, CLR

High Level 155 Mux (HLM-155)

The HLM-155 unit transmits and receives data at 155 Mbit/s through the front connectors. Transmission media is electrical or optical, SDH or SONET. This unit also iterfaces with the Modem, Wayside (DS1/E1), NMS, and the Service Channel. The HLM-155 unit can be either protected or unprotected in hot standby Constellation terminals, depending on whether the OEM multiplexer is protected.

In the transmit direction, the HLM-155 receives the STM1 or OC3 from the customer and recovers the clock and data, inserts the Wayside, Serivce Channel and NMS into the SONET frame, and converts the data to a byte format and sends it to the modem(s).

In the receive direction, the HLM-155 gets the clock and data from the modem(s), passes clock and data through a hitless switch, which aligns them when the radio is set up in a protected configuration and the delay between the two channels is equal or less than 200nsec, allowing the system or user to select between the data streams without errors. The Wayside, Service Channel, and NMS data is demultiplexed and sent to the LIU, Service Channel Card, and SPU controller respectively.

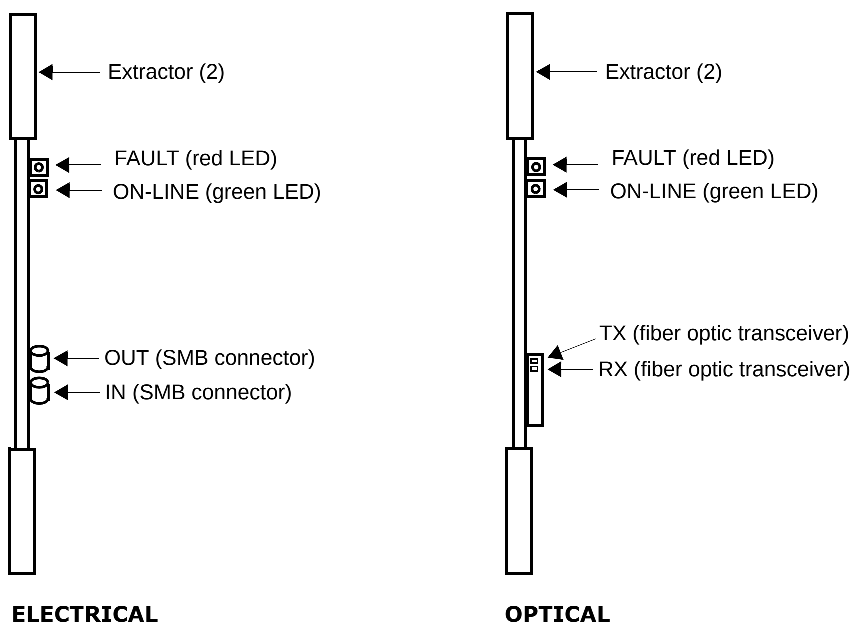
The Wayside is protected using 2 HLM cards, is programmable, and can be configured as DS1, E1, or disabled, and the Service Channel and NMS can be set at 128Kbps or disabled.

Table 11-9: High Level 155 Mux Options (10x-115450-00x)

Option[a]	Interface	Description
-001	Electrical	Receives and transmits electrical data at 155.52 Mbit/s through its BNC connectors.
-002	Multimode	Receives and transmits optical data at 155.52 Mbit/s through a multimode transceiver.
-003	Singlemode	Receives and transmits optical data at 155.52 Mbit/s through a singlemode transceiver.

a. See *Table C-6* *for compatibility.*

Figure 11-25: HLM-155, front view



Removing the HLM-155

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

In a nonprotected configuration, removing the HLM-155 is a service-affecting procedure.

1. Use the Keypad command to **lock traffic** on to the HLM that is *not* being removed. This step causes a minor alarm.

CONTROL > LOCK/IF LPBK > LOCK HLM, SET

2. Carefully disconnect the cables from the HLM-155.

3. Use the 2 extractor tabs to unlock the HLM from the shelf.

4. Carefully pull out the HLM from the shelf.

Installing the HLM-155

1. Check the part number of the HLM-155 to ensure that the correct unit is being installed.

2. Ensure that the 2 extractors are in the unlocked position.

3. Carefully slide the HLM-155 into the designated slot in the shelf until the unit plugs into the backplane.

4. Use the 2 extractor tabs to lock the unit into place.

5. Reconnect the cables.
- Electrical: the top BNC connector is OUT.
- Optical: the top SC connector is TX.

MHSB System

Use the Keypad command to take the switched unit out of **lock** status.

CONTROL > LOCK/IF LPBK > LOCK HLM, CLR

High Level 3xDS3/4xDS3 Mux (HLM-3xDS3/ HLM-4xDS3)

3xDS3 and 2xDS3+28xDS1

The 3xDS3 HLM unit multiplexes/demultiplexes three DS3 signals into/out of a SONET frame but is not SONET-compliant. This unit also interfaces with the Modem, Wayside (DS1), NMS, and the Service Channel.

The HLM-3xDS3 unit operates only in a terminal radio. The radio can be configured so that one of the selected T3 signals routed from the radio can be sent to the multiplex/demultiplex section where 28 DS1 signals can be accessed. In a “back-to-back” terminal mode, the radio also can be configured so that up to 4 T2 signals can be dropped and inserted into one of the selected T3 tributaries. The non-dropped T2 signals pass through the DS3 cabling between the terminals. Since the multiplex/demultiplex section of the Constellation radio is protected as well, complete system protection is available.

At the front of the HLM-3xDS3 unit are three DS3 ports where the coaxial cables are connected and routes to a wire-OR connection. Both the primary and stand-by HLM-3xDS3 units are connected togheter through this connection, which provides protection for all three DS3 signals. The DS1 wayside channel connection is in the Customer Access area on the backplane. The DS1 Wyaside is protected using 2 HLM cards, is programmable, and can be configured fore line coding, line length, and enable/disable. The Serivce Channel and NMS can be set at 128Kbps or disabled.

The part number for the 3xDS3 HLM is **101-115429-001**. See Table C-6 for compatibility.

4xDS3 and 3xDS3+28xDS1

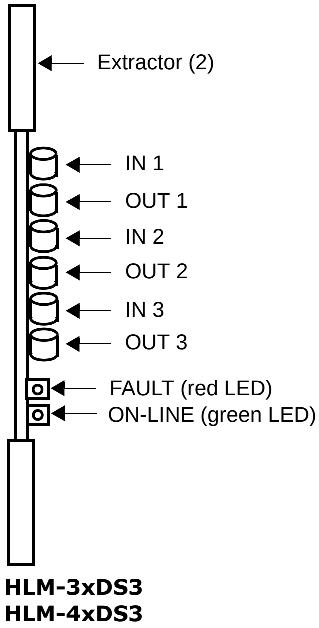
The 4xDS3 HLM unit multiplexes/demultiplexes four DS3 signals into/out of a high speed frame. This unit also interfaces with the Modem, fourth DS3 connected at the backplane in the Customer Access area, NMS, and the Service Channel.

The HLM-4xDS3 unit operates only in a terminal radio. The radio can be configured so that one of the selected T3 signals (from T3 #1, T3 #2, and T3 #3 only) routed from the radio can be sent to the multiplex/demultiplex section where 28 DS1 signals can be accessed. In a “back-to-back” terminal mode, the radio also can be configured so that up to 4 T2 signals can be dropped and inserted into one of the selected T3 tributaries (from T3 #1, T3 #2, and T3 #3 only). The non-dropped T2 signals pass through the DS3 cabling between the terminals. Since the multiplex/demultiplex section of the Constellation radio is protected as well, complete system protection is available.

At the front of the HLM-4xDS3 unit are three DS3 ports where the coaxial cables are connected and routed to a wire-OR connection. For DS3 #1, DS3 #2, and DS3 #3, both the normal and protected HLM-4xDS3 units are connected together through this connection which provides protection. The fourth DS3 is connected on the backplane in the Customer Access area and also is protected using two HLM cards. The 4xDS3 does not have a DS1 wayside. Instead, the fourth DS3 "replaces" the DS1 wyaside, using its configuration (equalizer), alarms (input loss, output fail) and controls (loopback). The Service Channel and NMS can be set at 128Kbps or disabled.

The part number for the 4xDS3 HLM is **101-115589-001**. See Table C-6 for compatibility.

Figure 11-26:HLM-3xDS3/HLM-4xDS3 units front view



FIELD-REPLACEABLE UNITS

Removing the HLM-3xDS3/4xDS3

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

In a nonprotected configuration, removing the HLM-3xDS3/4xDS3 is a service-affecting procedure.

1. Use the Keypad command to **lock traffic** on to the HLM that is *not* being removed. This step causes a minor alarm.

   CONTROL > LOCK/IF LPBK > LOCK HLM, SET

2. Disconnect the cables by pulling the connectors straight out from the HLM-3xDS3/4xDS3.
3. Use the 2 extractor tabs to unlock the HLM from the shelf.
4. Carefully pull out the HLM from the shelf.

Installing the HLM-3xDS3/4xDS3

1. Check the part number of the HLM-3xDS3/4xDS3 to ensure that the correct unit is being installed.
2. Ensure that the 2 extractors are in the unlocked position.
3. Carefully slide the HLM-3xDS3/4xDS3 into the designated slot in the shelf until the unit plugs into the backplane.
4. Use the 2 extractor tabs to lock the unit into place.
5. Reconnect the cables. Ensure that the cables match the connector labels.

MHSB System

Use the Keypad command to take the switched unit out of **lock** status.

CONTROL > LOCK/IF LPBK > LOCK HLM, CLR

M12 Unit

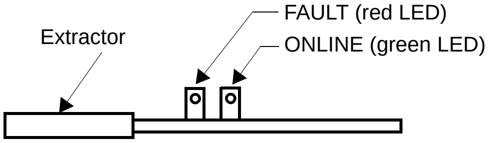
The M12 Unit transmits and receives four DS1 signals and multiplexes/ demultipelxes them into/from a T2 NRz data stream. Both AMI and B8ZS DS1 signals can be inserted or transmitted into/from the M12 Unit.

The M12 Unit has the ability to set the Line Build-Out (LBO) length from 0 ft. to 655 ft. for each of the four tributaries. This feature allows the M12 Standby Unit to adjust the LBO for any length of cable it protects.

Loopback tests can be performed by using the Keypad commands (see Appendix B).

The part number for the M12 Unit is **101-115071-001**. The part number for the M12 Standby Unit is **028-110880-001**.

Figure 11-27:M12 Unit, front view



Protection

The four DS1 input signals are protected by connecting them to a set of four relays that when energized are routed to a M12 Standby Unit. Another set of four relays, energized at the same time, routes the M12 Standby DS1 output signals to the customer via the normal M12 Unit.

The M12 Unit is 1:N protected. To prevent any possibilities of placing multiple M12 Units into protection, a hardware circuit inhibits the portection switching of a M12 Unit when another M12 Unit has already been protected. The protection switching is inhibited as well when any one of the nine M12 slots is unoccupied. In other words, all nine M12 slots must be occupied by either a M12 Unit or a M12 Standby Unit.

In an MHSB configuration, any slot not occupied by a M12 Unit must be occupied by a M12 Standby Unit. If a M12 slot is unoccupied, the DS1 or E1 input and output signals are routed to the M12 Standby Unit. Therefore, when a slot is unoccupied, the M12 protection is disabled.

Removing the M12 Unit

- In a MHSB configuration, start with step 1.
- In a nonprotected configuration, start with step 2.

1. Ensure that the M12 Unit to be removed is in PROTECT mode.
   CONTROL > LOCK/IF LPBK > PROTECT M12, SET
2. Use the extractor to unlock the M12 Unit from the shelf.
3. Carefully pull out the unit from the shelf.

This procedure causes a hit.

Installing the M12 Unit

1. Check the part number of the M12 Unit to ensure that the correct unit is being installed.
2. Ensure that the extractor on the M12 Unit is in the unlocked position.
3. Carefully slide the unit into the designated slot in the shelf until the unit plugs into the backplane.

This procedure causes a hit.

4. Push the extractor to lock the unit into place.
5. For a MHSB unit, use the Keypad command to release the Standby Unit.
   CONTROL > LOCK/IF LPBK > RELEASE STBY, EXEC

Removing the Standby M12 Unit

1. Do this step if the Standby M12 Unit is carrying traffic.
   Use the Keypad command to **RELEASE STBY** on the M12 Unit.
   CONTROL > LOCK/IF LPBK > RELEASE STBY, EXEC
2. Use the extractor to unlock the M12 Unit from the shelf.
3. Carefully pull out the unit from the shelf.

Replacing the Standby M12 Unit

1. Ensure that the extractor of the M12 Unit is in the unlocked position.
2. Carefully slide the unit into the topmost slot of the M12 shelf until the unit plugs into the backplane.
3. Push the extractor to lock the unit into place.

CHAPTER

12

CUSTOMER SERVICE & WARRANTY INFORMATION

Ordering Parts or Spares

Harris MCD equipment is designed to be repaired by replacement at the unit level with readily available spares. For this reason, parts lists are not furnished with an order, nor are they recommended as a requirement.

To maintain your microwave radio with a minimum of down time, however, your organization will have to maintain a stock of spare units. To do so, you may wish to order additional spares from time to time, to assure that you have enough spares to properly maintain the system. In addition, after you replace a faulty unit with a spare, you will want to return the faulty unit to Harris for repair. This section explains how to accomplish these tasks.

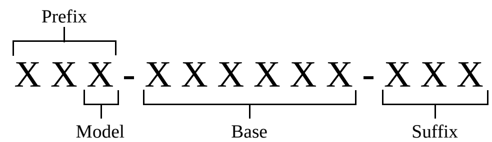
Part Numbers Versus Product Codes

The best way to identify an item that you wish to order is to give us a part number. A part number identifies a specific part and is found on a label affixed to the part, as shown in Figure 12-1. On that label, there may also be a product code, which is a more general number that identifies the most up to-date part that serves a specific function. If possible, please provide the part number.

The part numbers may appear in two ways. Each part-numbering scheme is explained as follows.

12-digit Part Number

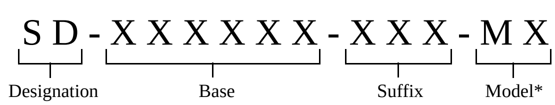
For a 12-digit part number on the bill of materials:



Prefix	The first three digits of the part number indicate the type of unit or level of assembly.
Model	The third digit of the part number is the unit or assembly model number.
Base	The 6-digit base number is a consecutive numerical set indicates a specific unit or assembly
Suffix	The 3-digit suffix indicates the unit or assembly option. For example, 003 indicates unit or assembly is Option 3.

SD Part Number

For an SD part number marked on the equipment:



*Not shown for Model 1

Designation	The designation is always "SD".
Base	The 6-digit base number indicates a specific unit or assembly.
Suffix	The 3-digit suffix indicates the unit or assembly option. For example, 003 indicates unit or assembly is Option 3.
Model	The model number indicates the unit or assembly model number.

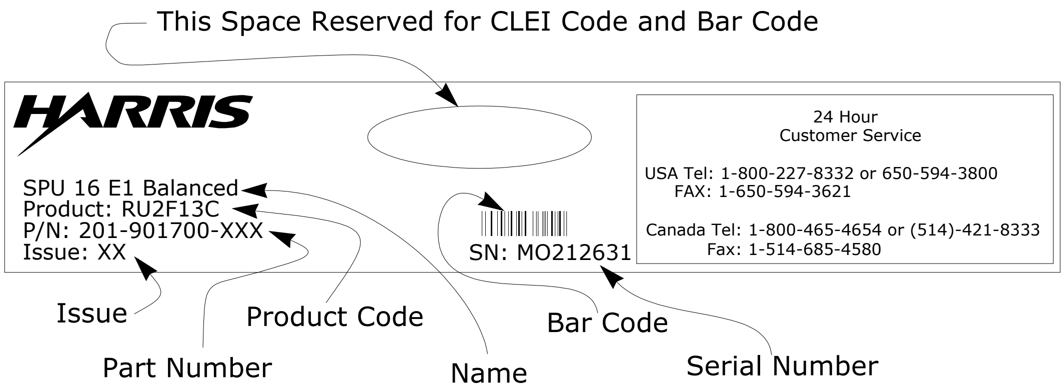
The part number on the replacement unit must have the same base digits and option number as the one you removed; however, the model number can be higher.

For example, a failed unit with no Model indication in its part number is an "M1" model. It can be replaced by an "M2" Model. Or, a unit with "M2" in its part number can be replaced by an "M3" model. Units cannot be replaced with ones that have lower model numbers. Refer to the original equipment list to find the correct replacement parts for the specific unit.

Spare Unit Ordering Information

When you order spare parts for your existing system, refer to the OMSA report that came with your system and provide the replacement part number.

Figure 12-1: Example Part Label



Whenever ordering a spare or replacement unit, make sure to specify the Harris part number *and* option. It is recommended that you order by specifying the part number and option appearing on the existing unit in your radio or by the part number and option specified on the bill of materials given in the Sales Order-specific binder.

To order spare or replacement units, and return items for repair, fill out the "Rapid Request for Return Material Authorization (RMA)", see Figure 12-2.

Any order above the component level must be for a complete unit or for an assembly that includes one or more units. Make all inquiries for spare units to the Spare Products Support Center at the following address.

Harris Microwave Communications Division
Spare Products Service Centre
3, rue de l'Hôtel de Ville
Dollard-des-Ormeaux, Quebec
CANADA H9B 3G4

Telephone Nos.:	Fax No.:
USA & Canada: 1-800-227-8332, Option 2	(+1) 514-421-3555
Worldwide: (+1) 514-421-8333	

E-mail address:	Website:
cs-order@harris.com	https://premier.harris.com/microwave/

Spare Unit Part List

Part Number	Description
091-020085-107	Handset
098-115027-001	Keypad Kit
101-110190-001	COAX Switch
101-115070-001	M12 (4T1)
101-115070-002	M12 (4E1)
101-115072-001	Modem 8T
101-115072-002	Modem 16T Standard Power
101-115072-003	Modem 28T/DS3 Standard Power
101-115076-001	Service Channel
101-115232-014	Multiplier (9,500 MHz): TX/RX Freqency 7200 > 7300 MHz
101-115232-015	Multiplier (9,600 MHz): TX/RX Freqency 7300 > 7400 MHz
101-115232-016	Multiplier (9,700 MHz): TX/RX Freqency 7400 > 7500 MHz
101-115232-017	Multiplier (9,800 MHz): TX/RX Freqency 7500 > 7600 MHz
101-115232-018	Multiplier (9,900 MHz): TX/RX Freqency 7600 > 7700 MHz
101-115232-019	Multiplier (10,000 MHz): TX/RX Freqency 7700 > 7800 MHz
101-115232-020	Multiplier (10,100 MHz): TX/RX Freqency 7800 > 7900 MHz
101-115232-021	Multiplier (10,200 MHz): TX/RX Freqency 7900 > 8000 MHz
101-115232-022	Multiplier (10,300 MHz): TX/RX Freqency 8000 > 8100 MHz
101-115232-023	Multiplier (10,400 MHz): TX/RX Freqency 8100 > 8200 MHz
101-115232-024	Multiplier (10,500 MHz): TX/RX Freqency 8200 > 8300 MHz
101-115232-025	Multiplier (10,600 MHz): TX/RX Freqency 8300 > 8400 MHz
101-115232-026	Multiplier (10,700 MHz): TX/RX Freqency 8400 > 8500 MHz
101-115232-113	Multiplier (9,400 MHz): TX/RX Freqency 7100 > 7200 MHz

Part Number	Description
101-115254-001	IF Filter (5 MHz)
101-115254-002	IF Filter (10 MHz)
101-115254-003	IF Filter (14 MHz)
101-115254-004	IF Filter (30 MHz)
101-115280-001	Fan Assembly
101-115429-001	High Level Mux 3DS3
101-115430-001	Cable Modem 8T
101-115430-002	Cable Modem 16T
101-115430-003	Cable Modem 28T/DS3
101-115430-006	Cable Modem 24E1
101-115450-001	High Level Mux Electrical 155
101-115450-002	High Level Mux Multimode 155
101-115450-003	High Level Mux Single Mode 155
101-115515-001	Fan Assembly
101-115540-001	Modem 155/3DS3
101-115540-002	Modem 16T High Power
101-115540-003	Modem 28T/DS3 High Power
101-115540-004	Modem 4DS3
101-115589-001	High Level Mux 4DS3
102-115075-001	Controller
103-115071-001	High Level Mux 8T
103-115071-002	High Level Mux 8T
103-115071-003	High Level Mux 16T
103-115071-004	High Level Mux 16T
103-115071-005	High Level Mux 28T
103-115071-006	High Level Mux 28T
103-115071-007	High Level Mux DS3
103-115071-009	High Level Mux 24E1
103-115071-010	High Level Mux 24E1
103-115232-001	Multiplier (8,200 MHz): TX/RX Frequency 5900 < 6000 MHz/10400 < 10500 MHz
103-115232-002	Multiplier (8,300 MHz): TX/RX Frequency 6000 < 6100 MHz/10500 < 10600 MHz
103-115232-003	Multiplier (8,400 MHz): TX/RX Frequency 6100 < 6200 MHz/10600 < 10700 MHz

Part Number	Description
103-115232-004	Multiplier (8,500 MHz): TX/RX Frequency 6200 < 6300 MHz/10700 < 10800 MHz
103-115232-005	Multiplier (8,600 MHz): TX/RX Frequency 6300 < 6400 MHz/10800 < 10900 MHz
103-115232-006	Multiplier (8,700 MHz): TX/RX Frequency 6400 < 6500 MHz/10900 < 11000 MHz
103-115232-007	Multiplier (8,800 MHz): TX/RX Frequency 6500 < 6600 MHz/11000 < 11100 MHz
103-115232-008	Multiplier (8,900 MHz): TX/RX Frequency 6600 < 6700 MHz/11100 < 11200 MHz
103-115232-009	Multiplier (9,000 MHz): TX/RX Frequency 6700 < 6800 MHz/11200 < 11300 MHz
103-115232-010	Multiplier (9,100 MHz): TX/RX Frequency 6800 < 6900 MHz/11300 < 11400 MHz
103-115232-011	Multiplier (9,200 MHz): TX/RX Frequency 6900 < 7000 MHz/11400 < 11500 MHz
103-115232-012	Multiplier (9,300 MHz): TX/RX Frequency 7000 < 7100 MHz/11500 < 11600 MHz
103-115232-013	Multiplier (9,400 MHz): TX/RX Frequency 11600 < 11700 MHz
103-115232-101	Multiplier (8,100 MHz): TX/RX Frequency 5800 < 5900 MHz/10300 < 10400 MHz
103-115346-001	Power Supply (18-60 VDC)
193-115038-001	XMTR Assembly, Low/Med Cap, Standard Power (8T/16T/28T/DS3)
193-115038-002	XMTR Assembly, Low/Med Cap, Standard Power (8T/16T/28T/DS3)
193-115038-003	XMTR Assembly, Low/Med Cap, Standard Power (8T/16T/28T/DS3)
193-115038-011	XMTR Assembly, High Cap, Standard Power (155/3DS3)
193-115038-012	XMTR Assembly, High Cap, Standard Power (155/3DS3)
193-115038-013	XMTR Assembly, High Cap, Standard Power (155/3DS3)
193-115038-111	XMTR Assy, Med/High Cap, High Power (16T/28T/DS3/155/3DS3/4DS3)
193-115038-112	XMTR Assy, Med/High Cap, High Power (16T/28T/DS3/155/3DS3/4DS3)
193-115038-113	XMTR Assy, Med/High Cap, High Power (16T/28T/DS3/155/3DS3/4DS3)
193-115039-001	RCVR Assembly, Low/Med Cap (8T/16T/28T/DS3)
193-115039-002	RCVR Assembly, Low/Med Cap (8T/16T/28T/DS3)
193-115039-003	RCVR Assembly, Low/Med Cap (8T/16T/28T/DS3)

Part Number	Description
193-115039-011	RCVR Assembly, Med/High Cap (16T/28T/DS3/155/3DS3/4DS3)
193-115039-012	RCVR Assembly, Med/High Cap (16T/28T/DS3/155/3DS3/4DS3)
193-115039-013	RCVR Assembly, Med/High Cap (16T/28T/DS3/155/3DS3/4DS3)
786-020590-053	100 MHz OCXO

Technical Assistance Center

For all information related to the *Technical Assistance Center* nearest you, refer to the Preface of this Manual.

Business Hours

Normal business hours for the Technical Assistance Center:

06:30 to 17:00 (Pacific Time)
Monday through Friday

Technical Assistance Web Site

E-mail address: crcusa@harris.com

For online support, software downloads and product technical news, sign in to the Harris Premier Customer Site:

https://premier.harris.com/microwave/

24-Hour Technical Assistance

Technical support is available 24 hours per day, seven days a week. Product Support Engineers are available in the USA from 6:30am to 5pm PST, Monday through Friday, and 7:30am to 5:00pm EST in Canada. At all other times, our Product Support Engineers will return your call within 30 minutes whenever you have traffic affecting or traffic threatening situations. For the USA, call us at **1-800-227-8332**. For International, call us at **1-514-421-8333** or fax to

1-514-421-3555. Please provide us with the following information when you call:

1. Your name, company and telephone number.
2. Equipment type and Sales Order number or FWL number found at the bottom of the rack.
3. Detailed description of the problem.

Repair and Return

Harris MCD repairs all its manufactured products as well as coordinates repairs on vendor items which are part of its systems. The standard repair turn around time for current production models is 5 working days upon receipt of the defective parts. The part number listing following this section shows which items are current production models by the designator “RBP” or “SOB.” Standard repair turn around time for other products is 15 working days. Manufacturing Discontinued items repair turnaround is subject to the availability of parts.

Repair charges and turn around time for OEM (vendor) items are set by Harris MCD suppliers. Our close working relationships with our suppliers assure us of the best repair prices and turn around time.

Call **1-800-227-8332** or **1-514-421-8333** (Canada), or fax your request to **1-514-421-3555**.

Repair and Exchange Warranty

Harris MCD's warranty policy is as follows:

Repair Warranty	90 days
Exchange Warranty	90 days

and/or the remainder of the original product warranty period, whichever is greater.

Module Exchange

You may prefer to receive a replacement unit before you send your defective unit to us. Harris MCD maintains an inventory of many different modules that can be shipped to you within 24 hours. Parts requiring return can be shipped within 48 hours.

Emergency exchange is available with a 24 hour turnaround for current production models of some products and 48 hours for other products. Emergency exchanges are billed at actual exchange prices (zero for warranty units) plus 200.00 USD per unit regardless of warranty status.

All exchanged units must be returned to us within 20 calendar days (domestic) / 45 calendar days (international) from date of shipment to avoid getting invoiced for the difference between the exchange price and the list price.

The returned unit must match the product specification of the advance exchange unit like for like. If the returned unit is non-repairable you will be invoiced for the difference between the exchange price and the list price. The unit will be discarded unless advised otherwise.

Evaluation Fee

There is a 195.00 USD evaluation charge per unit if no problem is found and no repair is required.

Irreparable Units

Equipment which has been damaged due to customer negligence or which has parts removed will be repaired at prevailing flat repair fee or on a time and material basis, whichever is higher, regardless of the warranty status. Any equipment that we have determined to be irreparable, will be returned to the customer. A 195.00 USD evaluation fee will be assessed. This fee will be credited if the customer purchases a replacement unit within 30 days.

Emergency Repair

Emergency repair is available with a 24 hour turn around time for products that are of current production and 48 hours for other products. Turnaround time for Manufacturing Discontinued items is subject to the nature of the problems. Emergency repairs are billed at actual repair price (zero for warranty units) plus 200.00 USD per unit regardless of warranty status. Our normal shipping time is 4:00 PM unless special shipping instructions are requested.

Equipment Damaged During Shipment

Please check for shipping damage when your equipment is received.

Inspect all cartons at the time of delivery. Visible damage should be brought to the attention of the carrier at once. In the event of concealed damage, keep the shipping container, packing material and equipment intact. It is your responsibility to file any claims for damage or loss with the carrier.

After the carrier has inspected the damaged material, contact Harris' Repair Administration Department to obtain a return authorization, then return the damaged equipment to Harris. Once repair costs including any and all associated freight costs have been established, you will be advised and these charges may be included in your claim. Harris will make every effort to expedite replacement of damaged goods that are the result of shipping damage.

Return Freight

Harris MCD prepays standard return freight back to our customers. Return freight back to customers on billable repairs is invoiced to the customers. A 200.00 USD handling charge is added in excess of freight charges for international shipments.

Incoming shipments should be sent DDU (delivered duty unpaid). Outgoing shipments will be sent EXW (EX Works), Service Center locations.

Customers are responsible for clearance and insurance of goods (except for USA / Canada custom clearance).

The customer pays for shipping units to Harris MCD for both warranty and out-of warranty repairs. Harris does not accept inbound shipments that are C.O.D. Special shipping requests may be subject to additional charge.

Please make sure to pack the unit in such a way as to prevent electrostatic discharge and physical damage in transit.

Return Material Authorization

Before sending in your equipment for repair, please call us at **1-800-227-8332**, or **1-514-421-8333**, (Repair and Return) or fax your request to **1-514-421-3555**. This will ensure that the repairs will be done in a timely manner and eliminate any delays due to incomplete information. Please provide us with the following information when you call us.

1. Your name, company and telephone number.
2. Equipment type, part number, serial number and FWL number found at the bottom of the rack.
3. Detailed description of the problem.
4. Purchase order number.
5. Billing and shipping addresses.
6. Any special return packing or shipping instructions.
7. Customs clearance information if from overseas.

Please return the part with a 'Trouble Reporting Tag' attached to it to the address provided by the return coordinators.

Figure 12-2: Example of the Trouble Reporting Tag

Product:
Part Number:
Serial Number:
Frequency:
Software Version:
Contact Name:
E-mail:

RMA:
Sales Order:
Configuration / Strapping:
Tel:
Fax:

Failure Type
- ☐ Steady
- ☐ Intermittent
- ☐ Temperature Sensitive:
- ☐ Microphonic

Occured
- ☐ At start-up
- ☐ Each time:
- ☐ After certain period:

Problem Description
- ☐ Output Power
- ☐ AGC / RSL
- ☐ Communication Port
- ☐ Software Problem
- ☐ Errors / Sync Loss
- ☐ Unstable Frequency
- ☐ Physical / Electrical Damage
- ☐ Protection / Switching Problem
- ☐ Shows Alarm (specify):
- ☐ Comments:
- ☐ Lightning Hit
- ☐ Blows Fuse / Breaker Trip
- ☐ Does not turn on
- ☐ Test to Specifications
- ☐ Upgrade as per ECO or CSB
- ☐ Realign
- ☐ Option Change / Re-tune

**You will be asked to provide the following information when contacting us for the RMA#:*
1-A return shipping and billing address
2-A Purchase Order Number if the order will be non-warranty or requesting an exchange unit regardless of warranty status

CUSTOMER SERVICE & WARRANTY

Repair Service Locations

Our customer service representatives will ask you to ship your defective units after the RMA is given to you in one of the following locations:

Harris MCD Division (U.S.A.)
5727 Farinon Drive
San Antonio, TX 78249, USA
Phone: 1-800-227-8332,
Option 1
Fax: 514-421-3555

Harris MCD Division (Canada)
3 Hotel-de-Ville
Dollard-des-Ormeaux, Quebec
Canada H9B 3G4
Phone: 1-800-227-8332 or
514-421-8333
Fax: 514-421-3555

On-Site Field Service Repair

Harris MCD factory trained Field Service engineers are available to perform on-site repairs on an as needed basis when telephone assistance can not be effectively rendered. All request for on-site assistance should be made to Technical Assistance Center. Call the Technical Assistance Center nearest you.

Annual Repair Service Program (ARSP)

Our ARSP service will assure you that all your repairs will be covered for a minimal fee paid up front. Repairs will be processed immediately and unexpected large repair expenses will be avoided. Only Harris MCD manufactured units are covered by the Annual Repair Service Program. The antenna system as well as OEM equipment like the channel banks are excluded. ***This warranty extension excludes any units deemed "irreparable" due to misuse or abuse of the units and replacement of parts subject to normal wear and tear.*** Equipment must be in good operating condition prior to purchasing a warranty extension service.

Customer Training

Harris MCD offers courses in microwave, lightwave and multiplex system operation designed to maximize product performance and minimize maintenance costs. Regular classes are held in some of our North-American and International facilities. For information on currently available courses and training locations, please visit our WEB site at

http://www.microwave.harris.com/cservice/ctmain.htm

Special classes can be held at customer sites. Training is available for standard products. All other training requirements must be quoted by the Customer Training Department.

General Training Policy

- Quoted prices are in USD unless noted otherwise.
- Class size is limited to 12 students maximum, except for FarScan™ courses which are limited to 6, unless specified otherwise.
- Training manuals are provided by Harris.
- Courses are in English unless specified otherwise.
- A Purchase Order is required to confirm registration.
- A cancellation fee of 50% will be applied if a customer cancels a scheduled class or reservation in a pre-scheduled class within three weeks of the scheduled date.
- A cancellation fee of 100% will be applied if a customer cancels a scheduled class or reservation in a pre-scheduled class within one week of the scheduled date.
- The Customer shall provide traffic-free radio equipment, computer(s), (if required), and test equipment when training is held at locations other than at a Harris Training and Education Center.
- All pre-scheduled courses can be cancelled or postponed at the discretion of Harris three weeks prior to the scheduled date if the minimum attendance is not met.
- All Quoted prices are valid for a period of ninety (90) days.
- Courses cannot be filmed, videotaped or recorded.
- Students attending courses are responsible for arranging for their meals, accommodations and transportation.
- An attendance of 100% is required of each student to complete the course and to be awarded a certificate of completion.

Standard Product Warranty

Harris Microwave Communications Division, (hereafter Harris MCD), warrants that each product of its own manufacture shall, at the time of delivery and for a period of twenty-four (24) months thereafter, be free from defects in materials and workmanship. For such products that are installed by Harris MCD, this warranty shall extend for eighteen (18) months from date of installation, provided that the time from the date of delivery to the date of installation does not exceed six months. Such warranty shall not include any consumable components to which a specific manufacturer's guarantee applies. If any Harris MCD product shall prove to be defective in materials or workmanship under normal intended usage, operation and maintenance during the applicable warranty period as determined by Harris MCD after examination of the product claimed to be defective, then Harris MCD shall repair or replace, at Harris MCD's sole option, such defective product, in accordance with procedures specified below, at its own expense, exclusive, however, of the cost of labor by the customer's own employees, agents or contractors in identifying, removing or replacing the defective part(s) of the product.

In composite equipment assemblies and systems, which include equipment of such other than Harris MCD manufacture, Harris MCD's responsibility under this warranty provision for the non Harris MCD manufactured portion of the equipment shall be limited to the other equipment manufacturer's standard warranty. Provided, however, that if the other manufacturer's standard warranty period is of a shorter duration than the warranty period applicable to Harris MCD's manufactured equipment, then Harris MCD shall extend additional coverage to such other equipment manufacturer's warranty equal to the differential in time between the expiration of the other manufacturer's warranty and the duration of Harris MCD's manufactured equipment warranty applicable to such order.

Harris MCD shall repair or replace, at Harris MCD's sole option, such other manufacturer's defective part(s) within sixty (60) days after receipt of such parts by Harris MCD in accordance with the below specified procedures, at Harris MCD's own expense, exclusive, however, of cost of labor by the customer's own employees, agents or contractors in identifying, removing or replacing the defective part(s) of the product.

An authorization to return products to Harris MCD under this warranty must be obtained from a Harris MCD representative prior to making shipment to Harris MCD's plant, and all returns shall be shipped freight prepaid. Collect shipments will not be accepted, but Harris MCD will prepay return freight charges on repaired and replaced products found to be actually defective.

Liability of Harris MCD for breach of any and all warranties hereunder is expressly limited to the repair or replacement of defective products as set forth in this Chapter, and in no event shall Harris MCD be liable for special, incidental or consequential damages by reason of any breach of warranty or defect in materials or workmanship. Harris MCD shall not be responsible for repair or replacement of products which have been subjected to neglect, accident or improper use, or which have been altered by other than authorized Harris MCD personnel.

The foregoing warranties are in lieu of all other warranties whether oral, written, expressed, implied, or statutory. In particular, the implied warranties of fitness for particular purpose and merchantability are hereby disclaimed and shall not be applicable either from Harris MCD or any other equipment manufacturer. Harris MCD's warranty obligations and buyer's remedies thereunder are solely and exclusively as stated herein. In no case shall Harris MCD be liable for indirect kinds of damages, including but not limited to special, incidental, and consequential damages, or loss of capital, revenue, or profits. In no event shall Harris MCD's liability to buyer, or any party claiming through buyer, be in excess of the actual sales price paid by buyer for any items supplied hereunder.

APPENDIX

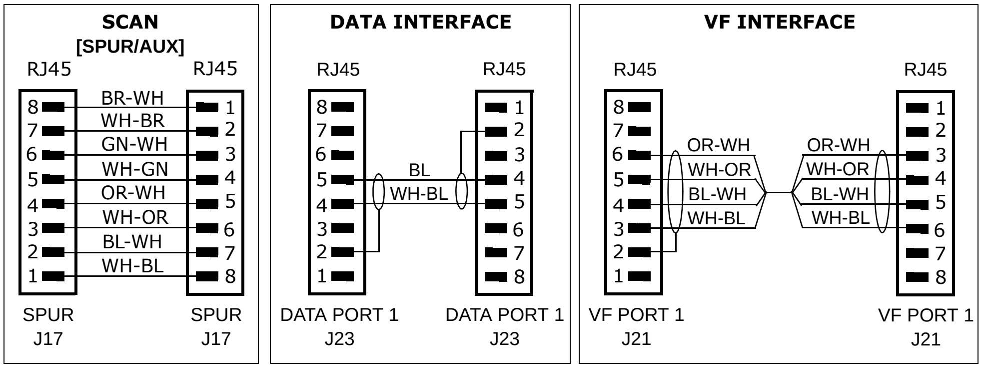
A

WIRING SPECIFICATIONS

Cable Specifications

Connecting to Other Radios

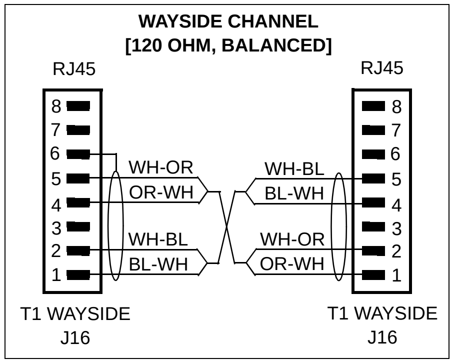
Figure A-1: Constellation to Constellation



Harris Cable	Length (ft)
087-115560-010	10
087-115560-025	25

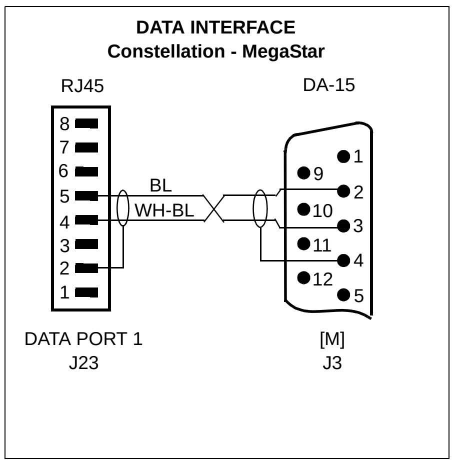
Harris Cable	Length (ft)
087-115565-010	10
087-115565-025	25

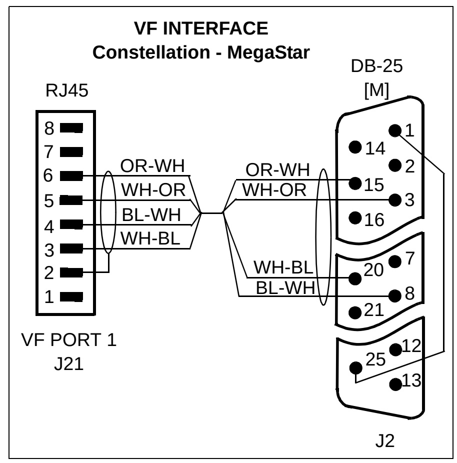
Harris Cable	Length (ft)
087-115570-010	10
087-115570-025	25



Harris Cable	Length (ft)
087-115620-010	10
087-115620-025	25

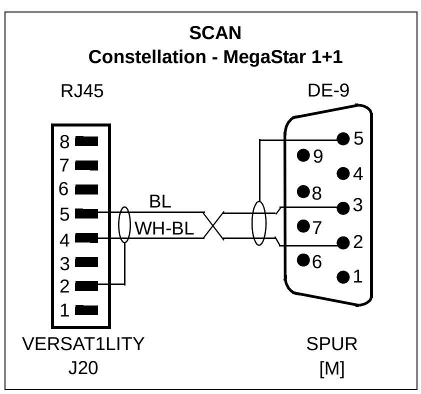
Figure A-2: Constellation to MegaStar





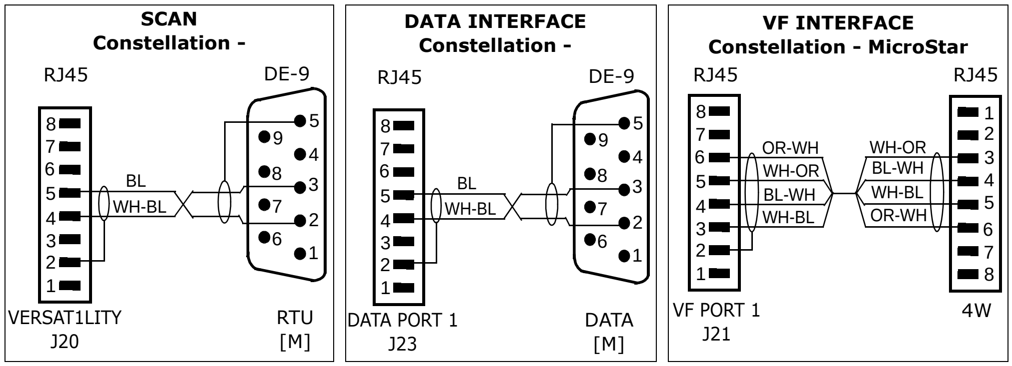
Harris Cable	Length (ft)
087-115575-025	25
087-115575-035	35

Harris Cable	Length (ft)
087-115580-025	25
087-115580-035	35



Harris Cable	Length (ft)
087-115585-025	25
087-115585-035	35

Figure A-3: Constellation to MicroStar

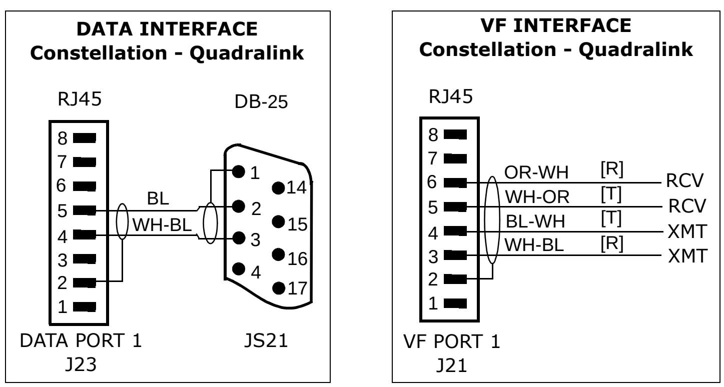


Harris Cable	Length (ft)
087-115590-025	25
087-115590-035	35

Harris Cable	Length (ft)
087-115590-025	25
087-115590-035	35

Harris Cable	Length (ft)
087-115595-025	25
087-115595-035	35

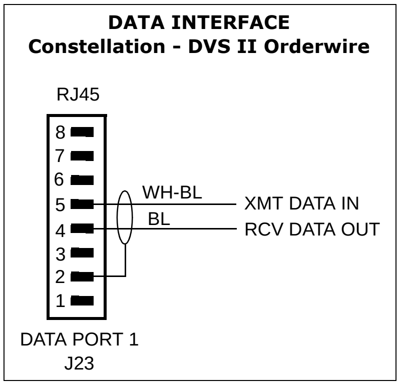
Figure A-4: Constellation to Quadralink

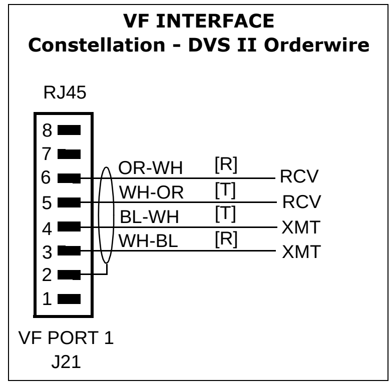


Harris Cable	Length (ft)
087-115600-030	30
087-115600-040	40

Harris Cable	Length (ft)
087-115605-030	30
087-115605-040	40

Figure A-5: Constellation to DVS II Orderwire

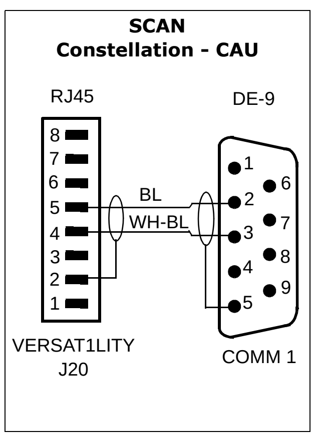


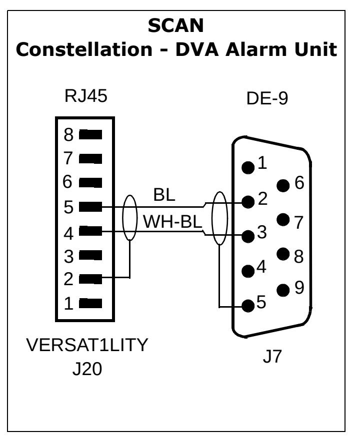


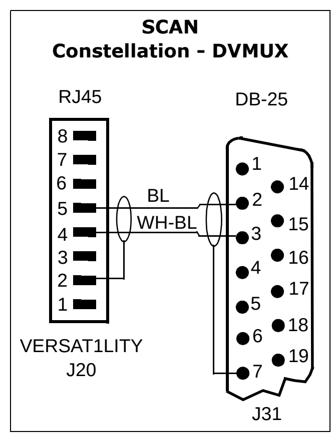
Harris Cable	Length (ft)
087-115610-030	30
087-115610-040	40

Harris Cable	Length (ft)
087-115605-030	30
087-115605-040	40

Figure A-6: Constellation to CAU, DVA Alarm Unit, and DVMUX







Harris Cable	Length (ft)
087-115615-010	10
087-115615-025	25

Harris Cable	Length (ft)
087-115615-010	10
087-115615-025	25

Harris Cable	Length (ft)
087-115625-025	25
087-115625-035	35

Customer Access Areas

External Alarm/Control Connector

Located at the top left side of the radio, this 50-pin D connector (Figure A-8) is available for customer-configured alarms. The SPU Controller provides 8 opto-isolated alarm inputs. The system provides 8 dry-contact, relay outputs as defined in Table A-2. The Service Channel provides the Callout outputs. Table A-1 lists the relay specifications.

Figure A-7: Constellation backplane (top left)

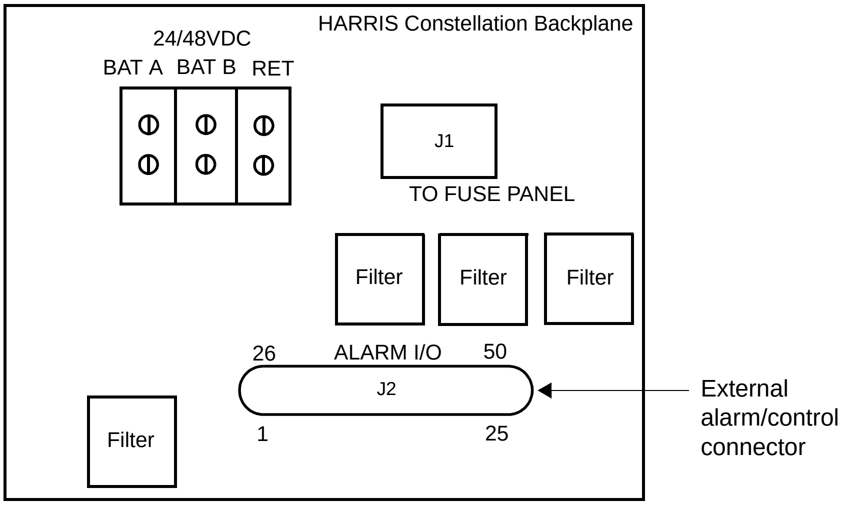


Table A-1: Relay specifications

Characteristic	Value
Nominal switching capacity (resistive)	2 A, 60 Vdc
Max. switching power (resistive)	60 W
Max. switching voltage	220 Vdc
Max. switching current	2 A
Min. switching capability	10 μA, 10 mV dc

WIRING SPECIFICATIONS

Table A-2: Relay outputs

Relay	Function	Definition
1 2	Local Major Local Minor	Default relay outputs. Definable through the Keypad.
3 through 8	Customer-definable output	Definable through the Keypad.
Callout	Callout relay for orderwire	Indicates that a call is being received. The customer can use these outputs for additional call-in detection.
FA	Fuse alarm relay	These outputs can be used for remote fuse alarm indication.

Alarm List for Relay Output

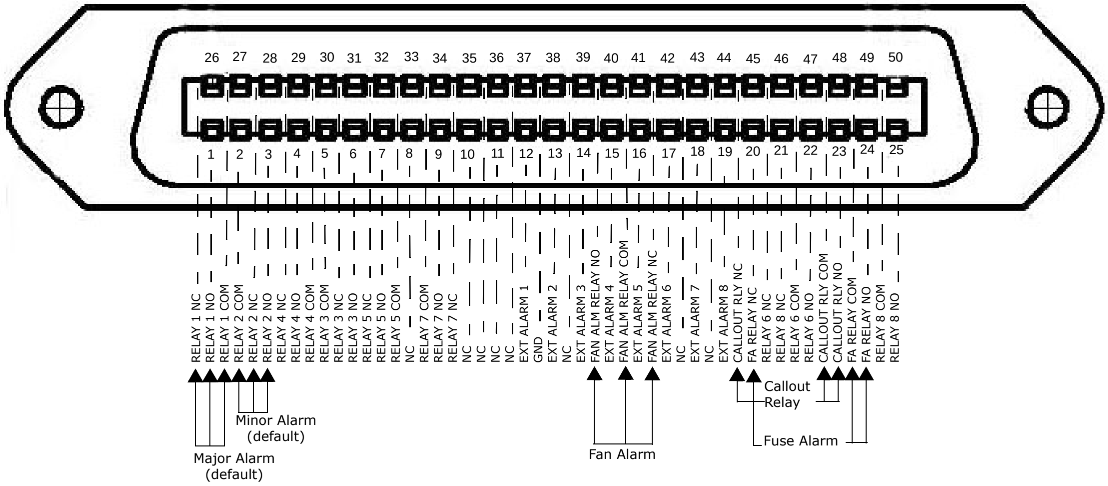
The following radio alarms can be configured through the Keypad.

- Major Alarm
- Minor Alarm
- Input LOS
- Sync Loss A
- Sync Loss B
- Errored Seconds A
- Errored Seconds B
- Signal Degradation A1
- Signal Degradation A2
- Signal Degradation B1
- Signal Degradation B2
- On Line Mod/Tx A
- On Line Mod/Tx B
- On Line Rx A
- On Line Rx B
- On Line HLM
- Manual Control (external site control)

Alarm I/O Pinouts

Figure A-8 shows the Alarm I/O pinouts.

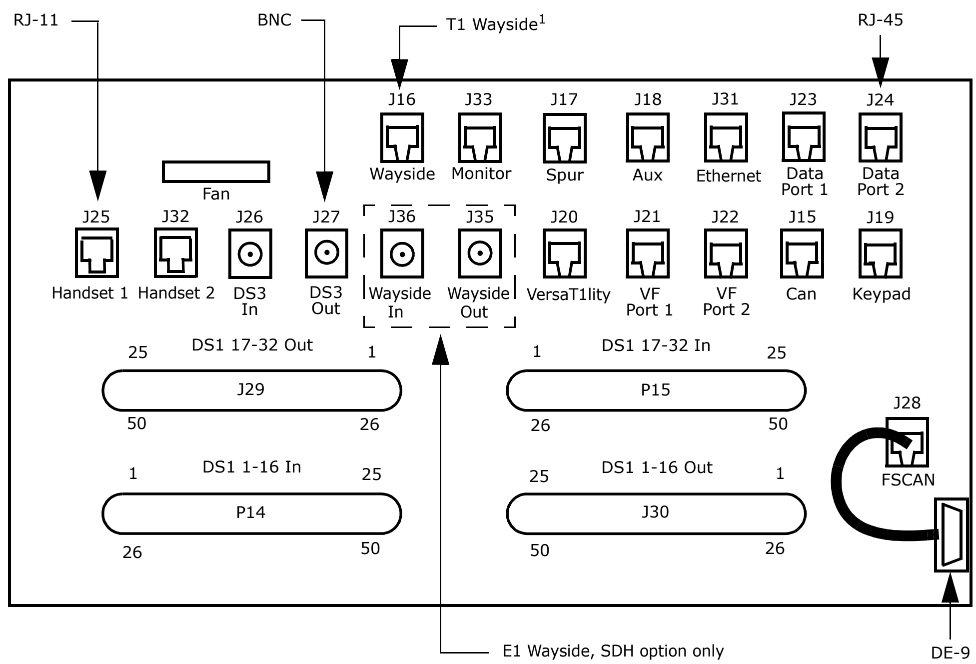
Figure A-8: Alarm I/O pinouts, Telco connector



Access Area for Interconnection Cabling

Located at the bottom right-hand side of the card cage, connectors are available for customer interconnection cables. Refer to Figure A-9 and Table A-3.

Figure A-9: Constellation backplane (bottom right)



Notes:
1. The wayside connection for T1 is not for 1xDS3 or 4xDS3 but only for OC-3, 3xDS3, and 2xDS3 +28xDS1.
2. DS1 In = Input to the radio from the customer's DSX.
3. DS1 Out = Output from the radio to the customer's DSX.

Table A-3: Serial ports

Port	Signal	Baud Rate (kbit/s)	Application	Comments
AUX[a]	RS-422 sync		non-SCAN-compatible	Reserved for interconnecting the Constellation radios
SPUR	RS-422 sync		non-SCAN-compatible	
CAN				Factory use only
ETHERNET[a]	10BASE-T		SNMP	Reserved for StarView
FSCAN	RS-232 async	1.2 to 57.6	FarScan	Use cable 087-112962-025.
KEYPAD	RS-232 async	9.6	8 bits, no parity	Can also be used for PC/VT-100 terminal
MONITOR[b]	RS-232 async	1.2 to 57.6	SCAN-compatible	
VERSAT1LITY[b]	RS-232 async or Inverted RS-423 async	1.2 to 9.6	SCAN-compatible	For interconnecting the Constellation to: • CAU • DVA • DVM • MegaStar • MicroStar

a. *Cannot use both AUX and ETHERNET ports at the same time.*

b. *Monitor and VersaT1lity ports are FARSCAN ports. They pass ONLY FARSCAN and ESCAN download traffic. Their purpose is to connect Constellation to legacy equipment such as Megastar, DVM, DVA, etc. You cannot connect two Constellations using these ports.*

Figure A-10 to Figure A-15 show the pinout specifications of the connectors.

Figure A-10: RJ-45 connector pinouts

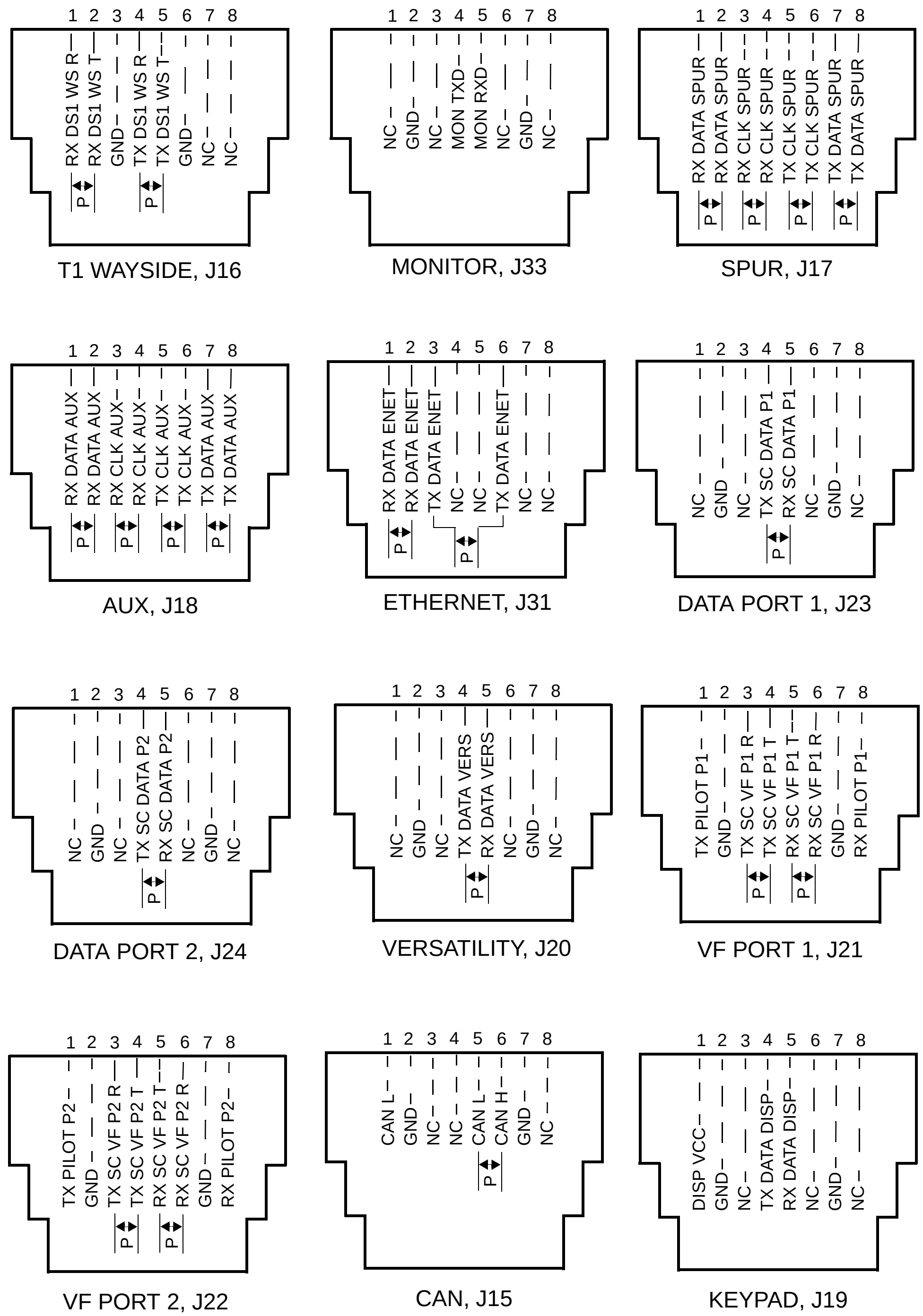
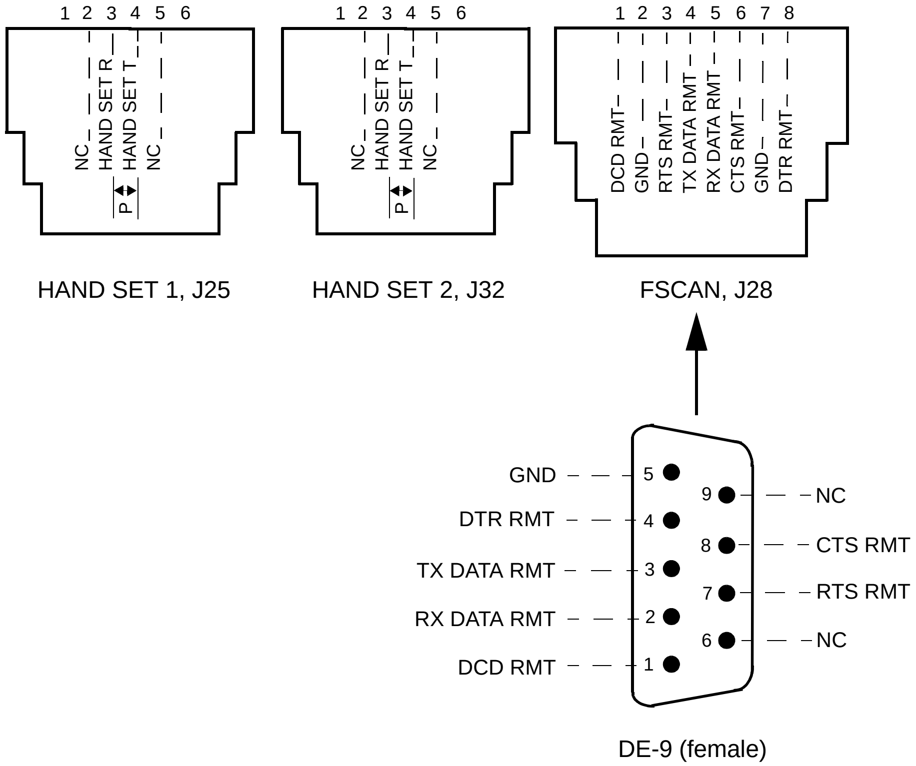


Figure A-11: RJ-11, FSCAN, DE-9, and BNC connector specifications



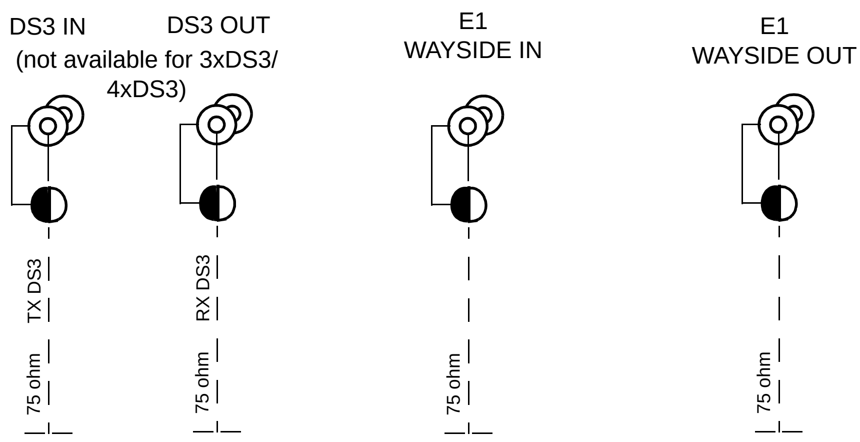


Figure A-12: DS1 1 to 16 In pinouts, P14 (male)

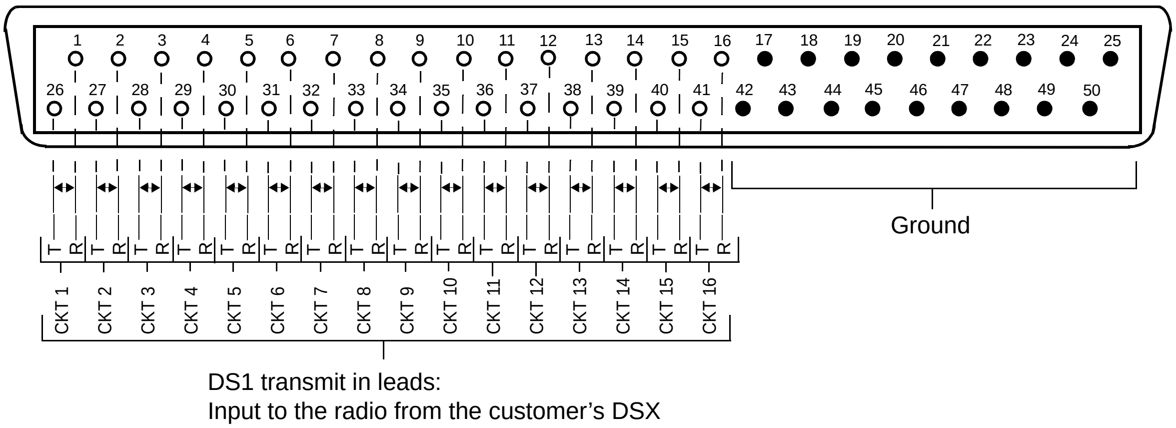


Figure A-13: DS1 1 to 16 out pinouts, J30 (female)

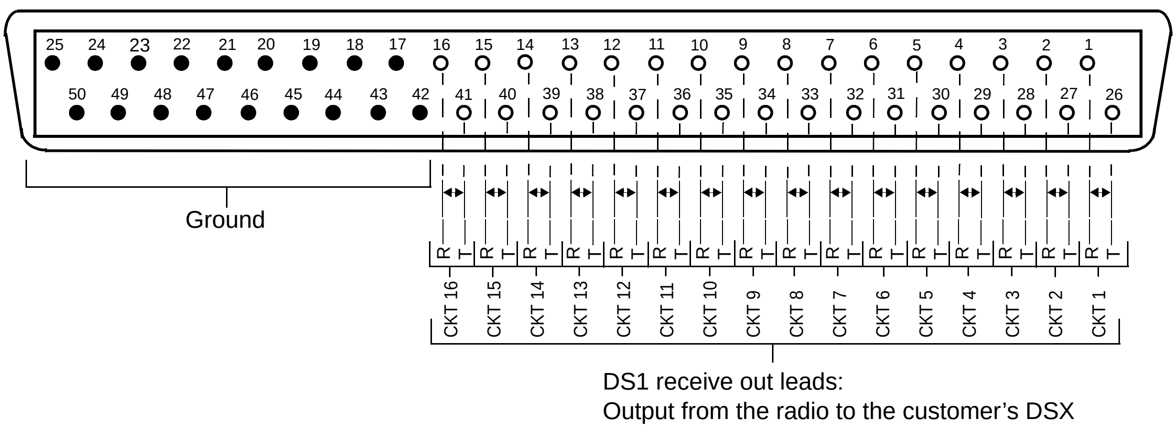


Figure A-14: DS1 17 to 32 out pinouts, J29 (female)

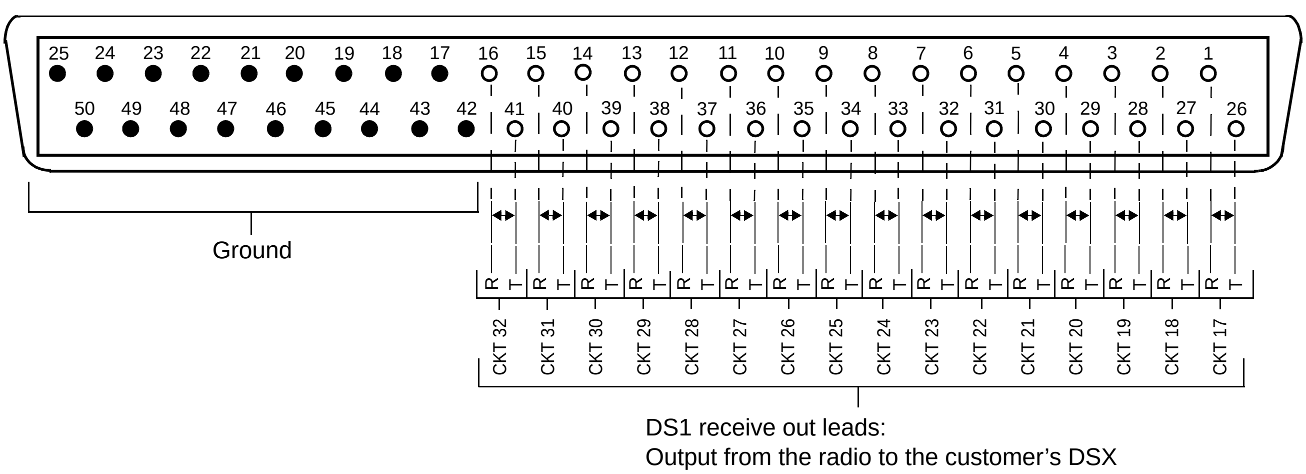
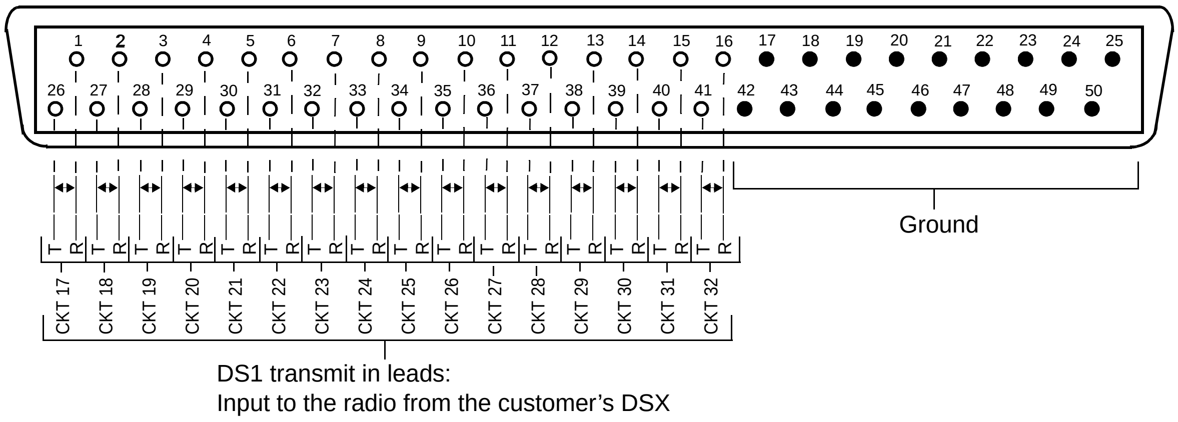


Figure A-15: DS1 17 to 32 in pinouts, P15 (male)

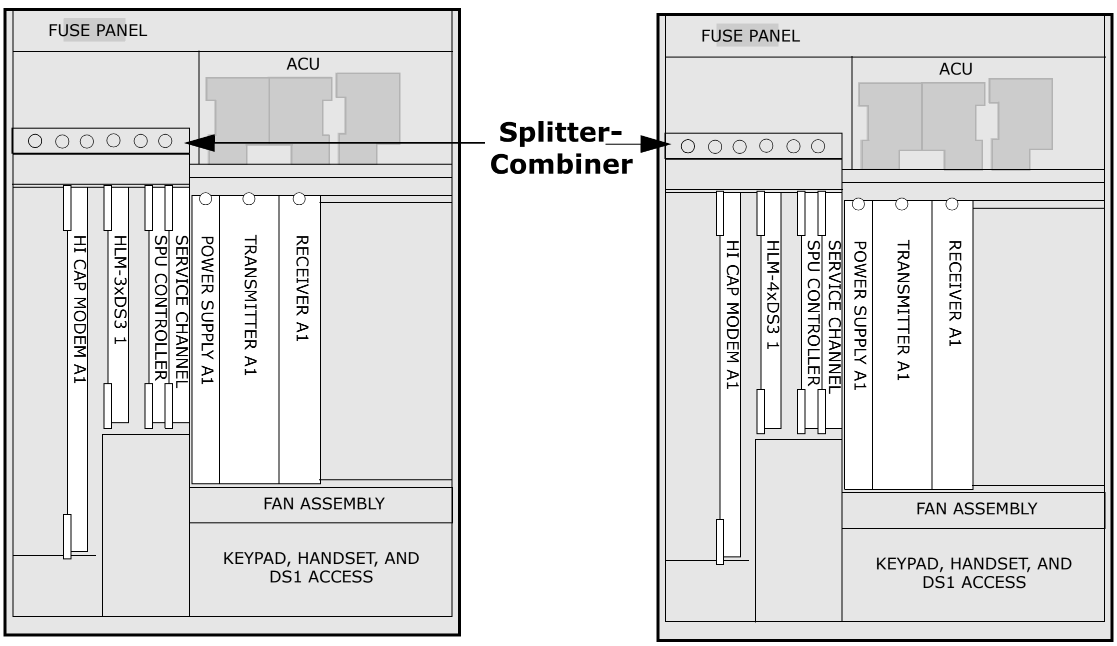


WIRING SPECIFICATIONS

Constellation 155 and 3xDS3/4xDS3 Customer Interface

Splitter Combiner 3xDS3/4xDS3

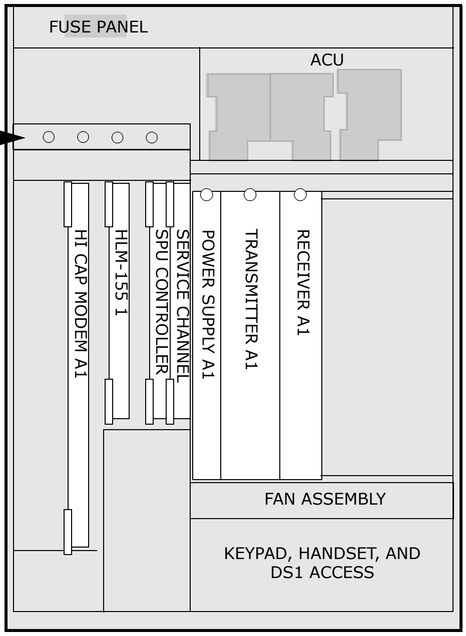
6 BNC connectors, 75 ohm



155 Cable Interconnection Bracket

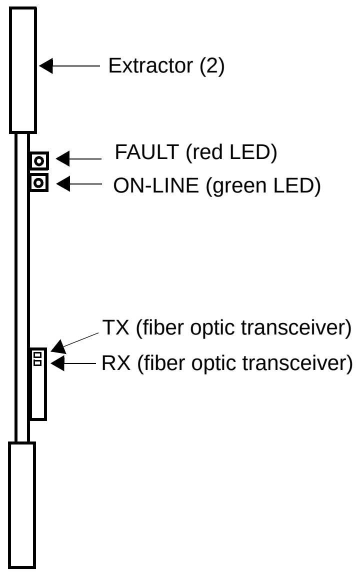
4 BNC connectors, 75 ohm

Cable interconnection bracket



OC-3 Optical Interface

SC connectors: multimode
SC connectors: single mode



HLM-155, OPTICAL

APPENDIX

B

KEYPAD MENU TREE

Introduction

For software updates, refer to the Harris Premier Customer Site:

https://premier.harris.com/microwave/

Keypad or VT-100 Terminal Emulator

Introduction

The keypad is used for:

- Configuration
- Manual switching
- Alarm monitoring

In place of the Keypad, a VT-100 terminal or a PC with a VT-100 terminal emulation software can be used to communicate with the radio.

Cable

A cable (087-115028-001) is required to connect the Keypad to the radio's KEYPAD (RJ-45) serial port. This cable can also be used to connect the radio to the 9-pin serial port on a VT-100 terminal or a PC with emulator.

Setting Up a PC with Emulator

The following is an example of how to set up the PC to communicate with the radio.

From the Windows-based desktop, click on the

Start button and select

Programs
Accessories
Communication or **Hyperterminal**

In the dialog boxes that appear on the screen, type or select the correct information.

In the **Flow control** box, select **None**.

Screen Format

Alphanumeric Display	Size
Keypad	4 lines by 20 columns
VT-100/PC screen	20 lines by 20 columns

Serial Interface

- 9600 bits/s
- 8 bits
- No parity

Pinout Table

Table B-1: Pinouts

Signal	Keypad or VT-100 Terminal Emulator DE-9 (Pin Number)	Constellation Backplane RJ-45 (Pin Number)
No connection	1, 4, 5, 6, 7	3, 6, 8
Tx Data	2	4
Rx Data	3	5
Ground	5	2
Vcc (+5 Vdc)	9	1

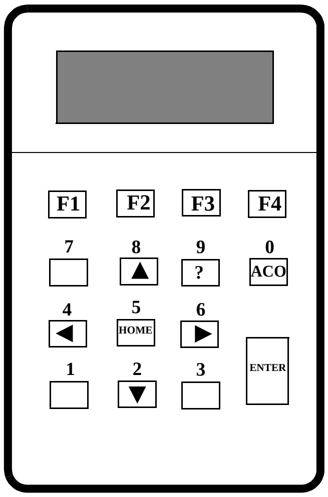
Keypad

Technical Data

Table B-2: Keypad technical data

Measurement	
Dimension	5.5 x 3.38 x 0.75 in.
Weight	0.5 lb
Interface Type	
Interface type	RS-232
Connector	
Connector	DE-9, female

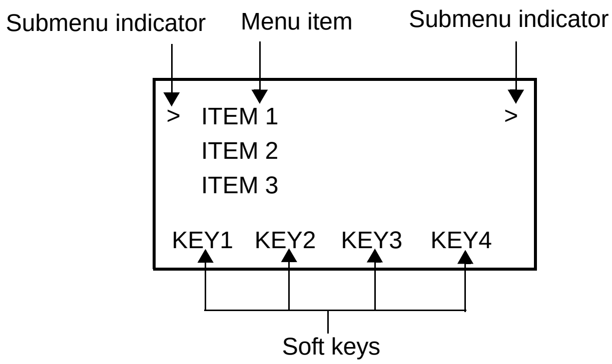
Figure B-1: Keypad layout



Function of the Keys

Keypad	PC	Function
8	↑	Scroll up
2	↓	Scroll down
4	←	Page up
6	→	Page down
5	.	HOME
ENTER	ENTER	Enter a menu or carry out a command
0 to 9	0 to 9	Numeric keys
F1	PF1	Function key 1
F2	PF2	Function key 2
F3	PF3	Function key 3
F4	PF4	Function key 4

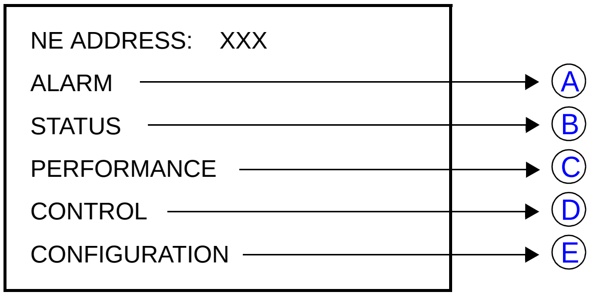
Menu Format



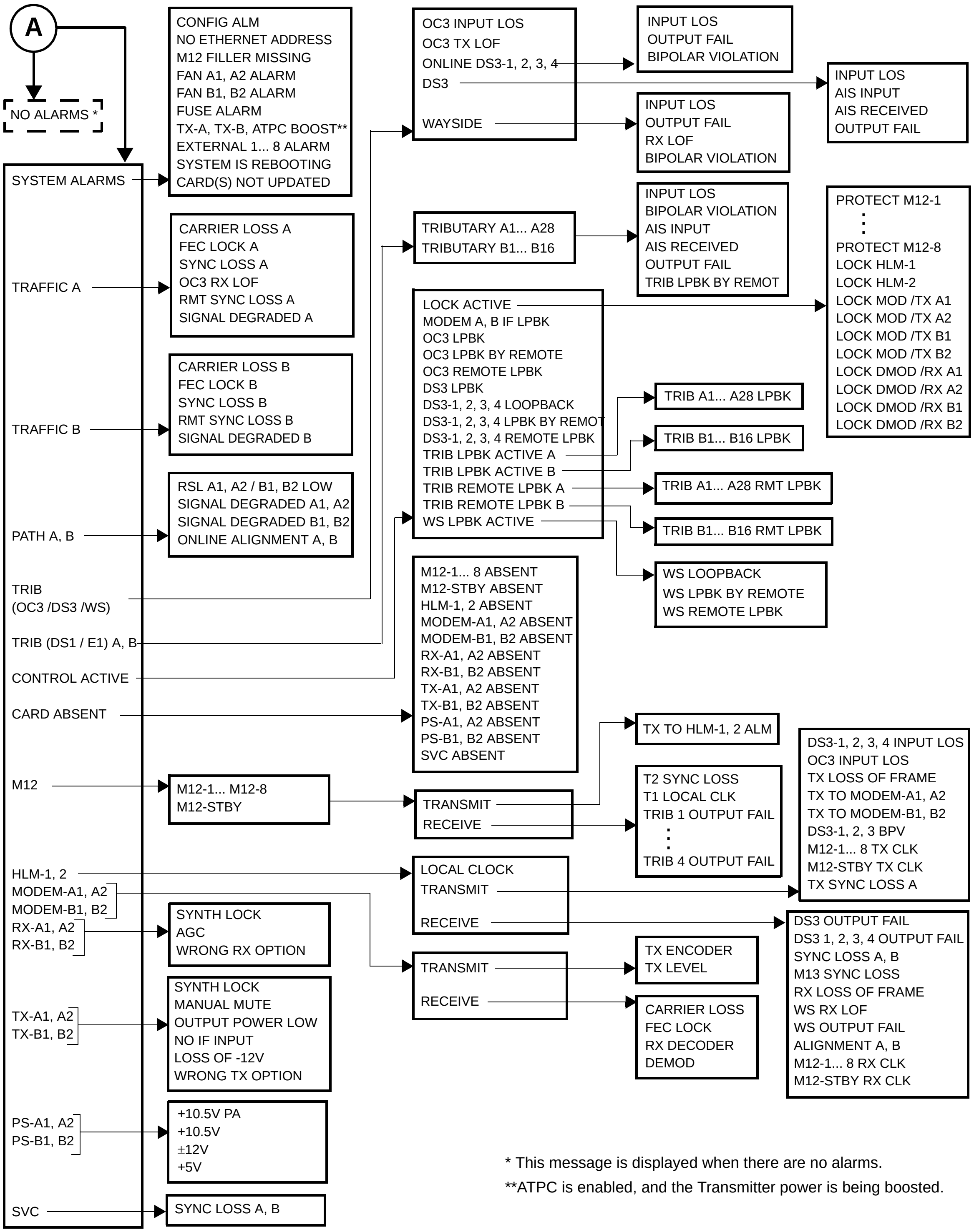
The Menu Tree

The Keypad display depends on the configuration.

Main Menu



Alarm Submenu

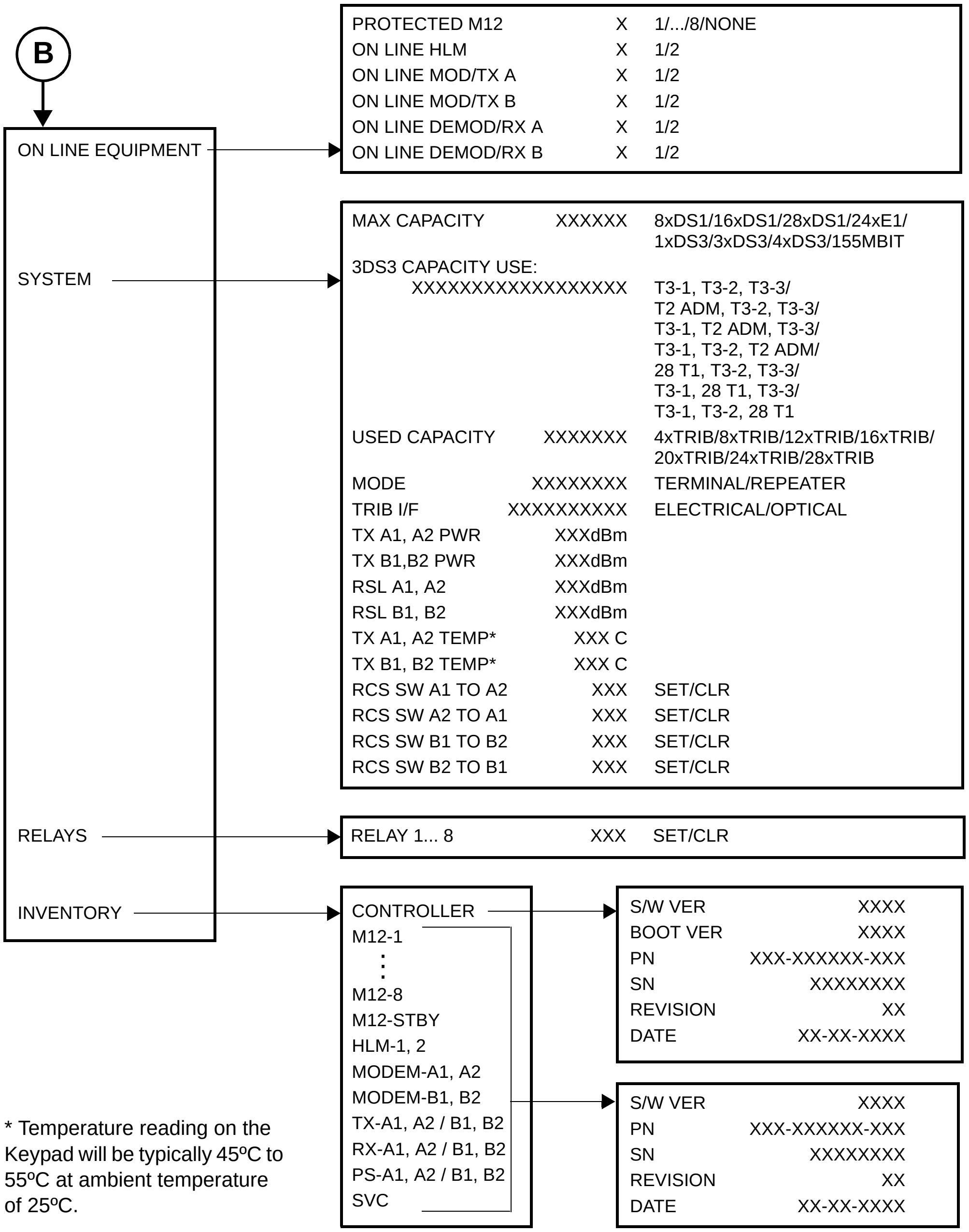


* This message is displayed when there are no alarms.

**ATPC is enabled, and the Transmitter power is being boosted.

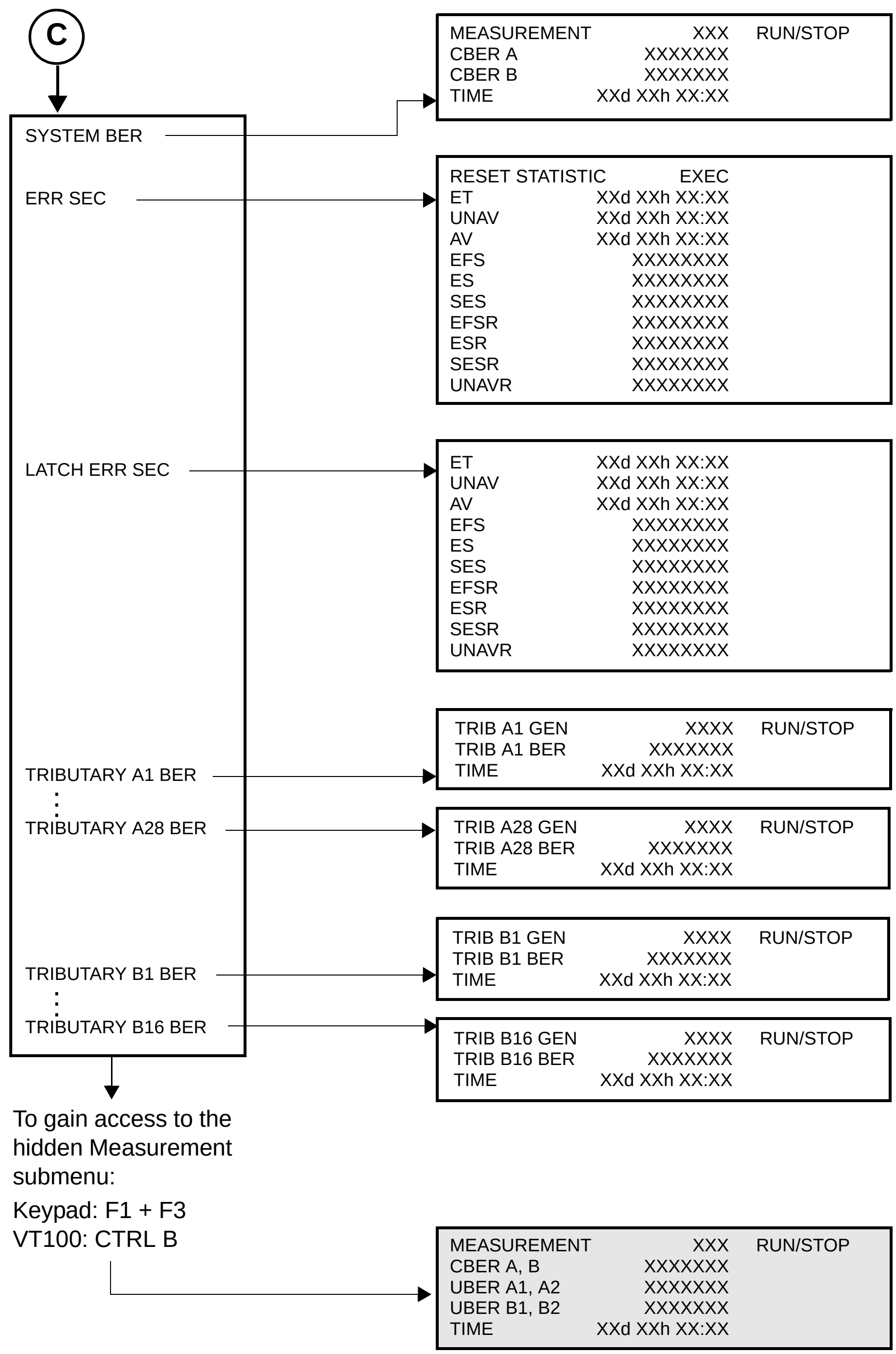
Status Submenu

The values in the Status Submenu cannot be modified.

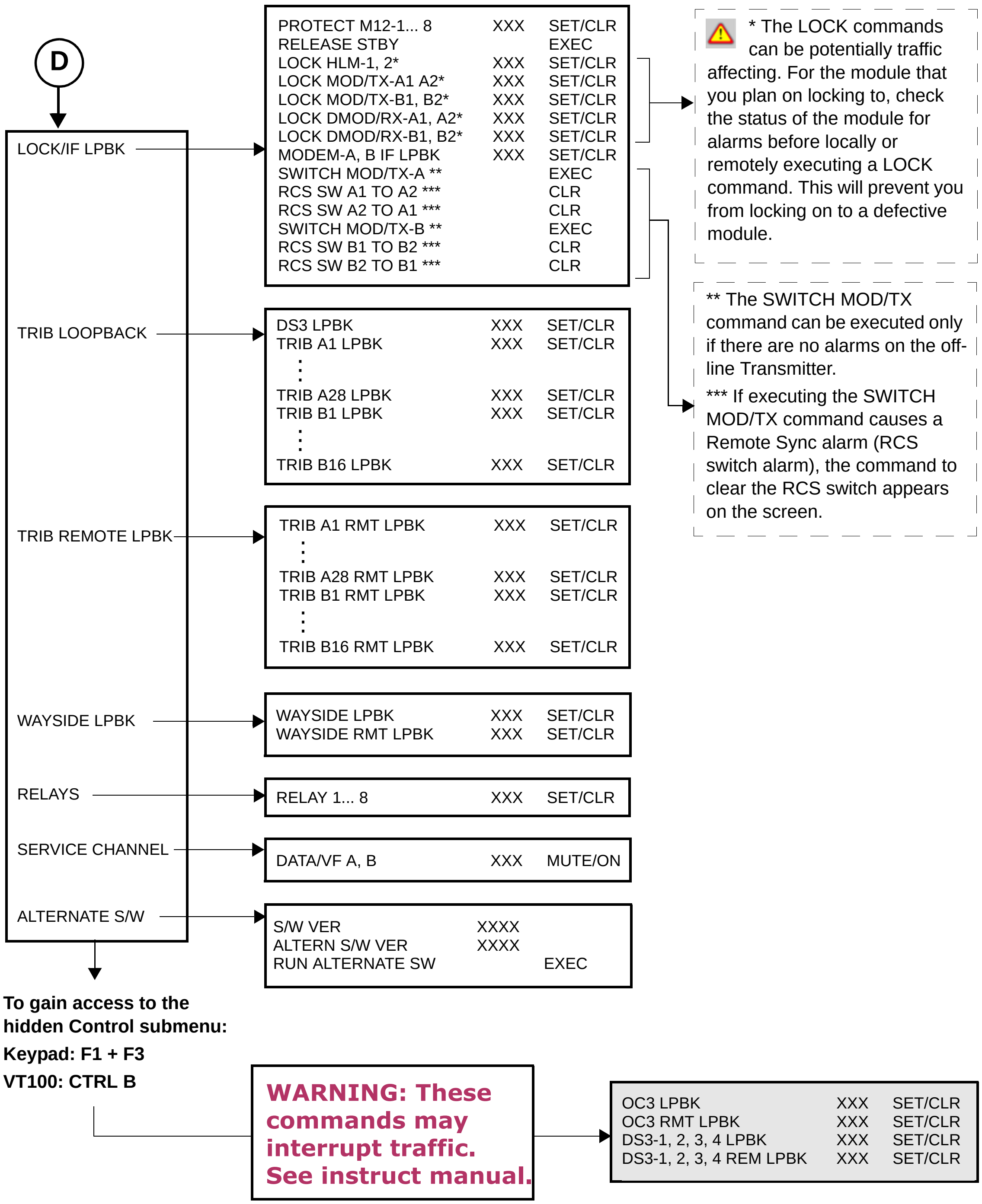


* Temperature reading on the Keypad will be typically 45ºC to 55ºC at ambient temperature of 25ºC.

Performance Submenu



Control Submenu



Configuration Submenu

E

SYSTEM	
ADM	
NETWORK MANAGEMENT	
TRIBUTARIES	
RELAYS	
SERVICE CHANNEL	

SYSTEM

3DS3 CAPACITY USE*	T3-1, T3-2, T3-3/T2 ADM, T3-2, T3-3/ T3-1, T2 ADM, T3-3/ T3-1, T3-2, T2 ADM/28 T1, T3-2, T3-3/ T3-1, 28 T1, T3-3/T3-1, T3-2, 28 T1
USED CAPACITY	4xTRIB/8xTRIB/12xTRIB/16xTRIB/ 20xTRIB/24xTRIB/28xTRIB
PROTECTION A, B	UNPROT/UNPR TX/MHSB/FREQ DIV/ RX&M12/M12 ONLY
HLM PROTECTION	HLM UNPROTECTED/ MAY PROTECT HLM
RCS DELAY (SEC)	0-20 SEC
SYNCHRONIZATION MX	THRU TIMED/SOURCE
STUFFING MODE	M13/C-BIT PARITY
TX A, B, ATPC **	DISABLE HIGH / DISABLE LOW / ENABLE
M12 PROTECTION	NON REV/REVERTIVE
SVC OPTION	INSTALL / UNINSTAL
FAN OPTION	INSTALL / UNINSTAL
PATH A, B ALARMS MENU	HIDE/SHOW
CONFIG ALARM	CLR/SET

ADM

M12-1/5 T2 ADD/DRP	None/T2-1/.../T2-7
M12-1/5 DROP&CONT***	Drop&Cont***/Drop A/Drop B
M12-2/6 T2 ADD/DRP	None/T2-1/.../T2-7
M12-2/6 DROP&CONT***	Drop&Cont***/Drop A/Drop B
M12-3/7 T2 ADD/DRP	None/T2-1/.../T2-7
M12-3/7 DROP&CONT***	Drop&Cont***/Drop A/Drop B
M12-4/8 T2 ADD/DRP	None/T2-1/.../T2-7
M12-4/8 DROP&CONT***	Drop&Cont***/Drop A/Drop B
M12-1... 4 T2 ADD/DRP	None/T2-1/... /T2-7

NETWORK MANAGEMENT

NE ADDRESS	001 … 999
IP ROUTING	
NETCOM OVER ETHERNET	DISABLE/ENABLE
SNMP	→ F
COMM PORT SETTINGS	→
REBOOT SYSTEM	NO/YES

F

IP ROUTING

AUX PORT CONFIG	Netcom/Ethernet/None
NETCOM IP INTERFACE	Disable/Enable
NETCOM IP ADDRESS	xxx.xxx.xxx.xxx
NETCOM IP MASK	xxx.xxx.xxx.xxx
ETHERNET IP INTERFACE	Disable/Enable
ETHERNET IP ADDRESS	xxx.xxx.xxx.xxx
ETHERNET IP MASK	xxx.xxx.xxx.xxx
RIP	Disable/Ver 1/Ver 2/Ver 1&2
RIP ON NETCOM IF	Disable/Enable
RIP ON ETHERNET IF	Disable/Enable
IP ROUTE 1 ADDRESS	xxx.xxx.xxx.xxx
IP ROUTE MASK 1	xxx.xxx.xxx.xxx
NEXT IP ROUTER 1	xxx.xxx.xxx.xxx
⋮	
IP ROUTE 7 ADDRESS	xxx.xxx.xxx.xxx
IP ROUTE MASK 7	xxx.xxx.xxx.xxx
NEXT IP ROUTER 7	xxx.xxx.xxx.xxx

COMM PORT SETTINGS

VERSAT BAUD	1200/2400/4800/9600
VERSAT PARITY	None/Odd/Even
VERSAT DRIVER	RS-232/RS-423
REMOTE BAUD	1200/2400/4800/9600/ 19200/38400/57600
REMOTE PARITY	None/Odd/Even
FARSCAN BAUD	1200/2400/4800/9600/ 19200/38400/57600
FARSCAN PARITY	None/Odd/Even

TRIBUTARIES

ENABLE
CODE
EQUALIZER

ENABLE

DS3-1,2,3,4 INPUT ALARMS	ENABLE/DISABLE
TRIBUTARY A1... A28	ENABLE/DISABLE
TRIBUTARY B1... B16	ENABLE/DISABLE
WAYSIDE	ENABLE/DISABLE

CODE

TRIBUTARY A1 CODE	AMI / B8ZS, HDB3
⋮	
TRIBUTARY A28 CODE	AMI / B8ZS, HDB3
TRIBUTARY B1 CODE	AMI / B8ZS, HDB3
⋮	
TRIBUTARY B16 CODE	AMI / B8ZS, HDB3
WAYSIDE CODE	AMI / B8ZS
WAYSIDE CODE	AMI / B8ZS, HDB3

EQUALIZER

DS3 EQUALIZER	0-120'/120'-450'
DS3 1, 2, 3, 4 EQUALIZER	0-120'/120'-450'
TRIB A1... A28 EQUALIZER TRIB B1... B16 EQUALIZER	0-133'/ 133'-266'/ 266'-399'/ 399'-533'/ 533'-655'/ E1
WAYSIDE EQUALIZER	0-133'/ 133'-266'/ 266'-399'/ 399'-533'/ 533'-655'
WAYSIDE EQUALIZER	T1 0-133'/ T1 133'-266'/ T1 266'-399'/ T1 399'-533'/ T1 533'-655'/ E1 UNBALANCED/ E1 BALANCED

RELAYS

RELAY 1 INPUT ⋮ RELAY 8 INPUT	Manual Control Major Alarm Minor Alarm Input LOS Sync Loss A, B Errored Second A, B Signal Degrad A1, A2, B1, B2 On Line Mod/TX A, B On Line RX A, B On Line HLM

SERVICE CHANNEL

ADDRESS	000-999
MODE	LINEAR / LPMASTER/ LP SLAVE
VF PORT 1 LEVEL	-16dBm/7dBm or 0dBm/0dBm
VF PORT 2 LEVEL	0dBm/0dBm or 7dBm/-16dBm
DATA BRIDGE	ISOLATE/BRIDGE
LOCAL OFF HOOK	DISABLE/ENABLE
EXTERNAL PILOT	DISABLE/ENABLE
DATA PORT A, B BAUD	SAMPLE/9600/19200/38400
DATA PORT A, B PARITY	DISABLE/ENABLE

To gain access to the hidden RF Configuration menu:
Keypad: F1 + F3
VT100: CTRL B

G

** You can select one of the three options:
DISABLE HIGH: Disable ATPC, set Tx at High power.
DISABLE LOW: Disable ATPC, set Tx at Low power.
ENABLE: Enable ATPC.

*** DROP&CONT: Traffic can be dropped from both A and B at the same time.

*The 3DS3 CAPACITY USE submenu is used for the 4DS3 option as well as the 3DS3 option.

SNMP Submenu

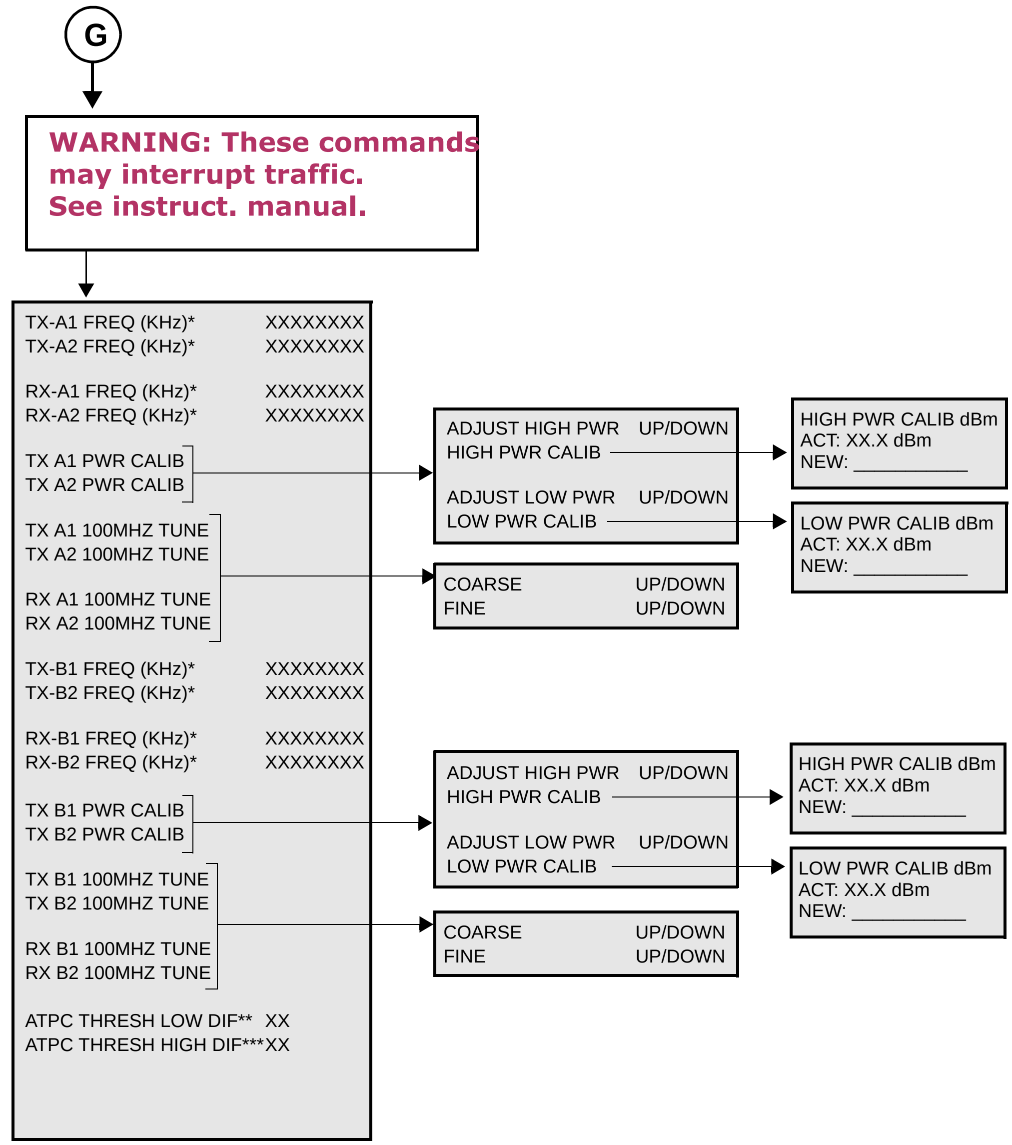
F

MANAGER 1 IP ADDR	xxx.xxx.xxx.xxx
⋮	
MANAGER 10 IP ADDR	xxx.xxx.xxx.xxx
RD/WR COMMUNITY*	Public
RD ONLY COMMUNITY*	Private
TRAP DEST 1 IP ADDR	xxx.xxx.xxx.xxx
⋮	
TRAP DEST 10 IP ADDR	xxx.xxx.xxx.xxx
TRAP TIMEOUT (SEC)	xxx
TRAP REPEAT	xxx
TRAP COMMUNITY	Constellation
DISABLE TRAPS	→

ALL TRAPS	Disable All/CFG Individually
SYSTEM ALARM TRAPS	Enable/Disable
CONF ALM TRAP	Enable/Disable
FUSE TRAP	Enable/Disable
EXTERNAL ALM TRAP	Enable/Disable
ABSENT TRAP	Enable/Disable
MANAGED TRAP	Enable/Disable
PS ALM TRAP	Enable/Disable
TX HIGH PWR ALM TRAP	Enable/Disable
TX MAN MUTE ALM TRAP	Enable/Disable
TX SYNTH TRAP	Enable/Disable
TX ALC TRAP	Enable/Disable
TX FAN ALM TRAP	Enable/Disable
RX RSL ALM TRAP	Enable/Disable
RX SYNTH TRAP	Enable/Disable
RX AGC ALM TRAP	Enable/Disable
ONLINE MDM CARRIER	Enable/Disable
ONLINE MDM FEC LOCK	Enable/Disable
MODEM TX TRAP	Enable/Disable
MODEM RX TRAP	Enable/Disable
MODEM RX EQM TRAP	Enable/Disable
MODEM UBER ALM TRAP	Enable/Disable
HLM RX TRAP	Enable/Disable
HLM SYNC TRAP	Enable/Disable
HLM RX LOF TRAP	Enable/Disable
HLM RX AIS TRAP	Enable/Disable
HLM DS3 OUT TRAP	Enable/Disable
HLM ALIGN TRAP	Enable/Disable
HLM TX TRAP	Enable/Disable
HLM TX LOF TRAP	Enable/Disable
HLM LOS TRAP	Enable/Disable
DS3 LOS ALM TRAP	Enable/Disable
DS3 BPV ALM TRAP	Enable/Disable
M12 MISSING TRAP	Enable/Disable
M12 STBY ONLINE TRAP	Enable/Disable
M12 RX TRAP	Enable/Disable
M12 TX TRAP	Enable/Disable
M12 SYNC TRAP	Enable/Disable
OUT ALM TRAP	Enable/Disable
LOS ALM TRAP	Enable/Disable
BPV ALM TRAP	Enable/Disable
AIS INPUT ALM TRAP	Enable/Disable
RX AIS ALM TRAP	Enable/Disable
RX REM LPBK ALM	Enable/Disable
WAYSIDE ALM TRAP	Enable/Disable
SVC SYNC TRAP	Enable/Disable

* These items are editable only from an SNMP interface such as StarView™ and not from the keypad.

Hidden RF Configuration Submenu



* You must enter exactly 7 digits for the frequency, but for 11 GHz systems, you must enter 8 digits.
** Default: 5 dB.
*** Default: 17 dB.
† This value should be kept at 3.

APPENDIX

C

HARDWARE COMPATIBILITY TABLES

Transmitter Assembly

When replacing a transmitter (Tx) assembly you must be sure that the option number of the Multiplier-Filter (last three digits of the part number) in the replacement Tx is the same as the option number of the Multiplier-Filter in the Tx that it replaces. See "Multiplier-Filter" on page C-4.

Table C-1: History of Released Transmitters (TX) & Compatibility

Tx Frequency	Part Number & Model *Released Sept. 1999*	Part Number & Model *Released Feb. 2001*	Part Number & Model *Released Feb. 2002 to support the High Capacity Option*	Part Number & Model *Released June 2003 to support the High Gain option*
6 GHZ	Legacy model 192-115038-001 / Model 2 Used in Low/Medium capacity radios: 8xDS1/16xDS1/28DS1 and DS3 **Compatibility:** This option replaces models with part # 192-115038-001 / Model 2	193-115038-001 / Model 3 Used in Low/Medium capacity radios: 8xDS1/16xDS1/28DS1 and DS3 **Compatibility:** This option replaces models with part # • 192-115038-001 / Model 2 • 193-115038-001 / Model 3	193-115038-011 / Model 3 Used in High & Low/ Medium capacity radios **Compatibility:** This option replaces models with part # • 193-115038-011 / Model 3 • 193-115038-001 (SPU software 5.0 and above) • 192-115038-001 (SPU software 5.0 and above)	193-115038-111 / Model 3 Used in High Gain radios **Compatibility:** This option replaces models with part # • 193-115038-111 / Model 3 • 193-115038-011 / Model 3[a] • 193-115038-001[a] (SPU software 5.0 and above) • 192-115038-001[a] (SPU software 5.0 and above)
7/8 GHz	Legacy model 192-115038-003 / Model 2 Used in Low/Medium capacity radios: 8xDS1/16xDS1/28DS1 and DS3 **Compatibility:** This option replaces models with part # 192-115038-003 / Model 2	193-115038-003 / Model 3 Used in Low/Medium capacity radios: 8xDS1/16xDS1/28DS1 and DS3 **Compatibility:** This option replaces models with part # • 192-115038-003 / Model 2 • 193-115038-003 / Model 3	193-115038-013 / Model 3 Used in High & Low/ Medium capacity radios **Compatibility:** This option replaces models with part # • 193-115038-013 / Model 3 • 193-115038-003 (SPU software 5.0 and above) • 192-115038-003 (SPU software 5.0 and above)	193-115038-113 / Model 3 Used in High Gain radios **Compatibility:** This option replaces models with part # • 193-115038-113 / Model 3 • 193-115038-013 / Model 3[a] • 193-115038-003[a] (SPU software 5.0 and above) • 192-115038-003[a] (SPU software 5.0 and above)
10/11 GHz	Legacy model 192-115038-002 / Model 2 Used in Low/Medium capacity radios: 8xDS1/16xDS1/28DS1 and DS3 **Compatibility:** This option replaces models with part # 192-115038-002 / Model 2	193-115038-002 / Model 3 Used in Low/Medium capacity radios: 8xDS1/16xDS1/28DS1 and DS3 **Compatibility:** This option replaces models with part # • 192-115038-002 / Model 2 • 193-115038-002 / Model 3	193-115038-012 / Model 3 Used in High & Low/ Medium capacity radios **Compatibility:** This option replaces models with part # • 193-115038-012 / Model 3 • 193-115038-002 (SPU software 5.0 and above) • 192-115038-002 (SPU software 5.0 and above)	193-115038-112 / Model 3 Used in High Gain radios **Compatibility:** This option replaces models with part # • 193-115038-112 / Model 3 • 193-115038-012 / Model 3[a] • 193-115038-002[a] (SPU software 5.0 and above) • 192-115038-002[a] (SPU software 5.0 and above)

a. *The High Gain option can be used as a spare for standard system gain; however, the output power should be reduced.*

Receiver Assembly

When replacing a receiver (Rx) assembly you must be sure that the option numbers (last three digits of the part numbers) of the Multiplier-Filter and the IF Filter in the replacement Rx are the same as the option numbers of the Multiplier-Filter and IF Filter in the Rx that it replaces. See "Multiplier-Filter" on page C-4 and "IF Filter" on page C-4.

Table C-2: History of Released Receivers and Compatibility

Rx Frequency	Part Number & Model *Released Sept. 1999*	Part Number & Model *Released Feb. 2001*	Part Number & Model *Released Feb. 2002 to support the High Capacity option*
6 GHz	192-115039-001 / Model 2 Used in Low/Medium capacity radios: 8xDS1/ 16xDS1/28xDS1 and DS3 Compatibility: This option replaces models with part # 192-115039-001 / Model 2.	193-115039-001 / Model 3 Used in Low/Medium capacity radios: 8xDS1/ 16xDS1/28xDS1 and DS3 Compatibility: This option replaces models with the following part # • 192-115039-001 / Model 2 • 193-115039-001 / Model 3	193-115039-011 / Model 3 Used in High capacity radios Compatibility: This option replaces models with the following part #: • 193-115039-011 / Model 3 • 193-115039-001 / Model 3[a] • 192-115039-003 / Model 2[a]
7/8 GHz	192-115039-003 / Model 2 Used in Low/Medium capacity radios: 8xDS1/ 16xDS1/28xDS1 and DS3 Compatibility: This option replaces models with part # 192-115039-003 / Model 2.	193-115039-001 / Model 3 Used in Low/Medium capacity radios: 8xDS1/ 16xDS1/28xDS1 and DS3 Compatibility: This option replaces models with the following part # • 192-115039-001 / Model 2 193-115039-001 / Model 3	193-115039-013 / Model 3 Used in High capacity radios Compatibility: This option replaces models with the following part #: • 193-115039-013 / Model 3 • 193-115039-003 / Model 3[a] • 192-115039-003 / Model 2[a]
10/11 GHz	192-115039-002 / Model 2 Used in Low/Medium capacity radios: 8xDS1/ 16xDS1/28xDS1 and DS3 Compatibility: This option replaces models with part # 192-115039-002 / Model 2.	193-115039-001 / Model 3 Used in Low/Medium capacity radios: 8xDS1/ 16xDS1/28xDS1 and DS3 Compatibility: This option replaces models with the following part # • 192-115039-001 / Model 2 193-115039-001 / Model 3	193-115039-012 / Model 3 Used in High capacity radios Compatibility: This option replaces models with the following part #: • 193-115039-012 / Model 3 • 193-115039-002 / Model 3[a] • 192-115039-002 / Model 2[a]

a. *If you replace your Rx with one of these models, the RSL value shown in the keypad will be ~2.55 dB higher than the actual RSL (actual RSL does not change). The trigger point for the low RSL alarm also will be off (late) by ~2.55 dB. A future software release will correct the RSL reading and alarm trigger point.*

HARDWARE COMPATIBILITY TABLES

IF Filter

The IF Filter is a component located inside the Rx assembly. See Figure 11-17.

Table C-3: History of Released IF Filters & Compatibility

Filter	Part Number & Model	Compatibility
IF Filter Used on Rx assembly	101-115254-xxx / Model 1 • Option 001, 3.75 & 5 MHz for 8xDS1 and 16xDS1 capacity radio • Option 002, 10 MHz for 28DS1/DS3 capacity radio • Option 004, 30 MHz for 155 Mb or 4xDS3 capacity radio	When replacing filters the spare unit must have the same part and option number as the one that is being replaced.

When replacing a receiver (Rx) assembly you must check the Multiplier-Filter and IF Filter option numbers (last three digits in the part number). These numbers must be the same for the original and the replacement.

Multiplier-Filter

The Multiplier-Filter is a component located inside the Tx and Rx assemblies. See Figure 11-17.

Table C-4: Multiplier-Filter Options

Option	Multiplier-Filter Frequency (MHz)	TX or RX Frequency (MHz)	TX or RX Frequency (MHz)
101	8100	5800 < 5900	10300 < 10400
001	8200	5900 < 6000	10400 < 10500
002	8300	6000 < 6100	10500 < 10600
003	8400	6100 < 6200	10600 < 10700
004	8500	6200 < 6300	10700 < 10800
005	8600	6300 < 6400	10800 < 10900
006	8700	6400 < 6500	10900 < 11000
007	8800	6500 < 6600	11000 < 11100
008	8900	6600 < 6700	11100 < 11200

Table C-4: Multiplier-Filter Options (continued)

Option	Multiplier-Filter Frequency (MHz)	TX or RX Frequency (MHz)	TX or RX Frequency (MHz)
009	9000	6700 < 6800	11200 < 11300
010	9100	6800 < 6900	11300 < 11400
011	9200	6900 < 7000	11400 < 11500
012	9300	7000 < 7100	11500 < 11600
013	9400		11600 < 11700
113	9400	7100 < 7200	
014	9500	7200 < 7300	
015	9600	7300 < 7400	
016	9700	7400 < 7500	
017	9800	7500 < 7600	
018	9900	7600 < 7700	
019	10000	7700 < 7800	
020	10100	7800 < 7900	
021	10200	7900 < 8000	
022	10300	8000 < 8100	
023	10400	8100 < 8200	
024	10500	8200 < 8300	
025	10600	8300 < 8400	
026	10700	8400 < 8500	

When replacing a receiver (Rx) assembly you must check the Multiplier-Filter and IF Filter option numbers (last three digits in the part number). These numbers must be the same for the original and the replacement.

LO MON Frequency Calculation

Calculate the LO MON frequency as follows.

1. First, find the difference between the TX Frequency and the Multiplier Frequency.
2. Then subtract 140 MHz from the difference to arrive at the LO MON frequency.

7/8 GHz Example:

Multiplier Frequency = 9800.000 MHz
Transmit Frequency = 7561.500 MHz
Difference = 2238.500 MHz
Subtract –140.000 MHz
LO MON Frequency = 2098.500 MHz

11 GHz Example:

Transmit Frequency = 11192.500 MHz
Multiplier Frequency = 8900.000 MHz
Difference = 2292.500 MHz
Subtract –140.000 MHz
LO MON Frequency = 2152.500 MHz

The LO MON frequency is always between 2060 and 2160 MHz.

Modem Assembly

The new modem is only forward compatible. Across a HOP, a “like” modem must face a “like” modem. A “near end” legacy modem cannot face a “far end” new modem and vice versa. The legacy and new modems are compatible end-to-end in a multi-hop system. A multi-hop system can use both new and legacy modems as long as “like” modems face “like” modems across any HOP in the system. New modems can be used in all previously shipped Constellation radios.

Table C-5: History of Released Modems & Compatibility

Modem Type	Part Number & Model	Compatibility
Modem	101-115540-xxx / Model 1 Used with the High capacity radio: 155 or 3xDS3 • Option 001 for 155 or 3xDS3 or 2xDS3+28DS1 • Option 002 for 16 T1 High Gain • Option 003 for 28 T1 or 1DS3 High Gain • Option 004 for 4xDS3 (High or Standard Gain)	This unit only replaces modems with part # 101-115540-xxx where xxx is the option number. **Caution**: It cannot replace a modem (101-115072-xxx) or a cable modem (101-115430-xxx). The modems from the local and far end radio must match; they must have the same part and option numbers.
Cable Modem	101-115530-xxx / Model 1 Used in Low/Medium capacity radios: 8xDS1, 16xDS1, 28xDS1 and DS3 • Option 001 for 8xDS1 • Option 002 for 16xDS1 • Option 003 for 28xDS1 or 1DS3	This unit only replaces modems with part # 101-115530-xxx where xxx is the option number. When replacing modules, the spare unit must have the same option # as the one that is being replaced. **Caution**: It cannot replace a modem (101-115072-xxx) or a high capacity modem (101-115540-xxx). The modems from the local and far end radio must match; they must have the same part and option numbers.
Modem Legacy	101-115072-xxx / Model 1 Used in Low/Medium capacity radios: 8xDS1, 16xDS1, 28xDS1 and DS3 • Option 001 for 8xDS1 • Option 002 for 16xDS1 • Option 003 for 28xDS1 or 1DS3	This unit only replaces modems with part # 101-115072-xxx where xxx is the option number. When replacing modules, the spare unit must have the same option # as the one that is being replaced. **Caution**: It cannot replace a cable modem (101-115430-xxx) or a high capacity modem (101-115540-xxx). The modems from the local and far end radio must match; they must have the same part and option numbers.

High Level Mux (HLM) Assembly

Table C-6: History of Released High Level Mux & Compatibility

HLM Type	Part Number & Model	Compatibility
HLM High Capacity (4xDS3 or 3xDS3+28xDS1)	101-115489-001 Used in 4xDS3 or 3xDS3+28xDS1 High capacity configuration	This unit only replaces models with the following part #: • 101-115489-001
HLM High Capacity (3xDS3 or 2xDS3+28xDS1)	101-115429-001 Used in 3xDS3 or 2xDS3+28xDS1 High capacity configuration	This unit only replaces models with the following part #: • 101-115429-001
HLM High Capacity (155)	101-115450-xxx / Model 1 102-115450-xxx / Model 2 *Note: Model 2 was released shortly after Model 1. Both models have the same capabilities and functionalities; they are compatible with each other. Model 2 has some electronic components that differ from Model 1.* Used in 155 High capacity configurations - xxx is the option number Option 001 Electrical 155 Option 002 Fiber multi mode 155 Option 003 Fiber single mode 155	These two High Level Muxes, Model 1 and 2 are interchangeable. A HLM with part # 101-115450-xxx can replace a HLM with part # 102-115450-xxx and vice versa. ***Caution:*** *When replacing modules, the spare unit must have the same option # as the one that is being replaced.*
HLM Low/Medium Capacity	Used in Low/Medium capacity radios: 8xDS1, 16XDS1, 28xDS1 and DS3. 101-115071-xxx used in a terminal configuration. Terminal options: Option 001 HLM 8xDS1 Option 003 HLM 16xDS1 Option 005 HLM 28xDS1 Option 007 HLM DS3 102-115071-xxx used in a repeater configuration. Repeater options: Option 002 HLM 8xDS1 Option 004 HLM 16xDS1 Option 006 HLM 28xDS1 103-115071-xxx supports both configurations for terminal and repeater. Terminal options: Option 001 HLM 8xDS1 Option 003 HLM 16xDS1 Option 005 HLM 28xDS1 Option 007 HLM DS3 Repeater options: Option 002 HLM 8xDS1 Option 004 HLM 16xDS1 Option 006 HLM 28xDS1	A Model 2 (part # 102-115071-xxx) cannot replace Model 1 (part # 101-115071-xxx). This is not possible because Model 1 supports the terminal options and Model 2 supports the repeater options. The new HLM model 103-115071-xxx could replace a Model 1 with part # 101-115071-xxx or a Model 2 with part # 102-115071-xxx as long as they have the same option number (the last three digits of the part #). The new HLM Model 3 supports both options for the terminal and repeater. A HLM Model 1 or 2 can be used instead of a Model 3 if they have the same option numbers (the last three digits of the part #). ***Caution:*** *When replacing modules, the spare unit must have the same option # as the one that is being replaced.*

DC-DC Power Supply Assembly

Table C-7: History of Released Power Supplies & Compatibility

Power Supply Type	Part Number & Model	Compatibility
DC-DC Power Supply Model 2 **LATEST**	102-115346-001 / Model 2 Used for 18-60 Vdc. Wide mouth, auto polarity. Model 2, provides improved EMI performance.	This unit can replace modules with the following part #: • 101-115337-001 • 101-115346-001 • 102-115346-001 Model 2
DC-DC Power Supply Model 1	101-115346-001 / Model 1 Used for 18-60 Vdc. Wide mouth, auto polarity.	This unit replaces modules with the following part #: • 101-115337-001 • 101-115346-001 Model 1 ***Note**: This unit can replace the latest power supply 102-115346-001 Model 2*
DC-DC Power Supply Model 1 (early version) **LEGACY**	101-115337-001 / Model 1 Used for 18-60 Vdc. Wide mouth, auto polarity.	This unit only replaces modules with part # 101-115337-001.

APPENDIX

D

SERVICE CHANNEL

Loop System

The Constellation Service Channel is capable of operating as a repeater or a terminal in a linear system or providing protection in a single or multiple loop system.

The Service Channel can be set up in the following ways.

- Linear or loop system
- Master or slave (for loop system only)
- External pilot on or off (for slave loop system only)
- Local off-hook, enable or disable

The Service Channel in a loop system must always have one break in the loop to prevent the data from propagating in a continuous loop. This break is always done at the Master site in the A direction. Whenever a system failure occurs that causes another break in the loop, the Master site must know about this failure so it can remove its break. The pilot signal communicates this information to the Master site. As long as there is only one break in the loop, all system sites will have communication. All Service Channel loop systems, even in multitude loops, work on this principle.

Loop System Configurations

Single Loop System Using Repeaters

Single Loop System Using Repeaters (Figure D-1) shows the Service Channel's settings. Note that the Service Channel setting does not always correspond to the radio or multiplexer system settings. However, in this case, it does.

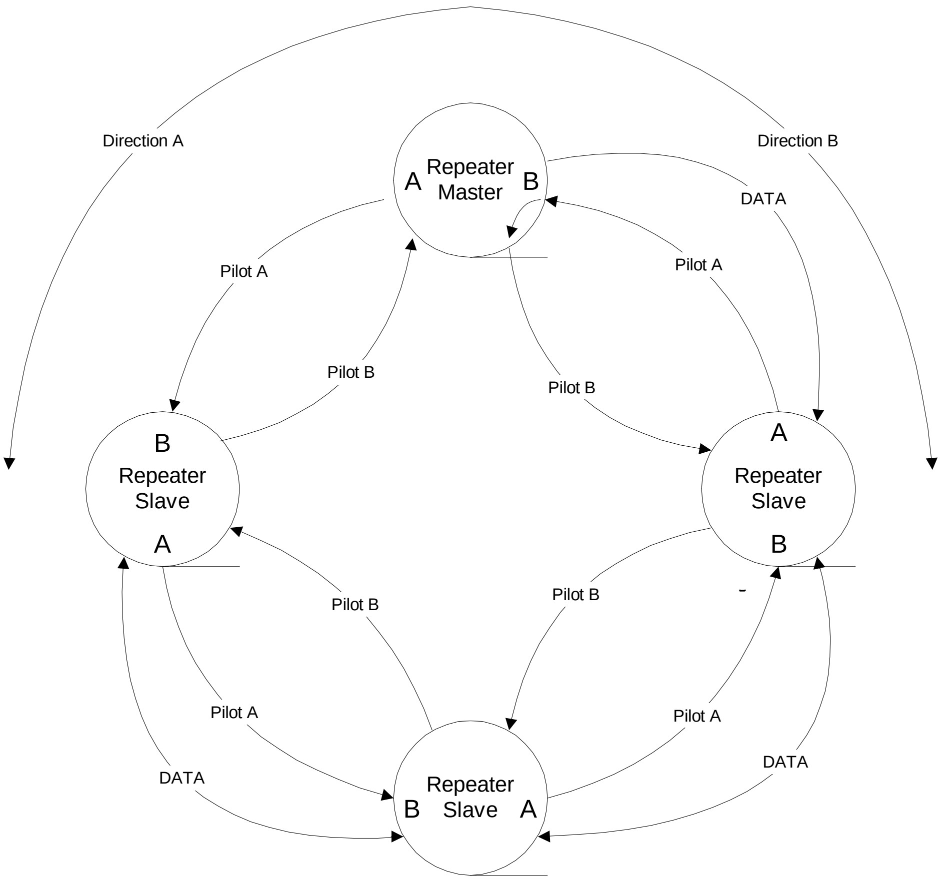
To explain how this system works, a pilot A signal is generated from the Master Repeater A site. The pilot signal propagates through three other Slave Repeater Service Channels where it is received back at the Master Repeater B. The pilot is looped and sent back to Master Repeater A where it is detected.

When the pilot is detected, the data is prevented from being transmitted or received at Master Repeater A. This process causes a break in the loop which is necessary under normal conditions.

However, if the pilot is not detected because of a system failure, a second break in the loop is created. The data at Master Repeater A is now allowed to transmit and receive by removing the original break.

When a sync alarm occurs in one direction, the Service Channel prevents data from being transmitted or received in that direction.

Figure D-1: Single loop system using repeaters

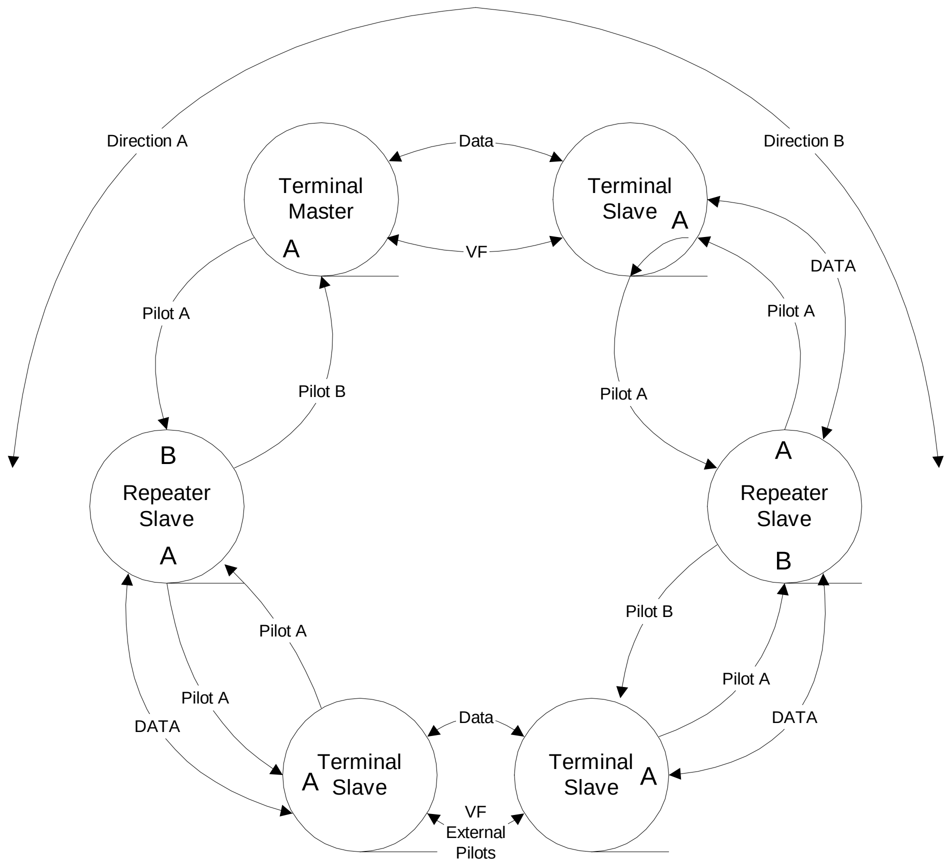


Single Loop System with Two Terminals at Repeater Site

Single Loop System with Two Terminals at Repeater Site (Figure D-2) shows a loop system but with two of the system sites having Service Channel Terminals. The same principle of operation applies here as discussed previously. However, the setup is different. An external cable is needed to link the VF and pilot signals between the two Slave Terminals which must enable their External Pilot.

SERVICE CHANNEL

Figure D-2: Single loop system with two terminals at repeater site



Multiple Loop System, a Loop within a Loop

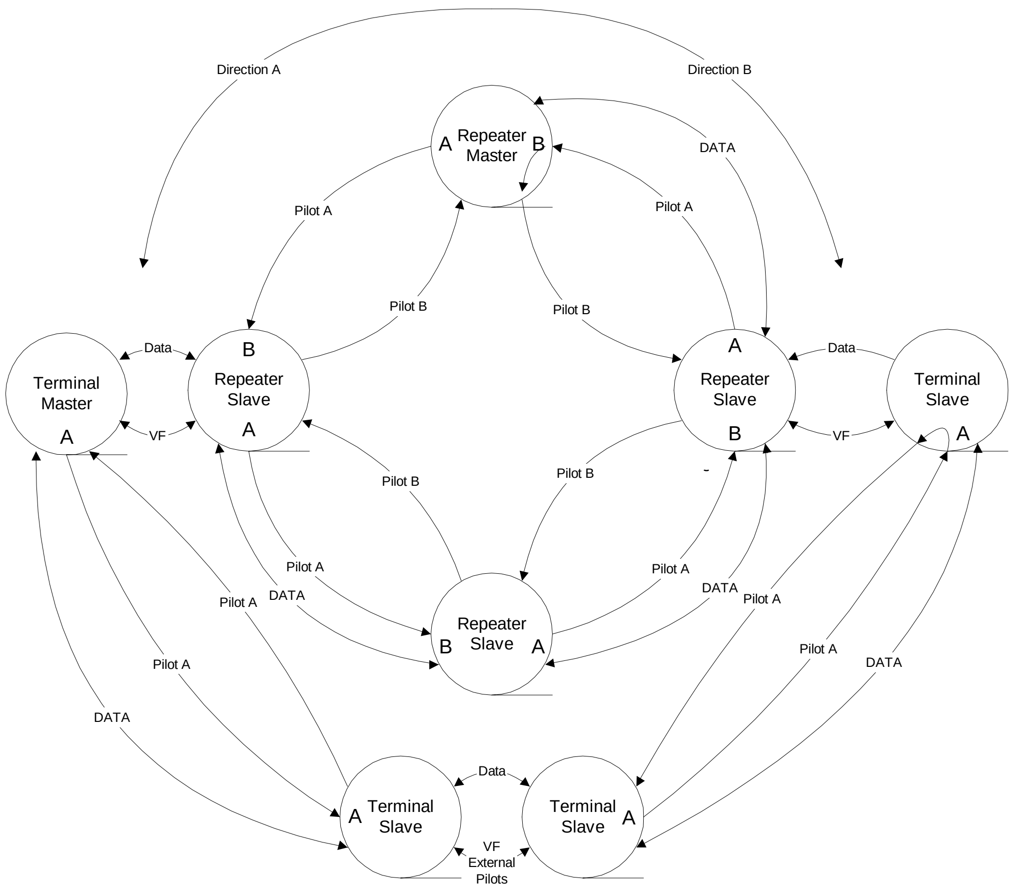
Multiple Loop System, a Loop within a Loop (Figure D-3) shows a loop system within a loop system. The inner loop is the same loop as discussed in the first loop system (Single Loop System Using Repeaters), and its operation is identical. The second loop is made up of a Master Terminal and three Slave Terminals and looks like a linear system that is connected to the main loop.

The outer loop operates as follows. The Master Terminal generates a pilot so that it can propagate through two Slave Terminals and to the third Slave Terminal where it is looped back and returned to the Master Terminal. If the pilot is detected, the Master Terminal does not transmit or receive any data.

The cables that connect the VF and Data between the Master Terminal and the Slave Repeater allow communication between the two systems. Any data that is received at the third Slave Terminal on the outer loop is passed through the cables that are connected to the Slave Repeater of the inner loop.

If the pilot is not detected at the Master Terminal because of a break in the outer loop, data is allowed to transmit and be received at the Master Terminal. Note that the two Slave Terminals of the outer loop must have the External Pilot option enabled to allow the pilots to propagate between them.

Figure D-3: Multiple loop system, a loop within a loop

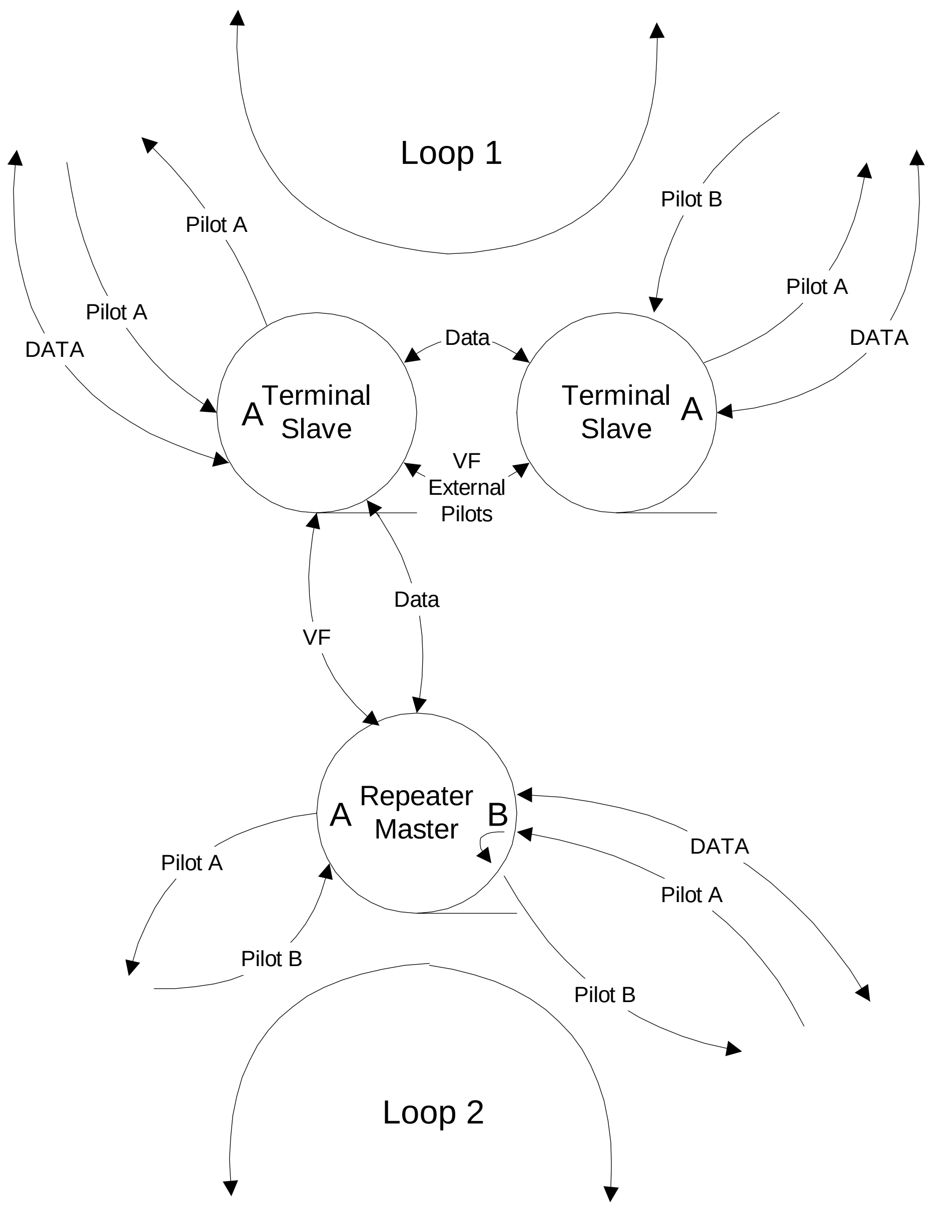


Two Separate Loop Systems

Example A

Two Separate Loop Systems, Example A (Figure D-4) shows two loop systems connected together by two cables. The two loop systems operate independently and identical as previously discussed. Note that both Slave Terminals in Loop 1 must have the External Pilots enabled.

Figure D-4: Two separate loop systems, Example A



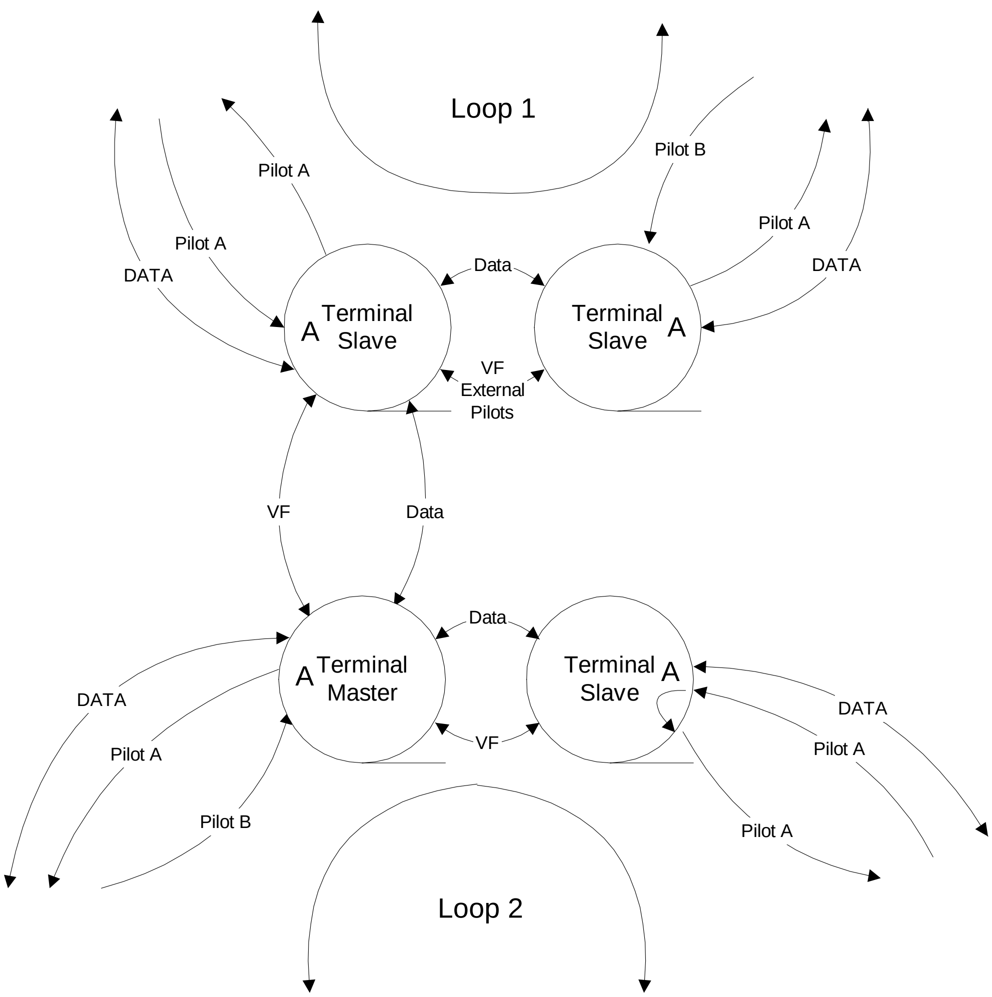
Example B

Two Separate Loop Systems, Example B (Figure D-5) is the same as Example A. However, the VF and data signals are connected between a Slave Terminal and a Master Terminal each in its own loop. The system operation is identical as previously mentioned.

It is important to know not to connect two Slave Terminals with their External Pilot enabled if each Terminal is from a separate loop. Connecting the pilot signal from one loop to the pilot signal of the other loop is forbidden.

Note that at no time should a Master site have its External Pilot enabled. This process is forbidden and will not allow the Service Channel to work properly.

Figure D-5: Two separate loop systems, Example B



SERVICE CHANNEL

Customer Setup

Set the Service Channel for Loop Master or Loop Slave. There can be only one Master system in a Loop System, but there must be at least one. Each loop in a multiple Loop System must have a Master.

Enable External Pilot for back-to-back Loop Slave terminal so that the pilot signal passes between two terminals.

Enable Local Off-Hook if an external VF signal is applied to a VF port or if the repeater timing is set to Source in a loop system.

GLOSSARY

A

ACU Antenna Coupling Unit.

A/D Analog to Digital.

ADM Add-Drop Multiplexer.

AGC Automatic Gain Control; automatic gain adjustment of a varying input signal level to produce a constant output signal level.

AIS Alarm Indication Signal.

ALC Automatic Level Control.

AMI Alternate Mark Inversion.

ANSI American National Standards Institute.

AUX Auxiliary port.

B

B8ZS Bipolar with Eight Zero Substitution.

baseband A frequency band occupied by a modulating information signal.

Bellcore Bell Communications Research, Inc. (source of telephony standards in the U.S.).

BER Bit Error Ratio.

BERT Bit Error Ratio Tester.

BPF BandPass Filter.

BPV BiPolar Violation.

BW BandWidth.

C

CAN Controller Area Network. An interface standard (ISO 11898) for interconnecting microcontrollers.

CEPT Conference Européen des Administrations des Postes et des Télécommunications.

CIT Craft Interface Terminal.

D

DMM Digital MultiMeter.

DRAM Dynamic Random-Access Memory.

D connectors, subminiature The size of the subminiature D connector is specified by the standard shell size and the number of connectors. For example, a 15-pin connector is referred to as a DA-15. See the following table.

Standard Shell Size	No. of Connectors
E	9
A	15
B	25
C	37
D	50

DTMF Dual-Tone MultiFrequency.

DUART Dual Universal Asynchronous Receiver-Transmitter.

E

EEPROM Electronically Erasable Programmable Read-Only Memory.

EFS Error-Free Seconds.

EFSR Error-Free Seconds Ratio.

EMI Electro-Magnetic Interference.

EPLD Erasable Programmable Logic Device.

EQM Eye Quality Monitor.

ES Errored Seconds.

ESR Errored Seconds Ratio.

ET Elapsed Time.

ETSI European Telecommunications Standards Institute.

F

FarScan Harris' network management system software.

FCC Federal Communications Commission (U.S.).

FD Frequency Diversity. Diversity transmission and reception in which the same information signal is transmitted and received simultaneously on two or more independently fadings carrier frequencies.

FEC Forward Error Correction.

H

HLM High Level Mux.

hop The span between a transmitter and a receiver.

I

IEC International Electrotechnical Commission.

IF Intermediate Frequency; frequency below the radio frequency.

ISO International Organization for Standardization.

L

LED Light-Emitting Diode.

LNA Low-Noise Amplifier.

LO Local Oscillator.

Loopback Test A test of the coupling of a signal from the transmitting path back to the local receiving path.

LOS Loss Of Signal.

LVDS Low-Voltage Differential Signaling.

M

M12 A multiplexing method that transforms between 1 DS1 up to 4 DS1 input/outputs and a T2 output/output.

M2X A multiplexing method that transforms between 1 T2 up to 7 T2 input/outputs and a T3 output/output.

MCD Microwave Communications Division, formerly Farinon Division.

MHSB Monitored Hot StandBy.

MIB Management Information Base.

N

NC Normally Closed; No Connection.

NEC National Electric Code (registered trademark of the National Fire Protection Association).

Noise Figure The ratio of the output noise power to the portion of the output noise power stemming from thermal noise at the input at standard noise temperature.

NP NonProtected.

O

OCXO Ovenized (proportional Control) Crystal Oscillator.

OEM Original Equipment Manufacturer.

P

PDU Protocol Data Unit.

PLL Phase-Locked Loop.

Q

QUICC QUad Integrated Communications Controller.

R

RCS Reverse Channel Switch.

RF Radio Frequency.

RIP Routing for Internet Protocol.

RMA Return Material Authorization.

RMS Rack-Mounting Space.

RSL Received Signal Level.

RX Receiver.

S

SCAN System Control And Alarm Network. Harris' proprietary standard for sending alarm/status/control messages over a serial port.

SD Space Diversity. Pertaining to signal transmission and reception in which two or more separate and independent propagation media or paths are used for transmitting the same information.

SES Severely Errored-Seconds.

SESR Severely Errored-Second Ratio.

SNMP Simple Network Management Protocol.

SNR Signal-to-Noise Ratio.

SPSC Spare Products Support Center.

SPU Signal Processing Unit.

SPUR Extended SCAN port. A communications channel branching of from the trunk and generally carrying less traffic than the trunk.

T

TCP/IP Transmission Control Protocol/Internet Protocol.

T/I Threshold-to Interference ratio.

TIA Telecommunication Industries Association.

TSL Transmitted Signal Level.

TTL Transistor-Transistor Logic.

TvX Transmitter.

U

UBER Uncorrected Bit Error Ratio.

V

VCO Voltage-Controlled Oscillator.

VF Voice Frequency.

X

XO Crystal Oscillator.

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