



Microwave Digital Radios

TRuepoint® 5000,

6 to 38 GHz

The SPU Installation

P/N IMN-903002-E06



TRUEPOINT® 5000 SERIES

THE SPU INSTALLATION
PART No. IMN-903002-E06
OCTOBER 2006



Revision history

Issue date	Status	Description of change / revision
March 22, 2004	DRN C9650	• First release
October 4, 2004	ECO 22745	• General update, including General Specifications, page 2-45 • Added new procedure Fine align the antenna, page 3-22 • Appendix A; added Wayside information and pictorial changes • Appendix B; added on Connectivity
March 17, 2005	ECO 24037	• Added new MUX/SDM options, and Trib Interface Units • General Update
June 3, 2005	ECO 24705	• Added New options to Current Multiplexer Options, Current SDM Options, and Auxiliary Channels sections • Added CEPT Trib Interface Unit information • New Appendix C added: Application Notes • Editorial Update, with Specs to all the above
April 2006	PCO 25548	• Added New Controller V2 and Modem, Dual Battery Input options, per product Release 6 and 7 • Added information on the Configuration Transfer Utility (CTU), and Connectivity of TRuepoint® to MegaStar® Radios
October 2006	PCO 26986	• Added RoHS P/Ns (Table 5-2) and ROHS Compliance declaration • Added information on The 32 E1 Configuration • Added new MUX versions (Figure 2-5 through Figure 2-8)

Part N° IMN-903002-E06

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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.

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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.

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PREFACE

ROHS Compliance

Harris Corporation – Microwave Communications Division
Compliance with Restriction of the Use of Certain Hazardous Substances
(RoHS) European Directive
TRuepoint[®] 4000 and TRuepoint[®] 5000

Harris MCD holds strong commitments to comply with the requirements of applicable environmental laws and regulations, including those of the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Harris MCD anticipates RoHS-compliant module releases of the TRuepoint[®] product family by no later than July 1, 2006, and has determined that non-RoHS compliant equipment cannot be shipped after the implementation date into countries which have adopted the directive.

In order to achieve this objective, Harris MCD has been working with its supply chain partners to eliminate the identified hazardous substances from its products and to secure vendor statements of compliance. Additionally, Harris MCD has assigned new part numbers in order to distinguish field replaceable units (FRUs) as RoHS-compliant.

Exemptions:

Harris MCD acknowledges that the “Directive does not apply to spare parts for the repair, or to the reuse, of electrical and electronic equipment put on the market before July 1, 2006”, and may continue to support these existing products with non-RoHS-compliant product after the implementation date.

Harris MCD further recognizes that certain exemption criteria apply as defined in the Annex of Directive 2002/95/EC, according to Article 4.2, such as applications 5, 6, 7 and 8 (use of lead in glass, use of lead as an alloying element, lead used in high-melting temperature solders, and cadmium plating, respectively) or any other relevant Commission Decisions, amending for the purposes of adapting to technical progress, the Annex to Directive 2002/95/EC.

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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**Harris Microwave Customer Support**

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All other countries: +1-514-421-8333

You can also contact us through e-mail at:
crcusa@harris.com

Registered customers can obtain key product information on our
Premier Web Site at: <https://premier.harris/microwave>



Service Registration Form

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<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.

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Requestor's Name: _____

Title: _____ Dept: _____

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ZIP/Postal Code: _____ Country: _____

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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.

SCOPE OF THIS MANUAL

Foreword

This document provides instructions for installing the TRuepoint® 5000 SPU and its components (modules), according to planned or acquired options.

It also provides

- Cable connections,
- General Setup information,
- Basic troubleshooting.



This document is subject to change without notice.

Using this Manual

This manual has been optimized for fast Web viewing, and text shown in [this format](#) identifies navigation links leading to locations that are internal or external to the manual.



You would normally use this manual after completing the **RFU Installation**. This manual provides information specific to the [SPU](#), although some reference is made to particular sections of the other system-[Related Manuals](#), as appropriate.

Structure of this Manual

Besides this introductory Chapter, this Manual contains the following:

Chapter 2, General Description

Identification and functional description of the modules that compose various SPU options. General Specifications and System Compliance to known Standards are also covered.

Chapter 3, Installing the SPU

The Manual's core Chapter: provides steps for installing the SPU, and the required cable connections for general Setup.

Chapter 4, Maintenance

Steps for replacing units and modules.

Chapter 5, Options and Ordering

Ordering information for all modules and SPU's configuration options.

Chapter 6, Glossary

Compilation of common and special terms — and their definitions, where appropriate — used throughout the TRuepoint® user documentation.

Appendix A, Module Ports' Pinouts

Pinout description of hardware-configurable ports on the MUX, SDM and Controller.

Appendix B, Connectivity

Connection and wiring information requirements for connecting TRuepoint® radios to other MCD radios.

Appendix C, Application Notes

Reference information on **Typical** radio setups and configurations.

Key Features of Harris' TRuepoint® 5000 SPU

- SPU is RF independent
- Optional application-specific modules
- 1 RMS SPU for 1+0 (Unprotected), 2 RMS SPU for 1+1 (Protected). Refer to [Current SPU Configurations](#), on [page 2-2](#).
- Optional multiplexer protection, when using the 1+1 SPU.
- In-service performance monitoring with parameters compliant to ITU-T G.826/828 recommendations
- Self-diagnostics/expert system to differentiate the path alarms from the equipment alarms
- Optional digital orderwire (Up to 2 in one SPU)
- Optional 64 kbit/s data interface (Up to 2 in one SPU, future)
- Built-in Asynchronous data channel (19.2 kbit/s); standard offering
- Built-in agent to support SNMP protocol
- [FarScan™](#) support
- Programmable relay contacts for alarm indication or site control
- Site alarms monitoring
- [Web-CIT](#) interface for radio maintenance
- Telnet
- E-Keypad
- IP interfaces
- Tributary (local and remote) loopback.
- Multiplexer Switching
- Demultiplexer Switching
- Capacity upgrade through hardware key (for 16 x DS1/E1 module), MUX modules swap for other capacities
- Bandwidth selection by software.
- [Enhanced features](#) and capacity upgrades using software keys.

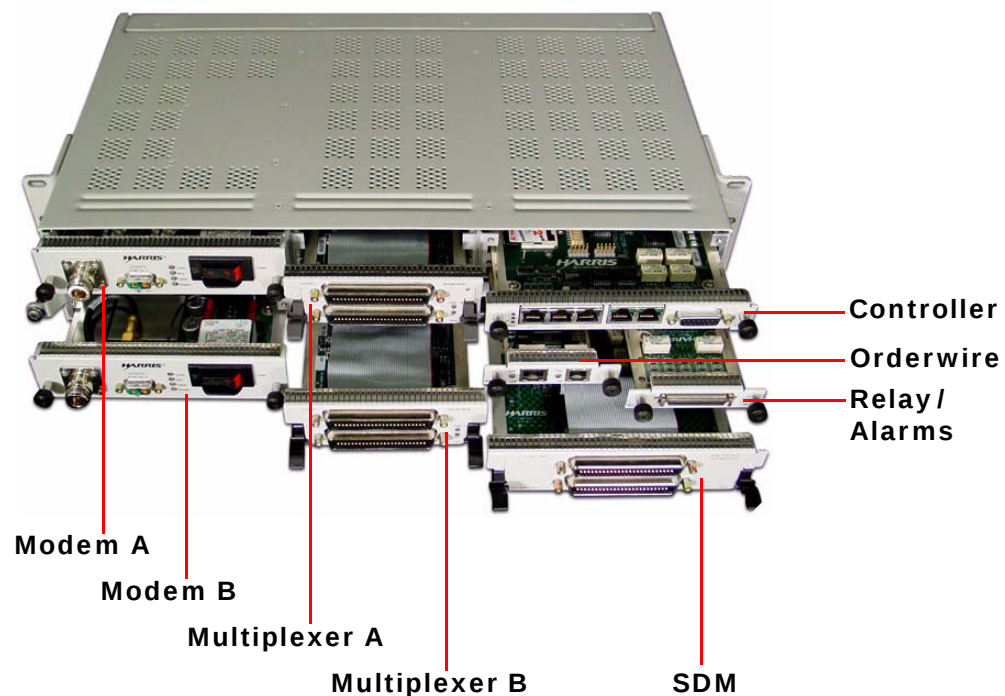
Related Manuals

Manual P/N	Title	Comments
Top Level		
IMN-903000-Exx	System Description	Top level document providing a broad overview of the TRuepoint® 5000 platform. Includes Theory of Operation, General Specifications, and Performance Tables
User Manuals (recommended order of use)		
IMN-903001-Exx	RFU Installation	Start with this manual: provides instructions for installing the TRuepoint® 5100 and 5200 RFUs; cable connections to the SPU; Grounding, and basic troubleshooting.
IMN-903002-Exx	SPU Installation	This document
IMN-903003-Exx	Operator's Interface	Provides advanced system configuration, monitoring, control and troubleshooting information
Quick Reference		
QRC-903000-Exx	Quick Reference Card	Provides a graphical representation of the TRuepoint® software menus

GENERAL DESCRIPTION

The TRuepoint® 5000 SPU

Figure 2-1: TRuepoint® 5000 Protected Configuration SPU,
Identifying Module Locations



Current SPU Configurations

Unprotected

(1-RMS SPU)



STM-1/STS-3 Configuration shown, (electric interface)



NxE1/DS-1 Configuration shown

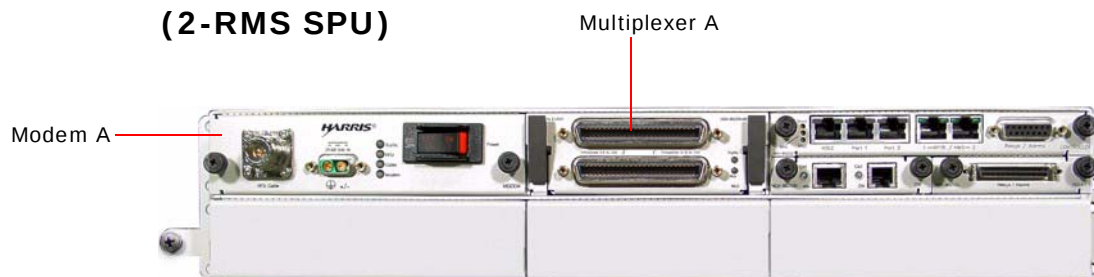
(2-RMS SPU)



32 E1 Configuration shown

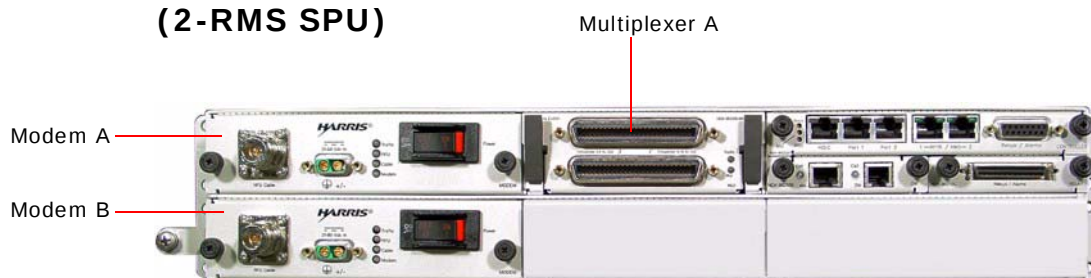
Unprotected Expandable

(2-RMS SPU)



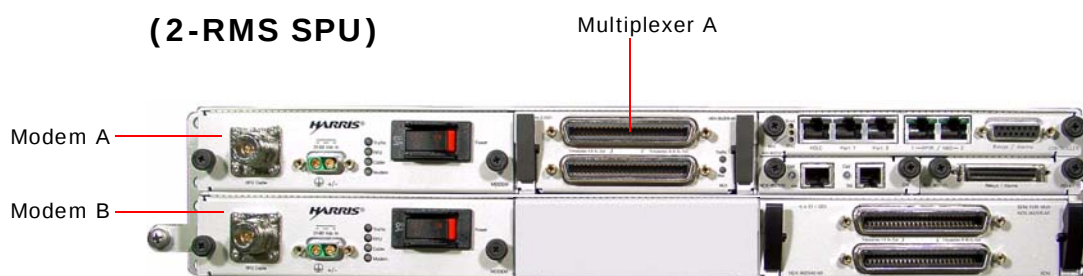
NxE1/DS-1 Configuration shown: unprotected and wired for expansion. SDM bay is blanked, but may be equipped with SDM

Protected Light (2-RMS SPU)

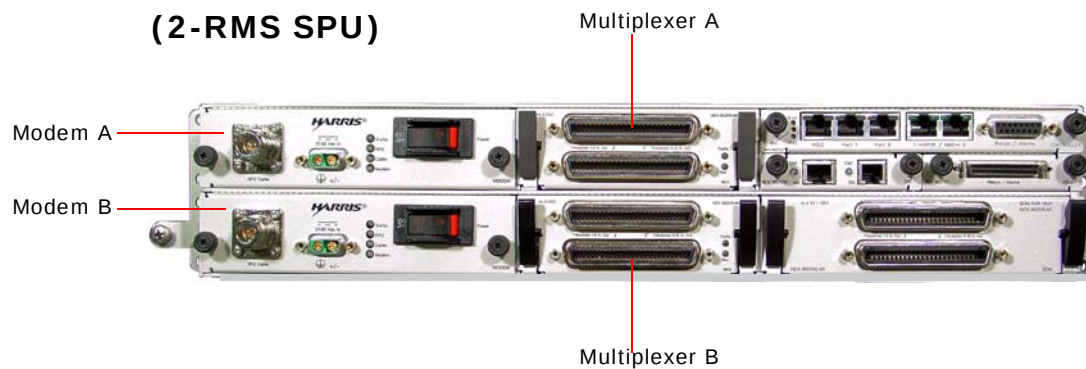


NxE1/DS-1 Configuration shown: SDM bay is blanked, but may be equipped with SDM. MUX A received power from both modems.

Protected-Ready (2-RMS SPU)



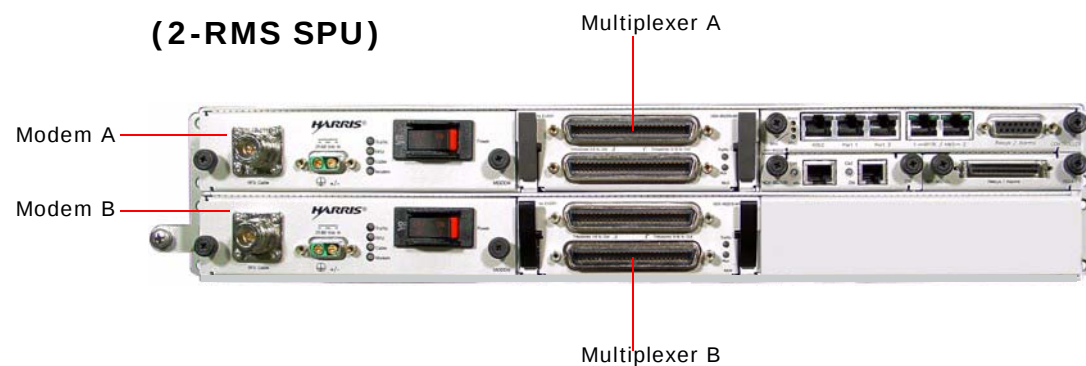
NxE1/DS-1 Configuration shown. With tributaries connected to the SDM, inserting a second MUX in this shelf will not cause hits on traffic.

Protected**(2-RMS SPU)**

NxE1/DS-1 Configuration shown



32 E1 Configuration shown — Protected Modem

2 + 0**(2-RMS SPU)**

SDM bay is blanked, and cannot be equipped.

Figure 2-2: Modem, Narrow / Wide Band

Model: 902510



GENERAL
DESCRIPTION

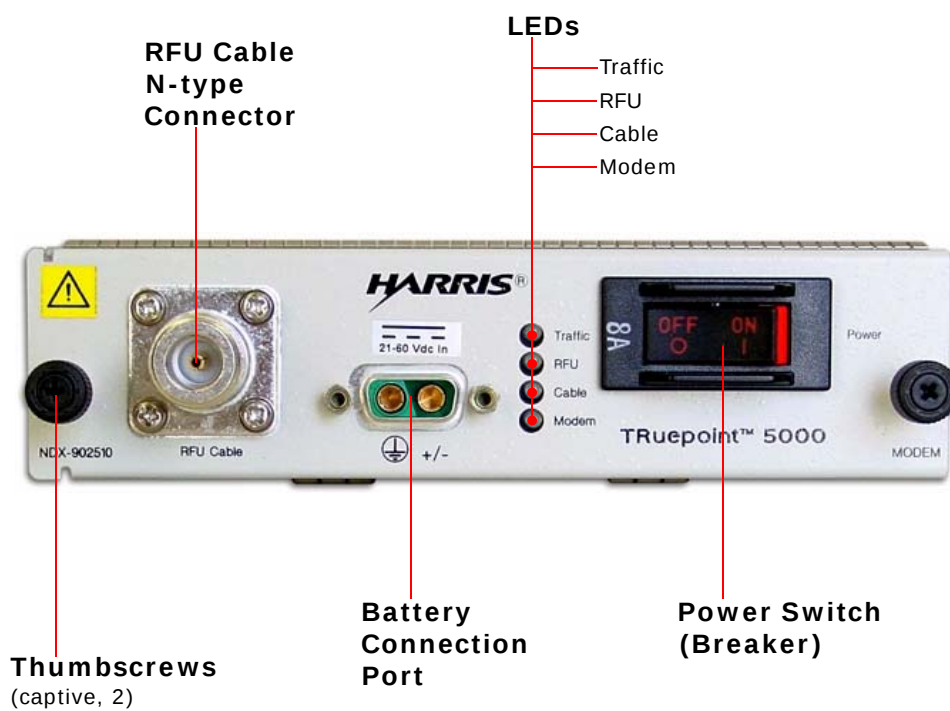
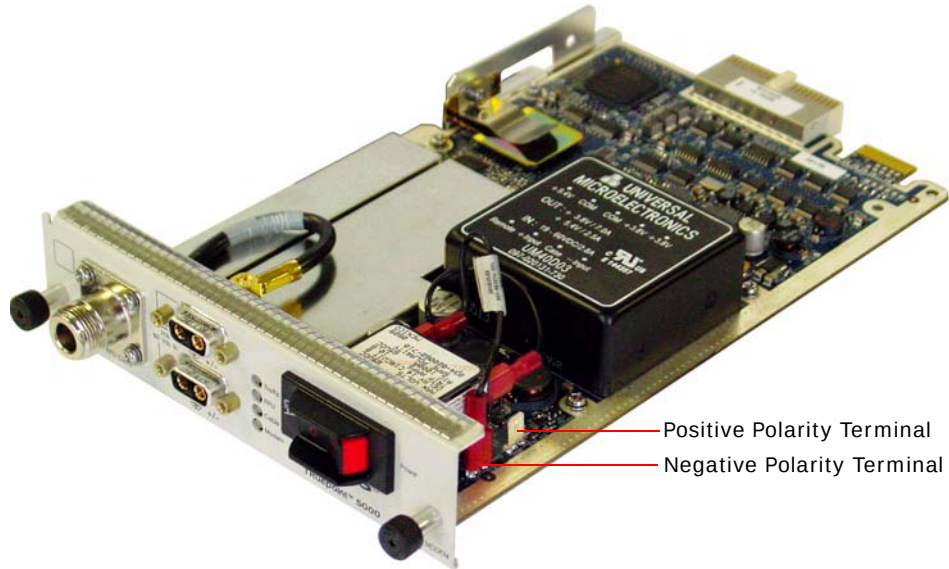
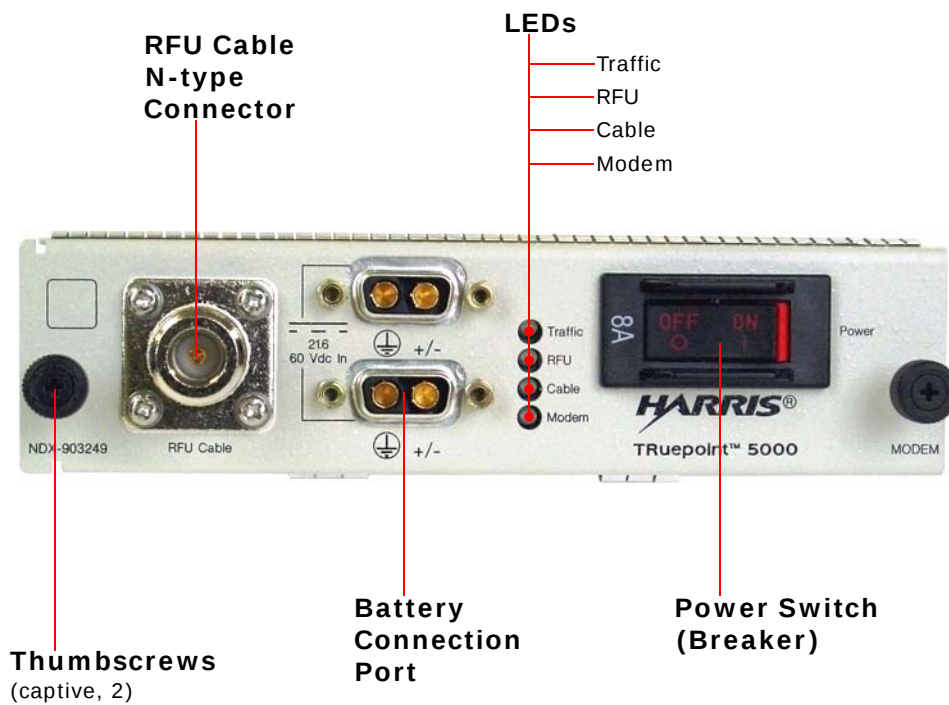


Figure 2-3: Modem, Dual Battery Input**Model: 903249****Strapping for negative polarity shown — factory default**

The 32 E1 Configuration

Main Features

- Combines two “Nx E1+2x10-100BASE-T” muxes.
Payloads from the two muxes are multiplexed in the SPU, then sent through a single RF carrier over the air. The **first** 16 E1 tributaries connect to the **upper** mux, and the other 16 E1 tributaries connect to the lower mux.
- Possible SPU configurations are: [Unprotected](#) and [Protected](#).
The Mux **cannot** be protected.
- Total air link is 64 Mbit/s.
Can split traffic in any mix of E1's + Ethernet for a total of 64 Mbit/s.
Example:
 - 32 E1 and no Ethernet traffic, or
 - 24 E1 + 16 Mbit/s Ethernet traffic, or
 - 2 E1 + 62 Mbit/s of Ethernet traffic, etc.
- Hardware requirements, refer to the [Compatibility Matrix for a 32 E1 System](#), on page 2-8:
 - Controller V2;
 - New version of the SPU (201-902595-511 and up); and
 - New version of the Nx E1+2x10/100BASE-T mux (101-902582-511 and up). For countries requiring RoHS: 202-902595-511 and 102-902582-511, respectively.
- Software requirements:
 - Software version 7.5.1 and up.
 - Special “32 E1 dual mux” software capacity key, (included by default when ordering a full 32 E1 system). Only such key can enable the 32 E1 mode.
 - The “32 E1 dual mux” software capacity key is still required as part of the upgrade even if the customer has already a software capacity key (for the mux Nx E1+2x10-100BASE-T, for example).
 - The “32E1 dual mux” software capacity key will co-exist with the original software capacity key if one is already present. It will be shown in the *Web-CIT* as another alternative the user can select, making it possible for the user to revert back to the original capacity key, if desired.
- Field upgrades
 - Field upgrades are possible; please ensure referring to the [Compatibility Matrix for a 32 E1 System](#), on page 2-8.
 - All field upgrades must be done via TAC.

Compatibility Matrix for a 32 E1 System

Hardware	Compatible Part Number	Incompatible Part Number
Controller	Controller V2: 101-903460-001 102-903460-001	Controller V1: 101-902520-001
Modem	102-902510-501 102-902510-502 103-902510-501 103-902510-502	101-902510-501 101-902510-502
MUX Nx E1 + 2x10 / 100BASE-T	101-902582-511 102-902582-511	101-902582-501 101-902582-502 101-902582-503
SPU shelf, 2-RMS	201-902595-511 202-902595-511	201-902595-501

The 2-RMS SPU

The [Protected](#) configuration SPU, in addition to the main modules, (Modem A, Multiplexer A and Controller), contains a redundant Modem module, an optional redundant Multiplexer module, and an optional [SDM](#). The Signal Distribution Module is equipped only, (exception of 2, 3 and 4 DS3) when the Multiplexer is protected or in a configuration that is [Unprotected Expandable](#). The [SDM](#) is not available with the 32 E1 configuration.

In a [Protected Light](#) configuration, [Multiplexer A](#) receives power from both modems.

The [32 E1 Configuration](#) uses the 2-RMS SPU but is available in an [Unprotected](#) or [Protected](#) configuration, where each of the split dual MUXes are powered redundantly by Modem A and Modem B.

All modules composing the 2-RMS SPU, except for the 32 E1, connect to the same 2-RMS backplane. The 32 E1 requires a different backplane.

Functional Description of the Modules

The Modem

Features and Functions

- Dual Battery Input model, negative or positive polarity, per [Figure 2-3](#)
- Narrow Bandwidth: 2.5 to 30 Mhz
- Wide Bandwidth: 2.5 to 56 MHz
- Modulation, programmable to QPSK, 16 QAM, 32 QAM, 64 QAM, 128 QAM and 256 QAM¹, with 2-Dimensional [TCM](#), or 4-Dimensional TCM concatenated with Reed Solomon (high capacity) and Reed Solomon only for some capacities
- Demodulation
- Power supply², providing DC voltage to the SPU and Protection Unit, (from 21 to 60 V_{dc}, positive or negative battery DC voltage; auto-detecting)
- [FEC](#) encoder and decoder
- [DADE](#), enabling errorless receiver switching
- Connects to the transceiver through a single standard coaxial cable (RG-8 or equivalent), with an [N-type Connector](#)
- Transmit [IF](#) and receive IF are 310 and 70 MHz, respectively
- Mounting type in SPU enclosure: [Thumbscrews](#)
- Four LEDs provide status/alarms, per [Table 4-1](#).

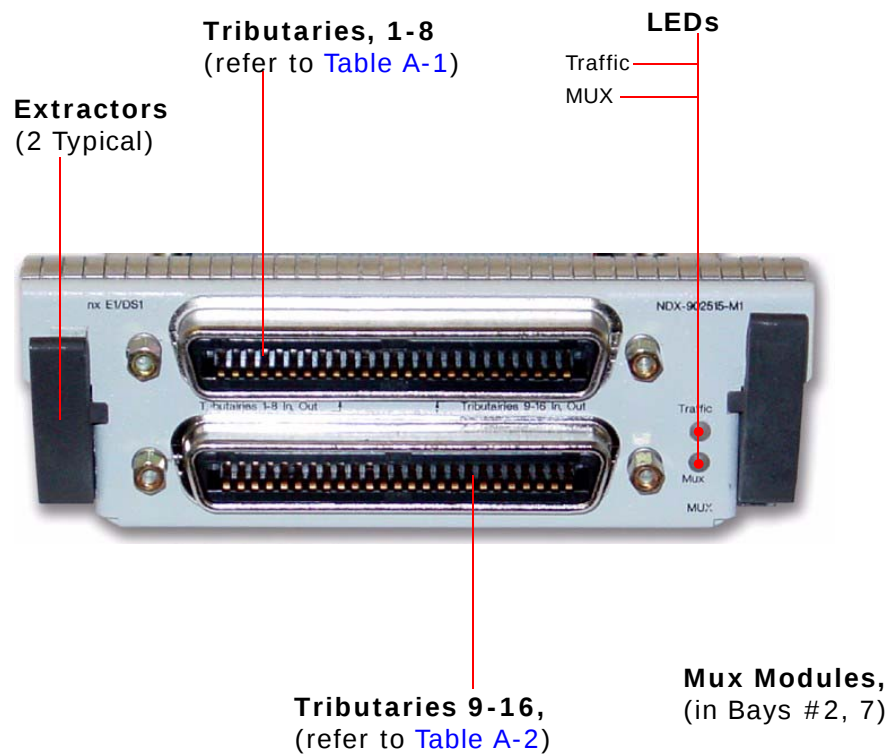
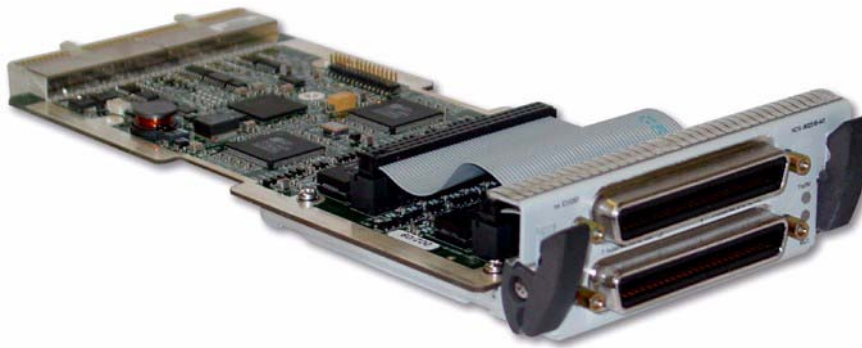
Installs in Bays 1 and 6, in a fully protected SPU, per [Figure 4-1](#).

1. Future availability

2. Power source recommended to follow ETSI EN 300 132-2 guidelines and Telcordia objective GR-499.

Figure 2-4: Multiplexer, NxE1 / DS-1

Model: MUX 902515



The Multiplexer (MUX)

General Features

- Provides different interfaces to accommodate the PDH, SDH, SONET, and the IP applications.
- Figures 2-4 through 2-15 provide the information applicable to current Multiplexer options, per Table 2-1.
- Protection of the MUX in a 1+1 shelf is optional.
- For each protected-MUX, there is a companion SDM. SDM options are given in Figures 2-18 through 2-25.

Installs in Bays 2 and 7, in a fully protected SPU, refer to Figure 4-1.

Table 2-1: Current Multiplexer Options

ANSI Capacity / Interface	CEPT Capacity / Interface	Reference
4-16 DS-1	2-16 E1	Figure 2-4
OC-3 + 1 DS-1 (opt. 501)	STM-1 + 1 E1 (opt. 501)	Figure 2-5
OC-3 + 1 DS-1 (opt. 505/506)	STM-1 + 1 E1 (opt. 505/506)	Figure 2-7
1 DS3 + 1 DS-1 (opt. 501)	1 E3 + 1 E1 (opt. 501)	Figure 2-9
1 DS3 + 1 DS-1 and 2x10-100BASE-T, (opt. 502)	1 E3 + 1 E1 and 2x10-100BASE-T, (opt. 502)	Figure 2-10
3 DS3 + 3 DS-1 (proprietary)	N/A	Figure 2-11
28 DS-1 / DS3 + 1 DS-1	N/A	Figure 2-12
N/A	21 E1/STM-1 (p. filled)+ 1 E1	Figure 2-13
ADM 8 DS-1/DS3 + 1 DS-1	N/A	Figure 2-14
N-16 DS-1 + 2x10/100BASE-T, (opt.502)	N-16 E1 + 2x10/100BASE-T, (opt.503/opt. 511 ^a)	Figure 2-15

a. For a 32 E1, you must select two of option 511.



Every MUX ships with ESD caps, one installed on each unused “Tributaries” port. Always remember to cover any unused port with such a cap. This is an ESD protection requirement. You need to keep all removed caps for future use.

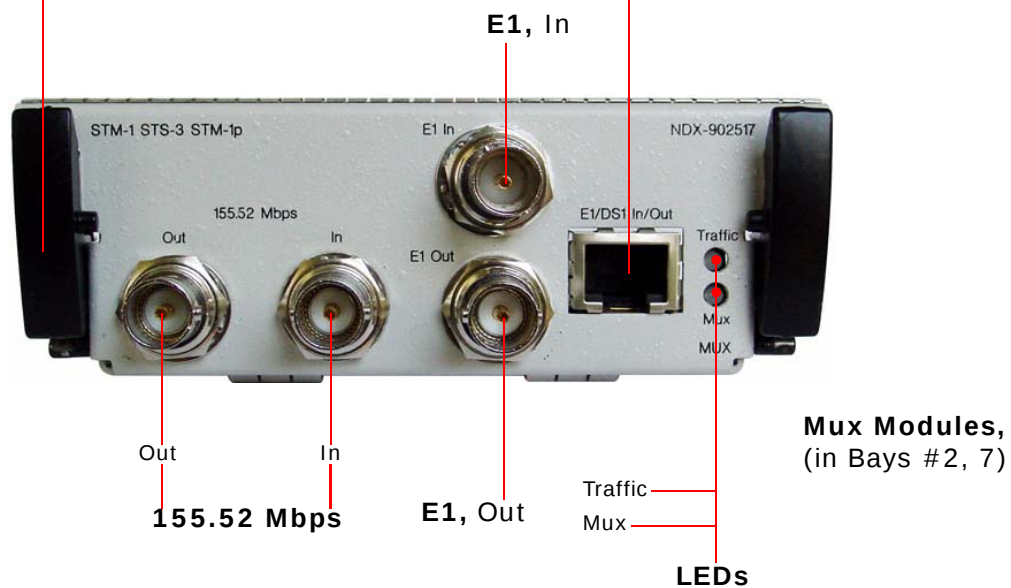
**Figure 2-5: Multiplexer, STM-1, STS-3 Electric Interface
(with Wayside)**

Model: MUX 902517, Opt. 501
P/N: 103-902517-501 is RoHS Compliant

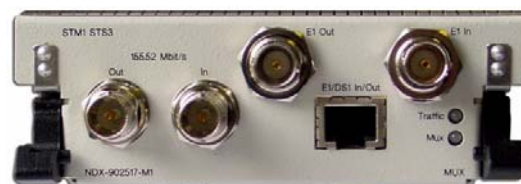


Extractors
(2 Typical)

E1/DS-1 In/Out
(Refer to [Table A-5](#))



Earlier Model: MUX 902517, Opt. 501



**Figure 2-6: Multiplexer, STM-1, STS-3 Electric Interface
(no Wayside)**

Model: MUX 902517, Opt. 507
P/N: 103-902517-507 is RoHS Compliant



GENERAL
DESCRIPTION

Extractors
(2 Typical)



Out
In
155.52 Mbps

Traffic
Mux

LEDs

Mux Modules,
(in Bays #2, 7)

Specifications: MUX Part No. 102-902517-xxx

General Description

- Transmits and receives data at 155 Mbit/s Electrical or Optical, SDH or SONET
- Supports a DS-1 or E1 wayside and Service Channel data
- Hot plug-in card, can be used in a protected or unprotected system configuration

Stuffing Options

MUX, 155 Mbit/s + Wayside		MUX, 155 Mbit/s, no Wayside	
• 102-902517-501	Electrical	• 102-902517-507	Electrical
• 102-902517-502	Multimode (MM)	• 102-902517-508	Multimode (MM)
• 102-902517-503	Singlemode (SM)	• 102-902517-509	Singlemode (SM)
STM-1, Partially filled + Wayside		STM-1, Partially filled, no Wayside	
• 102-902517-504	Electrical	• 102-902517-510	Electrical
• 102-902517-505	Multimode (MM)	• 102-902517-511	Multimode (MM)
• 102-902517-506	Singlemode (SM)	• 102-902517-502	Singlemode (SM)

Mechanical Description

PCB mounted on a wrapper, installs in Bays #2 and 7 with [Extractors](#). Two LEDs ([Mux](#) and [Traffic](#)) provide alarm and traffic status: a **red** Mux LED requires replacing the module.

Electric Interface:

- 4 BNC connectors, unbalanced connection for main 155.52 Mbit/s signal;
- 2 BNC connectors, unbalanced connection for the E1 wayside signal; and
- RJ-45 port, balanced DS-1 / E1 wayside connection

Optical Interface:

- SC-Type dual-connector, transceiver for main 155.52 Mbit/s signal;
- Other connectors similar to those of the Electric Interface

Power Interface

- Installed in Bay 2: receives power for Modems A and B. This is also a required position for an unprotected MUX in a 2-RMS SPU ([Protected Light](#) configuration)
- Installed in Bay 7: receives power for Modem B only

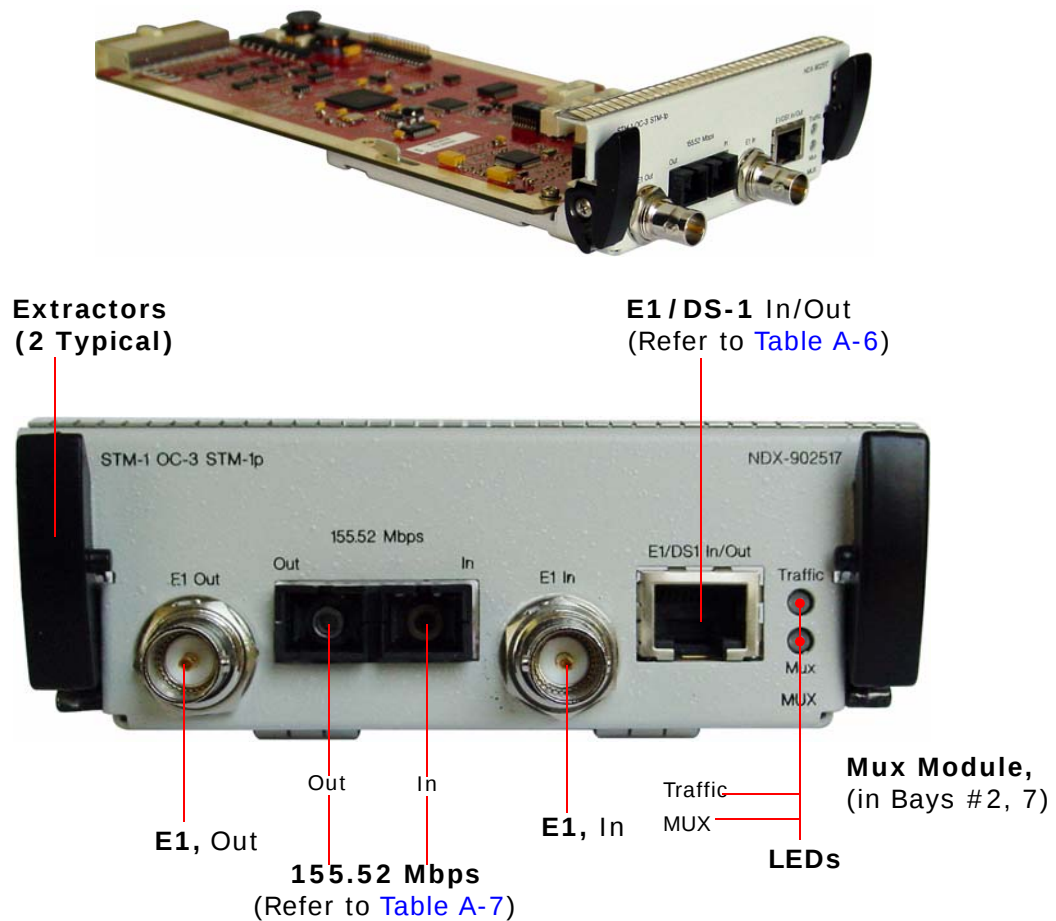
	Intra Office	Short Haul	Interface Compliance
Nominal wavelength, nm	1310	1310	STM-1: G.703
Transmitter Type	MM LED	SM Laser	OC-3/STS-3: FDDI PMD ATM/SONET (Multimode); Telcordia – SONET OC-3/IR-1 and ITU-T G.957 STM1/S.1.1
Transmit Level, dBm	-14 to -19	-15 to -8	
Receive Level, dBm	-32.5 to -14	-28 to -8	
Attenuation range, dB	0 to 13.5	0 to 13	DS-1 WS: G.703
Path Length, km	< 2	< 15	E1 WS: Telcordia GR-499

**Figure 2-7: Multiplexer, STM-1, OC-3 Optical Interface
(with Wayside)**

(For model types, refer to [Stuffing Options](#), on the previous page)

Model: MUX 902517, Opt. 506

P/N: 103-902517-506 is RoHS Compliant



Earlier Model: MUX 902517, Opt. 506

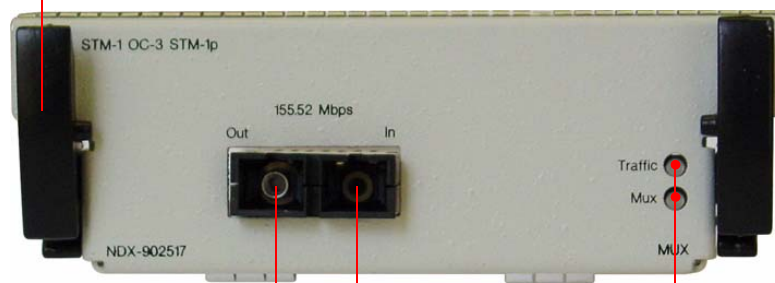


Figure 2-8: Multiplexer, STM-1, OC-3 Optical Interface
(no Wayside)

Model: MUX 902517, Opt. 511
P/N: 103-902517-511 is RoHS Compliant



Extractors
(2 Typical)



Out In
155.52 Mbps

Traffic
Mux
LEDs

Mux Modules,
(in Bays #2, 7)

Figure 2-9: Multiplexer, E3/DS3 + Wayside

Model: MUX 902550, Opt. 501



GENERAL
DESCRIPTION

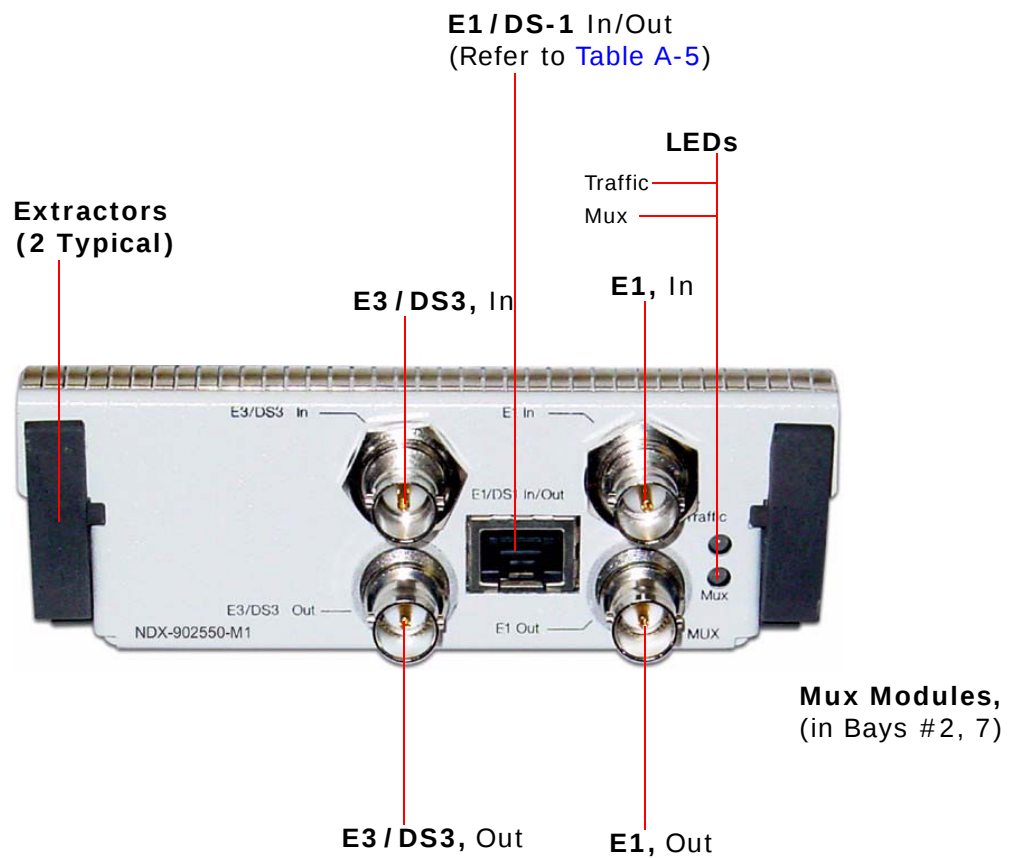
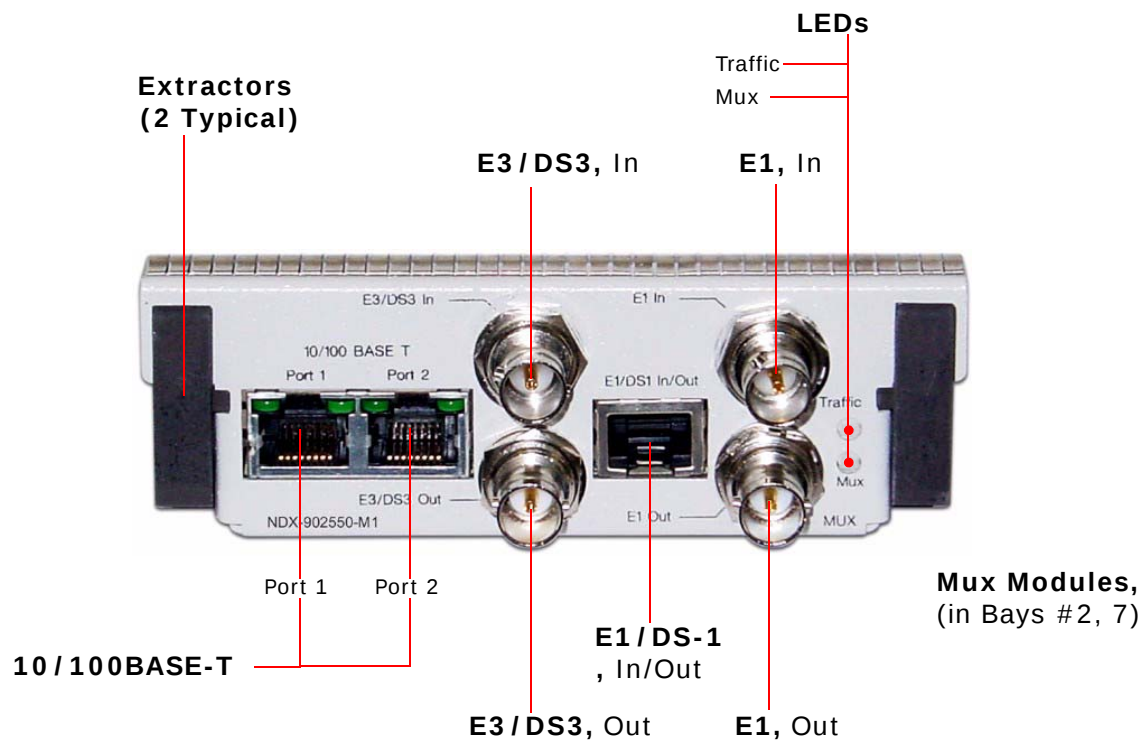
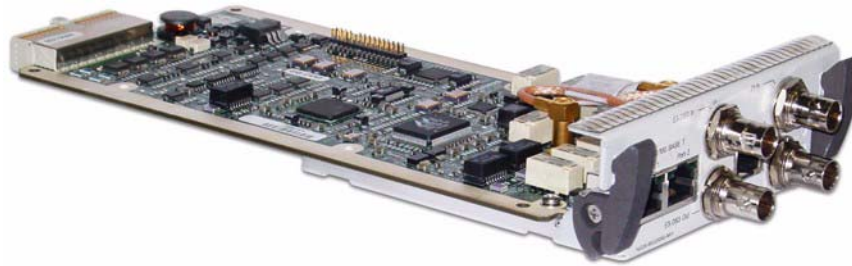


Figure 2-10: Multiplexer, E3/DS3 + Wayside and 2x10/100BASE-T over E3/DS3

Model: MUX 902550, Opt. 502



Specifications: MUX Part No. 101-902550-xxx

General Description

- Transmits and receives data at a maximum of 34.368 or 44.736 Mbit/s, (E3 or DS3) or; 2x10/100BASE-T over E3/DS3
- Supports an E1 or DS-1 wayside and Service Channel data
- Hot plug-in card, can be used in a protected or unprotected system configuration

Stuffing Options, Software Configurable Functions

E3 / DS3, Opt. 101-902550-501

- | | |
|--------------|-------------------------------|
| • E3 + E1 | Main signal E3, E1 wayside |
| • DS3 + DS-1 | Main signal DS3, DS-1 wayside |
| • DS3 | Main signal DS3, no wayside |

2x10/100BASE-T over E3/DS3, Opt. 101-902550-502

- | | |
|-------------------|--|
| • 10/100BT + E1 | Main signal 10/100BASE-T over E3, E1 wayside |
| • 10/100BT + DS-1 | Main signal 10/100BASE-T over DS3, DS1 wayside |
| • 10/100BT | Main signal 10/100BASE-T over DS3, no wayside |

Mechanical Description

PCB mounted on a wrapper, installs in Bays #2 and 7 with [Extractors](#).

Two LEDs ([Mux](#) and [Traffic](#)) provide alarm and traffic status: a [red](#) Mux LED requires replacing the module.

E3 / DS3 Interface:

- 2 BNC connectors, unbalanced connection for main 34.368 or 44.736 Mbit/s signal;
- 2 BNC connectors, unbalanced connection for the E1 wayside signal; and
- RJ-45 port, balanced E1 / DS1 wayside connection

2x10/100BASE-T over E3/DS3 Interface:

- All connectors and ports same as those of the E3/DS3 Interface; plus
- 2 RJ-45 Ports 1 and 2, for the 10/100BASE-T signal

Power Interface

- Installed in Bay 2: receives power for Modems A and B. This is also a required position for an unprotected MUX in a 2-RMS SPU ([Protected Light](#) configuration)
- Installed in Bay 7: receives power for Modem B only

Performance

Compliance (Output Mask)

- | | |
|-------------|---|
| E3 | • G.703, continuity: 12 dB loss due to cable length |
| DS3 | • Telcordia GR-499, output mask: cable length to 450 ft (137.2 m) |
| E1 Wayside | • G.703, continuity: 6 dB loss due to cable length |
| DS1 Wayside | • Telcordia GR-499, output mask: cable length to 655 ft (199.8 m) |

Power Consumption

- | | |
|---------|-----------|
| Maximum | • 4 Watts |
|---------|-----------|

Figure 2-11: Multiplexer, 3 DS3 + 3 Wayside Harris Frame

Model: MUX 902573



**Extractors
(2 Typical)**

LEDs

Traffic
Mux



**Mux Modules,
(in Bays #2, 7)**

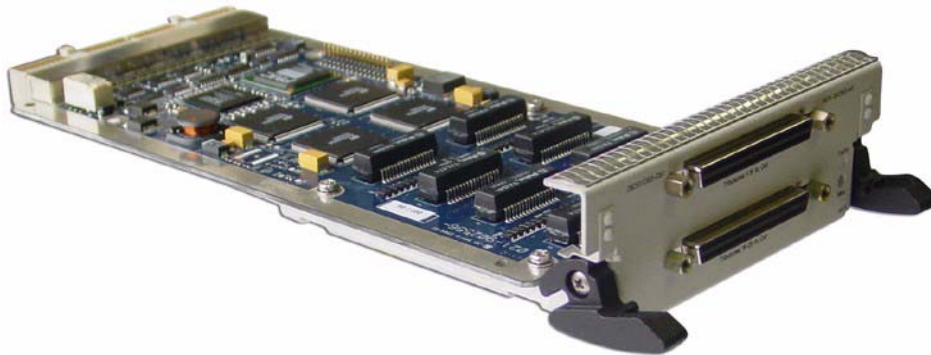
Specifications: MUX Part No. 101-902573-501

General Description	
• Uses proprietary framing format to multiplex 3 DS3 (3 x 44.736 Mbit/s) tributaries and optionally 3 DS1 wayside channels • Processes service channel data and other frame overhead bits • Hot plug-in card, must be used in a Protected shelf Only, to allow for DS3 and DS1 access through the SDM	
Configurations, set by Controller	
• 3 DS3 + 3 DS1	
Mechanical Description	
PCB mounted on a wrapper, installs in Bays #2 and 7 with Extractors. Two LEDs (Mux and Traffic) provide alarm and traffic status: a red Mux LED requires replacing the module	
Power Interface	
• Installed in Bay 2: receives power for Modems A and B • Installed in Bay 7: receives power for Modem B only	
Performance	Compliance (Output Mask)
DS3	• Telcordia GR-499, Cable length to 450 ft (137.2 m), Type 721A
DS1 Wayside	• Telcordia GR-499, Cable length to 655 ft (199.8 m), ABAM cable
Power Consumption	
Maximum	• 5 watts

GENERAL
DESCRIPTION

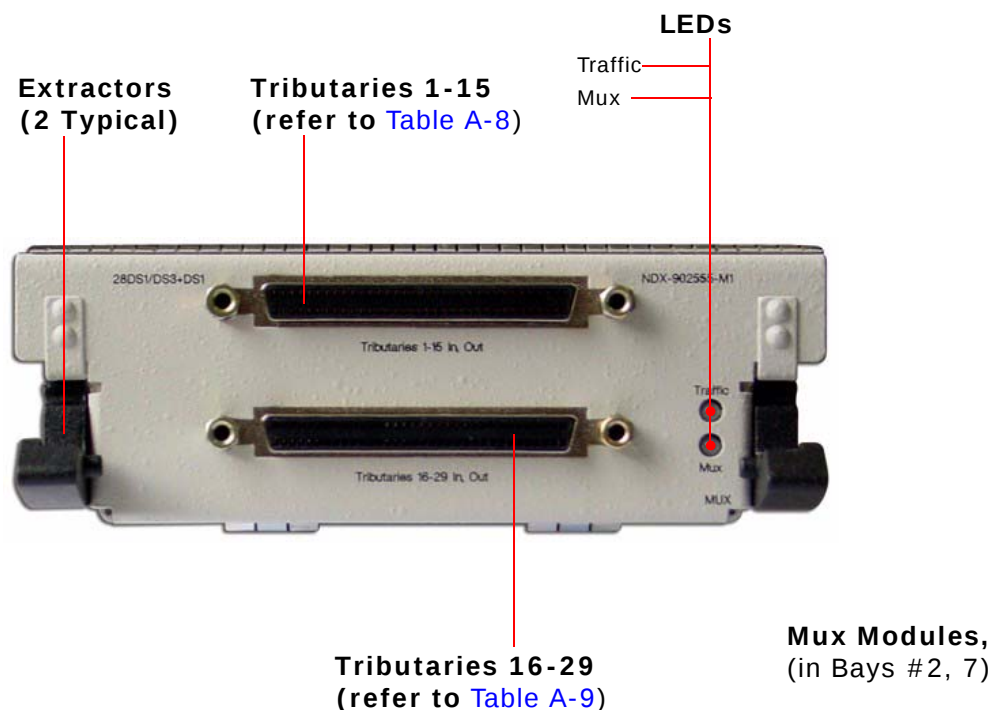
Figure 2-12: Multiplexer, 28 DS1/DS3 + Wayside

Model: MUX 902555



Sparing Considerations:

When selecting the “Unprotected MUX” option, ensure that there is no MUX B present in the SPU. Otherwise, you may lose traffic when you power off Modem A or disconnect power from it.



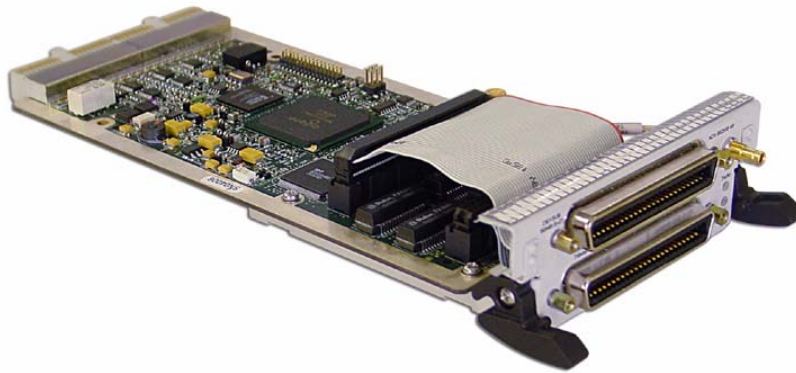
Specifications: MUX Part No. 101-902555-xxx

General Description	
Multiplexes 28 DS1 data signal into a DS3 signal (44.736 Mbit/s), using an • M13 framing format, where: 4 DS1 are first multiplexed and mapped to one DS2, then 7 DS2 are multiplexed and mapped to one DS3, (44.736 Mbit/s); or a • C-bit Parity framing format, with same multiplexing steps as those of M13, where 4 DS1 are multiplexed into pseudo-DS2, then 7 pseudo-DS2 are multiplexed and mapped to one DS3; stuffing indication bits used for other purposes • Supports an optional DS1 wayside channel • Hot plug-in card, can be used in a protected or unprotected system configuration	
Mechanical Description	
PCB mounted on a wrapper, installs in Bays #2 and 7 with Extractors. Two LEDs (Mux and Traffic) provide alarm and traffic status: a red Mux LED requires replacing the module User Interface: • 2 SCSI-3 68-pin ports, balanced connection for Tributaries 1-15, and Tributaries 16-29, (including wayside)	
Power Interface	
• Installed in Bay 2: receives power for Modems A and B. This is also a required position for an unprotected MUX in a 2-RMS SPU (Protected Light configuration) • Installed in Bay 7: receives power for Modem B only	
Performance	Compliance (Output Mask)
DS1	• Telcordia GR-499, Cable length to 655 ft (199.8 m) ABAM cable
Power Consumption, maximum	
Maximum	• 8 Watts

GENERAL
DESCRIPTION

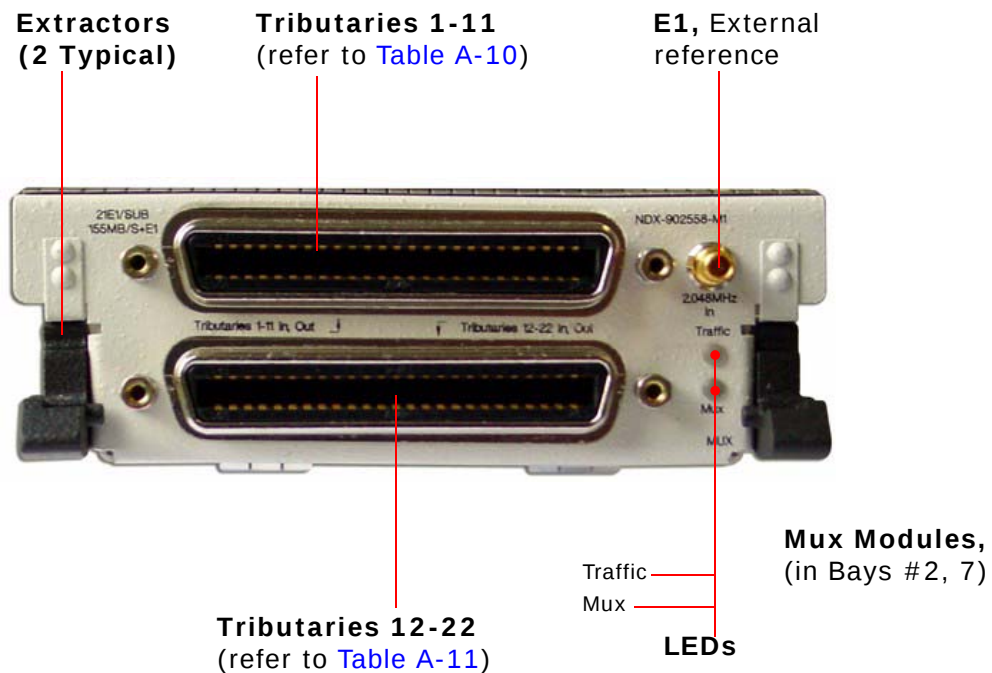
Figure 2-13: Multiplexer, 21 E1 + Wayside

Model: MUX 902558



Sparing Considerations:

When selecting the “Unprotected MUX” option, ensure that there is no MUX B present in the SPU. Otherwise, you may lose traffic when you power off Modem A or disconnect power from it.



Specifications: MUX Part No. 101-902558-xxx

General Description	
• This Mux will carry an airlink capacity of 55.296 Mbit/s (21 E1). • Supports an E1 wayside and Service Channel data • Hot plug-in card, can be used in a protected or unprotected system configuration	
Mechanical Description	
PCB mounted on a wrapper, installs in Bays #2 and 7 with Extractors. Two LEDs (Mux and Traffic) provide alarm and traffic status: a red Mux LED requires replacing the module User Interface: • 2 D-Type 50-pin ports, balanced connection for main 55.296 Mbit/s signal; Tributaries 1-11 and Tributaries 12-22 • One 1.0/2.3 coaxial connector, for the E1, External reference connection	
Power Interface	
• Installed in Bay 2: receives power for Modems A and B. This is also a required position for an unprotected MUX in a 2-RMS SPU (Protected Light configuration) • Installed in Bay 7: receives power for Modem B only	
Performance	Compliance
E1	• ITU-T, G.703: Continuity; Cable length (line input) to 1200 ft (366 m) with a loss of 6 dB • ITU-T, G.703: Output mask
Power Consumption	
Maximum	• 8 Watts

GENERAL
DESCRIPTION

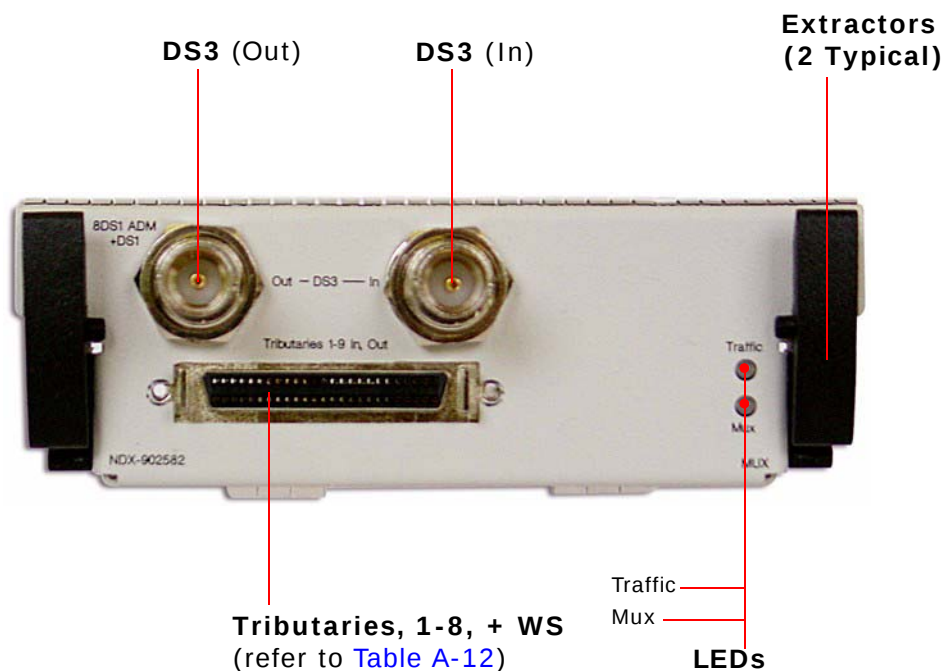
Figure 2-14: Multiplexer, ADM 8 DS1 + Wayside

Model: MUX 902582, Opt. 501



Sparing Considerations:

When selecting the “Unprotected MUX” option, ensure that there is no MUX B present in the SPU. Otherwise, you may lose traffic when you power off Modem A or disconnect power from it.



Specifications: MUX Part No. 101-902582-xxx

General Description

- Adds/drops DS1 tributary traffic to/from high-speed DS3 traffic streams (Opt. 501), supporting also a DS1 wayside and Service Channel data
- In **N-16 DS1/E1 + 2x10-100BASE-T mode**: supports bit rates from **4 to 155 Mbps** (180 Mbit/s or 116 DS1, *future availability*). This data stream can contain a mix of TDM and/or Ethernet traffic (Opt. 502 and 503). All bandwidth parameters are software configurable. Software capacity keys limit the maximum capacity that can be programmed through the HHT or WebCIT.
- Through the software capacity key **already in place**, the user can perform field capacity upgrades through the HHT or the WebCIT, when done within the maximum capacity allowed by that key; or, can purchase a larger capacity software key to extend the maximum capacity allowed by the key already in place.
- Hot plug-in card, can be used in a protected or unprotected system configurations

Stuffing Options

- **Opt. 501**: ADM 8 DS1/DS3 + WS — Added/dropped 8 DS1 tributaries to/from DS3 signal, 1 DS1 wayside
- **Opt. 502**: N-16 DS1 + 2x10/100BASE-T over air link equivalent of up to 100 DS1/155 Mbps currently and up to 116 DS1/180 Mbps as future availability (contact Harris for more details). The user can activate 0 to 16 DS1 of TDM traffic (in 1 DS1 increments). Any airlink capacity that is not used for DS1s is available for Ethernet traffic. Each of the Ethernet ports can accommodate up to 100 Mbps of Ethernet traffic. However, the two ports combined cannot carry more than the total airlink capacity available for Ethernet traffic. There's no wayside available on this Mux.
- **Opt. 503**: N-16 E1 + 2x10/100BASE-T over air link equivalent of up to 75 E1/155 Mbps currently and up to 180 Mbps as future availability (contact Harris for more details). The user can activate 0 to 16 E1 of TDM traffic (in 1 E1 increments). Any airlink capacity that is not used for DS1s is available for Ethernet traffic. Each of the Ethernet ports can accommodate up to 100 Mbps of Ethernet traffic. However, the two ports combined cannot carry more than the total airlink capacity available for Ethernet traffic. There's no wayside available on this Mux.
- **Opt. 511**: N-16 E1 + 2x10/100BASE-T — this Mux replaces Opt. 503 Mux. Besides providing the same features as those of the Opt. 503 Mux, it can be used for the 32 E1 applications. Such applications can work only if the Opt. 511 Mux is present. There's no wayside available on this Mux.

Mechanical Description

- PCB mounted on a wrapper, installs in Bays #2 and 7 with [Extractors](#)
- Two LEDs ([Mux](#) and [Traffic](#)) provide alarm and traffic status: a [red](#) Mux LED requires replacing the module

Power Interface

- Installed in Bay 2: receives power for Modems A and B. This is also a required position for an unprotected MUX in a 2-RMS SPU ([Protected Light](#) configuration)
- Installed in Bay 7: receives power for Modem B only

Tributary Compliance

- Refer to [Tributary Compliance](#).

Limitation of Use

These Muxes are destined for use in commercial, industrial and business environments only, according to the following rules: FCC Part 15, Subpart B; and ETSI EN301-489-4

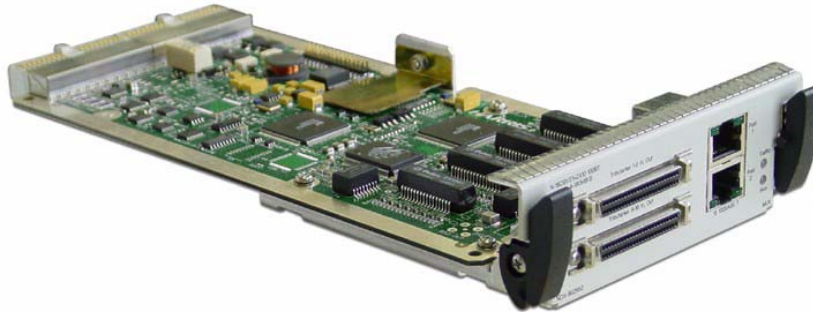
Power Consumption

Maximum • 5 Watts

Figure 2-15: Multiplexer, N-16 E1/DS-1 + 2x10/100BASE-T

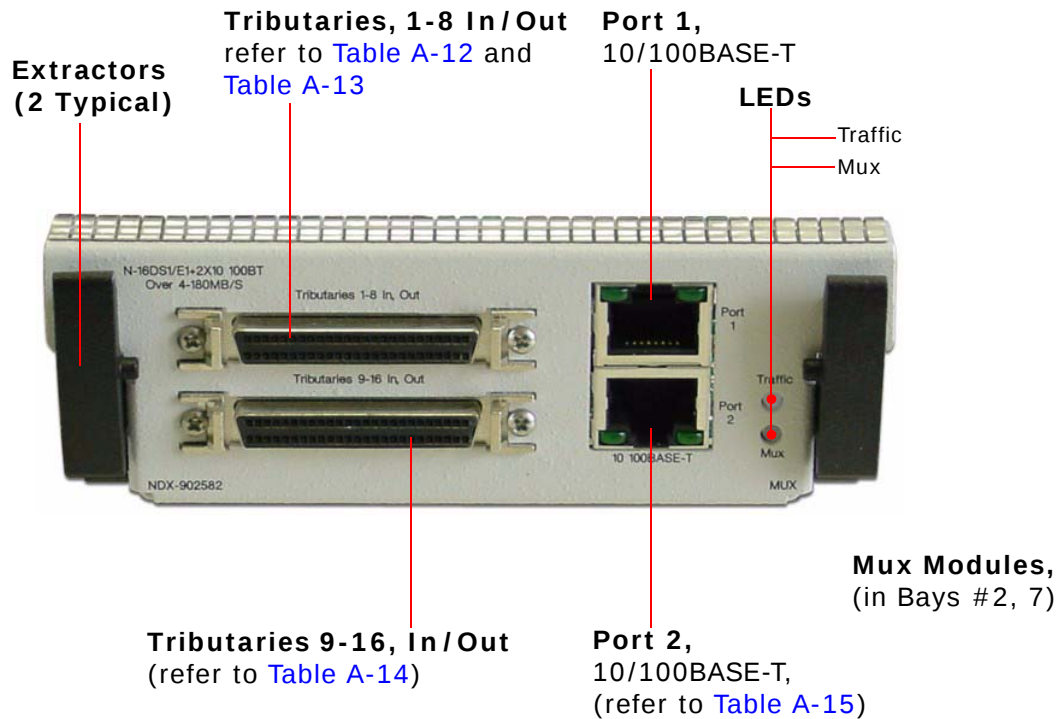
Model: MUX 902582, Opt. 502 (DS-1)

Model: MUX 902582, Opt. 503 (E1) / Opt. 511 (32 E1)



Sparing Considerations:

When selecting the “Unprotected MUX” option, ensure that there is no MUX B present in the SPU. Otherwise, you may lose traffic when you power off Modem A or disconnect power from it. This Caution does not apply for the 32 E1 (dual MUX) Option.



The Controller

General Features and Functions

- Monitors all the terminal's modules by indicating alarms through each module's LEDs. Controller is a **Hot Plug-in** module.
- Provides associated relay contacts.
- Displays the status of the radio upon request through the **HHT**, the **Web-CIT**, the **Element Manager** (such as StarView™), or another **Network Management System** (NMS).
- Allows radio configuration and control via the same tools.
- All configurations parameters are stored on a removable CompactFlash card for easy retrieval when replacing a Controller.

Current product releases provide additional Controller options, as shown in the following Table.

Table 2-2: Features Comparison by Controller Type

Feature	Controller V1	Controller V2
Memory card format, size	• MMC, 128 MB (earlier: 32 MB)	• CF (CompactFlash®), 128 MB
On board SDRAM	• 16 MB	• 64 MB
Software version	• Up to Version 4.x; • Not compatible with 6.X and later	• 6.x and later; • Not compatible with 4.X and earlier
Software Feature keys ^a	• No	• Yes
Software Capacity keys ^a	• No	• Presently, available for NxE1/DS-1 and NxE1/DS-1+2x10-100BASE-T
Supported Muxes	• NxE1 or DS-1, E3 or DS3 • STM-1/OC-3/STS-3 • 28 DS-1, 21 E1 or STM-1p • 2x10-100BASE-T over 34 or 45 Mbps • NxE1/ DS-1+2x10-100BASE-T • 8 DS-1 ADM over DS3	• NxE1 or DS-1, E3 or DS3 • STM-1/OC-3/STS-3 • 28 DS-1, 21 E1 or STM-1p • 2x10-100BASE-T over 34 or 45 Mbps • NxE1/ DS-1+2x10-100BASE-T • 32E1 dual split • 8 DS-1 ADM over DS3 • SMX (ADM 28 DS-1 or 21 E1), future • Any future Mux
Optional Cards	• Orderwire, or 10/100BASE-T over 64 Kbps, or V11/G703 64 Kbps data channel, plus 1 Alarm/Relay card	• Any two (no more than 1 Orderwire per site)
Bidirectional Switching	• No	• Yes (later)
Revertive Channel Switching	• No	• Yes

Table 2-2: Features Comparison by Controller Type (continued)

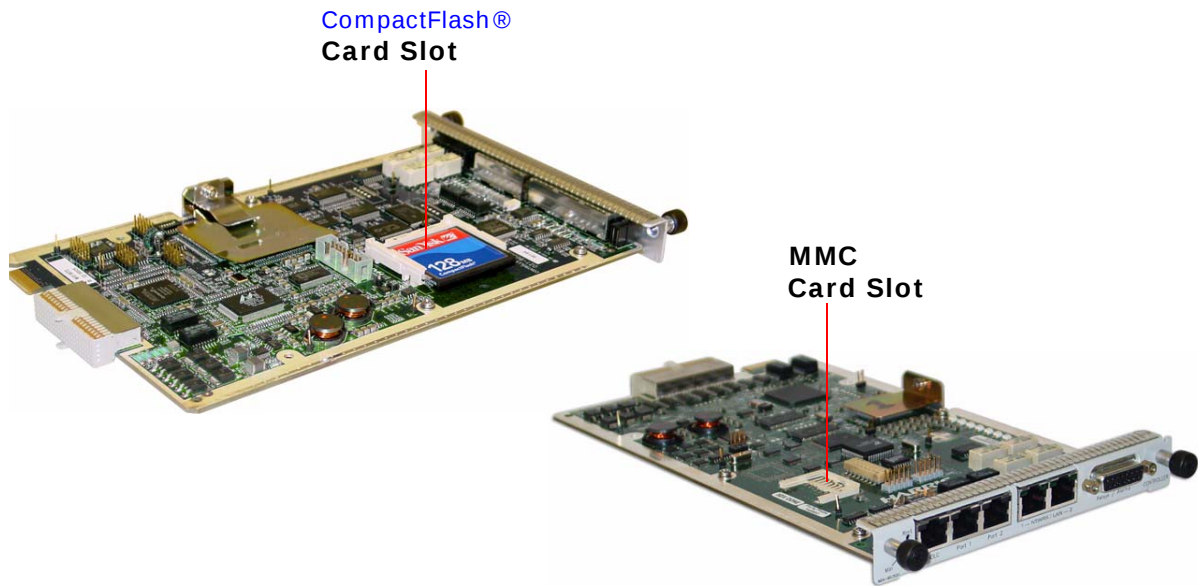
Feature	Controller V1	Controller V2
Real time clock (on-board backup power)	• No	• Yes
Performance monitoring G826/G828	• From boot time or last reset	• New options of 15 min. per day per month windows (on SMX only)
Ring protection	• 8 DS-1 ADM only	• 8 DS-1 ADM, and later on SMX
Spanning Tree Protocol (STP)	• No	• Yes (later)
Arboreal Routing Protocol	• No	• Yes, includes Orderwire Loop detection and resolution
Link ID	• No	• Yes
Customer banner	• No	• Yes
Number of PCR history records	• 16384 (max)	• 32768 (max)
Event Logging and Auto Dump of Event Logger Files	• No	• Yes, up to 3000 logged events ^b
Time synchronization (SNTP)	• No in SW 3.x and below; • Yes in 4.X	• Yes ^b
WebCIT	• Yes	• Yes ^b
VT-100 over Telnet	• No, except 4.x which allow this feature	• Yes ^b
Strong security (Secure protocols)	• No	• Optional (must be purchased) • SNMPv3 • WebCIT over HTTPS • FTPS • VT-100 over a Telnet secured connection • RADIUS client for user login authentication using company centralized authentication server

a. Allows purchasing additional features or capacity above maximum set at factory (at time of purchase/shipping)

b. If not readily available, features can be enabled through Harris Customer Support

Figure 2-16: Controller Module

Controller V2 Module: 101-903460-501



Controller V1 Module: 101-902520-501

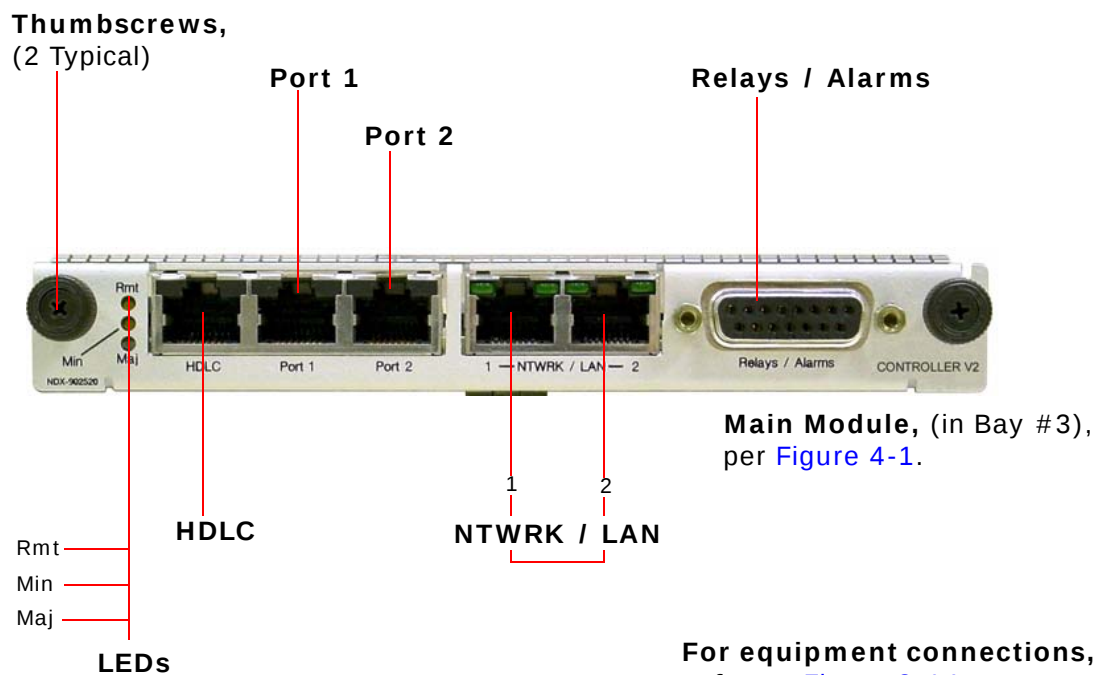


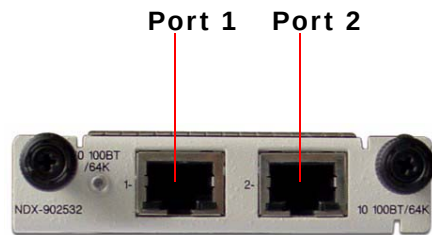
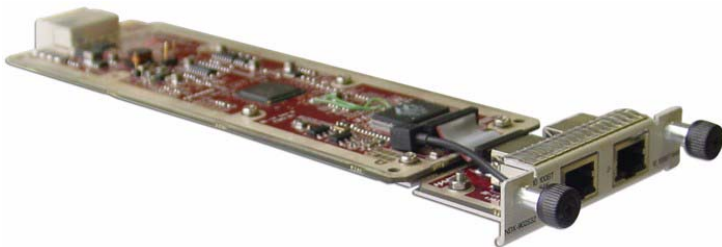
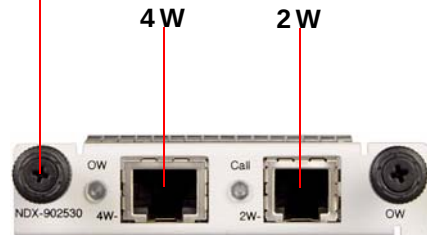
Figure 2-17: Controller: Orderwire and Relay / Alarms Options

All Modules shown, except the Orderwire, install in Bay # 5, per [Figure 4-1](#).

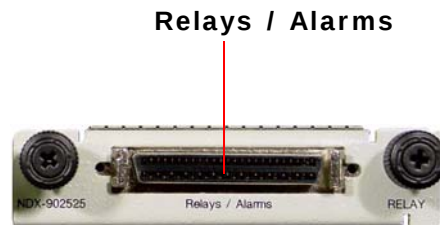
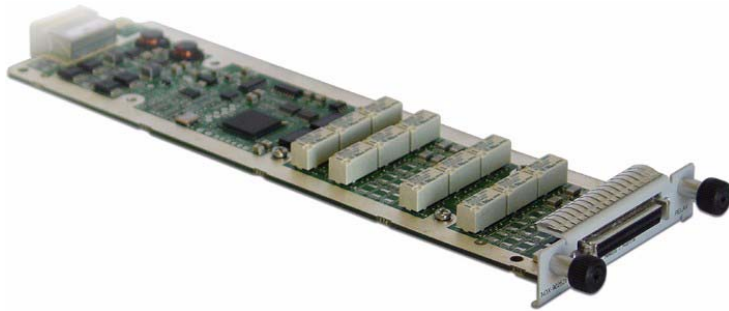
Orderwire Module installs in Bay # 4 only, per [Figure 4-1](#).



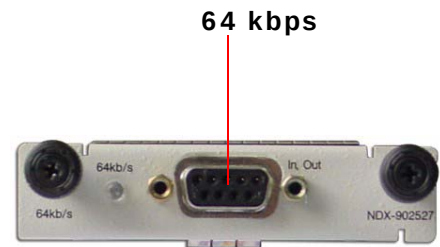
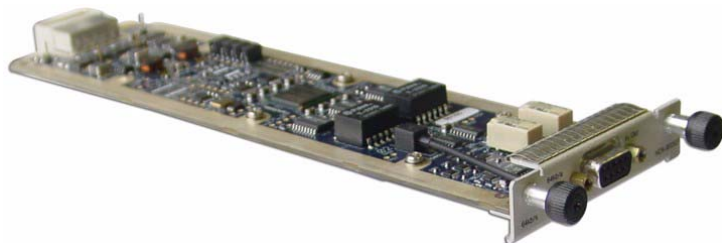
Thumbscrews,
(2 Typical)



10 / 100BASE-T / 64 kbps Option: 101-902532-501
(Pinout similar that of **Port 2** in [Table A-15](#))



Relays / Alarms Options: 101-902525-501 / 502
(Refer to [Table A-34](#) and [Table A-35](#))



64 kbps Option: 101-902527-501 (Refer to [Tables A-36](#) through [A-39](#))

Auxiliary Channels

Consist of the network communication (Net_Comm) data

- Net_Comm protocol encapsulates the SCAN (FarScan™), Orderwire, data channel, NMS and some additional services for transporting this information in the radio's overhead.
- Dynamically allocated payload to each service that is in use, replacing services that are not in use.
- Minimum payload of the auxiliary channel is 338 kbps up to 532 kbps, depending on the capacity of the radio and bandwidth optimization.
- Customer accessible services: a 2 x 64 kbps payload (through 2 bays located underneath the Controller), and as part of the basic offering, 19.2 kbps data channel (RS-232).
- These bays can accommodate the optional modules given in the following table. Refer to [Figure 2-16](#) and [Figure 2-17](#).

Optional module	Functions provided
Orderwire	Voice capability to the TRuepoint® Microwave network
Co-directional or Contra-directional V.11 64 kbps data	Point-to-point 64 kbps data channel within a hop of TRuepoint® 5000 radios
Co-directional or Contra-directional G.703 64 kbps data	
Relays and Alarms	In addition to the basic 4 relays and 2 alarm inputs on the Controller, the module provides either 12 relays and 12 alarm inputs or 6 relays and 30 alarm inputs
10/100BASE-T over 64 kbps	Additional dedicated 10/100BASE-T point to point channel for the customer's own use (NMS or inter-sites LAN connectivity)

Signal Distribution Module, (SDM)

Features and Functions

- Provides a customer's access point for their tributary signals (for multiplexer-protected systems only, except for STM-1/OC-3 interface).
- At the transmit end, the SDM accepts the tributary signals and distributes them to both MUX A and B. At the receive end, under a command from the Controller, one of the DEMUXes is selected to provide tributary signals for the user.
- With the presence of the SDM and tributaries connected to the SDM, one of the MUXes can be replaced without affecting traffic.
- Figures 2-18 through 2-25 show current SDM options.

Installs in Bay 8, in a fully protected SPU, refer to [Figure 4-1](#).

Table 2-3: Current SDM Options

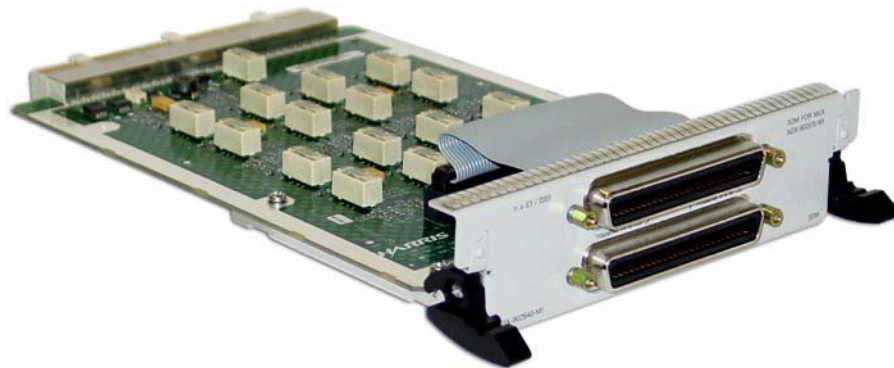
ANSI Capacity / Interface	CEPT Capacity / Interface	Reference
4-16 DS1	2-16 E1	Figure 2-18
OC-3 + 1 DS1	STM-1 + 1 E1	Figure 2-19
1 DS3 + 1 DS1	1 E3 + 1 E1	Figure 2-20
1 DS3 + 1 DS1 or 2x10-100BASE-T over 1 DS3 + 1 DS1	1 E3 + 1 E1 or 2x10-100BASE-T over 1 E3 + 1 E1	Figure 2-20
3 DS3 + 3 DS1 (proprietary)	N/A	Figure 2-21
28 DS1 / DS3 + 1 DS1	N/A	Figure 2-22
N/A	21 E1 + 1 E1	Figure 2-23
ADM 8 DS1 / DS3 + WS		Figure 2-24
N-16 DS1 + 2x10/100BASE-T	N-16 E1 + 2x10/100BASE-T	Figure 2-25



Every SDM ships with ESD caps, one installed on each unused "Tributaries" port. Always remember to keep any unused port covered with such cap. This is an ESD protection requirement. You need to keep all removed caps for future use.

Figure 2-18: SDM, Nx E1 / DS1

Model: SDM 902540, for MUX 902515



GENERAL
DESCRIPTION

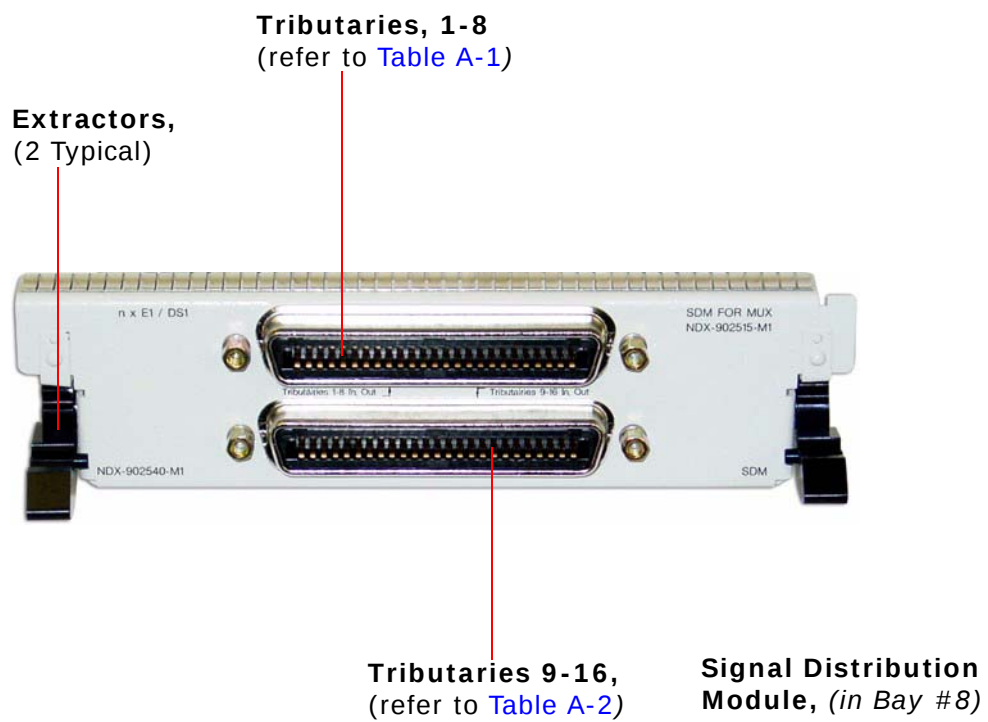
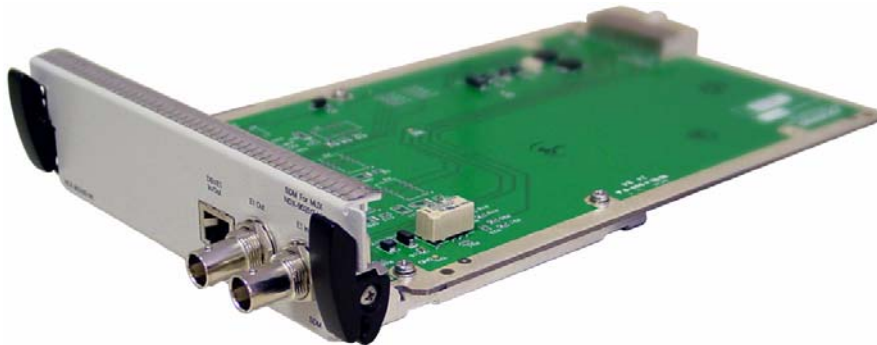


Figure 2-19: SDM Wayside, for STM1 / OC-3

Model: SDM 902585, for MUX 902517



**Extractors,
(2 Typical)**

E1, In

E1, Out

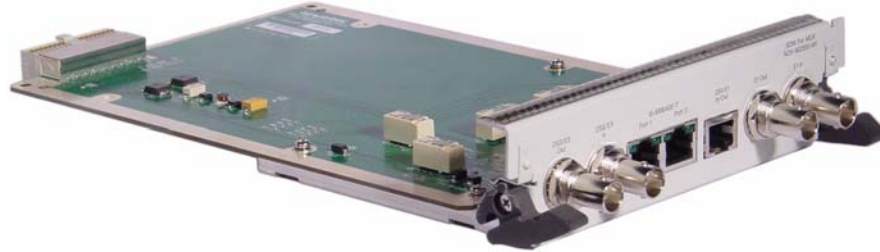


DS1/E1 In/Out

**SDM Module,
(in Bay #8)**

Figure 2-20: SDM, DS3/E3 + Wayside and 2x10/100BASE-T Over DS3/E3

Model: SDM 902585, for MUX 902550



GENERAL
DESCRIPTION

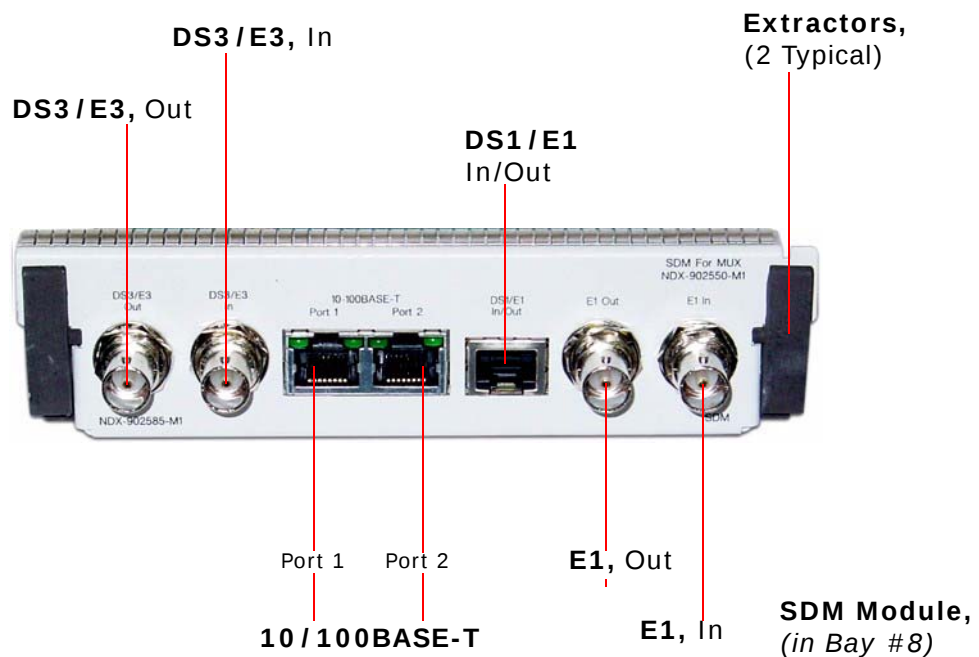


Figure 2-21: SDM, 3 DS3 + 3 DS1 Wayside Harris Frame

Model: SDM 902543, for MUX 902573

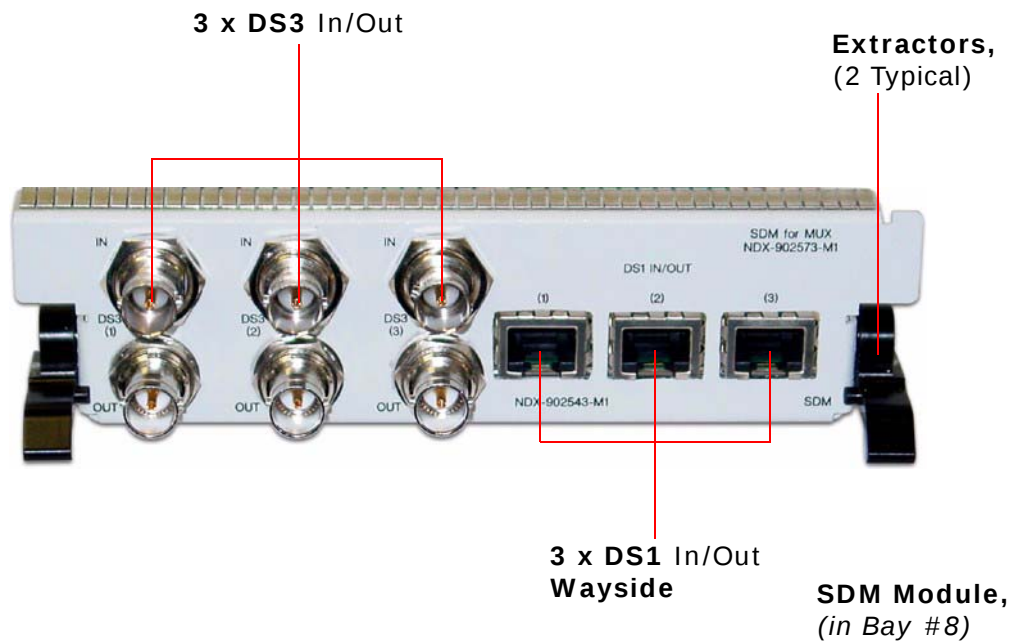
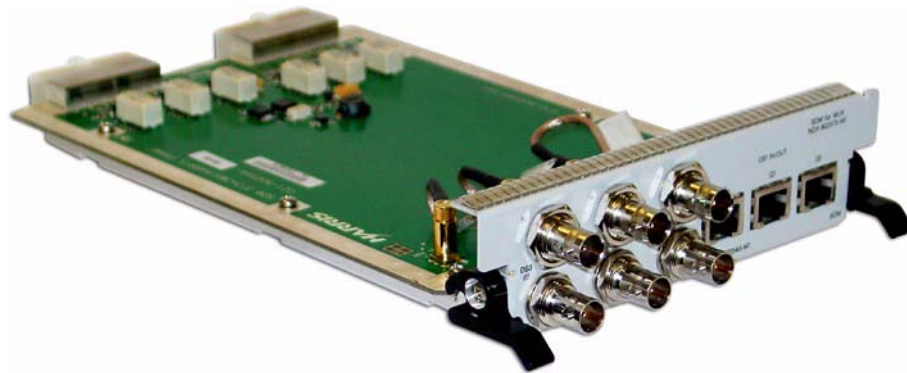
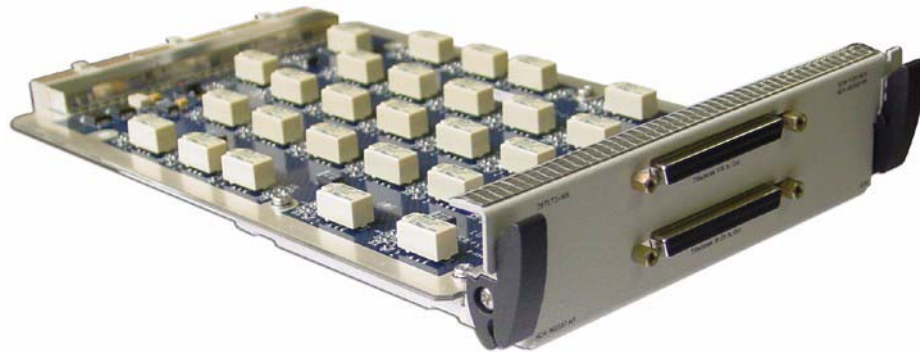


Figure 2-22: SDM, 28 DS1/DS3 + Wayside

Model: SDM 902587, for MUX 902555



GENERAL
DESCRIPTION

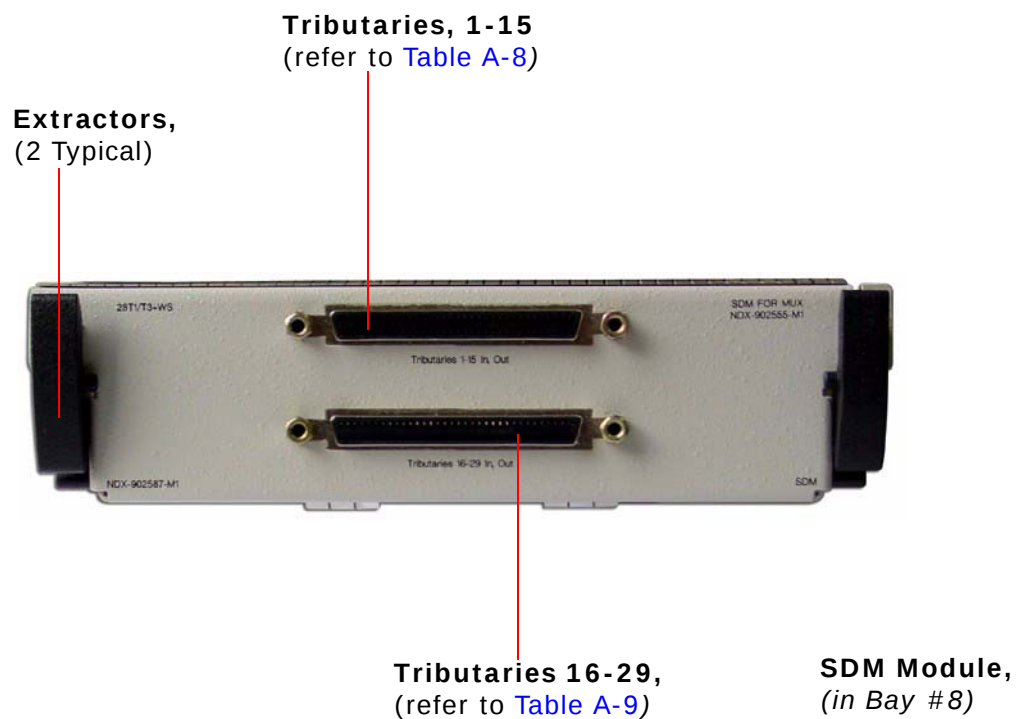


Figure 2-23: SDM, 21 E1 + WS

Model: SDM 902535, for MUX 902558

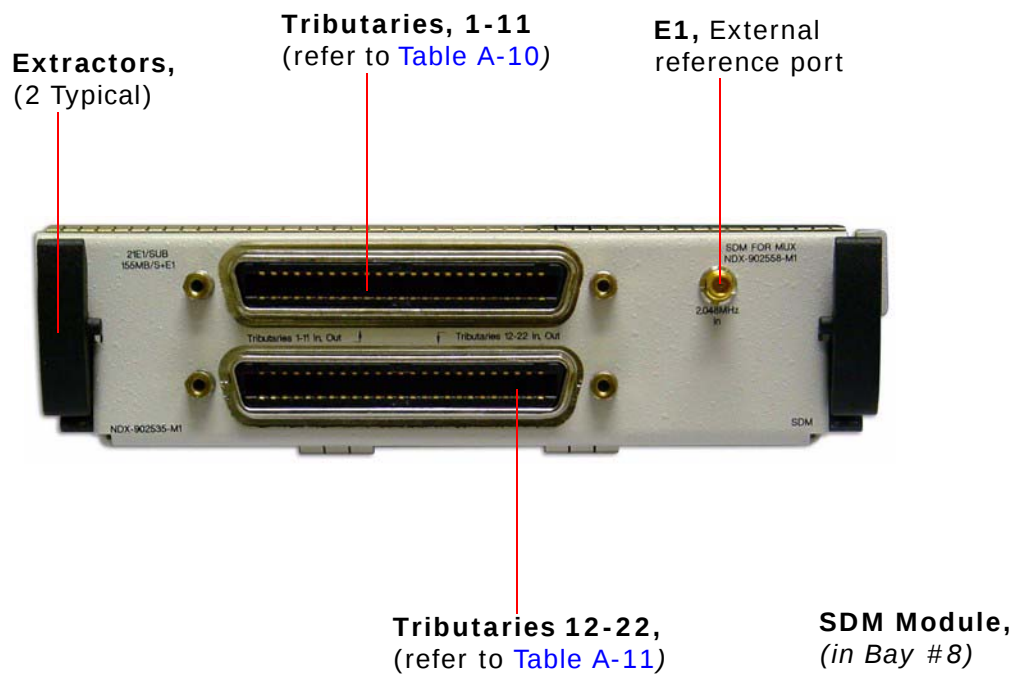
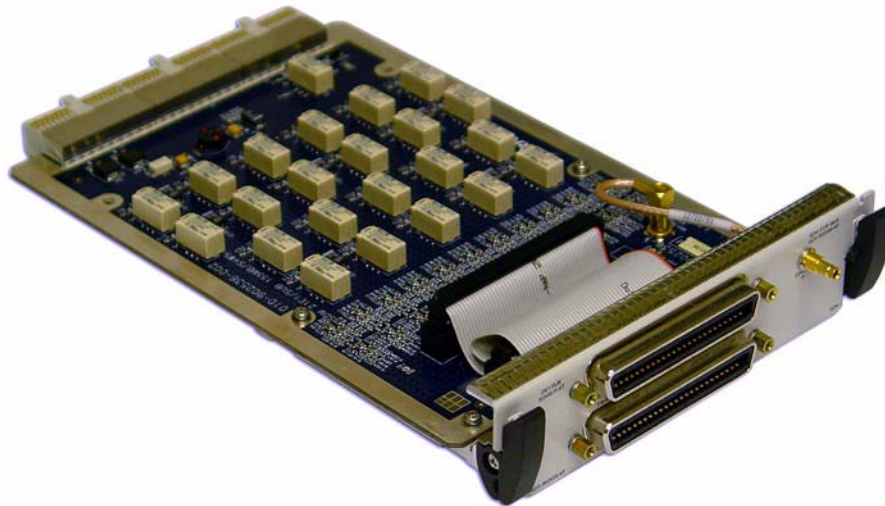
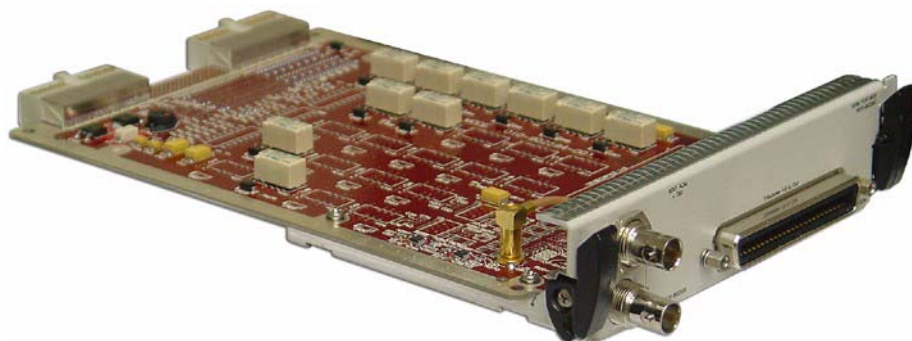
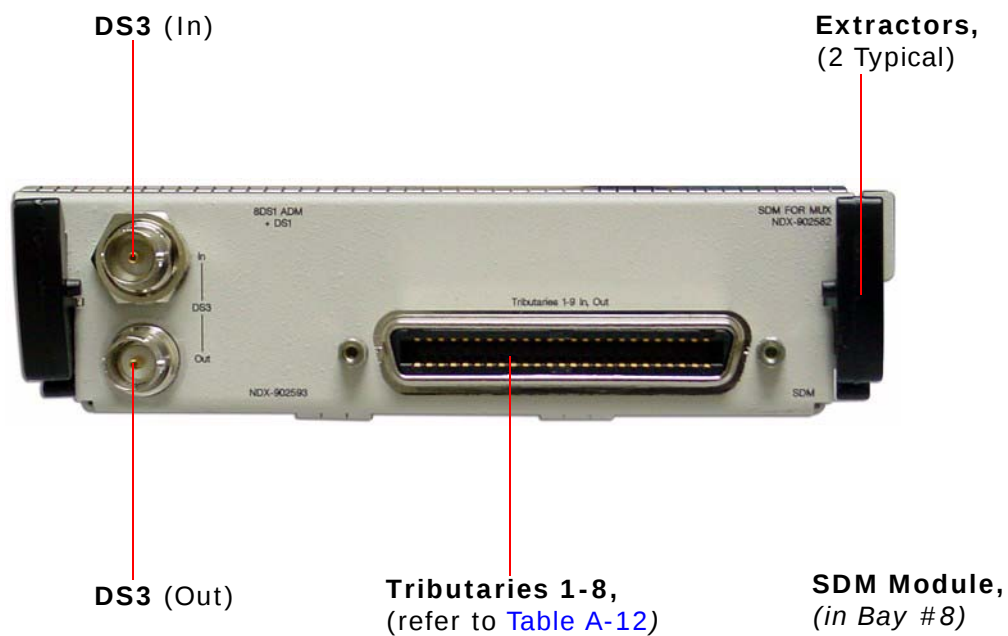
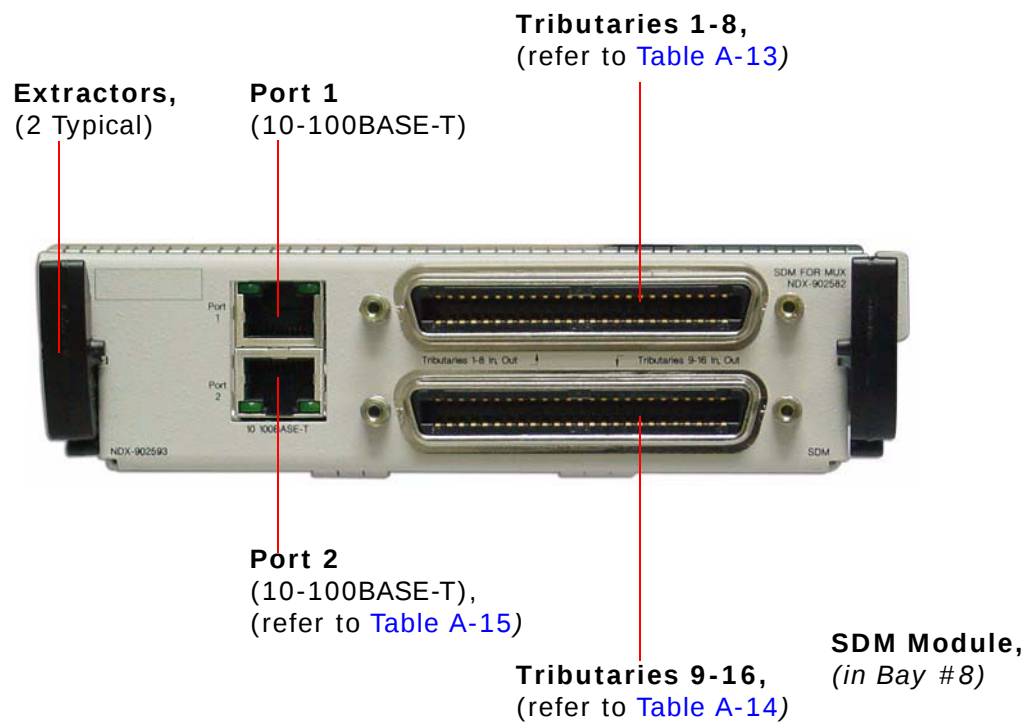
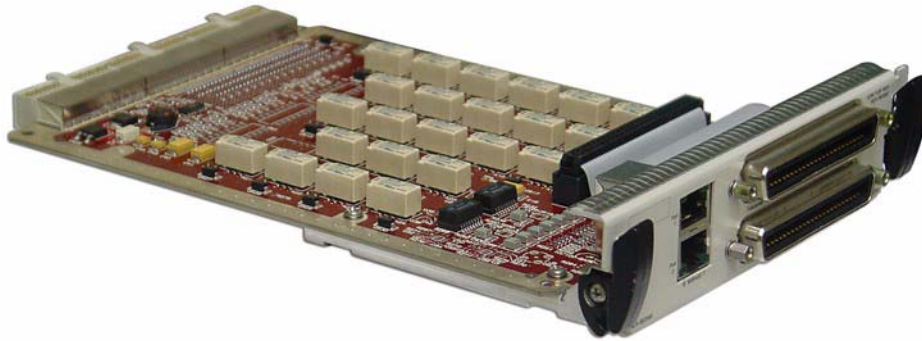


Figure 2-24: SDM, for ADM 8 DS1 / DS-3 + Wayside**Model: SDM 902593, for MUX 902582, Opt. 501**GENERAL
DESCRIPTION

**Figure 2-25: SDM, for Mixed Mode
NxDS-1/E1 + 2x10/100BASE-T**

Model: SDM 902593, for MUX 902582, Opt. 502 and 503



Ancillary Units — TIUs

The TIU (Tributary Interface Unit) is an additional 1-RMS shelf — an independent module from the SPU — that allows customers to connect their tributary lines to a standard density connector or a balanced termination, when that is not possible on the MUX or SDM modules.

This unit is offered in 2 versions;

- an ANSI version, supporting 28 DS1 + 1 DS1 wayside, and
- a CEPT version, supporting 21 E1 + 1 E1 wayside.

The following figures depict views of each TIU version, identifying ports and connectors.

Figure 2-26: The TIU — ANSI Version

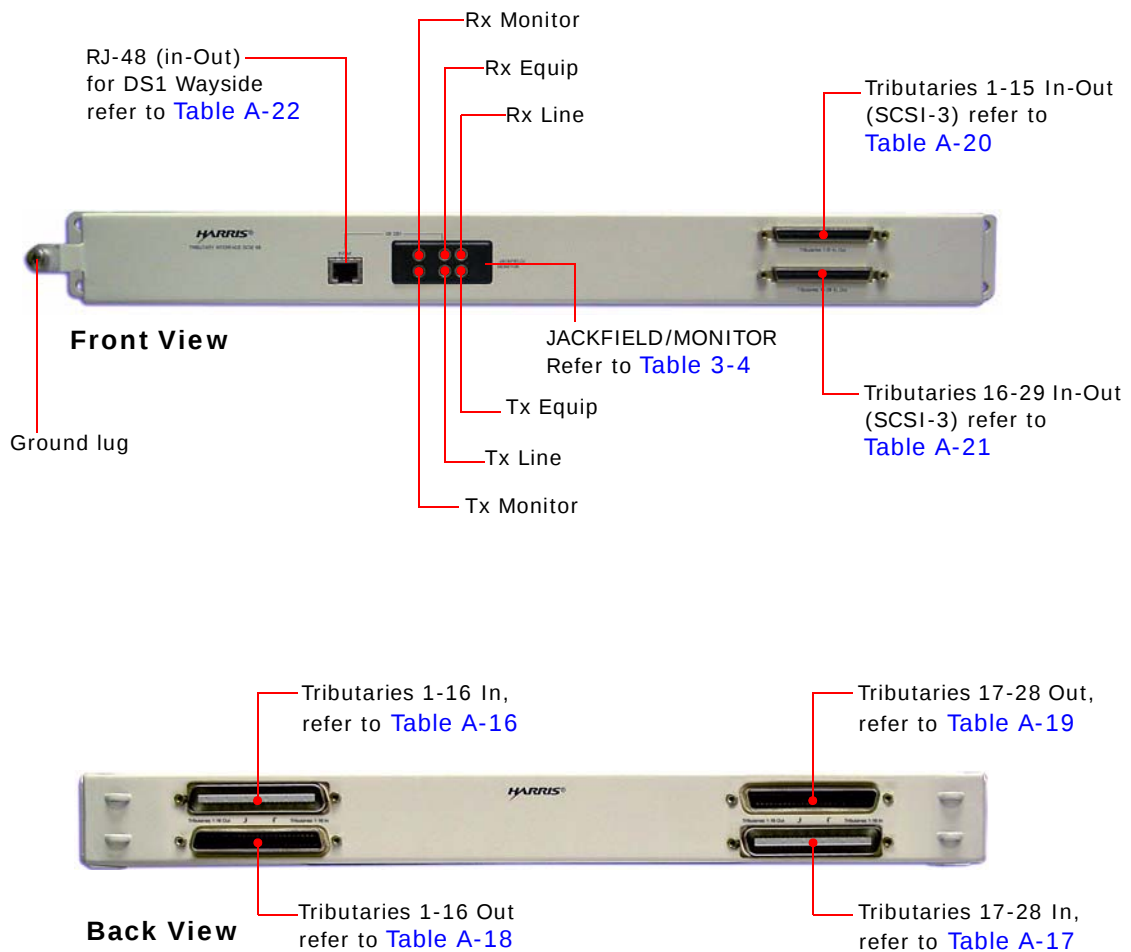
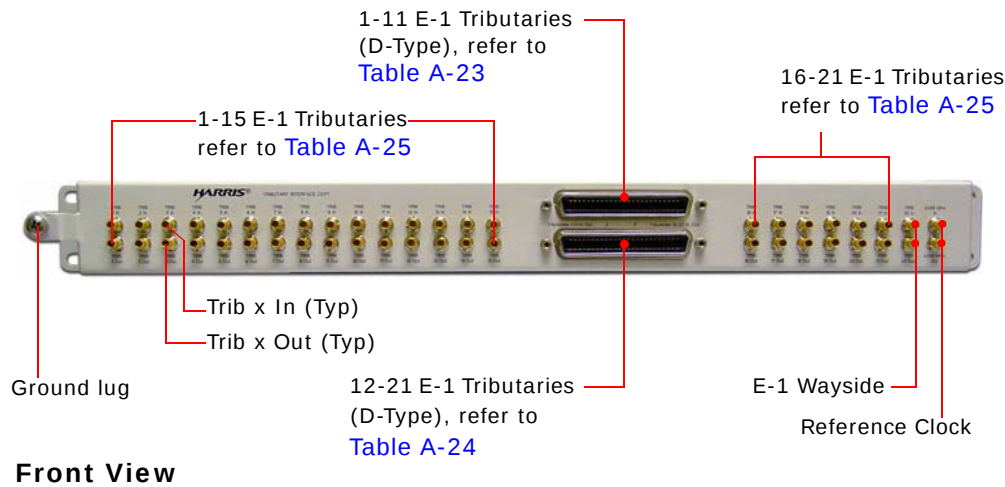


Figure 2-27: The TIU — CEPT Version

Features of the ANSI version

- One double-stacked SCSI connector (consisting of two 68-pin connectors),
- one RJ48C port, and
- one jackfield patch panel with monitoring jacks for the wayside (DS1) channel.

The back panel contains four 50-pin connectors (D-Type, 2 females for Rx data and 2 males for Tx data), that offer the following features:

- convenient conversion from SCSI connectors on the TRuepoint[®] MUX to standard 50 pin D-type connectors on current Harris and OEM jackfield panels,
- conformance to ANSI 655 foot cross-connect specification,
- can be fitted with wire-wrap adapters to provide such an interface, if required.

Features of the CEPT Version

- Two 50-pin D-Type connectors (D-Type),
- total of 46 coaxial connectors (1.0/2.3 series),
- provides up to 22 tributaries (including the wayside), and an external reference clock in an unbalanced configuration.
- each tributary meets the continuity requirements with a loss of 6dB @ 1.024 MHz due to cable loss,
- the input reference clock shall be in accordance with specifications part of the ITU-T G.703 document.

General Specifications



For ANSI and CEPT Frequency Planning and Regulatory Information, refer to Tables 4-11 through 4-14, in Chapter 4 of the **System Description** Manual, IMN-903000-Exx.

System Characteristics

Capacity

ANSI	CEPT
4, 8, 12, 16, 28 DS1 + 1 DS1; DS3+1 DS1, 3 DS3+3 DS1; OC-3+1 DS1	2, 4, 8, 16 E1; E3+1 E1, 21 E1; 32 E1, 2 E3; STM-1+1E1

Modulation

4, 16, 32, 64, 128 and 256 QAM ^a

FEC: Low Capacity

Reed-Solomon

Medium / High Capacity

Reed-Solomon concatenated with 2D or 4D [TCM](#), depending on bandwidth and system gain requirement

Digital Interfaces

ANSI	CEPT
• DS1 (110 Ω) • DS3 (75 Ω) • OC-3/STS-3 (75 Ω, OMM and OSM) • 10BASE-T, and 100BASE-T	• E1 (75 or 120 Ω) • E3 (75 Ω) • STM-1 (electrical 75 Ω, OMM and OSM) • 10BASE-T, and 100BASE-T

Auxiliary Channels

Standard	AUX1: 19.2 kbps asynchronous (RS-232)
Optional	AUX2 and AUX3: Orderwire or Data Channel 64 kbps synchronous co-contra directional V.11 or G.703

Network Management

FarScan™, StarView™, NetBoss™, SNMP Manager

Control Monitoring Tools

[Web-CIT](#), VT-100, Harris [HHT](#), [NMS](#)

Alarms

Programmable relay alarms	4 basic relays, 2 input (Controller)
Optional	12 relays/12 inputs, or 6 relays/30 inputs, or a combination using two relay and alarm modules in the optional bays

Operating Temperature Range		Indoor, °C		Outdoor, °C	
	Guaranteed Performance	-5 to +50		-33 to +55	
	Operational	-10 to +55		-40 to +55	
	Humidity	95% max			
Power Source		21 to 60 V _{dc} negative or positive ground (auto detection), recommended to follow ETSI EN 300 132-2 guidelines and Telcordia objective GR-499			
Power Consumption		See detailed Table 2-4 below			
Connections		SPU to RFU, coaxial cable with N-Type connectors			
Physical Description					
SPU mounted in a 19” rack		Height, mm	Width, mm	Depth, mm	Weight, kg
	SPU 1+0	45	483	258	3.3
	SPU 1+1	90	483	258	5.2

a. Future availability



Always consult your Harris representative for available frequency plans and options.

Table 2-4: Power Consumption, (Watts)

SPU Components	Maximum ^a	Typical ^b
Controller	7	7
Mux (N-16 E1/DS1)	6.25	4
Modem	10	9
SDM (28 DS1)	3.75	2
Optional cards: • orderwire	5	3.5

a. Maximum: as measured at 21V_{DC}

b. Typical: At 48V_{DC}

Tributary Compliance			
	Standard	JitterTransfer and Tolerance	Output Jitter
STM-1 Electrical	• ITU-T G.703	• ITU-T G.783 • ITU G.825	• ITU-T G.783 • ITU -T G.825
STM-1 Optical	• ITU-T G.957	• ITU-T G.783 • ITU-T G.825	• ITU-T G.783 • ITU-T G.825
STS-3/EC-3	• GR-253-CORE	• GR-253-CORE	
OC-3	• GR-253-CORE • ANSI T1.106/88 (replaced by T1.105.06 1996)	• GR-253-CORE	
10BASE-T	• IEEE 802.3	• IEEE 802.3	
100BASE-T	• IEEE 802.3	• IEEE 802.3	
E3	• ITU-T G.703	• ITU-T G.823	• ITU-T G.751
E1	• ITU-T G.703	• ITU-T G.823	• ITU-T G.742
DS3	• GR-499-CORE, • ANSI T1.102-1993	• GR-499-CORE, (section 7.3.1 & 7.3.2) • ANSI T1.102-1993, • ITU-T G.824	• GR-499-CORE, (section 7.3.3) • ITU-T G.752
DS1	• GR-499-CORE, • ANSI T1.102-1993	• GR-499-CORE, • ANSI T1.102-1993, • ITU-T G.824	• ITU-T G.743

Environmental	
Subject	Compliance
Lightning protection	Chapter 3 of Manual IMN-903001 (<i>RFU Installation</i>) recommends a protection scheme that uses grounding kits. Harris Corporation recommends that such lightning protection or other alternatives thereto be provided in compliance to Local and/or National Electrical Codes
Temperature range	• Full specification: -5° C to + 50° C (meets ETSI EN 300 019-1-3, class 3.1E)
	• Operational: -10° C to + 55° C (Operational means that the modules will start at cold and traffic will pass without synchronization losses and BER will be better than 1.0x10-6 after 15 minutes warm-up)
	• Storage: -55° C to + 70° C
Humidity	• 5 – 95% non condensing
Altitude	• 0 to 5000 m AMSL
Vibration	• ETSI EN 300 019-2-3 V2.1.2 (1999-09) class 3.3 - 5 sweep cycles per axis
Transit Vibration	• ETSI EN 300 019-2-2 V2.1.2 (1999-09) class 2.3 public transportation: (random vibration, shocks and drop)
EMI / EMC and Safety Compliance	
Subject	Compliance
Safety	• IEC 60950-1 • EN 60950-1 • CSA C22.2 No. 60950-1 • UL 60950-1 • EN 60215 • EN 60825, Class 1 Laser
EMC	• FCC Part 15, Subpart B, Class B • Canada ICES-003, Class B • ETSI EN 301 489-01 (Part 1: Common technical requirements = common part for all radio equipment) • ETSI EN 301 489-4 (Part 4: Specific conditions for fixed radio links and ancillary equipment and services)

CHAPTER

3

INSTALLING THE SPU

General

You would normally reach this point **after** completing the RFU Installation, (refer to Manual **IMN-903001-Exx**).

Before installing the SPU, ensure preparing a clean, secure room for it, such as a [Restricted Area](#), and provide the following:

- a coaxial cable, from the RFU;
- a 21-60 V_{DC} power source¹; and
- access to the building ground terminal.



Although the installation of the SPU does not require advanced technical skills, we strongly recommend that the technical personnel possesses the knowledge and skills appropriate for making such installations. Power connections to the microwave radio must be made in compliance with local electrical codes by a [Skilled Person](#). Harris Corporation disclaims any liability or responsibility for the results of improper or unsafe installation practices.

1. Power source recommended to follow ETSI EN 300 132-2 guidelines and Telcordia objective GR-499.

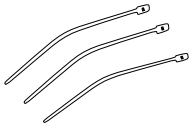
Table 3-1: Tools required

Tool	Required equipment specifications	Where used
Screwdriver ^a	Phillips #2	General
Multimeter	With ohm meter	
Miscellaneous tools for installing connectors on the SPU to RFU coaxial cable.	Refer to the manufacturer documentation provided with the connector.	• Connect the Coaxial Cables to the SPU, on page 3-6

a. Part of an optionally available tool kit, part number 098-093607-027.

Figure 3-1: Parts for SPU Installation, as a Minimum

Tie-Wraps or Cable Clamps to support Cables



NxE1 / DS1 Protected SPU shown

Mounting Brackets (2)



Grounding Lug



In order to easily replace a module, ensure that all cables are routed from the rack sides and at the level of their respective connectors. Doing so, allows you to replace a unit with the least operation disruption. The following steps assume that the SPU received is equipped with all purchased options. For modules sparing information, refer to Table 5-1.

Procedure

1 Install the SPU in the rack

Tools and material required

- A number-2 cross-head screw driver

Secure the SPU to the rack using the screws provided, in the position shown in Figure 3-2. The position will depend on your situation and what other equipment you have or plan to have in the rack.

Stacking Requirements

Allow for **1-RMS** free space between **stacked units** where indicated:

1. For conditions with no airflow (still air), refer to [Figure 3-2](#).
2. For conditions with a **minimum** airflow velocity of 0.625 m/s, refer to [Figure 3-3](#).
3. For an RFU installed indoors, allocate a free space of **2-RMS** between the bottom of the RFU's bracket and the SPU'S top to allow for sufficient space for connecting the RFU-SPU cable.

**Figure 3-2: SPU Stacking Configurations —
Still Air Conditions**

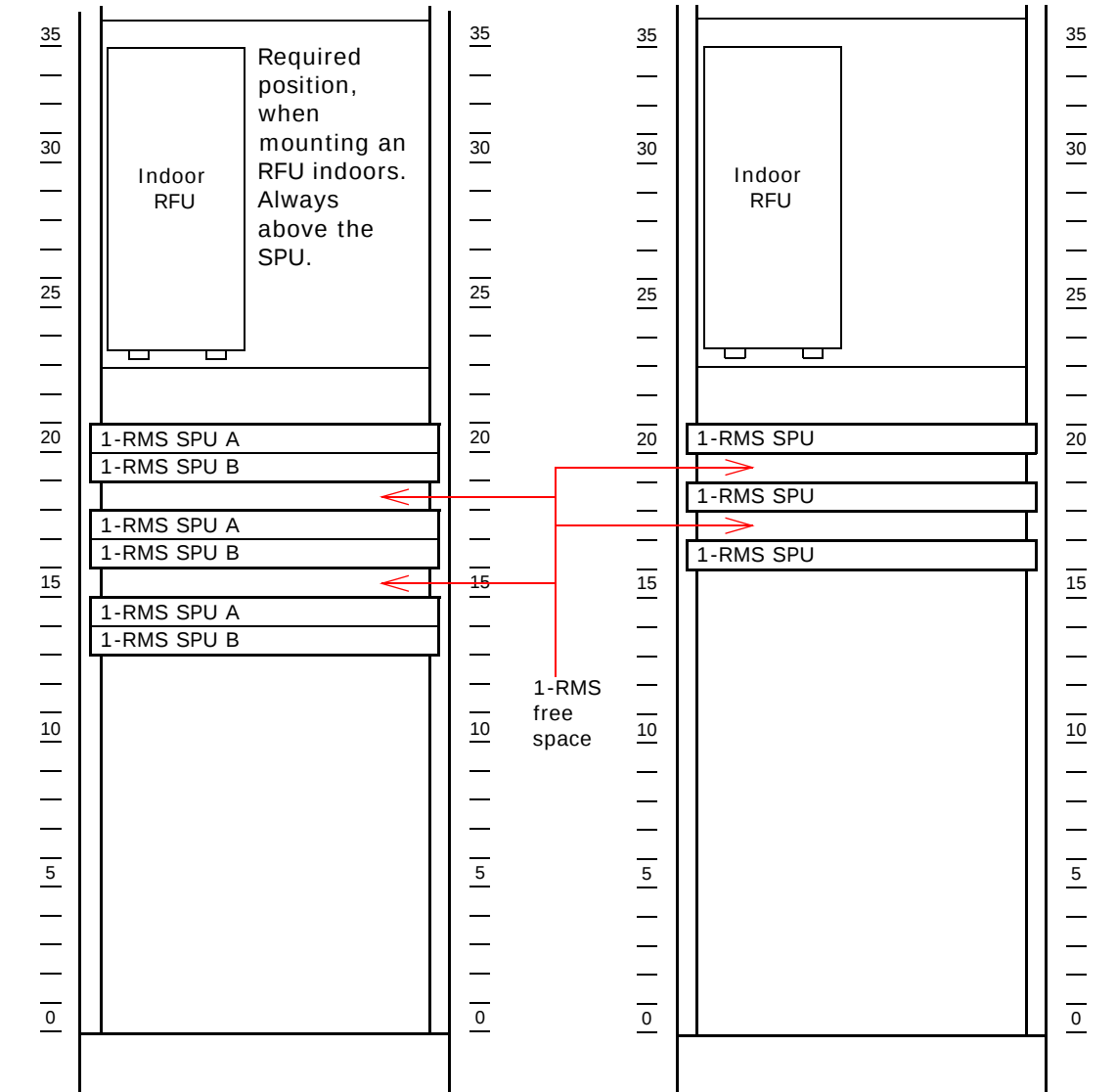
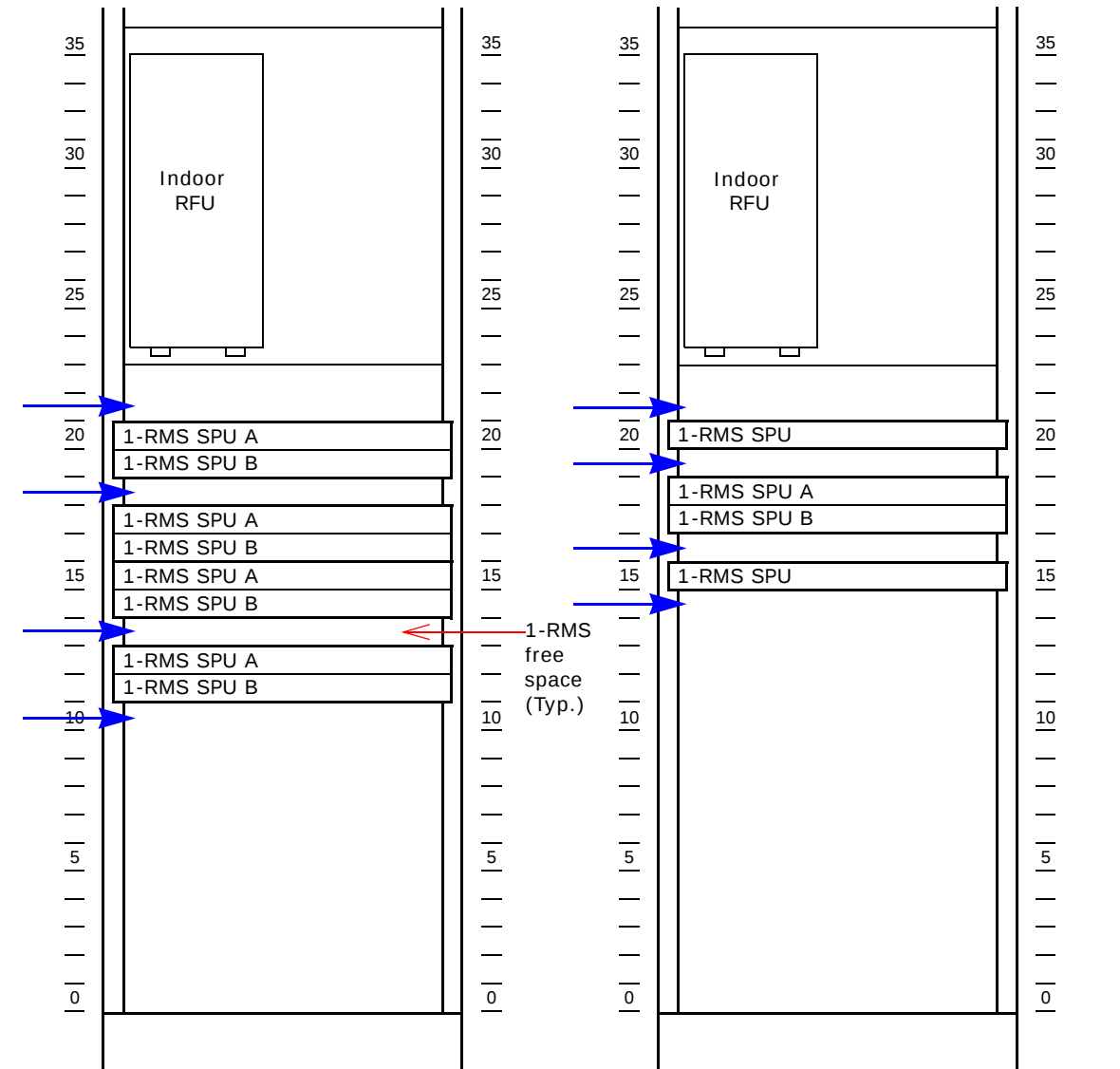


Figure 3-3: Other Allowable Stacking Configurations —
Cross Airflow Velocity Conditions of 0.625 m/s



When using the Dual Battery Input modem, ensure that the module is strapped for the correct polarity. A wrong polarity will damage the SPU. Refer to Figure 2-3.

2 Connect the Coaxial Cables to the SPU

Tools and material required

- Common tools
- A multimeter
- An N-type connector compatible with the type of coaxial cable that you are using.



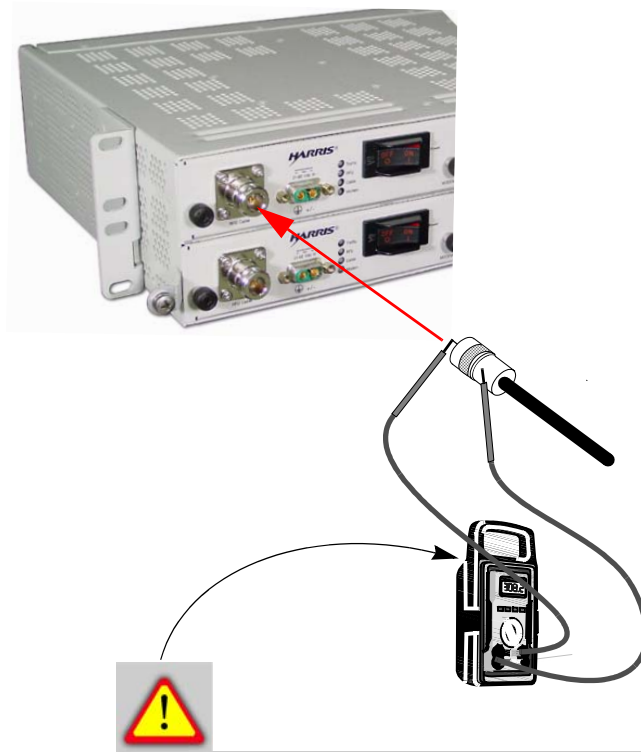
If the RFU has already been installed you should find the end of the interconnect cable near the SPU.

1. Cut the cable to a length which will leave about 6 inches (15 cm) of slack after it has been connected to the SPU.
2. Following the instructions that come with the connector, install an N-type connector on each cable.
3. Using the multimeter, check that the resistance between the coaxial cable's center connector and the shield is **more** than 100 Ω , with the far end connected to the RFU.



A lower resistance value indicates that there is a short in the coaxial cable or in the RFU that may damage the SPU's power switch (breaker) when it is switched ON. If this is the case, replace the faulty element (cable or RFU).

4. Connect the cables to the RFU Cable ports on the Modem(s). (Cable types and lengths are given in [Table 3-2](#)).
5. Support the cable if necessary.

Figure 3-4: Connecting the Coaxial Cable to the SPU

Resistance between the coaxial cable's center connector and the shield must be more than 100 Ω

Table 3-2: Coaxial Cable Types and Lengths

Description		Comments	Part Number
Foam core 50 Ω heliax shielded cable (Andrews LDF2-50)		Cable only, XX0 = 210 m to 300 m in 10 m increments	087-099499-XX0
Low loss 50 Ω RG 8/U kit	45 m	Kit contains low loss RG 8/U cable, sealing kit, 2 N-type connectors, and 3 grounding kits.	099-901208-001
	90 m		099-901208-002
	150 m		099-901208-003
	210 m		099-901208-004

3 Ground the SPU

Tools and material required

- A number-2 cross-head screw driver

Ground the SPU by connecting 3.26 mm (8 AWG) copper cable from the grounding point lug on the left side of the SPU enclosure to the radio system's main grounding point.

For a roof-top installation, the main grounding point could be the building ground, or the water supply pipe just before it enters the building.

For a tower installation, it should be a good ring ground system made from buried copper cables and rods. **DO NOT** connect to the electrical utility ground.

Safety Requirements for Grounding

1. It is very important that the path of lowest impedance go directly to the main grounding point.
2. Do not connect other equipment to the same grounding cable as the SPU. Each piece of equipment at the site should have a separate grounding cable to a common very low impedance main grounding point.
3. Locate this equipment in the same immediate area (adjacent cabinets) as any other equipment that has a connection between the grounded conductor of the same d.c. supply circuit and the grounding conductor, and also the point of grounding of the d.c. system. **DO NOT** ground the d.c. system elsewhere.
4. Connect this equipment directly to the d.c. supply system grounding electrode conductor or to a bonding jumper from a grounding terminal bar, or bus to which the d.c. supply grounding electrode is connected.
5. All intra-building cabling must be shielded and both ends of each shield must be grounded.
6. There shall be no switching or disconnecting devices in the grounded circuit conductor between the d.c. source and the point of connection of the grounding electrode conductor.



Connect power cable end to Harris' optional fuse panel, or provide fusing according to Local and National Electrical Codes. Fuse ratings must be: 4 A for 48 V, and 7.5 to 8 A for 24 V operations.

4 Connect power to the SPU

Connect the power supply as shown in Figure 3-5. Check that the junction-block screws are tight enough to hold the power wires securely in place.

If you have purchased the optional fuse panel see Figure 3-6 for installation instructions for it.

Figure 3-5: Power Connections

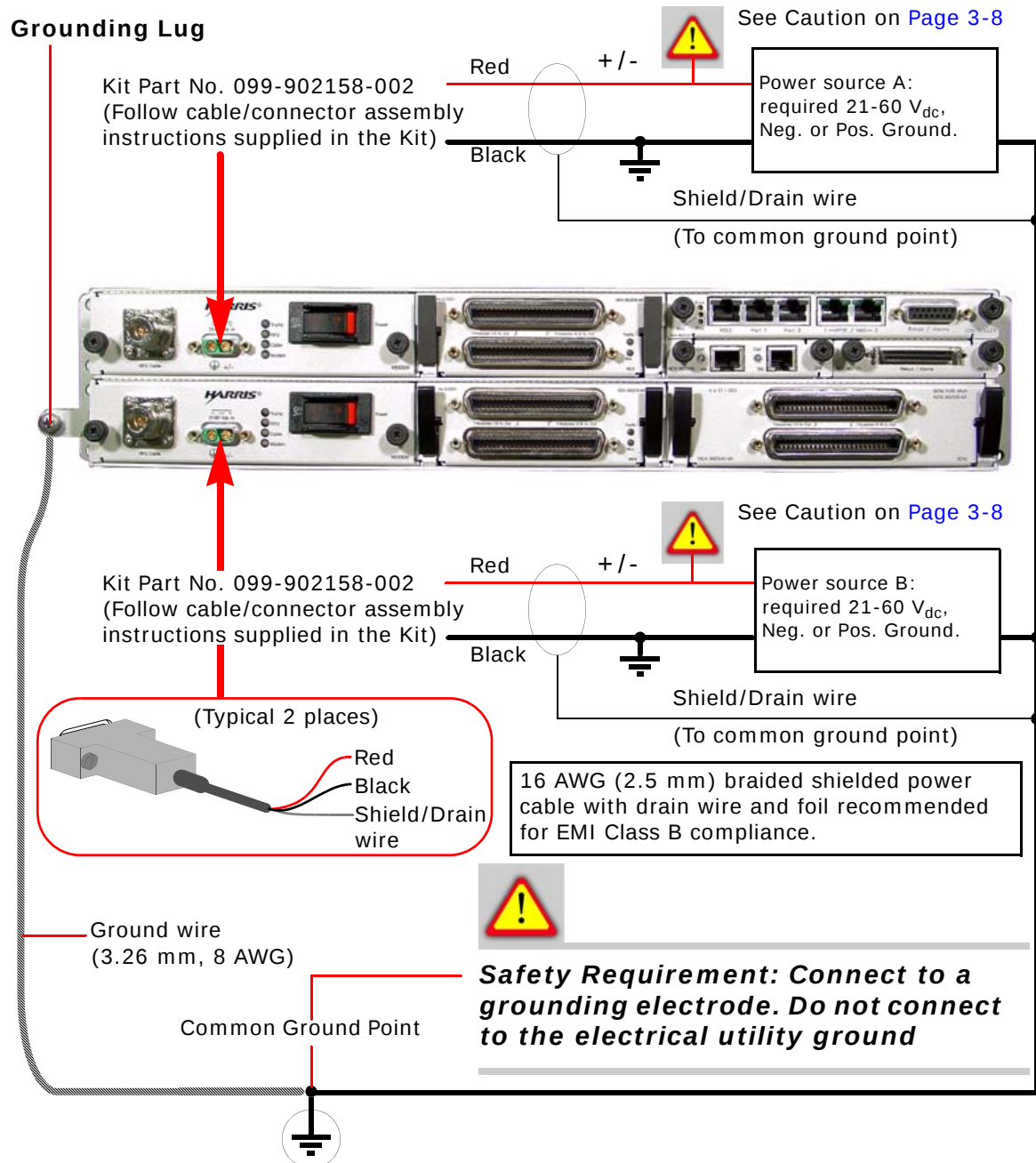


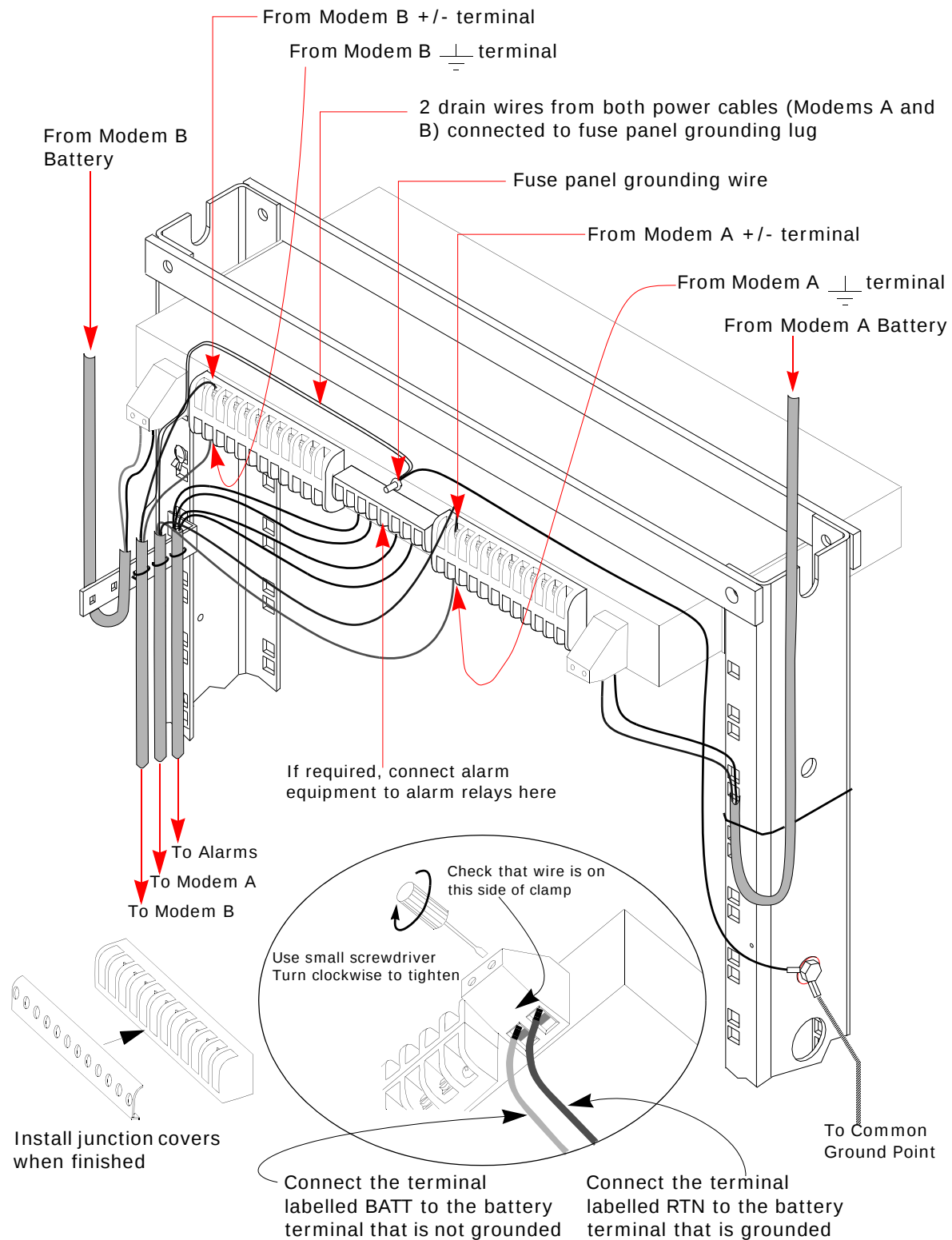
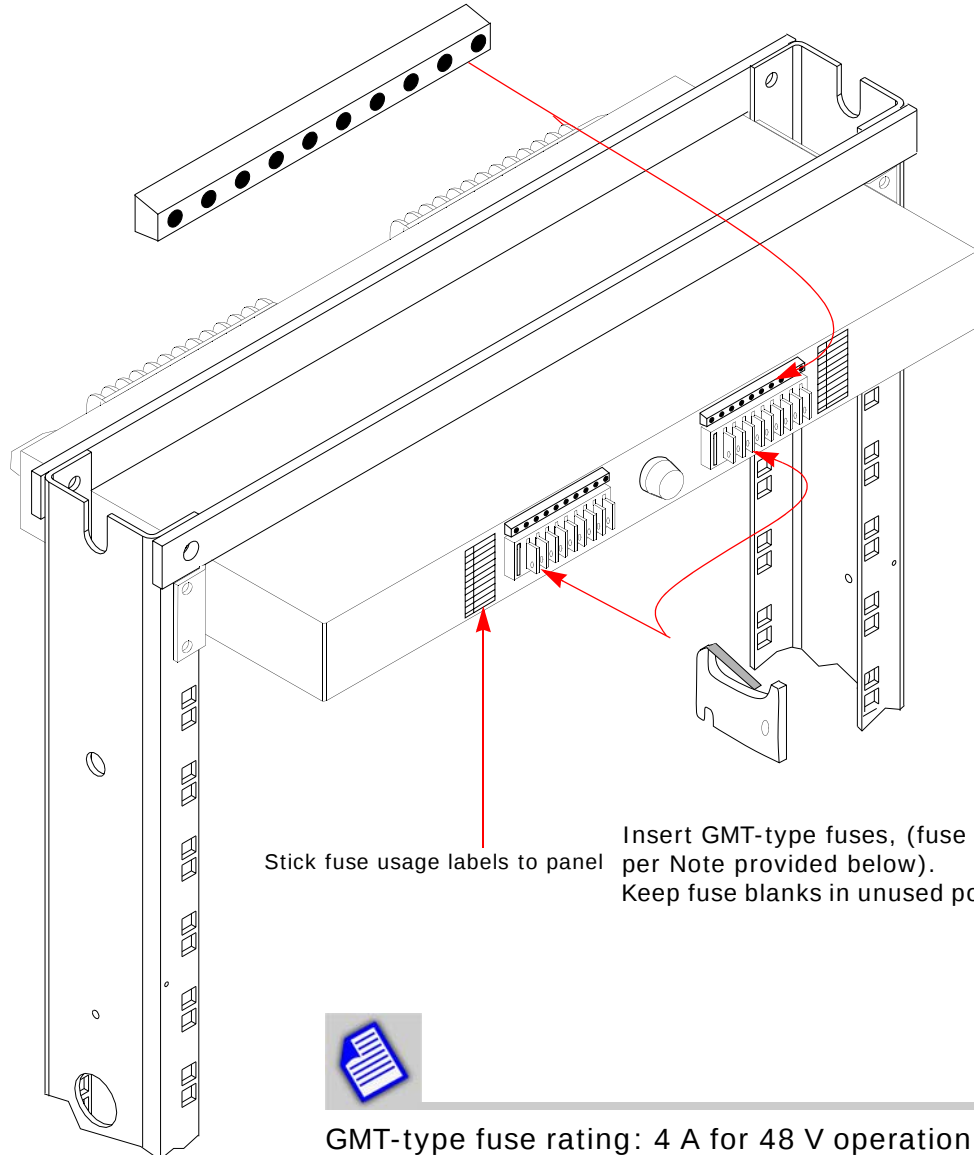
Figure 3-6: Optional Fuse Panel — Back View Wiring

Figure 3-7: Optional Fuse Panel — Front View

Stick peg holders on panel above fuse slots.
Insert colored pegs to indicate value of
corresponding fuses



Stick fuse usage labels to panel

Insert GMT-type fuses, (fuse ratings
per Note provided below).
Keep fuse blanks in unused positions.



GMT-type fuse rating: 4 A for 48 V operation,
and 7.5 A for 24 V operation.

5 Connect the MUX or SDM Tributaries



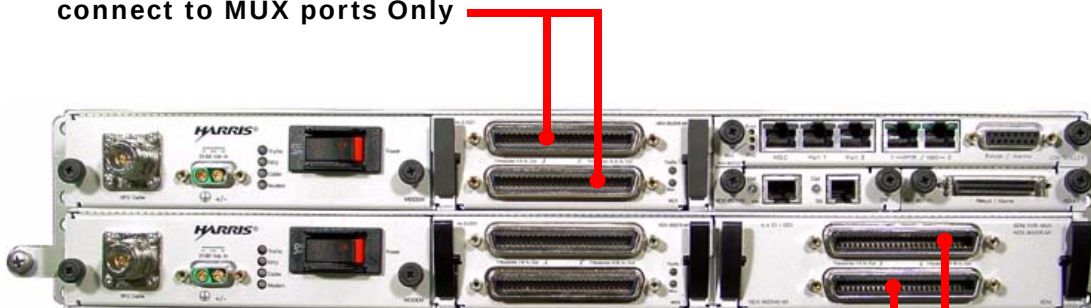
Tributary connection depends on the SPU Configuration. Refer to the [Table 3-3](#) for the appropriate setup.

Tools and material required

Cables with connectors appropriate to the Multiplexer options ordered, as described in [Table 3-3](#).

Figure 3-8: Connecting Tributaries —
Cables with D-Type Connectors

Tributaries for Configuration
Types A, B and C ([Table 3-3](#))
connect to MUX ports Only



Connect tributaries for
Configuration Type D ([Table 3-3](#)) here Only

An optional hardware key allows for upgrading the number of tributaries to 16 E1/ DS1. Refer to [Capacity Upgrade, on page 4-12](#) for detailed instructions

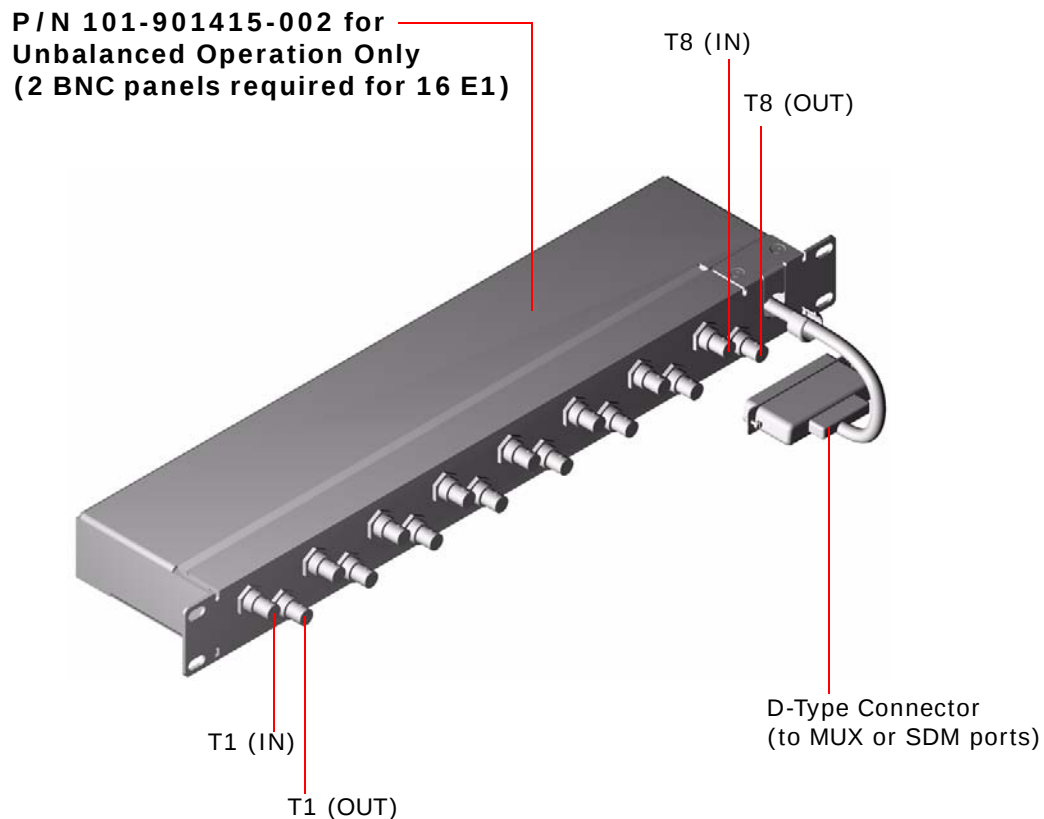
Table 3-3: Tributary Connection per SPU Configuration

Type	SPU Configuration	As required, use cables per	To Connect to Port(s)
A	Unprotected	Figure 3-9 and 3-10 , as required	MUX
B	Unprotected Expandable		MUX
C	Protected Light		MUX
D	Protected		SDM



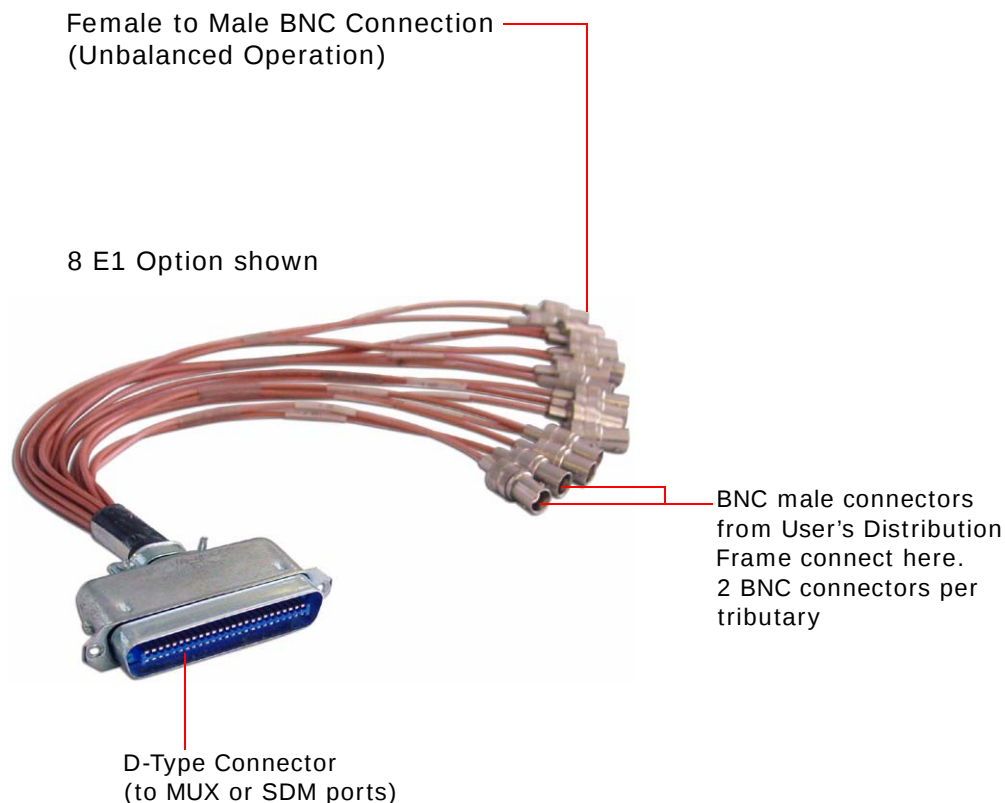
Every MUX and SDM ships with ESD caps, one installed on each unused “Tributaries” port. Always remember to keep any unused port covered with such cap. This is an ESD protection requirement. You need to keep all removed caps for future use. On a 2-RMS SPU, each of the 4 MUX ports must be covered with an ESD cap.

Figure 3-9: Tributary Connection Example — Using the BNC Interconnect Panel



Connect the **D-Type Connector** from the BNC panel to the **TRIBUTARIES (1-8)** and **TRIBUTARIES (9-16)** ports, on the MUX(es) or the SDM, where applicable. And, using 75 Ω coaxial cable with male BNC connectors at the SPU-end and the chosen connectors at the other, connect the tributary inputs and outputs on the panel to your equipment. The inputs and outputs are labelled on the panel, **T1 (IN)** through **T8 (OUT)**.

**Figure 3-10: Tributary Connection Example —
Using the 50-Pin D-Type to BNC Cable Assembly**



Connect the **D-Type Connector** on the assembly to the **TRIBUTARIES (1-8)** and **TRIBUTARIES (9-16)** ports, on the MUX(es) or the SDM, where applicable. And, using 75 Ω coaxial cable with male BNC connectors at the SPU-end and the chosen connectors at the other, connect the tributary inputs and outputs on the assembly to your equipment. The inputs and outputs are labelled on the female BNC connectors.

For Unbalanced Operation Only

50-Pin D-Type to BNC Cable Assembly		
Length, ft.	Part Number	Capacity
1.5	087-901346-001	2/4 E1, Unbalanced
1.5	087-901346-002	8 E1, Unbalanced
9	087-901346-003	2/4 E1, Unbalanced
9	087-901346-004	8 E1, Unbalanced

Figure 3-11: Tributary Connection — To MUX and SDM

Connect the D-Type connectors to the **TRIBUTARIES (1-8)** and **TRIBUTARIES (9-16)** ports on the balanced SPU. At the other end, install your own connector or wire-wrap the bare wires to your equipment. A label at the user's end of the cable indicates which tributaries the bare wires connect to. For the cable lengths, see table below.



This connector connects to SPU's **MUX** Port **TRIBUTARIES (1-8)** or **(9-16)** (Ref. P/N 087-903465-xxx)

Double-Shielded Cable, with Straight Connector		
Part Number	Description	Length
087-903465-001	Cable, for connecting MUX to customer tributaries, D-Type male 50-pin, straight connector one end, stub-end to customer side	• 3 ft (0.915 m)
087-903465-002		• 7 ft (2.14 m)
087-903465-003		• 19 ft (5.8 m)
087-903465-004		• 25 ft (7.625 m)
087-903465-005		• 60 ft (18.30 m)

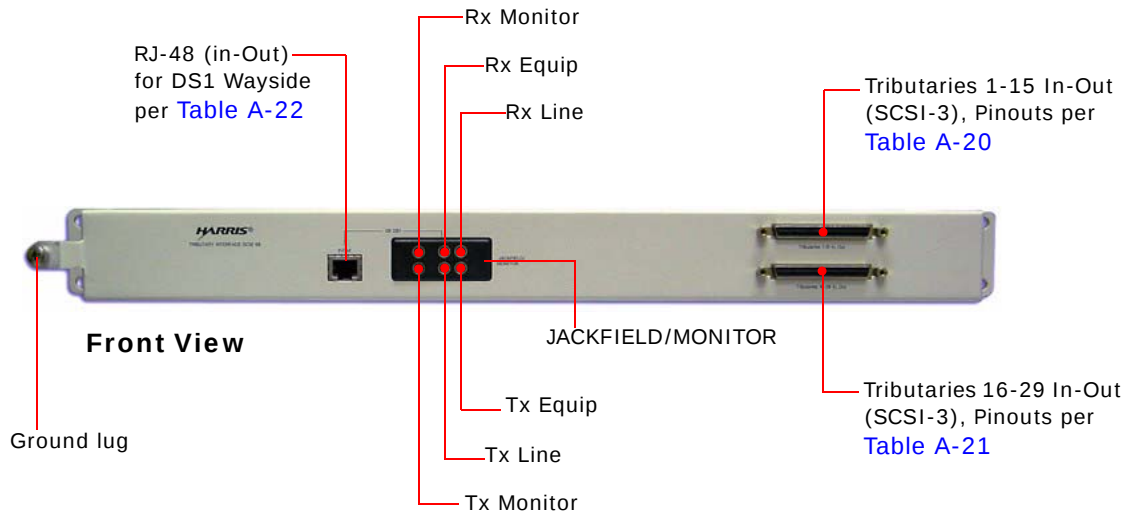


This connector connects to SPU's **SDM** Port **TRIBUTARIES (1-8)** or **(9-16)** (Ref. P/N 098-901250-xxx)

End of this cable connects to User's Distribution Frame

Shielded Cable with Right-Angle Connector		
Part Number	Description	Length
098-901250-001	Cable Kit, for connecting SDM to customer tributaries, D-Type male 50-pin, right-angle connector one end, stub-end to customer	• 32.5 ft (9.91 m)
098-901250-002		• 10 ft (3.05 m)
098-901250-003		• 20 ft (6.10 m)

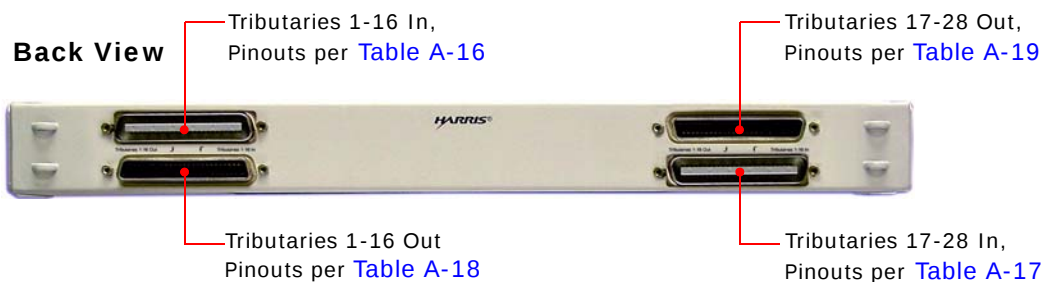
Figure 3-12: Tributary Connection Example — Using the TIU, ANSI Version



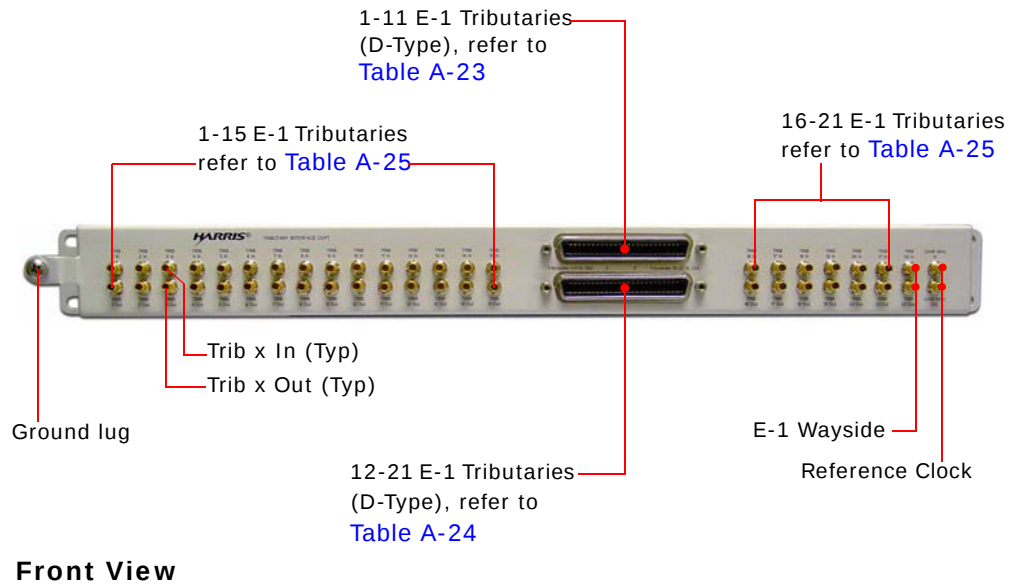
Where applicable, connect cables with SCSI-3, RJ-48C Connectors, or mini-weco jacks.

Table 3-4: Wayside Access and Monitoring

Connect	To	Function	Comments
Rx Equip	BER set Rx, mode = Terminate	• Wayside receive direction	• Intrusive nodes: inserting a plug in either jacks breaks connection associated with that circuit
Rx Line, Customer	BER set Tx		
Tx Equip	BER set Tx	• Wayside transmit direction	
Tx Line, Customer	BER set Rx, mode = Terminate		
Rx Monitor or Tx Monitor	BER set, mode = Monitor	• Monitoring wayside Rx equipment and Tx line	• Non-intrusive nodes: inserting a plug in either jacks does not break connection associated with that circuit



**Figure 3-13: Tributary Connection Example —
Using the TIU, CEPT Version**



Where applicable, connect cables with D-Type connectors, or Coaxial 1.0/2.3, 75 Ω Connectors.

6 Connect remote and local communications equipment

Tools and material required

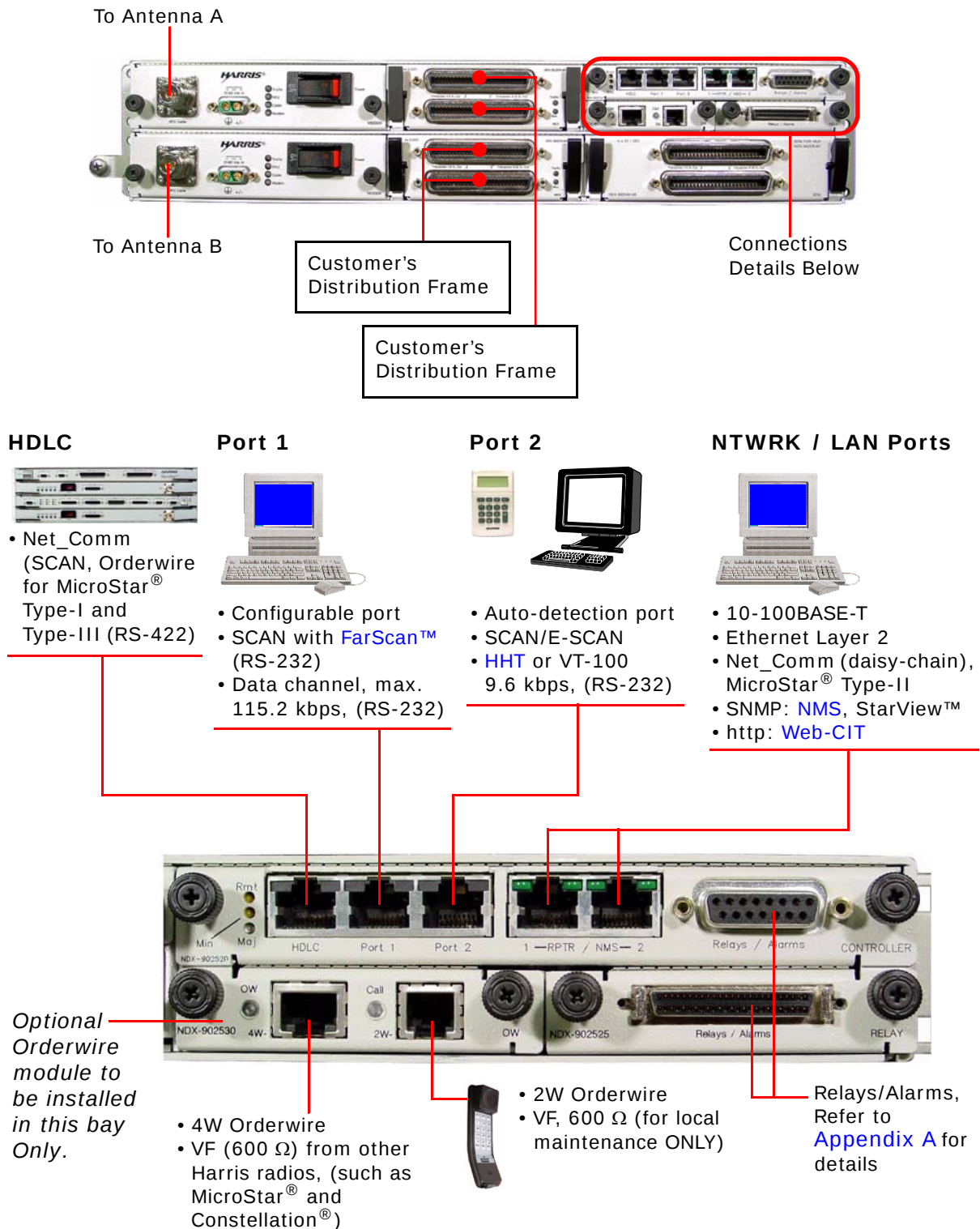
- Common tools

As part of a multi-hop system, the TRuepoint[®] radio allows you to communicate with/control equipment at remote sites through a telephone link, a data link to third party RTUs, and/or a FarScan[™] or SNMP data link. Depending on your needs, connect this equipment as shown in [Figure 3-14](#). Connectivity to the Harris' MicroStar[®] radios is also achieved as shown.



We recommend that all external devices support Auto-negotiation, when connected to a TRuepoint[®] Ethernet port. If not supporting Auto-negotiation, such devices should be configured as 10 Mbps, half-duplex.

Figure 3-14: Connecting Remote and Local Communications Equipment



7 Connect other SPUs in repeater or spur configuration

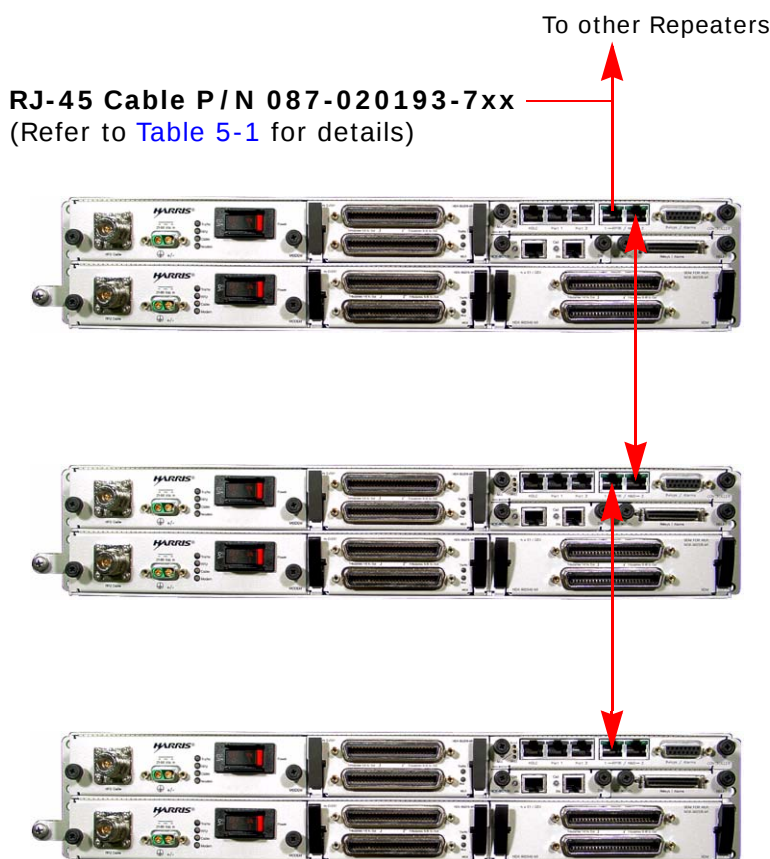
Tools and material required

- Common tools
- Network cables, RJ45, 10BASE-T compliant, length as required:
 - 1 for repeater
 - 1 for protected repeater
 - 2 for repeater with spur.



The NTWRK / LAN 1-2 connections provide protection for the auxiliary channels, as well as network data and customer data on SPUs.

Figure 3-15: Repeater Connections



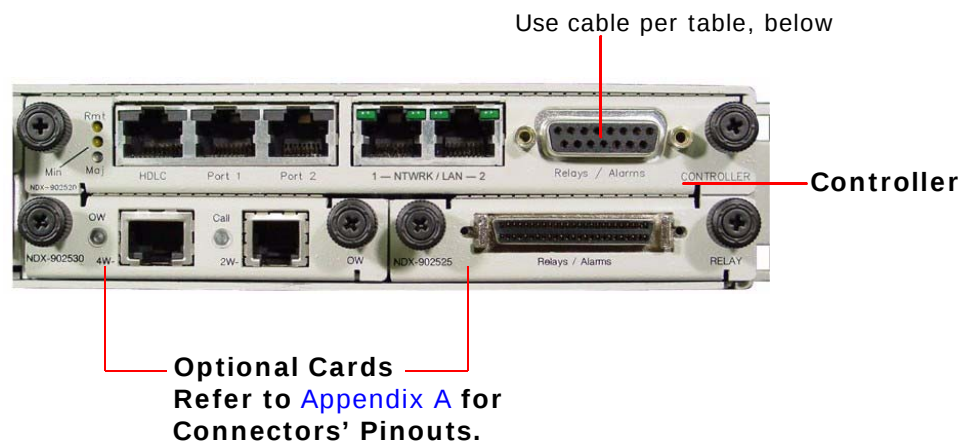
8 If required, connect alarm relays / inputs, and other optional cards

Tools and material required

- Common tools

Where required, connect the TRuepoint® relays to a third party RTU or other equipment, as shown in [Figure 3-16](#).

Figure 3-16: Connections for Relays/Customer-Generated Alarms, and other Options



Relay / Alarm Cables

Part Number	Length, ft (m)	Description
087-903151-001	3 (0.915)	
087-903151-002	6 (1.83)	Male DB15 to Stub-end, wiring color coding per Table A-31
087-903151-003	10 (3.05)	
087-903151-004	25 (7.625)	

9 Switch ON power to the SPU (*breakers*)

10 Configure the radio



For configuring the radio per options purchased, refer to the **Operator Interface** Manual, IMN-903003-Exx.

11 Fine align the antenna



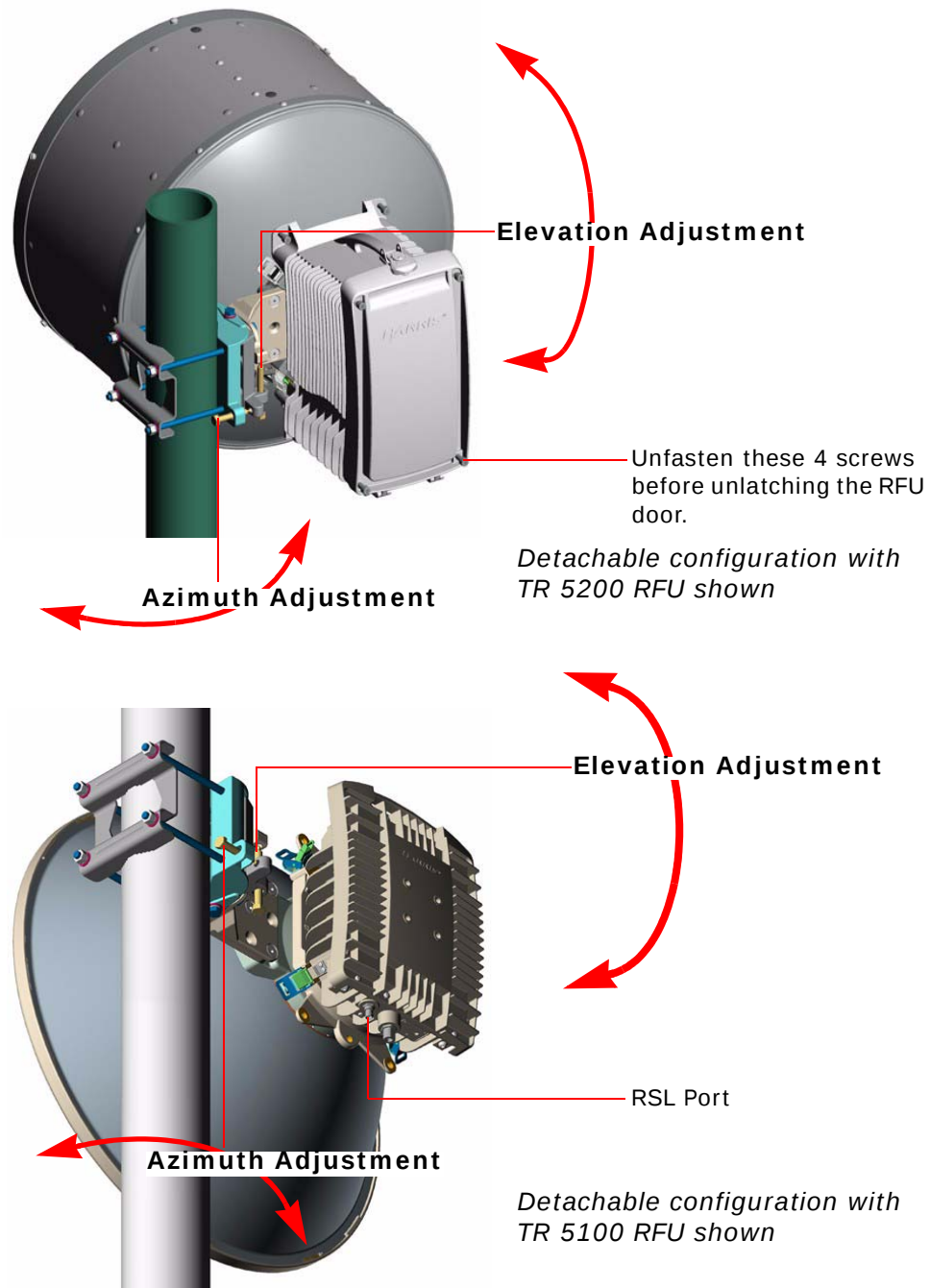
The Web-CIT interface can display many parameters related to the RSL, including the Nominal Remote RSL through path CONFIGURATION > RADIO > PARAMETERS. If at any time you receive an RSL LOW alarm, you will need to execute the following procedure. If it has not been done, ensure that the antenna has been properly aligned. Refer to the **RFU Instruction Manual**, IMN-903001-Exx, under **Install the Antenna**.

Table 3-5: Tools and equipment required

Tool	Required Equipment Specifications
Adjustable wrench	11/16" (18 mm) jaws
Ratchet with socket	11/16" (18 mm) socket
Digital Voltmeter, with probes	3-digit; 0.3% DC accuracy; 2% ac accuracy; 0 to 60 V range

1. Follow the antenna manufacturer's instructions for adjusting the azimuth and elevation of the antenna, by loosening the designated fasteners. For reference, [Figure 3-17](#) identifies the locations of both the [Azimuth Adjustment](#) and the [Elevation Adjustment](#) for the 5200 RFU, and likewise for the 5100 RFU.
2. Open the door of the 5200 RFU to gain access to the transceiver. For the 5100 RFU, remove the chained cap of the [RSL Port](#).
3. On the 5200 RFU, connect the (+) voltmeter probe to the [RSSI](#) port, and the (-) probe to the Ground port (below the RSSI port), as shown in [Figure 3-18](#).
On the 5100 RFU, connect the (+) voltmeter probe to the [RSL Port](#), and the (-) probe to the [Ground Port](#).

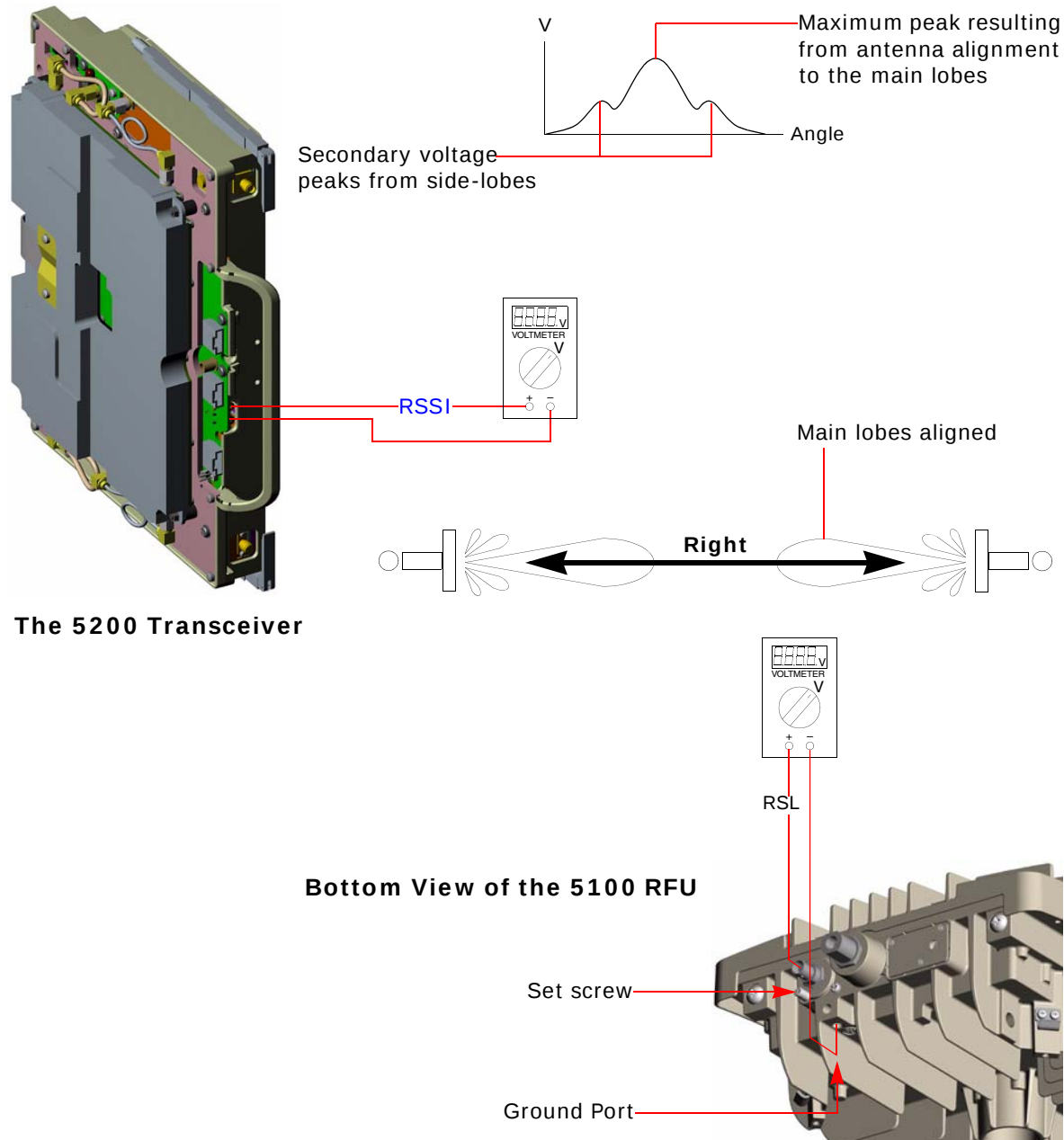
Figure 3-17: Locating the Azimuth and Elevation Adjustments



4. Adjust the direction of the antenna until you have a **maximum** RSL voltage¹ at the RSSI (or RSL) test points, as shown in [Figure 3-18](#).

1. Voltage value **directly** proportional to RSL, when the proportional option is selected during the SPU configuration, before the alignment

Figure 3-18: Measuring the RSL Voltage through the digital voltmeter



5. When finished, tighten ALL fasteners loosened previously to 22 N•m (16.2 lbf-ft.)
6. Finally, latch the 5200 RFU door, then tighten the four thumb screws on the door to 2.26 N•m (20 lbf-inch) to prevent water infiltration.
7. For the 5100 RFU, reconnect the 3.26 mm (8 AWG) RFU ground wire by threading it through the **Ground Port**, and tightening the **Set screw**.

RSSI Voltage / RSL

Depending on the scale configuration, the RSL voltage reading is either *directly* or *inversely* proportional to the RSL.

Step 4 above, uses the default *directly* proportional scale configuration, also known as the *Uncalibrated RSSI*,

Menu path: CONFIGURATION > SYSTEM > RFU > RSSI OUT > PROPORTIONAL

The *inversely* proportional scale uses a multiplication factor of -20. That is, an amplitude of 3 V_{dc} translates into an RSL of -60 dBm.

Menu path: CONFIGURATION > SYSTEM > RFU > RSSI OUT > INVERTED

Table 3-6: RSL Voltage to RSL Relationship

RSL Voltage, (V _{dc})	Corresponding RSL ^a , (dBm), inverse scale	Uncalibrated RSSI ^b , direct scale
.5	> -20 ^c	
.75	> -20	
1.0	-20	
1.5	-30	
2.0	-40	
2.5	-50	Uncalibrated raw RSSI voltage
3	-60	
3.5	-70	
4.75	-95	
5	< -95 ^c	

- a. *Inversely* proportional scale configuration using a conversion factor of -20
- b. *Directly* proportional scale configuration
- c. As displayed on the Hand-held terminal — out of range

12 Check for alarms and verify the functionality

1. Refer to [Table 4-1](#) on page 4-2 for determining possible alarm causes and solutions.
2. Verify the availability of the service options to which you are entitled, according to the following table; *example only*.

Service	Quick Verification
10/100BASE-T	• Referring to Figure 3-14 on page 3-19, connect a PC running the <i>Web-CIT</i> , and ping the IP address of a radio that is part of the same <i>Intnet</i>
E1/DS1 Tributaries	• Perform a tributary loopback through a remote site, then test the continuity using a BERT set
64 kbps, (G.703/V11)	• Through HHT or <i>Web-CIT</i> , Configuration points: CONFIGURATION > G703/V11 > OPT 1/2 > OPT N DEST NE, and DEST SLOT
10/100BASE-T over 64 kbps	• Through HHT or <i>Web-CIT</i> , Configuration points: CONFIGURATION > 10BT/64K OPT 1/2 > OPT N DEST NE, and DEST SLOT
Orderwire	• Connecting a handset on the 2W port, dial any 3-digit NE address on the network

Interoperation with some ADMs/routers



The TRuepoint® radio operates with ADMs that comply fully to the unidirectional [APS](#). Some ADMs/routers require that the transmit and receive signals be selected as a pair, even in a unidirectional mode. As a work around to this condition, the ADM/router might send a short L-AIS upstream of the radio on the active line to trigger a radio switch. The TRuepoint® radio would then respond to this trigger and initiate a TX switch accordingly. The switch action also results in a modem resynchronization at the far-end. In such condition, the TRuepoint® radio's behavior is normal.

Also, some ADMs/routers provide a user-selectable option for enabling/disabling the scrambler within the ADM. For optimal interoperation with the TRuepoint® radio, we recommend **enabling** this scrambler.

MAINTENANCE

Maintenance

There is no routine maintenance required on the TRuepoint[®] radio. If a radio does fail, it is repaired by replacing faulty module(s) in the SPU or the RFU. There are no field adjustments to be made within the SPU.



Figure 4-1 identifies the location of each module within the SPU enclosure.

Basic Troubleshooting

Refer to [Table 4-1](#) for identifying probable causes of typical problems through the modules' LEDs. For more advanced troubleshooting, refer to the *Operator's Interface* manual, IMN-903003-Exx.

Table 4-1: Indicator Light Display Description

Module	Label	Color	Meaning
MODEM 	Traffic	Green	The module is on-line, refer to Note below
		Off	No traffic passing
	RFU	Green	The RFU is operating properly
		Red	The RFU has failed (Refer to Manual IMN-903001-Exx)
	Cable	Green	The cable connecting the IDU to the RFU is working properly
		Red	The cable connecting the SPU to the RFU has failed
	Modem	Green	The modem is operating properly
		Red	The modem has failed
MUX 	Traffic	Green	The module is on-line
		Off	No traffic passing
	Mux	Green	The MUX is operating properly
		Red	The MUX has failed
Controller 	Rmt	Off	The remote site is operating properly
		Yellow	The remote site is in alarm
	Min	Off	The System is operating properly
		Yellow	Traffic has been manually forced to one of the two channels, or other minor alarms
	Maj	Green	The System is operating properly
		Red	Major Alarm; traffic-affecting problem (outage)
	All LEDs Off: No response to commands from the user's interface		



In a typical protected system, the receive protection switching is achieved through the RFU receive Decoder switch (Modem **B**) and the receive DADE demux switch (Modem **A**). For this reason, “Traffic” LEDs on **both** Modems will be lit and path STATUS/ONLINE EQUIPMENT will display “ONLINE” for **both** MDM A RX and MDM B RX.



When necessary, replacing a faulty module is a straightforward task that does not require special tools. In a **Protected** SPU, all replaceable modules are of the **hot plug-in** type, except the Modem.

Figure 4-1: SPU Enclosure, Identifying the Bays

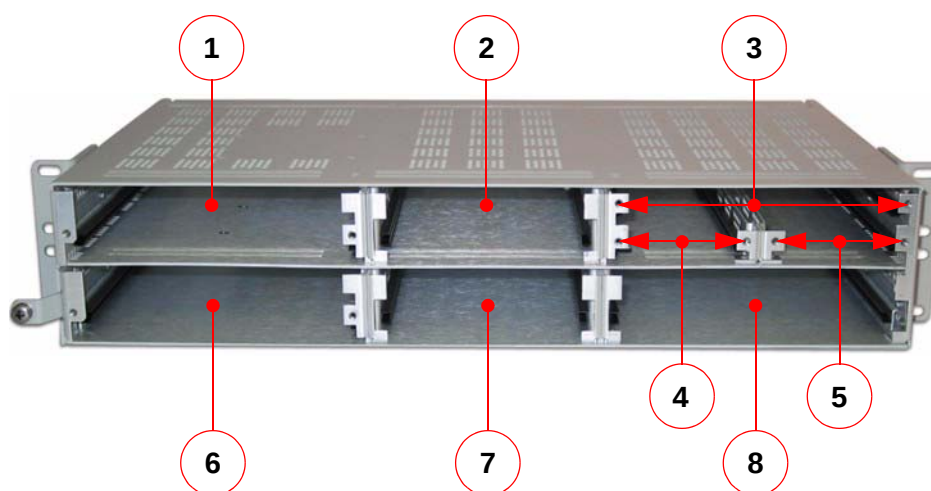


Table 4-2: Module Position in Enclosure

Bay #	Mounting Type	Protected SPU	Unprotected SPU
1	Captive thumbscrews	Modem A	Modem A
2	Extractors	MUX A Option	MUX A Option
3	Captive thumbscrews	Controller	Controller
4 or 5	Captive thumbscrews	Options: Orderwire ^a , 10/100 BASE-T over 64 kbps, or 64 kbps data channel; Relay/Alarms Opt. 1, 2	
6	Captive thumbscrews	Modem B	
7	Extractors	MUX B Option ^b	N/A
8	Extractors	SDM Option ^c	

a. When unequipped, Bays 4 and 5 are blanked by a cover plate.
Orderwire in Bay 4 Only. Relay/Alarms options in Bays 4 and 5

b. For an SPU with an unprotected MUX, these bays are blanked with a cover plate.

c. Always equipped with a 3 DS3 Mux, and can be equipped with unprotected mux

Replacing Modules

When to replace a module

Referring to [Table 4-1](#), if the designated LED ([Modem](#) or [Mux](#)) **remains RED**, this would indicate a hardware failure. A module replacement is warranted if the following menu items on the User's interface (HHT or *Web-CIT*) display a REPLACE_ME value, or if there's no communication between Controller and user's interface.

Failed Module	LED	Menu Item (or behaviour)
Modem	Modem	ALARM / MODEM A (B) / REPLACE_ME
MUX	Mux	ALARM / MUX A (B) / REPLACE_ME
Controller	All LEDs OFF	No response to commands from the user's interface

To resolve:

1. **First:** Upgrade the system with the latest firmware/software.
2. **Run** the appropriate software package.
3. If running the latest firmware/software **does not** resolve the issue, **Replace** the module.



Before removing and replacing a plug-in cards, wear an ESD wrist strap and attach it's free end (or clamp) to the [Grounding Lug](#) of the SPU. In an unprotected system, this procedure will affect traffic. In a protected system, ensure locking traffic on the available channel during maintenance.

Replacing a Modem



The following procedure applies to a **protected** system as well as an **unprotected** system.

Procedure

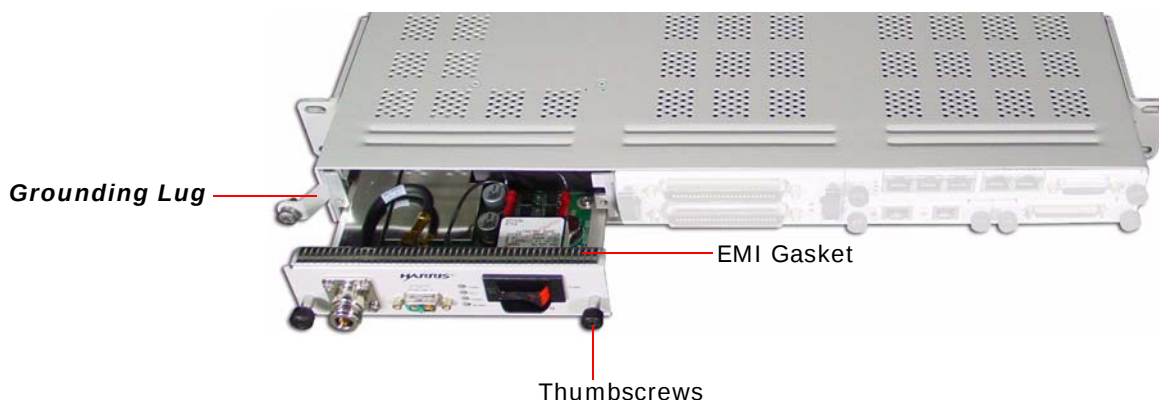
1. In a protected system, transfer traffic to the standby channel.
2. Switch OFF power to the Modem at the source, (breaker).
Refer to Figure 2-2. (Modem A is implied).



Energy hazard: Disconnect both the power and coaxial cables from the Modem before removing the Modem.

3. Unfasten both captive Thumbscrews until they are free (spring release), pull slightly on the module until the EMI Gasket clears the cavity, then grasp the module with both hands and pull it out to free it from the enclosure.
4. Replace the Modem with a new one that bears the *same* part number as the replaced one.
5. Align the new Modem card in the cavity's slide rails. Before completely inserting the module, apply a firm **downward** pressure on it's face plate to ensure that the EMI Gasket remains *entirely* inside the cavity's top edge.
6. Ensure tightening both captive thumbscrews to a torque of 5.2 lbf-inch, (0.59 N • m) for a positive grounding contact.
7. Reconnect both the power and coaxial cables.

Figure 4-2: Removing the Modem





When using the Dual Battery Input modem, ensure that the module is strapped for the correct polarity. A wrong polarity will damage the SPU. Refer to [Figure 2-3](#).



Before connecting the coaxial cable to the modem, make sure to check if there is a short along the cable length. A short in this cable or in the RFU may damage the modem when it is switched ON. If this is the case, replace the faulty element (cable or RFU).

8. Switch ON power to the Modem.
9. All LEDs on the new Modem will light up Red during initialization, then turn Green, indicating proper operation.

Replacing a Multiplexer or an SDM



Strict precautions to observe before replacing a MUX and / or SDM:

1. Inserting a MUX (SDM) that is incompatible with an existing SDM (MUX) will cause short circuits that may damage the SPU, (specifically for Ethernet-carrying MUXes).
2. ***Always*** remember to
3. Such incompatibility will also affect/stop the subscriber Ethernet traffic until the incompatible MUX (SDM) is removed.
4. Refer always to [Table 4-3](#), for pairing compatible MUXes/SDMs.

Table 4-3: Compatibility Table

Compatible		
MUX	SDM	Description
902515	902540	2-16 E1 / DS1
902517	902585	STM-1 / STS-3 Electrical Interface
902517	902585	STM-1 / OC-3 Optical Interface MM
902517	902585	STM-1 / STS-3 Electrical Interface
902517	902585	STM-1 / OC-3 Optical Interface MM
902550	902585	E3 or DS3 + E1 or DS1
902550	902585	2X10 100BT over E3 or DS3 + E1 or DS1
902555	902587	28 DS1 over DS3 + DS1
902558	902535	21 E1 + E1
902573	902543	3 DS3 + 3 DS1
902582	902593	ADM 8 DS1 over DS3 + DS1 (Opt. 501)
902582	902593	N-16 DS1 or E1 + 2x10/100BASE-T (Opt. 502/503)



This procedure applies to the Multiplexer and SDM. It **does not** affect traffic, if the SDM remains present **and** the replaceable MUX is **Off-line**.



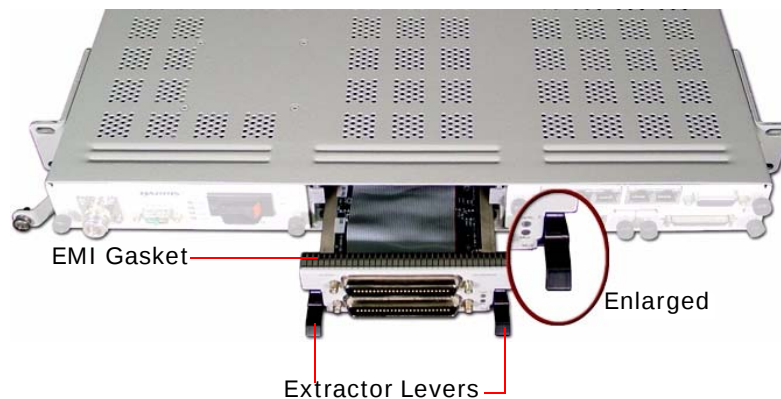
When selecting the “Unprotected MUX” option, ensure that there is no MUX B present in the SPU. Otherwise you may lose traffic when you power off Modem A or disconnect power from it. This applies when replacing the following MUXes.

MUX	MUX, ROHS	Description	Comments
101-902555-501	102-902555-501	• 28 DS1 over DS3 + DS1	Applies only When using software version 6.0 and later.
101-902558-501	102-902558-501	• 21 E1 + E1	
101-902582-502	102-902582-502	• N-16 DS1 + 2x10/100BASE-T	
101-902582-503	102-902582-503	• N-16 E1 + 2x10/100BASE-T	

Procedure

1. Disconnect all tributary cables (BNC or D-Type) from their respective ports on the module to replace.
2. With both thumbs, pull down on the **Extractor Levers** until the **EMI Gasket** clears the cavity, then grasp the module with both hands and pull it out to free it from the enclosure. Remember removing the hardware key, if present, and keep it in a safe place for reuse.
3. Replace the module with a new one that bears the **same** part number as the replaced one. Re-install the hardware key, referring to section **Heading3** on page 4-12.
4. Align the new module card in the cavity's slide rails. Before completely inserting the module, apply a firm **downward** pressure on it's face plate to ensure that the **EMI Gasket** remains **entirely** inside the cavity's top edge. Latch the module in place by pushing up on both extractor levers until they bottom.

Figure 4-3: Removing a MUX Module



5. LEDs on the new MUX will light up Red during initialization, then turn Green, indicating proper operation.
6. Reconnect all tributary cables (BNC or D-Type) to their respective ports on the module.

Replacing a Controller (V2)



This procedure does not affect traffic, but network communications are interrupted during the Controller replacement. This procedure applies also to all Controller optional cards.

Procedure

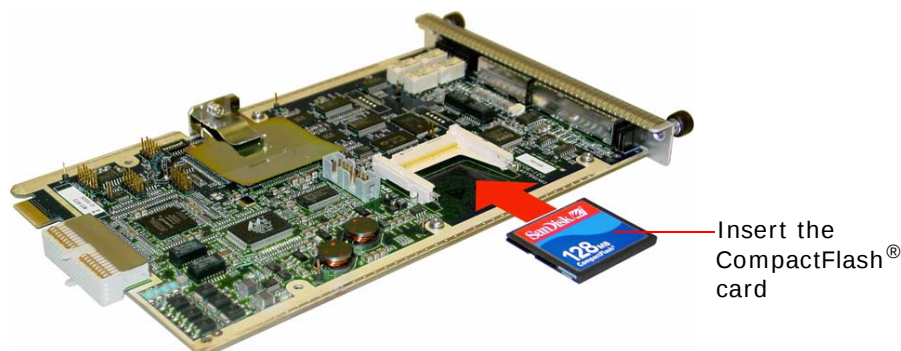
1. Disconnect all cables from the module.
2. Unfasten both captive **Thumbscrews** until they are free (spring release), pull slightly on the module until the **EMI Gasket** clears the cavity, then grasp the module with both hands and pull it out to free it from the enclosure.



Before discarding the main Controller module, remember to remove and keep the CompactFlash® card in a safe place for future use in the new Controller.

2. Replace the module with a new one that bears the **same** part number as the replaced one. Insert the CompactFlash® card as shown in Figure 4-4.

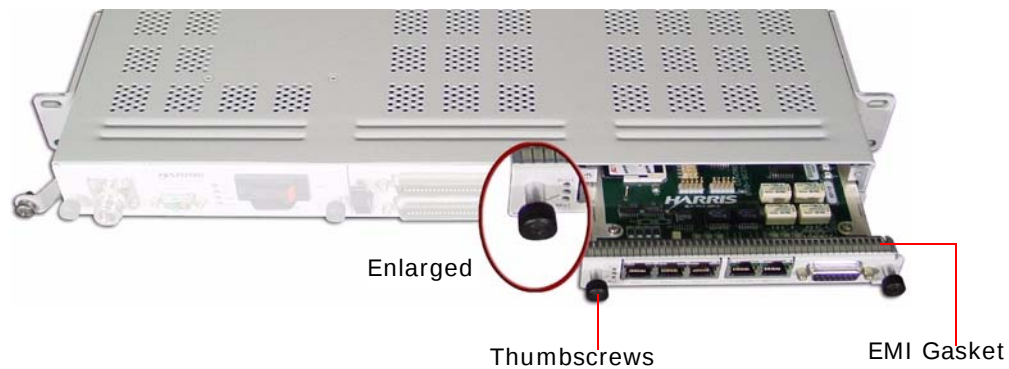
Figure 4-4: Replacing the CompactFlash® Card



3. Align the new Controller card in the cavity's slide rails. Before completely inserting the module, apply a firm **downward** pressure on it's face plate to ensure that the **EMI Gasket** remains **entirely** inside the cavity's top edge.

4. Ensure tightening both captive thumbscrews to a torque of 5.2 lbf-inch, (0.59 N • m) for a positive grounding contact.
5. Reconnect all cables to their respective ports on the module.

Figure 4-5: Removing the Controller



6. The LEDs on the new module (main Controller **Only**) will flicker for a short period until the system stabilizes, and then the **Maj** LED will turn Green, indicating proper operation.

Replacing a Controller (V1)



This procedure does not affect traffic, but network communications are interrupted during the Controller replacement. This procedure applies also to all Controller optional cards.



Doing a soft-boot on this Controller (re-inserting it or selecting “Software reboot” in Web-CIT), causes the relays to go in alarm for a few seconds, before returning to their initial condition.

Procedure

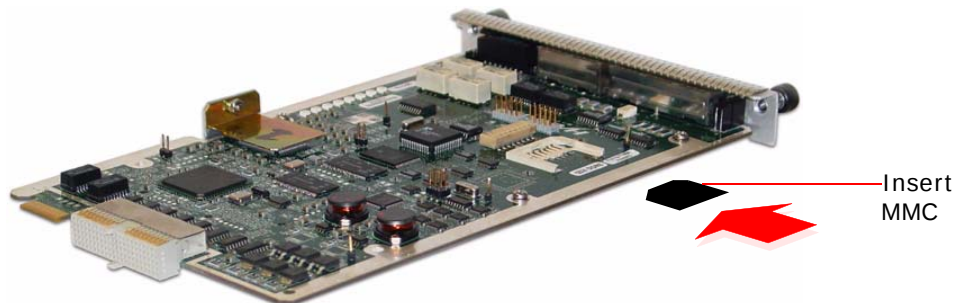
1. Disconnect all cables from the module.
2. Unfasten both captive **Thumbscrews** until they are free (spring release), pull slightly on the module until the **EMI Gasket** clears the cavity, then grasp the module with both hands and pull it out to free it from the enclosure.



Before discarding the main Controller module, remember to remove and keep the MMC in a safe place for future use in the new Controller.

2. Replace the module with a new one that bears the **same** part number as the replaced one. Insert the MMC as shown in Figure 4-6.

Figure 4-6: Replacing the MMC

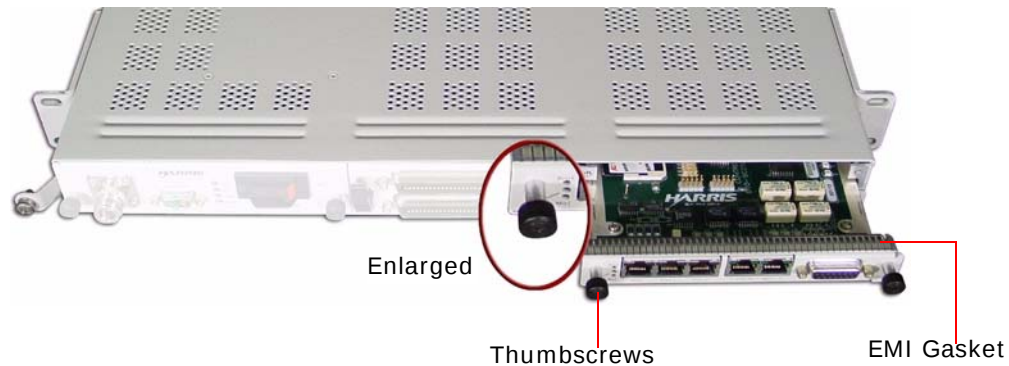


Software files from one flash card (MMC) should never be copied to a PC, then to another flash card. Use only the MSUU or the CTU to transfer the configuration from one flash card to another.

3. Align the new Controller card in the cavity's slide rails. Before completely inserting the module, apply a firm **downward** pressure on it's face plate to ensure that the **EMI Gasket** remains **entirely** inside the cavity's top edge.
4. Ensure tightening both captive thumbscrews to a torque of 5.2 lbf-inch, (0.59 N • m) for a positive grounding contact.

5. Reconnect all cables to their respective ports on the module.

Figure 4-7: Removing the Controller



The LEDs on the new module (main Controller **Only**) will flicker for a short period until the system stabilizes, and then the **Maj** LED will turn Green, indicating proper operation.

Capacity and Features Upgrades

SPU with Controller V1

Capacity Upgrade



Standard capacity on a MUX is 2 E1 or 4 DS1. An optional **hardware key** allows you to upgrade the radio's capacity to 4, 8, 12 or 16 tributaries, according to the purchased option. Hence, upgraded **E1** capacities will be 4, 8, or 16 E1, and upgraded **DS1** capacities will be 8, 12 or 16 DS1. Refer to [Table 5-1](#) for ordering. For the **Protected** configuration, traffic is assumed to pass through MUX_B, before upgrading.

Material and tools required

Hardware Keys

Part Number	From Kit	Upgrades Capacity		Upgradable MUX Option
		From	To	
101-902529-501 ^a	098-902529-001	2 E1 only	4 E1	• 101-902515-501 (2 E1) • 101-902515-502 (4 DS1)
101-902529-502	098-902529-002	2 E1 or 4 DS1	8 E1 or 8 DS1	
101-902529-503 ^b	098-902529-003	4 DS1 only	12 DS1	
101-902529-504	098-902529-004	2 E1 or 4 DS1	16 E1 or 16 DS1	

a. Does not upgrade 4 DS1

b. Does not upgrade 2 E1

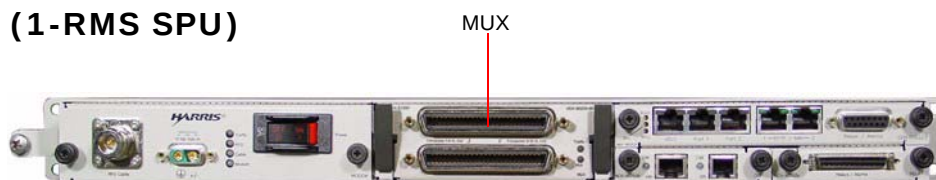
Tools:

- Phillips-tip screwdriver

Upgradable SPU Configurations

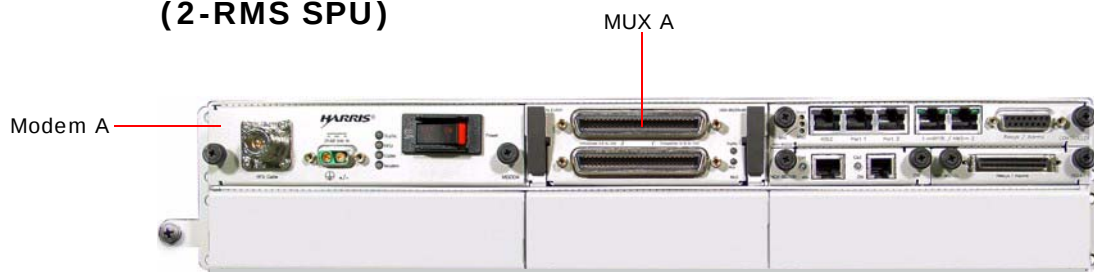
Unprotected

(1-RMS SPU)



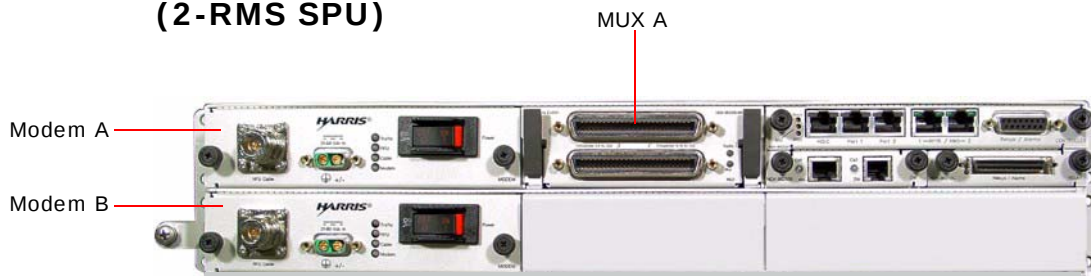
Unprotected Expandable

(2-RMS SPU)



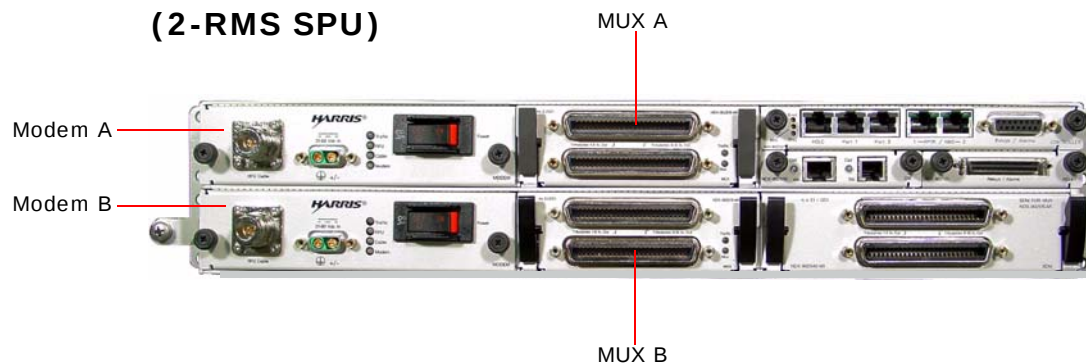
Unprotected and wired for expansion.

Protected Light **(2-RMS SPU)**



SDM bay is blanked, but may be equipped with SDM

Protected **(2-RMS SPU)**



Important Considerations

1. Perform the [Capacity Upgrade Procedure](#) in its entirety ***first*** on the ***Remote*** site, then immediately afterwards on the ***Local*** site, to minimize traffic interruption.
2. Hits on traffic will occur when:
 - traffic switches between MUX_A and MUX_B in a [Protected](#) configuration SPU;
 - changing [USED CAPACITY](#) on ***any one*** site ***until*** the same command is executed on the ***other*** site.

Capacity Upgrade Procedure

Remove the MUX Module

1. Disconnect all tributary cables (D-Type) from their respective ports on the MUX to upgrade, (MUX_A assumed).
2. With both thumbs, pull down on the [Extractor Levers](#) until the [EMI Gasket](#) clears the cavity, then grasp the module with both hands and pull it out to free it from the enclosure.
3. Deposit the module on a firm flat surface, such as an ESD mat (recommended) and wear an ESD wrist strap.

Install the Hardware Key

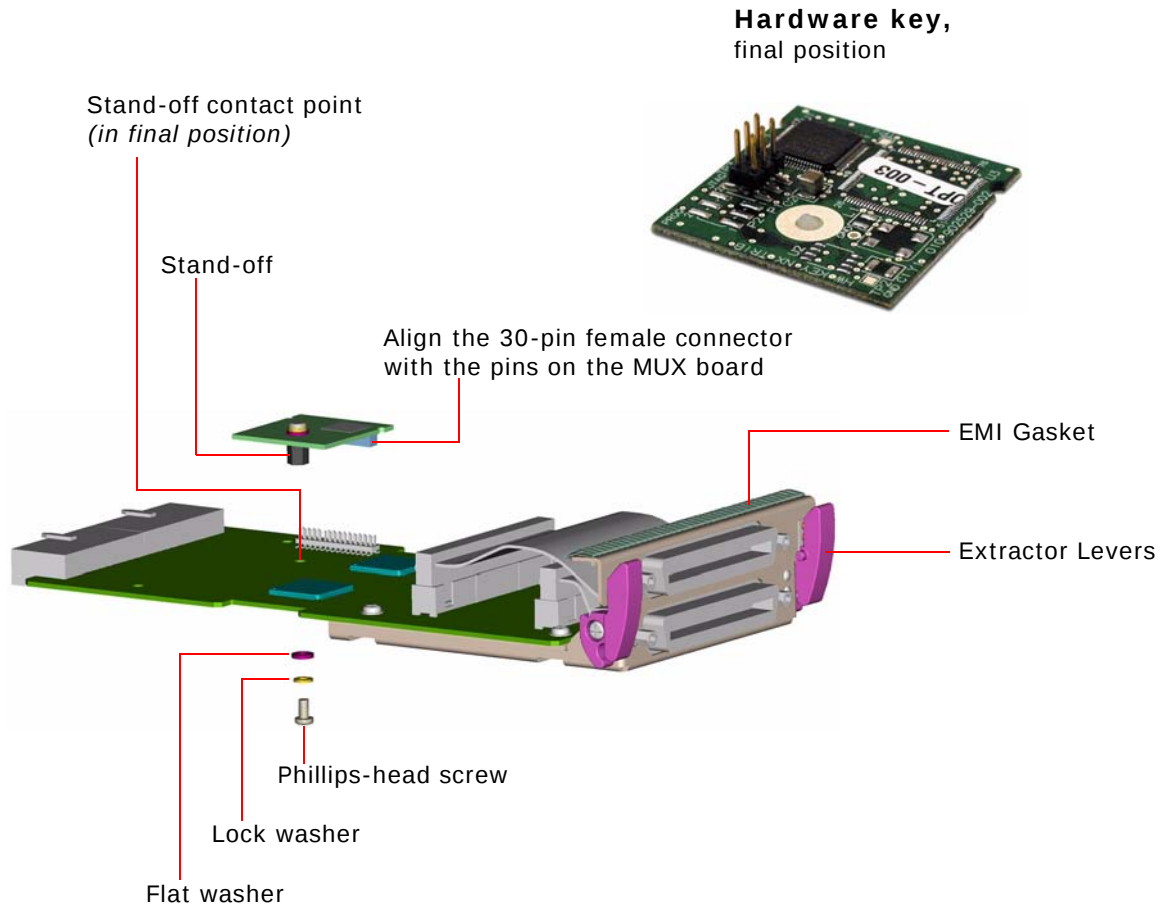
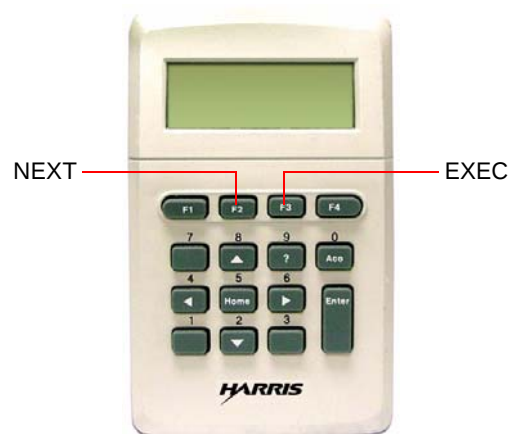
1. Remove the hardware key out of its packaging, being careful not to touch the key's PC board.
2. Remove **by hand only** the [Phillips-head screw](#), lock washer and plain washer, per Figure 4-8, from the [Stand-off](#) attached to the hardware key.
3. Carefully align the hardware key's 30-pin female connector with the corresponding pins on the MUX board. With thumb and index only, push down firmly on the hardware key until it bottoms.
4. Re-install the fasteners removed in Step 2 above, in the order shown in Figure 4-8, for securing the hardware key to the MUX board, from underneath the board. Using a Phillips screwdriver, tighten the [Phillips-head screw](#) (without over tightening), approximately to 5.2 lb-in (.59 N•m).



To avoid damaging the MUX board, use extreme care in not touching it's underside with the screwdriver.

Re-install the MUX Module

1. Align the module's edges in the cavity's slide rails.
2. Before completely inserting the module, apply a firm **downward** pressure on the top edge of it's face plate to ensure that the [EMI Gasket](#) remains **entirely** inside the cavity's top edge.
3. Latch the module in place by pushing up on both extractor levers until they bottom.

Figure 4-8: Installing the Hardware Key**Figure 4-9: Handheld Terminal**

Complete the Upgrade — at Each Site

Seq.	Protected MUX Configuration	Unprotected MUX Configuration
1	Tributary cables already on SDM	Connect tributary cables to the MUX ports
2	Power-ON: - LEDs of MUX A remain red. - System reports a MUX/SDM MISMATCH^a - System does not detect upgraded MUX_A	Power-ON: LEDs of MUX will turn Red, then Green after system stabilizes.
3	Remove MUX B: referring to Remove the MUX Module, page 4-15 : - LEDs on upgraded MUX A will turn green - Traffic is switched to MUX A, causing a hit	Confirm CAPABILITY through Table 4-4 : Example Only. End of Procedure
4	Re-install upgraded MUX B, referring to Re-install the MUX Module, page 4-15 LEDs on upgraded MUX B will turn Red, then Green after a short while	
5	Confirm CAPABILITY through Table 4-4 : Example Only. End of Procedure	

a. ALARM > SYSTEM > SPU MUX MISMATCH

Table 4-4: Upgraded Capacity Verification

Parameter	Path	Value	Comments
USED CAPACITY	STATUS > SYSTEM > USED CAPACITY	4 E1	Present number of tributaries used before the upgrade
CAPABILITY	STATUS > SYSTEM > CAPABILITY	16 E1	Maximum number of tributaries available after the upgrade
USED CAPACITY	CONFIGURATION > SYSTEM > SPU > USED CAPACITY	16 E1 ^a	Allowable number of tributaries that can be used after the upgrade
USED CAPACITY	STATUS > SYSTEM > USED CAPACITY	16 E1	Confirmed number of tributaries used after the upgrade

a. On the HHT, press the **NEXT** key (F2) repeatedly, as needed, to reach the desired number of tributaries to use, then press **EXEC** (F3).

SPU with Controller V2

Capacity and Features Upgrades

Hardware Key Option



If upgrading (MUX) capacity through an available **hardware key**, refer to section [SPU with Controller V1](#).

Software Key Option — Features and Functions

- An encrypted (software key) file in the radio's embedded file system provides access to software keys that allow for [Enhanced features](#), and Mux Capacity Upgrades.
- Software keys are loaded from that file at boot time.
- In the absence of such a file, no capacity upgrade or other enhanced features are available to the user.
- Enhanced features accessible through path CONFIGURATION > INVENTORY > SW KEY (Software key required, unless noted otherwise)

Strong Security

- Optional, software key must be purchased

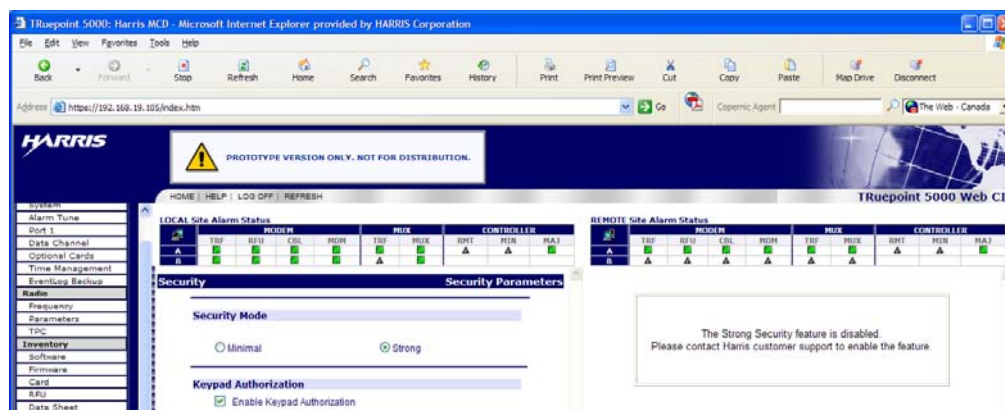
Event Logger

Time Synchronization

- If not readily available, (error message displays as follows), features can be enabled through Harris Customer Support

WebCIT

VT-100 over Telnet



- These upgrades can only be handled through the [MSUU](#), according to the following procedure¹.

Updating a Customer Key File

1. Harris' support requests the key file from a customer.
2. Customer retrieves the key file from the radio using the MSUU.
3. Customer e-mails the key file to Harris' support.
4. Harris' support updates the key file using a proprietary application.
5. Harris' support e-mails the updated key file to the customer.
6. Customer downloads the key file to the radio using the MSUU.
7. Customer softboots the radio to turn on the new features, without traffic interruption.

Configuration Transfer Utility (CTU)

Background Information

Located on the SPU Controller (Figure 4-4), a removable Flash Card stores

- the TRuepoint[®] radio configuration data, and
- the SPU software.

Features of the CTU²

- For the data transfer, the Flash Card with TRuepoint[®] 5000 valid software should be located in the target Card Reader slot.
- Configuration data can be transferred from an existing Flash Card that contains TRuepoint[®] 5000 software v.1.x.x or higher.
- Configuration data on the target Flash Card will be stored in a format that is compatible with TRuepoint[®] 5000 software in the Primary Bank of this card.
- The CTU can create a new Flash Card for a TRuepoint[®] 5000 radio, using an Upgrade Pack provided by Harris MCD.
- The CTU can also use a Flash Card that has been already created or upgraded by the [MSUU](#), (Figure 4-11).

1. For complete details on applying this procedure, refer to the **Operator Interface** manual, IMN-903003-Exx

2. Refer to the **Operator Interface** manual, IMN-903003-Exx for complete details

Using the right tool: CTU or MSUU

Operation / Function	CTU	MSUU
Configuration files (direct) transfer	Yes	Yes
Configuration files backup/restore	No	Yes
Flash card creation	Yes	Yes
Flash card replacement (same Controller type)	Yes	Yes
Configuration files transfer when upgrading Controller V1 to V2	Yes	No
Software and Firmware upgrades	No	Yes
Software keys information retrieval and features enabling	No	Yes

Figure 4-10: The CTU Main Screen

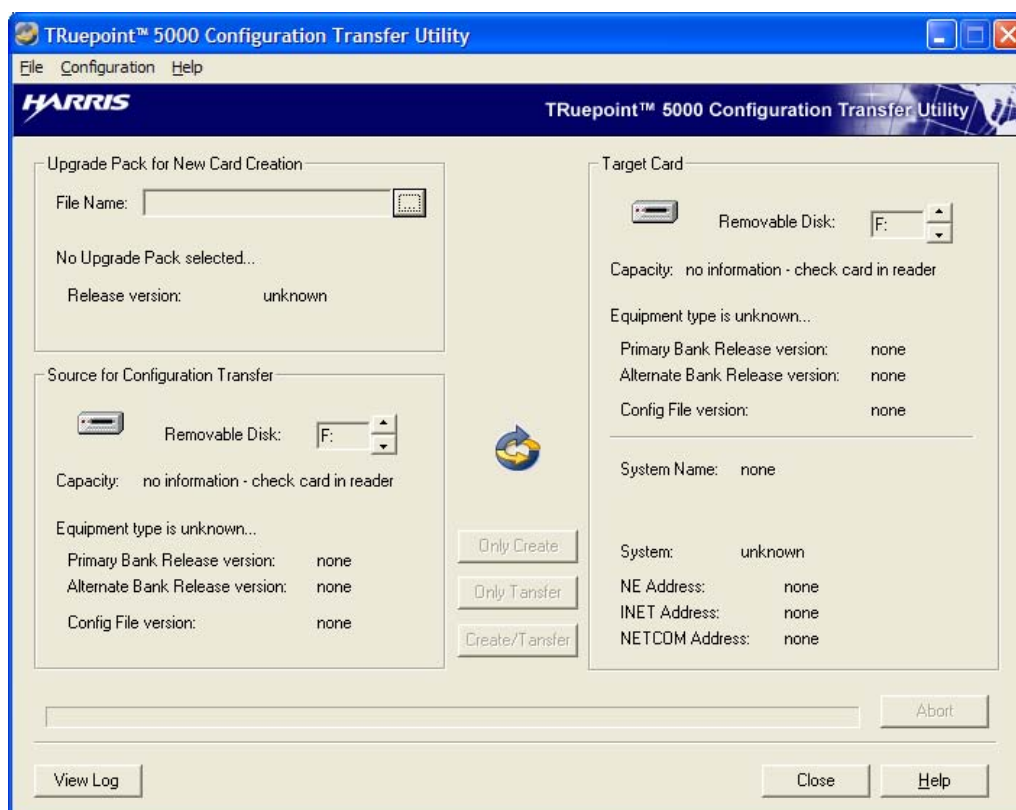
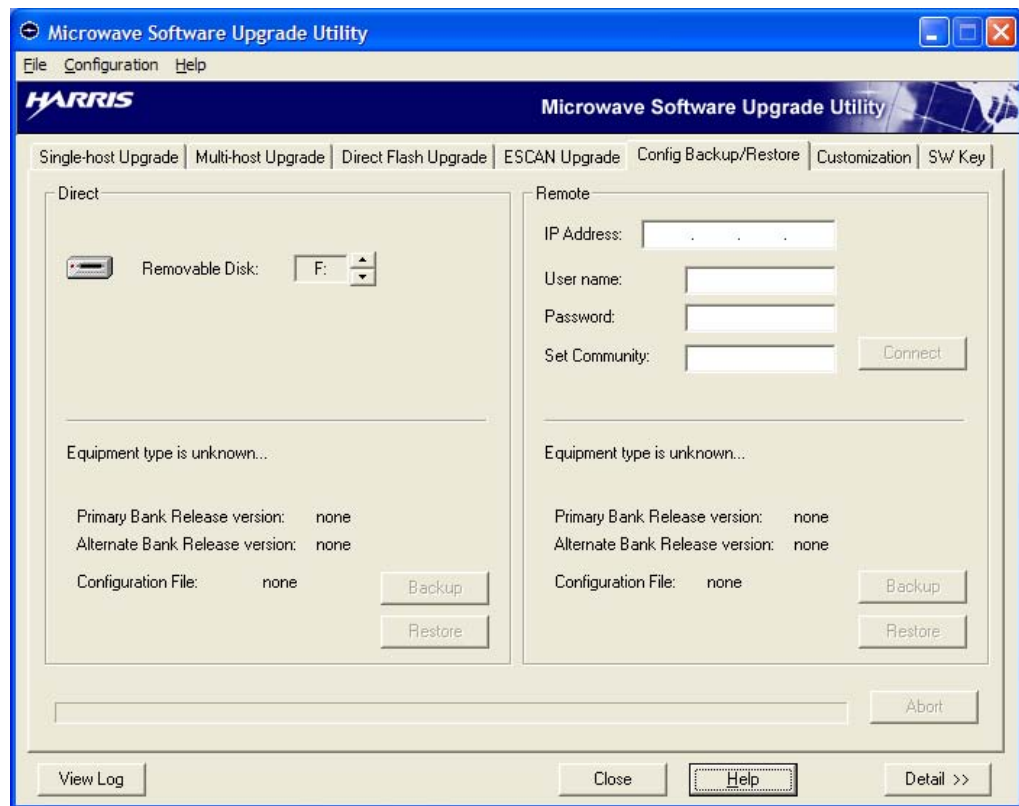


Figure 4-11: The MSUU Main Screen

OPTIONS AND ORDERING

To maintain your microwave radio with a minimum of down time, your organization will have to maintain a stock of spare units (or modules). 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 Chapter explains how to accomplish these tasks.

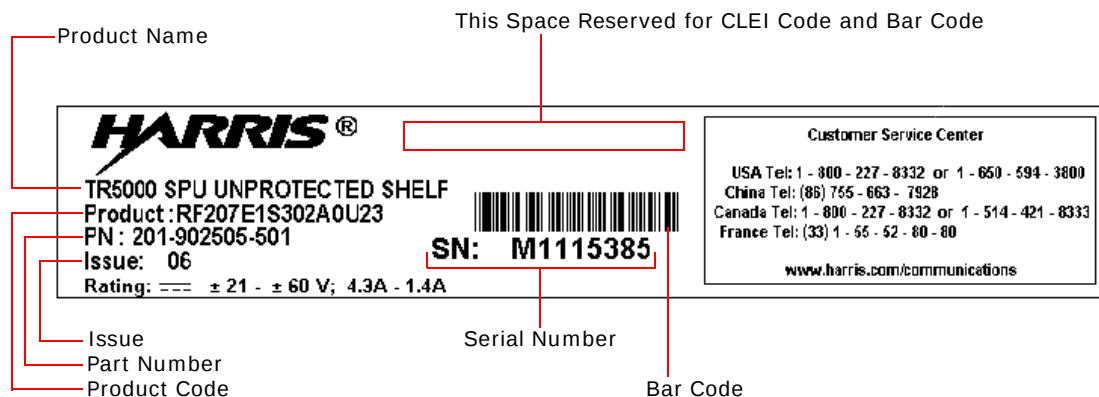
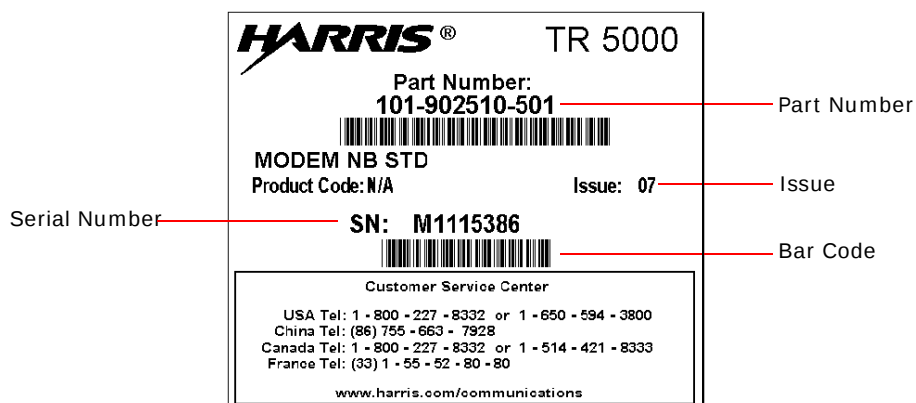
Ordering

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 5-1](#). 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.

Spare Unit Ordering Information

When you order spare parts for your existing system, refer to the parts list in [Table 5-1](#) and provide the Part Number.

Figure 5-1: Sample Part Label, SPU**Figure 5-2: Sample Part Label, SPU Module**

Placing the order

Address all orders for spare units to:

In Canada

Spare Parts Service Centre
Harris Corporation - Microwave Communications Division
 3, rue de l'Hôtel de Ville
 Dollard-des-Ormeaux, Québec,
 Canada H9B 3G4
 Phone: 1-800-227-8332
 1-514-421-8333
 Fax: 1-514-421-3555

Table 5-1: TRuepoint® 5000 SPU Spares and Accessories

Part Number	Description	Comments
102-902510-501	Modem, Narrow Band (NB), 2.5 to 30 MHz	• Select 2 for protected
102-902510-502	Modem, Wide Band (WB), 2.5 to 56 MHz	
102-903515-501	Modem, NB 2.5 to 30 MHz, Dual Battery Input	• Factory default is Neg. Polarity,
102-903515-502	Modem, WB 2.5 to 56 MHz, Dual Battery Input	
102-902515-503	MUX, 2 E1 (up to 4, 8, 16 E1, with H/W Key)	• Select one for unprotected or two for protected Config. • For protected light, select 1 MUX and 1 Assy Panel Blank 099-902288-001
102-902515-504	MUX, 4 DS1 (up to 8, 12, 16 DS1, with H/W Key)	
102-902515-505	MUX, 8 DS1	
101-902515-505	MUX, 4 DS1 (up to 8 DS1, with H/W Key)	
101-902515-506	MUX, 2 E1 (up to 8 E1, with H/W Key)	
101-902517-501	MUX, STM-1 Electrical Interface	
101-902517-502	MUX, STM-1 Optical Multimode Interface	
101-902517-503	MUX, STM-1 Optical Single mode Interface	
101-902517-504	MUX, STM-1 Electrical Interf., Part. filled	
101-902517-505	MUX, STM-1 Optical Multimode Interf., Part. filled	
101-902517-506	MUX, STM-1 Optical Single mode Interf. Part. filled	
101-902550-501	MUX, 2X10/100BASE-T over E3 DS3	
101-902550-502	MUX, 2X10/100BASE-T over E3 DS3	
101-902555-501	MUX, 28 DS1 over DS3 + DS1	
101-902558-501	MUX, 21 E1 + E1	
101-902573-501	MUX, 3 DS3 + 3 DS1	
101-902582-501	MUX, ADM 8 DS1/DS3 + DS1	
101-902582-502	MUX, N-16 DS1 + 2x10/100BASE-T	
101-902582-503	MUX, N-16 E1 + 2x10/100BASE-T	
101-902535-501	SDM, 21 E1 + E1, Unbalanced	• Select if using MUX 101-902558
101-902535-502	SDM, 21 E1 + E1, Balanced	
101-902540-501	SDM, Nx E1, Balanced	• Select if using MUX 101-902515
101-902540-502	SDM, Nx E1, Unbalanced	
101-902540-503	SDM, Nx DS1, Balanced	• Select if using MUX 101-902515
101-902543-501	SDM, 3 DS3 + 3 DS1	• Select if using MUX 101-902573
101-902585-501	SDM, 155 Mbps E1/DS1 + DS1	• Select if using MUX 101-902517-501, through 101-902517-506

Table 5-1: TRuepoint® 5000 SPU Spares and Accessories (continued)

Part Number	Description	Comments
101-902585-502	SDM, 10/100BASE-T over E3+DS1 or DS3+DS1	• Select if using MUX 101-902550
101-902587-501	SDM, 28 DS1/DS3 + DS1	• Select if using MUX 101-902555-501
101-902593-501	SDM, for ADM 8 DS1/DS3 + DS1	• Select if using MUX 101-902582-501
101-902593-502	SDM, N-16 DS1 + 2x10/100BASE-T	• Select if using MUX 101-902582-502
101-902593-503	SDM, N-16 E1 + 2x10/100BASE-T	• Select if using MUX 101-902582-503
101-903050-501	Tributary Interface Unit, SCSI-to-50 pin D-type connectors, up to 28 DS1	• Option, for connecting tributaries when MUX/SDM not present
101-903070-501	Tributary Interface Unit, SCSI-to-50 pin D-type and 1.0/2.3 series connectors, up to 21 E1 + E1	
101-902520-501	Controller, V1	• Software up to V4.x
101-903460-501	Controller, V2	• Software V6.x and later
101-902525-501	Option, Relay Alarms, 12-Relays, 12 inputs	• Options as required. Any factory non-equipped option is covered by a blank panel
101-902525-502	Option, Relay Alarms, 6-Relays, 30 inputs	
101-902527-501	Option, 64 kbps Synch Data, G.703 and V11	
101-902530-501	Option, Orderwire, 4W and 2W	
101-902532-501	Option, 10/100BASE-T over 64 kbps	
101-902529-501	Hardware Key, 4 Tributaries	• MUX capacity upgrade kit. Select upgrade options per section Hardware Keys , on page 4-13
101-902529-502	Hardware Key, 8 Tributaries	
101-902529-503	Hardware Key, 12 Tributaries	
101-902529-504	Hardware Key, 16 Tributaries	
087-020192-006	Fiber Optic Cable, 62.5/125 µm	• Optional. Fiber cable. For Mux OC-3, to customer equipment/repeater configurations.
087-020193-702	Patch cord shielded, RJ-45 4 pair, 7 ft	• Cables to connect RPTR IN to RPTR OUT, or RPTR OUT to other MCD radios
087-020193-703	Patch cord shielded, RJ-45 4 pair, 15 ft	
087-020193-704	Patch cord shielded, RJ-45 4 pair, 25 ft	

Table 5-1: TRuepoint® 5000 SPU Spares and Accessories (continued)

Part Number	Description	Comments
087-099499-XXX	Cable to connect SPU to RFU, LDF2-50, (By Andrew's Corporation, or equivalent)	• Use the XXX field to specify the length in 10 ft increments, from 10 ft to 1000 ft • For outdoor installation
087-099975-005	Cable to connect SPU to RFU, RG-214/U, 5 ft	• For indoor use only
087-901346-002	Cable assembly adapter, 50-pin D-Type to 16 BNC (1.5 ft), EMI compliant	• D-Type to BNC • Optional.
087-901346-004	Cable assembly adapter, 50-pin D-Type to 16 BNC (9 ft), EMI compliant	• For 8 E1 Tributaries, Unbalanced
087-902159-014	Cable to connect 28 DS1 TIU to SPU, SCSI-3, 68-pin Male to 68-pin Male, (when purchased separately from the TIU)	• 14 inch (0.356 m)
087-902159-036		• 36 inch (0.915 m)
087-902159-072		• 72 inch (1.83 m)
087-902159-144		• 144 inch (3.66 m)
087-902756-006		• 6 ft (1.83 m)
087-902756-008	Cable, DC Power, shielded, stub end to customer side	• 8 ft (2.44 m)
087-902756-015		• 15 ft (4.58 m)
087-902756-045		• 45 ft (13.73 m)
087-903151-001	Cable for Relay/Alarms, DB-15 to Stub End (Main Controller Module)	• 3 ft (0.915 m)
087-903151-002		• 6 ft (1.83 m)
087-903151-003		• 10 ft (3.05 m)
087-903151-004		• 25 ft (7.625 m)
087-903465-001	Cable, for connecting MUX to customer tributaries, D-Type male 50-pin, straight connector one end, stub-end to customer side	• 3 ft (0.915 m)
087-903465-002		• 7 ft (2.14 m)
087-903465-003		• 19 ft (5.8 m)
087-903465-004		• 25 ft (7.625 m)
087-903465-005		• 60 ft (18.30 m)
087-903466-006	Cable, DC Power, double shielded for connecting SPU to customer power source. Cable is 16 AWG with screw-on connector on one end and stub end on the other.	• 6 ft (1.83 m)
087-903466-008		• 8 ft (2.44 m)
087-903466-015		• 15 ft (4.58 m)
087-903466-045		• 45 ft (13.73 m)
091-020085-704	Telephone, handset	• For use with SPU with optional orderwire only
098-093607-001	Outdoor Sealing kit, Cold Shrink	—

Table 5-1: TRuepoint® 5000 SPU Spares and Accessories (continued)

Part Number	Description	Comments
098-901202-003	Hand Held Terminal (Keypad Display)	• Required if Web CIT is not used
098-901250-001	Cable Kit, for connecting SDM to customer tributaries, D-Type male 50-pin, right-angle connector one end, stub-end to customer	• 32.5 ft (9.91 m)
098-901250-002		• 10 ft (3.05 m)
098-901250-003		• 20 ft (6.10 m)
098-901700-001	SPU mounting kit for 23 in. rack	• Optional
098-903030-002	Display keypad (HHT) kit, straight cord 1.8 m	• Standard offering
098-903055-001	Straight cable kit, shielded, 3 m (for HHT)	• Optional, per customer's request. Use with 098-903030-002
098-903055-002	Coiled cable kit, shielded (for HHT)	
098-903263-014	Cable Kit, for connecting 28 DS1 TIU to SPU, SCSI-3, 68-pin Male to 68-pin Male, (when purchased with the TIU)	• 14 inch (0.356 m)
098-903263-036		• 36 inch (0.915 m)
098-903263-072		• 72 inch (1.83 m)
098-903263-144		• 144 inch (3.66 m)
099-099500-002	Extra grounding kit for LDF2-50 coaxial cable	• Each coaxial cable requires at least 3 grounding kits
099-901043-001	Cable kit to connect SPU to RFU (LDF2-50: 100 m (328'))	• For outdoor RFU • Kit contains cable, sealing kit, 2 N-type connectors, and 3 grounding kits
099-901043-006	Cable kit to connect SPU to RFU (LDF2-50: 150 m (492'))	
099-901043-012	Cable kit to connect SPU to RFU (LDF2-50: 210 m (689'))	
099-901043-020	Cable kit to connect SPU to RFU (LDF2-50: 290 m (952'))	
099-901206-001	Cable installation tools for C2FP and (RG-8/U) cables	• Optional. Tools required to install connectors on C2FP and (RG-8/U) cables
099-901207-001	Cable installation tools for LDF2-50	• Tools required to install connectors on LDF2-50 cable

Table 5-1: TRuepoint® 5000 SPU Spares and Accessories (continued)

Part Number	Description	Comments
099-901208-001	Cable kit to connect SPU to RFU (C2FP: 45.7 m (150'))	• For outdoor RFU • Kit contains cable, sealing kit, 2 N-type connectors, and 3 grounding kits • You require one coaxial cable per RFU
099-901208-002	Cable kit to connect SPU to RFU (C2FP: 91.4 m (300'))	
099-901208-003	Cable kit to connect SPU to RFU (C2FP: 152.4 m (500'))	
099-901208-006	Cable kit to connect SPU to RFU (C2FP: 27.4 m (90'))	
099-902158-002	Connector kit for SPU DC power cable, male D-sub, cable with screwed ends. Not UL approved	• Standard offering
099-902158-003	Connector kit for SPU DC power cable, male D-sub, cable with soldered ends	• Optional
099-902696-001	Kit, Blank Panel Assembly (Controller Opt. Cards)	
099-920248-002	Cable kit to connect SPU to RFU (C2FP: 500 m)	• 10 Coaxial cable kits, 50 m each (Andrew's C2FP 1667 ft)
101-901415-001	BNC Connector Panel (4 E1, Unbalanced Option)	• Optional. • Occupies one rack-mount space
101-901415-002	BNC Connector Panel (8 E1, Unbalanced Option)	
103-097885-416	Grounding kit for LDF2-50 coaxial cable	• Order three per RFU if using LDF2-50 coaxial cable
IMN-903002-Exx	Extra Instruction Manual (English)	
CDR-903000-Exx	CD ROM containing manuals	

Table 5-2: TRuepoint® 5000 SPU ROHS Spares and Accessories

Part Number	Description	Comments
104-902510-501	Modem, Narrow Band (NB), up to 30 MHz	• Select 2 for protected
104-902510-502	Modem, Wide Band (WB), wider than 30 MHz	
103-902515-503	MUX, 2 E1 (up to 4, 8, 16 E1, with H/W Key)	• Select one for unprotected or two for protected Config. • For protected light, select 1 MUX and 1 Assy Panel Blank 099-902288-001
103-902515-504	MUX, 4 DS1 (up to 8, 12, 16 DS1, with H/W Key)	
103-902515-505	MUX, 4 DS1 (up to 8 DS1, with H/W Key)	
103-902515-506	MUX, 2 E1 (up to 8 E1, with H/W Key)	
103-902517-501	MUX, STM-1 Electrical Interface	
103-902517-502	MUX, STM-1 Optical Multimode Interface	
103-902517-503	MUX, STM-1 Optical Single mode Interface	
103-902517-504	MUX, STM-1 Electrical Interf., Part. filled	
103-902517-505	MUX, STM-1 Optical Multimode Interf., Part. filled	
103-902517-506	MUX, STM-1 Optical Single mode Interf. Part. filled	
102-902550-501	MUX, 2X10/100BASE-T over E3 DS3	
102-902550-502	MUX, 2X10/100BASE-T over E3 DS3	
102-902555-501	MUX, 28 DS1 over DS3 + DS1	
102-902558-501	MUX, 21 E1 + E1	
102-902573-501	MUX, 3 DS3 + 3 DS1	
102-902582-501	MUX, ADM 8 DS1/DS3 + DS1	
102-902582-502	MUX, N-16 DS1 + 2x10/100BASE-T	• Select if using MUX 102-902558
102-902582-503	MUX, N-16 E1 + 2x10/100BASE-T	
102-902535-501	SDM, 21 E1 + E1, Unbalanced	
102-902535-502	SDM, 21 E1 + E1, Balanced	• Select if using MUX 102-902515, or 103-902515
102-902540-501	SDM, Nx E1, Balanced	
102-902540-502	SDM, Nx E1, Unbalanced	
102-902540-503	SDM, Nx DS1, Balanced	• Select if using MUX 102-902573
102-902543-501	SDM, 3 DS3 + 3 DS1	
102-902585-501	SDM, 155 Mbps E1/DS1 + DS1	• Select if using MUX 102-902517-501, through 102-902517-506
102-902585-502	SDM, 10/100BASE-T over E3+DS1 or DS3+DS1	• Select if using MUX 102-902550

Table 5-2: TRuepoint® 5000 SPU ROHS Spares and Accessories

Part Number	Description	Comments
102-902587-501	SDM, 28 DS1/DS3 + DS1	• Select if using MUX 102-902555-501
102-902593-501	SDM, for ADM 8 DS1/DS3 + DS1	• Select if using MUX 102-902582-501
102-902593-502	SDM, N-16 DS1 + 2x10/100BASE-T	• Select if using MUX 102-902582-502
102-902593-503	SDM, N-16 E1 + 2x10/100BASE-T	• Select if using MUX 102-902582-503
102-903050-501	Tributary Interface Unit, SCSI-to-50 pin D-type connectors, up to 28 DS1	• Option, for connecting tributaries when MUX/SDM not present
102-903070-501	Tributary Interface Unit, SCSI-to-50 pin D-type and 1.0/2.3 series connectors, up to 21 E1 + E1	
102-902520-501	Controller, V1	• Software up to V4.x
102-903460-501	Controller, V2	• Software V6.x and later
102-902525-501	Option, Relay Alarms, 12-Relays, 12 inputs	• Options as required. Any factory non-equipped option is covered by a blank panel
102-902525-502	Option, Relay Alarms, 6-Relays, 30 inputs	
102-902527-501	Option, 64 kbps Synch Data, G.703 and V11	
102-902530-501	Option, Orderwire, 4W and 2W	
102-902532-501	Option, 10/100BASE-T over 64 kbps	• MUX capacity upgrade kit. Select upgrade options per section Hardware Keys , on page 4-13
102-902529-501	Hardware Key, 4 Tributaries	
102-902529-502	Hardware Key, 8 Tributaries	
102-902529-503	Hardware Key, 12 Tributaries	
102-902529-504	Hardware Key, 16 Tributaries	• Optional. Fiber cable. For Mux OC-3, to customer equipment/repeater configurations.
087-020192-006	Fiber Optic Cable, 62.5/125 µm	
087-020193-702	Patch cord shielded, RJ-45 4 pair, 7 ft	
087-020193-703	Patch cord shielded, RJ-45 4 pair, 15 ft	
087-020193-704	Patch cord shielded, RJ-45 4 pair, 25 ft	• Cables to connect RPTR IN to RPTR OUT, or RPTR OUT to other MCD radios
087-903760-005	Cable to connect SPU to RFU, RG-214/U, 5 ft	
087-903684-002	Cable assembly adapter, 50-pin D-Type to 16 BNC (1.5 ft), EMI compliant	• D-Type to BNC • Optional.
087-903684-004	Cable assembly adapter, 50-pin D-Type to 16 BNC (9 ft), EMI compliant	• For 8 E1 Tributaries, Unbalanced

Table 5-2: TRuepoint® 5000 SPU ROHS Spares and Accessories

Part Number	Description	Comments
087-903918-014	Cable to connect 28 DS1 TIU to SPU, SCSI-3, 68-pin Male to 68-pin Male, (when purchased separately from the TIU)	• 14 inch (0.356 m)
087-903918-036		• 36 inch (0.915 m)
087-903918-072		• 72 inch (1.83 m)
087-903918-144		• 144 inch (3.66 m)
087-903730-006	Cable, DC Power, shielded, stub end to customer side	• 6 ft (1.83 m)
087-903730-008		• 8 ft (2.44 m)
087-903730-015		• 15 ft (4.58 m)
087-903730-045		• 45 ft (13.73 m)
087-903879-001	Cable for Relay/Alarms, DB-15 to Stub End (Main Controller Module)	• 3 ft (0.915 m)
087-903879-002		• 6 ft (1.83 m)
087-903879-003		• 10 ft (3.05 m)
087-903879-004		• 25 ft (7.625 m)
087-903888-001	Cable, for connecting MUX to customer tributaries, D-Type male 50-pin, straight connector one end, stub-end to customer side	• 3 ft (0.915 m)
087-903888-002		• 7 ft (2.14 m)
087-903888-003		• 19 ft (5.8 m)
087-903888-004		• 25 ft (7.625 m)
087-903888-005	Cable, DC Power, double shielded for connecting SPU to customer power source. Cable is 16 AWG with screw-on connector on one end and stub end on the other.	• 60 ft (18.30 m)
087-903889-006		• 6 ft (1.83 m)
087-903889-008		• 8 ft (2.44 m)
087-903889-015		• 15 ft (4.58 m)
087-903889-045	Telephone, handset	• 45 ft (13.73 m)
091-903488-001		• Optional. DTMF Handset for Voice, Order Wire Channel. RoHS Compliant phone is charcoal color
098-901202-003	Hand Held Terminal (Keypad Display)	• Required if Web CIT is not used
098-903469-001	Cable Kit, for connecting SDM to customer tributaries, D-Type male 50-pin, right-angle connector one end, stub-end to customer	• 32.5 ft (9.91 m)
098-903469-002		• 10 ft (3.05 m)
098-903469-003		• 20 ft (6.10 m)
098-903030-702	Display keypad (HHT) kit, straight cord 1.8 m	• Standard offering

Table 5-2: TRuepoint® 5000 SPU ROHS Spares and Accessories

Part Number	Description	Comments
098-903931-001	Straight cable kit, shielded, 3 m (for HHT)	• Optional, per customer's request. Use with 098-903030-002
098-903931-002	Coiled cable kit, shielded (for HHT)	
098-903923-005	Cable Kit, for connecting 28 DS1 TIU to SPU, SCSI-3, 68-pin Male to 68-pin Male, (when purchased with the TIU)	• 14 inch (0.356 m)
098-903923-006		• 36 inch (0.915 m)
098-903923-007		• 72 inch (1.83 m)
098-903923-008		• 144 inch (3.66 m)
099-903616-001	Cable kit to connect SPU to RFU (C2FP: 45.7 m (150'))	• For outdoor RFU • Kit contains cable, sealing kit, 2 N-type connectors, and 3 grounding kits • You require one coaxial cable per RFU
099-903616-002	Cable kit to connect SPU to RFU (C2FP: 91.4 m (300'))	
099-903616-003	Cable kit to connect SPU to RFU (C2FP: 152.4 m (500'))	
099-903616-006	Cable kit to connect SPU to RFU (C2FP: 27.4 m (90'))	
099-903649-001	Kit, Blank Panel Assembly (Controller Opt. Cards)	• Optional. • Occupies one rack-mount space
102-901415-001	BNC Connector Panel (4 E1, Unbalanced Option)	
102-901415-002	BNC Connector Panel (8 E1, Unbalanced Option)	
IMN-903002-Exx	Extra Instruction Manual (English)	
CDR-903000-Exx	CD ROM containing manuals	

Customer Service Information

Standard Customer Service Support Guidelines

Harris MCD offers many after-sales services such as Technical Assistance, Repair and Advance Replacements. For details on our services, policies, procedures and how to reach us, please visit our web site at <https://premier.harris.com/microwave/> and access the *Worldwide Customer Service – Support Guidelines Document*. If you cannot access our web site, please call us at **1-800-227-8332 (514-421-8333)** or email us at cs-order@harris.com to get a copy.

Services Offered

- Technical assistance from highly qualified Product Support engineers to resolve technical questions / problems on the phone.
- Field Service support to resolve equipment problems on site by highly professional Field Service engineers.
- Repair of equipment at our Repair & Return facilities in a timely and cost-effective manner.
- Customers may benefit from the Harris MCD Refurbish and Retune Program to ensure that their systems will continue to operate at optimal performance as well as benefit from the latest engineering improvements which we continue to implement into Harris MCD products.
- 24-hour emergency telephone support by highly qualified Product Support engineers for traffic affecting or traffic threatening problems.
- 24-hour emergency shipment of replacement parts on selected items to minimize downtime.
- Product training by highly qualified instructors that maximizes product performance and minimizes maintenance costs.



Harris Microwave Customer Support

Harris provides world-class service for all our valued customers including 24/7 technical support. Your priority calls are handled through our Technical assistance Center (TAC):

USA, Canada, Caribbean: +1-800-227-8332

All other countries: +1-514-421-8333

You can also contact us through e-mail at:
crcusa@harris.com

Registered customers can obtain key product information on our
Premier Web Site at: <https://premier.harris.com/microwave>

Technical Assistance Centre

Technical support is available 24 hours per day, seven days a week, 365 days per year. Product Support Engineers are available worldwide to help you with your technical questions or problems. For the USA/Canada, call us at **1-800-227-8332**. For International, call the Technical Assistance Centre near you or contact us at **1-514-421-8333**, fax to **1-514-421-3555** or email us at crcusa@harris.com.

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 Returns Services

Harris MCD repairs all its manufactured products as well as coordinates repairs on vendor items which are part of its systems. The typical repair turn around time for current production models is 5 working days upon receipt of the defective parts and 15 working days for Manufacture Discontinued items, subject to the availability of parts (some restrictions apply).

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.

For more details, contact us in the USA/Canada at **1-800-227-8332**, for other regions, contact the Harris Repair and Return centre nearest you, or call us at **1-514-421-8333**, fax your request to **1-514-421-3555** or email us at cs-order@harris.com.

On-Site Field Service Support

Harris MCD factory trained Field Service engineers are available to perform on-site technical assistance on an as needed basis when telephone assistance can not be effectively rendered. All request for on-site assistance should be made to the Technical Assistance Center. Call the Technical Assistance Center nearest you or directly call our U.S.A. TAC office at **1-800-227-8332 (1-650-594-3800)** or email us at crcusa@harris.com.

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. For a more complete warranty coverage (including OEM equipment), please refer to our section titled Maintenance Level Agreements (MLA).

For more details please visit our web site at <https://premier.harris.com/microwave/> and access the Datasheet “Annual Repair Service Program”. For pricing information you can contact us at 1-800-227-8332 (514-421-8333) or email us at cs-order@harris.com.

Maintenance Level Agreements (MLA)

Harris MCD's Maintenance Level Agreements (MLA) provide ongoing support for Harris hardware, software and OEM products beyond the expiration of standard warranties. This comprehensive network maintenance program ensures that Harris-supplied networks will continue to perform critical functions, providing the peace of mind our customers expect.

For more details please visit our web site at <https://premier.harris.com/microwave/> and access the *Datasheet “Maintenance Level Agreements (MLA)”*. For pricing information you can contact us at 1-800-227-8332 (514-421-8333) or email us at cs-order@harris.com.

Customer Training

Harris MCD offers operation and maintenance courses for microwave, lightwave, multiplex and network operation and management systems. The courses are 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, pricing and training locations, please visit our WEB site at <http://www.microwave.harris.com/support/training/> or e-mail us at mcdtrain@harris.com.

GLOSSARY



This chapter provides an expanded description (as appropriate) of most of the acronyms used in this manual.

ACU	<i>Antenna Coupling Unit</i>
ADM	<i>Add/Drop Multiplexer</i> — A Digital multiplexing equipment that adds/removes individual signals to/from a collection of multiplexed signals in a network.
AGC	<i>Automatic Gain Control</i>
AIS	<i>Alarm Indication Signal</i> — In a DS1 system, a transmitted all-ones signal replacing the normal signal to maintain transmission continuity indicating to the receive terminal that there is a transmission fault located either at, or upstream from, the transmitting terminal.
AMI	<i>Alternate Mark Inversion</i>
APS	<i>Automatic Protection Switching</i> — A feature that allows a radio to recover automatically from failures.
ATM	<i>Asynchronous Transfer Mode</i> — A dedicated connection switching technology that organizes digital data into 53-byte cell units and transmits them over a physical medium using digital signal technology. Relative to other related cells, each cell is processed asynchronously and queued before being multiplexed over the transmission path.
ATPC	<i>Automatic Transmit Power Control</i> — A feature of digital microwave radio equipment that adjusts the transmitter output power based on path fading detected at the receiver.
B1	<i>Bit Interleaved Parity-8 (BIP-8)</i> — An RSOH byte for error checking the complete STM-1 signal at the end of a regenerator section.

B2	<i>Bit Interleaved Parity-24 (BIP-24)</i> — MSOH bytes for error checking an STM-1 signal (minus the RSOH) at the end of the multiplexer section.
B8ZS	<i>Bipolar 8 Zero Substitution</i>
CLEC	<i>Competitive Local Exchange Carrier</i> — A service provider that builds and operates communication networks in metropolitan areas, thus providing customers with an alternative to local telephone companies.
CompactFlash®	A compact, removable standard for storing and retrieving digital information in small, low-power devices. Such cards use flash technology for reusable recording, and ROM technology for read-only applications. Replaces the MMC (MultiMediaCard), as of Product Release 6.0
DACS	<i>Digital Access and Crossconnect System</i>
DADE	<i>Differential Absolute Delay Equalization</i> — An adjustment to render a protected system hitless.
DHCP	<i>Dynamic Host Configuration Protocol</i>
DTMF	<i>Dual Tone Multifrequency</i> — Tones generated when a button is pressed on a telephone, primarily used in North-America.
DTPC	<i>Dynamic Transmit Power Control</i> — A feature enabling the regulation of a target receive signal level by remotely and proportionally controlling the corresponding transmitter output power level.
ESD	<i>Electrostatic Discharge</i> — A rapid discharge of static electricity from one conductor to another of a different potential.
FD	<i>Frequency Diversity</i>
FEC	<i>Forward Error Correction</i> — A communication technique that compensates for a noisy transmission channel by sending, along with the primary data payload, additional information to correct for errors that occur in transmission.
FIR	<i>Finite Impulse Response filter</i> — Designates one of two primary types of digital filters used in Digital Signal Processing applications.
FTP	<i>File Transfer Protocol</i>
HDB3	<i>High Density Bipolar order 3</i>
HDLC	<i>High-level Data Link Control</i> — A bit-oriented synchronous data link layer protocol developed by ISO. HDLC specifies a data encapsulation method on synchronous serial links using frame characters and checksums.
HHT	<i>Hand-held terminal</i> — A Harris' user interface device (also known as a display keypad). It allows the user to configure and monitor the radio when not using CIT or Web-CIT .
IF	Intermediate Frequency
IP	<i>Internet Protocol</i> — A method or protocol by which data is sent from one computer to another on the Internet.
K1 and K2	In an SDH system, K1 and K2 are MSOH bytes used for controlling the multiplexer section protection switching, signalling Alarm Indication Signal (AIS), Far End Remote Failure (FERF), and signalling Automatic Protection Switching (APS) alarms, when implemented.

LAN	<i>Local-area Network</i> — A data network located on a user's premises within a limited geographical area. Widely used technology standards in LANs are Ethernet, FDDI, and Token Ring.
LIU	<i>Line Interface Unit</i> — An integrated circuit that interfaces to the physical cabling. The LIU provides clock recovery, pulse shaping and error detection functions.
LOH	<i>Line Overhead</i> — Contains the media's framing, routing protocol, and network-layer protocol overhead.
MHSB	<i>Monitored Hot Standby</i>
MSOH	<i>Multiplexer Section Overhead</i> — As part of an SDH frame (multiplexer), refers to the processing time required by codes for error checking and control of transmissions.
MSUU	<i>Microwave Software Upgrade Utility</i> — A Harris' proprietary software utility for upgrading the software and firmware of the TRuepoint® radios. Uses Microsoft Windows 2000® Service Pack 4 or later.
MUX	<i>Multiplexer</i> — A circuitry that combines two or more information-carrying channels for transmission over one channel, by using frequency division or time division techniques
NMS	<i>Network Management System</i> — such as Harris' StarView™.
OC-<i>n</i>	<i>Optical Carrier Level <i>n</i></i> — The optical signal that results from an optical conversion of a synchronous transport signal <i>n</i> (STS-<i>n</i>). This is the signal that will form the basis of the interface.
OMM	<i>Optical Multimode</i>
OSM	<i>Optical Single Mode</i>
PDH	<i>Plesiosynchronous Digital Hierarchy</i> — A complex multiplexing scheme of bit stuffing and byte interleaving. It multiplexes the lower level 64 kbps circuits into a successively higher order 2 Mbps, 34 Mbps, 140 Mbps and 565 Mbps aggregate rates.
PPP	<i>Point-to-Point Protocol</i> — A TCP/IP routing protocol that allows communications over serial communications lines without the use of other adapters, such as modems.
QAM	<i>Quadrature Amplitude Modulation</i> — A method of combining two amplitude-modulated signals into a single channel, thereby doubling the effective bandwidth.
QPSK	<i>Quadrature Phase Shift Keying</i> — A digital frequency modulation technique used for sending data over coaxial cable networks.
RDI-L	Remote Defect Indication - Line
RCS	<i>Reverse Channel Switching</i> — A rich feature set that provides protection against potential far-end transmitter silent failure.
Restricted Area	A location qualified in accordance with IEC Standard 60950-1 as providing an access that can only be gained by Skilled Persons or users who have been instructed about the reasons for the restriction applied to the location and about any precautions to be taken; and access achieved through the use of a Tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.

RFCOH	<i>Radio Frame Complementary Overhead</i> — Refers to data that is added to a data transmission unit, (such as Netcom data packets).
RFU	<i>Radio Frequency Unit</i> — The radio unit that is installed mainly outdoors.
RIP	<i>Routing Information Protocol</i>
RMS	<i>Rack Mounting Space</i>
RPC	<i>Radio Processing Card</i>
RS	<i>Revertive Switching</i> — A process that sends traffic back to the original working card after the card returns online.
RSL	<i>Received Signal Level</i>
RSOH	<i>Regenerator Section Overhead</i> — As part of an SDH frame (regenerator), refers to the processing time required by codes for error checking and control of transmissions.
RSSI	<i>Received Signal Strength Indicator</i> - A parameter returned from a transceiver that gives a measure of the RF signal strength, either uplink or downlink.
SD	<i>Space Diversity</i>
SDH	<i>Synchronous Digital Hierarchy</i> — An international standard for synchronous data transmission on optical media. SDH uses a multiplexing structure that enables direct access to individual 2 Mbps data streams from within the higher order aggregate line signals, which lays the foundation for benefits of distributed traffic switching and protection.
SDLC	<i>Synchronous Data Link Control</i> — A bit-oriented, full-duplex serial protocol that has spawned numerous similar protocols, including HDLC and LAPB.
SDM	<i>Signal Distribution Module</i> — An optional module used in conjunction with a redundant multiplexer, as part of the protection unit that is integrated with the SPU .
Skilled Person	A skilled person is considered to have the necessary knowledge and practical experience of electrical and radio engineering to appreciate the various hazards that can arise from working on radio transceivers, and takes appropriate precautions to ensure the safety of personnel. This individual is considered to be a skilled person only if he/she is competent to take responsibility for both his/her safety and for that of unskilled personnel under his/her immediate supervision, when working on the transceiver. Training requirements for a skilled person should not only be confined to technical matters and, preferably, should include first-aid treatment, especially methods of artificial resuscitation: respiration and cardiac compression (heart massage).
SNCP	<i>Subnetwork Connection Protection</i> — Designates path-switched SDH rings that employ redundant, fiber-optic transmission facilities. Organized in pairs, one fiber transmits in one direction while the backup fiber transmits in the other. If the primary ring fails, the backup takes over.
SNMP	<i>Simple Network Management Protocol</i> — A protocol used to facilitate network management by exchanging information between equipment on a network.

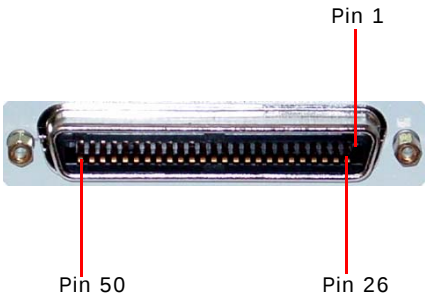
SONET	<i>Synchronous Optical Network</i> — An ANSI standard for synchronous data transmission on optical media that is the equivalent of SDH , described above.
SPU	<i>Signal Processing Unit</i> (Also referred to as IDU) — The indoor rack-mounted unit that contains plug-in modules for handling and processing the signal received from the RFU .
STM-<i>n</i>	<i>Synchronous Transport Module</i> — A data unit transmitted within a fixed time slot of 125 μ s, also known as frame. SDH transport defines a range of frames, STM-1...STM-64, each corresponding to a particular transmission rate, such as STM-1 (155 Mbps), STM-4 (622 Mbps), STM-16 (2.5 Gbps), and STM-64 (10 Gbps).
STP	<i>Spanning Tree Protocol</i> — A link management protocol that provides path redundancy while preventing undesirable loops in a network that are created by multiple active paths between stations.
STS-<i>n</i>	<i>Synchronous Transport Signal, Level <i>n</i></i> — The basic logical building block signal of a SONET . The STS-1 (level 1) signal has a rate of 51.840 Mbps. The international equivalent of this rate is the STM.
TCM	<i>Trellis-Coded Modulation</i> — A bandwidth-efficient scheme that combines error-correction coding with modulation. The redundancy thus introduced by the coding does not expand the bandwidth, since the parity bits are absorbed by the extended signal constellation. Two-dimensional (2D) TCM uses dependency between in-phase and quadrature symbols, while four-dimensional (4D) TCM introduces dependency between symbols of two successive intervals.
TCP / IP	<i>Transmission Control Protocol/Internet Protocol</i> — A standard that provides connectivity across computer platforms ranging from mainframes to Macintoshes. These computers can exchange data when connected over a compatible network scheme, such as Ethernet or X.25. Originally developed by the Department of Defense in the 70's, these protocols are now a de facto industry standard.
UDP	<i>User Datagram Protocol</i> — A TCP/IP protocol that describes how messages reach application programs within a destination computer.
UPSR	<i>Unidirectional Path-Switched Ring</i> — A survivable, closed-loop, transport architecture that protects against fiber cuts and node failures by providing duplicate, geographically diverse paths for each circuit.
WAN	<i>Wide-area Network</i> — A network that provides telecommunication services to a geographic area larger than that served by a local area network or a metropolitan area network.
Web-CIT	<i>Web-Craft Interface Tool</i> — A Harris' proprietary software utility for monitoring and controlling the operation and configuration of the TRuepoint [®] radios. Located on the TRuepoint [®] Controller, any of the two NTWRK/LAN ports allows for connecting a PC running the <i>Web-CIT</i> server that is embedded in the radio. This web server stores HTML pages and applets that provide a user interface for monitoring and controlling any TRuepoint [®] Network Element, using the Microsoft [®] Internet Explorer, version 5.5 and later.

A

MODULE PORTS' PINOUTS

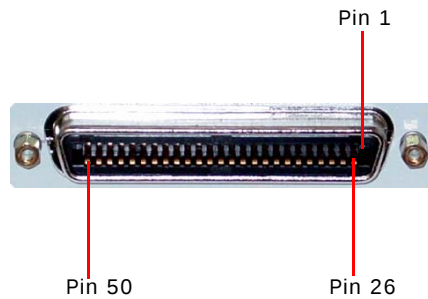
The MUX and SDM Ports

Table A-1: Balanced Tributaries 1-8: 50-Pin Female D-Type^a



- Applies to:
- MUX 902515, Nx E1 / DS1
 - SDM 902540

Pin	Name	Direction	Description
1	NC	-	No Connection
2	GND	-	Ground
3	RxRING8	Out	Tributary 8 Rx Output Ring
4	TxRING8	In	Tributary 8 Tx Input Ring
5	GND	-	Ground
6	RxRING7	Out	Tributary 7 Rx Output Ring
7	TxRING7	In	Tributary 7 Tx Input Ring
8	GND	-	Ground
9	RxRING6	Out	Tributary 6 Rx Output Ring
10	TxRING6	In	Tributary 6 Tx Input Ring
11	GND	-	Ground
12	RxRING5	Out	Tributary 5 Rx Output Ring
13	TxRING5	In	Tributary 5 Tx Input Ring
14	GND	-	Ground
15	RxRING4	Out	Tributary 4 Rx Output Ring
16	TxRING4	In	Tributary 4 Tx Input Ring
17	GND	-	Ground
18	RxRING3	Out	Tributary 3 Rx Output Ring

Table A-1: Balanced Tributaries 1-8: 50-Pin Female D-Type^a (continued)

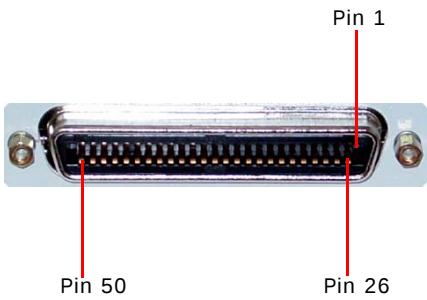
Applies to:

- MUX 902515, Nx E1 / DS1
- SDM 902540

Pin	Name	Direction	Description
19	TxRING3	In	Tributary 3 Tx Input Ring
20	GND	-	Ground
21	RxRING2	Out	Tributary 2 Rx Output Ring
22	TxRING2	In	Tributary 2 Tx Input Ring
23	GND	-	Ground
24	RxRING1	Out	Tributary 1 Rx Output Ring
25	TxRING1	In	Tributary 1 Tx Input Ring
26	NC	-	No Connection
27	GND	-	Ground
28	RxTIP8	Out	Tributary 8 Rx Output Tip
29	TxTIP8	In	Tributary 8 Tx Input Tip
30	GND	-	Ground
31	RxTIP7	Out	Tributary 7 Rx Output Tip
32	TxTIP7	In	Tributary 7 Tx Input Tip
33	GND	-	Ground
34	RxTIP6	Out	Tributary 6 Rx Output Tip
35	TxTIP6	In	Tributary 6 Tx Input Tip
36	GND	-	Ground
37	RxTIP5	Out	Tributary 5 Rx Output Tip
38	TxTIP5	In	Tributary 5 Tx Input Tip
39	GND	-	Ground
40	RxTIP4	Out	Tributary 4 Rx Output Tip
41	TxTIP4	In	Tributary 4 Tx Input Tip
42	GND	-	Ground
43	RxTIP3	Out	Tributary 3 Rx Output Tip
44	TxTIP3	In	Tributary 3 Tx Input Tip
45	GND	-	Ground
46	RxTIP2	Out	Tributary 2 Rx Output Tip
47	TxTIP2	In	Tributary 2 Tx Input Tip
48	GND	-	Ground
49	RxTIP1	Out	Tributary 1 Rx Output Tip
50	TxTIP1	In	Tributary 1 Tx Input Tip

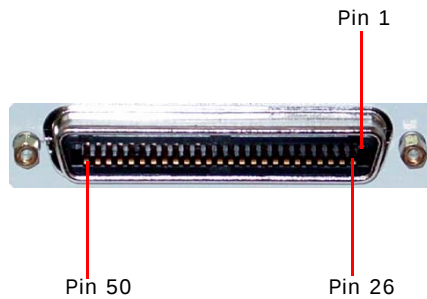
a. Also referred to as SCSI-1

Table A-2: Balanced Tributaries 9-16: 50-Pin Female D-Type^a



Applies to:
• MUX 902515, Nx E1 / DS1
• SDM 902540

Pin	Name	Dir.	Description
1	NC	-	No connection
2	GND	-	Ground
3	RxRING16	Out	Tributary 16 Rx Output Ring
4	TxRING16	In	Tributary 16 Tx Input Ring
5	GND	-	Ground
6	RxRING15	Out	Tributary 15 Rx Output Ring
7	TxRING15	In	Tributary 15 Tx Input Ring
8	GND	-	Ground
9	RxRING14	Out	Tributary 14 Rx Output Ring
10	TxRING14	In	Tributary 14 Tx Input Ring
11	GND	-	Ground
12	RxRING13	Out	Tributary 13 Rx Output Ring
13	TxRING13	In	Tributary 13 Tx Input Ring
14	GND	-	Ground
15	RxRING12	Out	Tributary 12 Rx Output Ring
16	TxRING12	In	Tributary 12 Tx Input Ring
17	GND	-	Ground
18	RxRING11	Out	Tributary 11 Rx Output Ring

Table A-2: Balanced Tributaries 9-16: 50-Pin Female D-Type^a (continued)

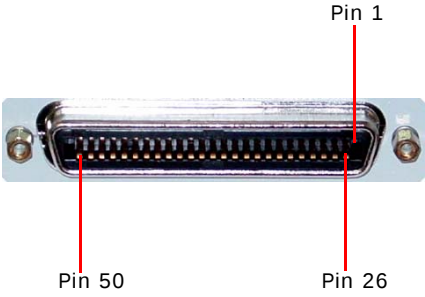
Applies to:

- MUX 902515, Nx E1 / DS1
- SDM 902540

Pin	Name	Dir.	Description
19	TxRING11	In	Tributary 11 Tx Input Ring
20	GND	-	Ground
21	RxRING10	Out	Tributary 10 Rx Output Ring
22	TxRING10	In	Tributary 10 Tx Input Ring
23	GND	-	Ground
24	RxRING9	Out	Tributary 9 Rx Output Ring
25	TxRING9	In	Tributary 9 Tx Input Ring
26	NC	-	No Connection
27	GND	-	Ground
28	RxTIP16	Out	Tributary 16 Rx Output Tip
29	TxTIP16	In	Tributary 16 Tx Input Tip
30	GND	-	Ground
31	RxTIP15	Out	Tributary 15 Rx Output Tip
32	TxTIP15	In	Tributary 15 Tx Input Tip
33	GND	-	Ground
34	RxTIP14	Out	Tributary 14 Rx Output Tip
35	TxTIP14	In	Tributary 14 Tx Input Tip
36	GND	-	Ground
37	RxTIP13	Out	Tributary 13 Rx Output Tip
38	TxTIP13	In	Tributary 13 Tx Input Tip
39	GND	-	Ground
40	RxTIP12	Out	Tributary 12 Rx Output Tip
41	TxTIP12	In	Tributary 12 Tx Input Tip
42	GND	-	Ground
43	RxTIP11	Out	Tributary 11 Rx Output Tip
44	TxTIP11	In	Tributary 11 Tx Input Tip
45	GND	-	Ground
46	RxTIP10	Out	Tributary 10 Rx Output Tip
47	TxTIP10	In	Tributary 10 Tx Input Tip
48	GND	-	Ground
49	RxTIP9	Out	Tributary 9 Rx Output Tip
50	TxTIP9	In	Tributary 9 Tx Input Tip

a. Also referred to as SCSI-1

Table A-3: Unbalanced Tributaries 1-8: 50-Pin Fem. D-Type^a



Pin 1

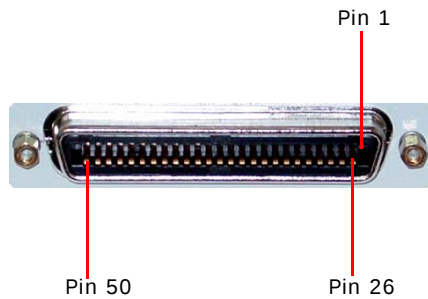
Pin 26

Pin 50

Applies to:

- MUX 902515, Nx E1 / DS1
- SDM 902540

Pin	Name	Dir.	Description
1	NC	-	No connection
2	GND	-	Ground
3	GND	-	Ground
4	GND	-	Ground
5	GND	-	Ground
6	GND	-	Ground
7	GND	-	Ground
8	GND	-	Ground
9	GND	-	Ground
10	GND	-	Ground
11	GND	-	Ground
12	GND	-	Ground
13	GND	-	Ground
14	GND	-	Ground
15	GND	-	Ground
16	GND	-	Ground
17	GND	-	Ground
18	GND	-	Ground

Table A-3: Unbalanced Tributaries 1-8: 50-Pin Fem. D-Type^a (continued)

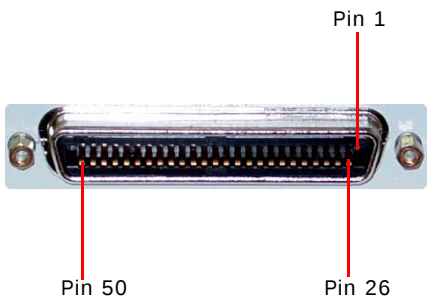
Applies to:

- MUX 902515, Nx E1 / DS1
- SDM 902540

Pin	Name	Dir.	Description
19	GND	-	Ground
20	GND	-	Ground
21	GND	-	Ground
22	GND	-	Ground
23	GND	-	Ground
24	GND	-	Ground
25	GND	-	Ground
26	NC	-	No Connection
27	GND	-	Ground
28	RxTIP8	Out	Tributary 8 Rx Output Tip
29	TxTIP8	In	Tributary 8 Tx Input Tip
30	GND	-	Ground
31	RxTIP7	Out	Tributary 7 Rx Output Tip
32	TxTIP7	In	Tributary 7 Tx Input Tip
33	GND	-	Ground
34	RxTIP6	Out	Tributary 6 Rx Output Tip
35	TxTIP6	In	Tributary 6 Tx Input Tip
36	GND	-	Ground
37	RxTIP5	Out	Tributary 5 Rx Output Tip
38	TxTIP5	In	Tributary 5 Tx Input Tip
39	GND	-	Ground
40	RxTIP4	Out	Tributary 4 Rx Output Tip
41	TxTIP4	In	Tributary 4 Tx Input Tip
42	GND	-	Ground
43	RxTIP3	Out	Tributary 3 Rx Output Tip
44	TxTIP3	In	Tributary 3 Tx Input Tip
45	GND	-	Ground
46	RxTIP2	Out	Tributary 2 Rx Output Tip
47	TxTIP2	In	Tributary 2 Tx Input Tip
48	GND	-	Ground
49	RxTIP1	Out	Tributary 1 Rx Output Tip
50	TxTIP1	In	Tributary 1 Tx Input Tip

a. Also referred to as SCSI-1

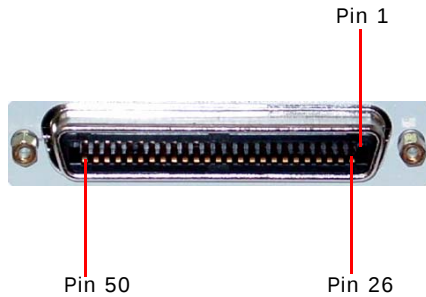
Table A-4: Unbalanced Tributaries 9-16: 50-Pin Fem. D-Type^a



Applies to:

- MUX 902515, NxEx1 / DS1
- SDM 902540

Pin	Name	Dir.	Description
1	NC	-	No connection
2	GND	-	Ground
3	GND	-	Ground
4	GND	-	Ground
5	GND	-	Ground
6	GND	-	Ground
7	GND	-	Ground
8	GND	-	Ground
9	GND	-	Ground
10	GND	-	Ground
11	GND	-	Ground
12	GND	-	Ground
13	GND	-	Ground
14	GND	-	Ground
15	GND	-	Ground
16	GND	-	Ground
17	GND	-	Ground
18	GND	-	Ground

Table A-4: Unbalanced Tributaries 9-16: 50-Pin Fem. D-Type^a

Applies to:

- MUX 902515, Nx E1 / DS1
- SDM 902540

Pin	Name	Dir.	Description
19	GND	-	Ground
20	GND	-	Ground
21	GND	-	Ground
22	GND	-	Ground
23	GND	-	Ground
24	GND	-	Ground
25	GND	-	Ground
26	NC	-	No Connection
27	GND	-	Ground
28	RxTIP16	Out	Tributary 16 Rx Output Tip
29	TxTIP16	In	Tributary 16 Tx Input Tip
30	GND	-	Ground
31	RxTIP15	Out	Tributary 15 Rx Output Tip
32	TxTIP15	In	Tributary 15 Tx Input Tip
33	GND	-	Ground
34	RxTIP14	Out	Tributary 14 Rx Output Tip
35	TxTIP14	In	Tributary 14 Tx Input Tip
36	GND	-	Ground
37	RxTIP13	Out	Tributary 13 Rx Output Tip
38	TxTIP13	In	Tributary 13 Tx Input Tip
39	GND	-	Ground
40	RxTIP12	Out	Tributary 12 Rx Output Tip
41	TxTIP12	In	Tributary 12 Tx Input Tip
42	GND	-	Ground
43	RxTIP11	Out	Tributary 11 Rx Output Tip
44	TxTIP11	In	Tributary 11 Tx Input Tip
45	GND	-	Ground
46	RxTIP10	Out	Tributary 10 Rx Output Tip
47	TxTIP10	In	Tributary 10 Tx Input Tip
48	GND	-	Ground
49	RxTIP9	Out	Tributary 9 Rx Output Tip
50	TxTIP9	In	Tributary 9 Tx Input Tip

a. Also referred to as SCSI-1

**Table A-5: E1/DS1 Wayside Balanced Interface, (RJ-45) —
On MUX 902550 (E3/DS3 + Wayside) and SDM 902585**



Pin 1

Pin	Name	Dir.	Description
1	RX_RING_OUT	Out	Balanced Output Ring, Receive
2	RX_TIP_OUT	Out	Balanced Output Tip, Receive
3	N/C	—	Not Connected
4	TX_RING_IN	In	Balanced Input Ring, Transmit
5	TX_TIP_IN	In	Balanced Input Tip, Transmit
6	N/C	—	Not Connected
7	GND	—	Ground
8	GND	—	Ground

**Table A-6: E1/DS1 Wayside Balanced Interface, (RJ-45) —
On MUX: 902573 (3 DS3 + 3 Wayside) and SDM 902543
On MUX: 902517 (STM-1/OC-3) and SDM 902585**



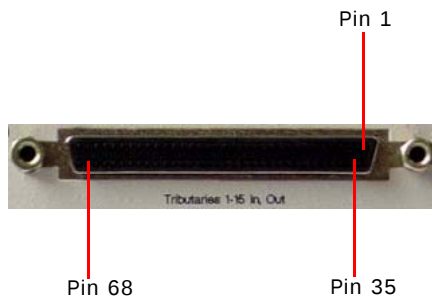
Pin 1

Pin	Name	Dir.	Description
1	RING_OUT	Out	Balanced Output Ring, Receive
2	TIP_OUT	Out	Balanced Output Tip, Receive
3	GND	—	Ground
4	RING_IN	In	Balanced Input Ring, Transmit
5	TIP_IN	In	Balanced Input Tip, Transmit
6	GND	—	Ground
7	GND	—	Ground
8	GND	—	Ground

Table A-7: OC3 Connector/Transceiver, on MUX 902517 (STM-1/OC-3)



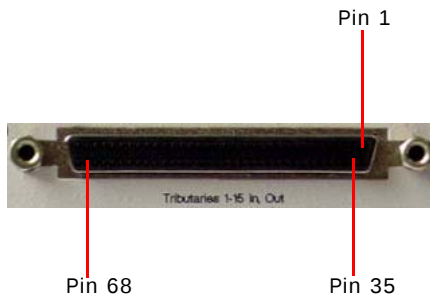
Specifications	
Type	SC-Duplex
Pinouts	1x9 footprint
Data Rate	155.52 Mbps
Wavelength	1300 nm FP

Table A-8: Balanced Tributaries 1-15: 68-Pin Female SCSI-3

Applies to:

- MUX 902555, 28 DS1/DS3+WS
- SDM 902587

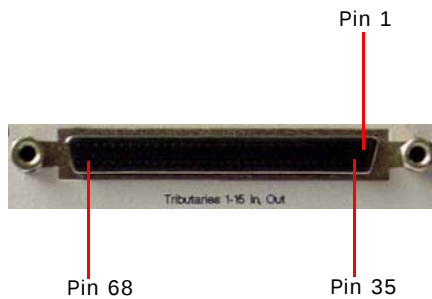
Pin	Name	Dir.	Description
1	RxTIP15	Out	Tributary 15 Rx Output Tip
2	TxTIP15	In	Tributary 15 Tx Input Tip
3	RxTIP14	Out	Tributary 14 Rx Output Tip
4	TxTIP14	In	Tributary 14 Tx Input Tip
5	RxTIP13	Out	Tributary 13 Rx Output Tip
6	TxTIP13	In	Tributary 13 Tx Input Tip
7	GND	GND	GND
8	RxTIP12	Out	Tributary 12 Rx Output Tip
9	TxTIP12	In	Tributary 12 Tx Input Tip
10	RxTIP11	Out	Tributary 11 Rx Output Tip
11	TxTIP11	In	Tributary 11 Tx Input Tip
12	RxTIP10	Out	Tributary 10 Rx Output Tip
13	TxTIP10	In	Tributary 10 Tx Input Tip
14	GND	GND	GND
15	RxTIP9	Out	Tributary 9 Rx Output Tip
16	TxTIP9	In	Tributary 9 Tx Input Tip
17	RxTIP8	Out	Tributary 8 Rx Output Tip
18	TxTIP8	In	Tributary 8 Tx Input Tip
19	RxTIP7	Out	Tributary 7 Rx Output Tip
20	TxTIP7	In	Tributary 7 Tx Input Tip
21	GND	GND	GND
22	RxTIP6	Out	Tributary 6 Rx Output Tip
23	TxTIP6	In	Tributary 6 Tx Input Tip
24	RxTIP5	Out	Tributary 5 Rx Output Tip
25	TxTIP5	In	Tributary 5 Tx Input Tip
26	RxTIP4	Out	Tributary 4 Rx Output Tip
27	TxTIP4	In	Tributary 4 Tx Input Tip
28	GND	GND	GND
29	RxTIP3	Out	Tributary 3 Rx Output Tip
30	TxTIP3	In	Tributary 3 Tx Input Tip
31	RxTIP2	Out	Tributary 2 Rx Output Tip
32	TxTIP2	In	Tributary 2 Tx Input Tip
33	RxTIP1	Out	Tributary 1 Rx Output Tip
34	TxTIP1	In	Tributary 1 Tx Input Tip

Table A-8: Balanced Tributaries 1-15: 68-Pin Female SCSI-3

Applies to:

- MUX 902555, 28 DS1/DS3+WS
- SDM 902587

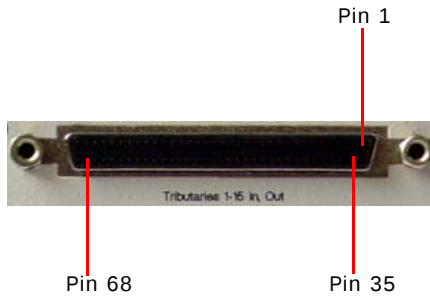
Pin	Name	Dir.	Description
35	RxRING15	Out	Tributary 15 Rx Output Ring
36	TxRING15	In	Tributary 15 Tx Input Ring
37	RxRING14	Out	Tributary 14 Rx Output Ring
38	TxRING14	In	Tributary 14 Tx Input Ring
39	RxRING13	Out	Tributary 13 Rx Output Ring
40	TxRING13	In	Tributary 13 Tx Input Ring
41	GND	GND	GND
42	RxRING12	Out	Tributary 12 Rx Output Ring
43	TxRING12	In	Tributary 12 Tx Input Ring
44	RxRING11	Out	Tributary 11 Rx Output Ring
45	TxRING11	In	Tributary 11 Tx Input Ring
46	RxRING10	Out	Tributary 10 Rx Output Ring
47	TxRING10	In	Tributary 10 Tx Input Ring
48	GND	GND	GND
49	RxRING9	Out	Tributary 9 Rx Output Ring
50	TxRING9	In	Tributary 9 Tx Input Ring
51	RxRING8	Out	Tributary 8 Rx Output Ring
52	TxRING8	In	Tributary 8 Tx Input Ring
53	RxRING7	Out	Tributary 7 Rx Output Ring
54	TxRING7	In	Tributary 7 Tx Input Ring
55	GND	GND	GND
56	RxRING6	Out	Tributary 6 Rx Output Ring
57	TxRING6	In	Tributary 6 Tx Input Ring
58	RxRING5	Out	Tributary 5 Rx Output Ring
59	TxRING5	In	Tributary 5 Tx Input Ring
60	RxRING4	Out	Tributary 4 Rx Output Ring
61	TxRING4	In	Tributary 4 Tx Input Ring
62	GND	GND	GND
63	RxRING3	Out	Tributary 3 Rx Output Ring
64	TxRING3	In	Tributary 3 Tx Input Ring
65	RxRING2	Out	Tributary 2 Rx Output Ring
66	TxRING2	In	Tributary 2 Tx Input Ring
67	RxRING1	Out	Tributary 1 Rx Output Ring
68	TxRING1	In	Tributary 1 Tx Input Ring

Table A-9: Balanced Tributaries 16-29: 68-Pin Female SCSI-3

Applies to:

- MUX 902555, 28 DS1/DS3+WS
- SDM 902587

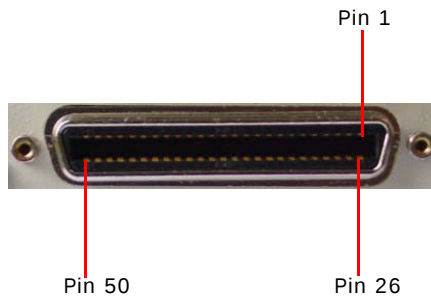
Pin	Name	Dir.	Description
1	GND	GND	GND
2	GND	GND	GND
3	RxTIP29	Out	Tributary 29 Rx Output Tip
4	TxTIP29	In	Tributary 29 Tx Input Tip
5	RxTIP28	Out	Tributary 28 Rx Output Tip
6	TxTIP28	In	Tributary 28 Tx Input Tip
7	GND	GND	GND
8	RxTIP27	Out	Tributary 27 Rx Output Tip
9	TxTIP27	In	Tributary 27 Tx Input Tip
10	RxTIP26	Out	Tributary 26 Rx Output Tip
11	TxTIP26	In	Tributary 26 Tx Input Tip
12	RxTIP25	Out	Tributary 25 Rx Output Tip
13	TxTIP25	In	Tributary 25 Tx Input Tip
14	GND	GND	GND
15	RxTIP24	Out	Tributary 24 Rx Output Tip
16	TxTIP24	In	Tributary 24 Tx Input Tip
17	RxTIP23	Out	Tributary 23 Rx Output Tip
18	TxTIP23	In	Tributary 23 Tx Input Tip
19	RxTIP22	Out	Tributary 22 Rx Output Tip
20	TxTIP22	In	Tributary 22 Tx Input Tip
21	GND	GND	GND
22	RxTIP21	Out	Tributary 21 Rx Output Tip
23	TxTIP21	In	Tributary 21 Tx Input Tip
24	RxTIP20	Out	Tributary 20 Rx Output Tip
25	TxTIP20	In	Tributary 20 Tx Input Tip
26	RxTIP19	Out	Tributary 19 Rx Output Tip
27	TxTIP19	In	Tributary 19 Tx Input Tip
28	GND	GND	GND
29	RxTIP18	Out	Tributary 18 Rx Output Tip
30	TxTIP18	In	Tributary 18 Tx Input Tip
31	RxTIP17	Out	Tributary 17 Rx Output Tip
32	TxTIP17	In	Tributary 17 Tx Input Tip
33	RxTIP16	Out	Tributary 16 Rx Output Tip
34	TxTIP16	In	Tributary 16 Tx Input Tip

Table A-9: Balanced Tributaries 16-29: 68-Pin Female SCSI-3

Applies to:

- MUX 902555, 28 DS1/DS3+WS
- SDM 902587

Pin	Name	Dir.	Description
35	GND	GND	GND
36	GND	GND	GND
37	RxRING29	Out	Tributary 29 Rx Output Ring
38	TxRING29	In	Tributary 29 Tx Input Ring
39	RxRING28	Out	Tributary 28 Rx Output Ring
40	TxRING28	In	Tributary 28 Tx Input Ring
41	GND	GND	GND
42	RxRING27	Out	Tributary 27 Rx Output Ring
43	TxRING27	In	Tributary 27 Tx Input Ring
44	RxRING26	Out	Tributary 26 Rx Output Ring
45	TxRING26	In	Tributary 26 Tx Input Ring
46	RxRING25	Out	Tributary 25 Rx Output Ring
47	TxRING25	In	Tributary 25 Tx Input Ring
48	GND	GND	GND
49	RxRING24	Out	Tributary 24 Rx Output Ring
50	TxRING24	In	Tributary 24 Tx Input Ring
51	RxRING23	Out	Tributary 23 Rx Output Ring
52	TxRING23	In	Tributary 23 Tx Input Ring
53	RxRING22	Out	Tributary 22 Rx Output Ring
54	TxRING22	In	Tributary 22 Tx Input Ring
55	GND	GND	GND
56	RxRING21	Out	Tributary 21 Rx Output Ring
57	TxRING21	In	Tributary 21 Tx Input Ring
58	RxRING20	Out	Tributary 20 Rx Output Ring
59	TxRING20	In	Tributary 20 Tx Input Ring
60	RxRING19	Out	Tributary 19 Rx Output Ring
61	TxRING19	In	Tributary 19 Tx Input Ring
62	GND	GND	GND
63	RxRING18	Out	Tributary 18 Rx Output Ring
64	TxRING18	In	Tributary 18 Tx Input Ring
65	RxRING17	Out	Tributary 17 Rx Output Ring
66	TxRING17	In	Tributary 17 Tx Input Ring
67	RxRING16	Out	Tributary 16 Rx Output Ring
68	TxRING16	In	Tributary 16 Tx Input Ring

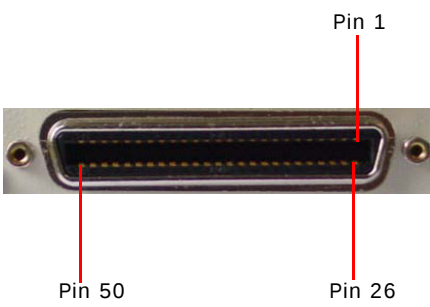
Table A-10: Balanced Tributaries 1-11: 50-Pin Female D-Type^a

Applies to:

- MUX 902558, 21 E1 + WS
- SDM 902535

Pin	Name	Dir.	Description
1	GND	-	Ground
2	RxRING11	Out	Tributary 11 Rx Output Ring
3	TxRING11	In	Tributary 11 Tx Input Ring
4	RxRING10	Out	Tributary 10 Rx Output Ring
5	TxRING10	In	Tributary 10 Tx Input Ring
6	RxRING9	Out	Tributary 9 Rx Output Ring
7	TxRING9	In	Tributary 9 Tx Input Ring
8	RxRING8	Out	Tributary 8 Rx Output Ring
9	TxRING8	In	Tributary 8 Tx Input Ring
10	RxRING7	Out	Tributary 7 Rx Output Ring
11	TxRING7	In	Tributary 7 Tx Input Ring
12	GND	-	Ground
13	RxRING6	Out	Tributary 6 Rx Output Ring
14	TxRING6	In	Tributary 6 Tx Input Ring
15	RxRING5	Out	Tributary 5 Rx Output Ring
16	TxRING5	In	Tributary 5 Tx Input Ring
17	RxRING4	Out	Tributary 4 Rx Output Ring
18	TxRING4	In	Tributary 4 Tx Input Ring
19	RxRING3	Out	Tributary 3 Rx Output Ring
20	TxRING3	In	Tributary 3 Tx Input Ring
21	RxRING2	Out	Tributary 2 Rx Output Ring
22	TxRING2	In	Tributary 2 Tx Input Ring
23	RxRING1	Out	Tributary 1 Rx Output Ring
24	TxRING1	In	Tributary 1 Tx Input Ring
25	GND	-	Ground

Table A-10:Balanced Tributaries 1-11: 50-Pin Female D-Type^a



Pin 1

Pin 26

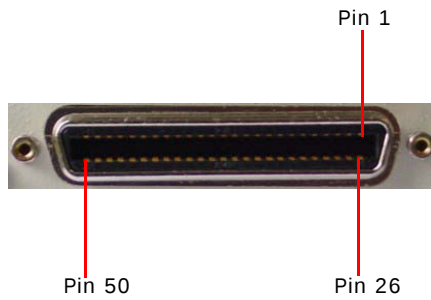
Pin 50

Applies to:

- MUX 902558, 21 E1 + WS
- SDM 902535

Pin	Name	Dir.	Description
26	GND	-	Ground
27	RxTIP11	Out	Tributary 11 Rx Output Tip
28	TxTIP11	In	Tributary 11 Tx Input Tip
29	RxTIP10	Out	Tributary 10 Rx Output Tip
30	TxTIP10	In	Tributary 10 Tx Input Tip
31	RxTIP9	Out	Tributary 9 Rx Output Tip
32	TxTIP9	In	Tributary 9 Tx Input Tip
33	RxTIP8	Out	Tributary 8 Rx Output Tip
34	TxTIP8	In	Tributary 8 Tx Input Tip
35	RxTIP7	Out	Tributary 7 Rx Output Tip
36	TxTIP7	In	Tributary 7 Tx Input Tip
37	GND	-	Ground
38	RxTIP6	Out	Tributary 6 Rx Output Tip
39	TxTIP6	In	Tributary 6 Tx Input Tip
40	RxTIP5	Out	Tributary 5 Rx Output Tip
41	TxTIP5	In	Tributary 5 Tx Input Tip
42	RxTIP4	Out	Tributary 4 Rx Output Tip
43	TxTIP4	In	Tributary 4 Tx Input Tip
44	RxTIP3	Out	Tributary 3 Rx Output Tip
45	TxTIP3	In	Tributary 3 Tx Input Tip
46	RxTIP2	Out	Tributary 2 Rx Output Tip
47	TxTIP2	In	Tributary 2 Tx Input Tip
48	RxTIP1	Out	Tributary 1 Rx Output Tip
49	TxTIP1	In	Tributary 1 Tx Input Tip
50	GND	-	Ground

a. Also referred to as SCSI-1

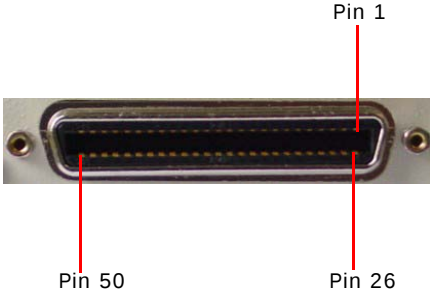
Table A-11: Balanced Tributaries 12-22 — 50-Pin Female D-Type^a

Applies to:

- MUX 902558, 21 E1 + WS
- SDM 902535

Pin	Name	Dir.	Description
1	GND	-	Ground
2	RxRING22	Out	Tributary 22 Rx Output Ring
3	TxRING22	In	Tributary 22 Tx Input Ring
4	RxRING21	Out	Tributary 21 Rx Output Ring
5	TxRING21	In	Tributary 21 Tx Input Ring
6	RxRING20	Out	Tributary 20 Rx Output Ring
7	TxRING20	In	Tributary 20 Tx Input Ring
8	RxRING19	Out	Tributary 19 Rx Output Ring
9	TxRING19	In	Tributary 19 Tx Input Ring
10	RxRING18	Out	Tributary 18 Rx Output Ring
11	TxRING18	In	Tributary 18 Tx Input Ring
12	GND	-	Ground
13	RxRING17	Out	Tributary 17 Rx Output Ring
14	TxRING17	In	Tributary 17 Tx Input Ring
15	RxRING16	Out	Tributary 16 Rx Output Ring
16	TxRING16	In	Tributary 16 Tx Input Ring
17	RxRING15	Out	Tributary 15 Rx Output Ring
18	TxRING15	In	Tributary 15 Tx Input Ring
19	RxRING14	Out	Tributary 14 Rx Output Ring
20	TxRING14	In	Tributary 14 Tx Input Ring
21	RxRING13	Out	Tributary 13 Rx Output Ring
22	TxRING13	In	Tributary 13 Tx Input Ring
23	RxRING12	Out	Tributary 12 Rx Output Ring
24	TxRING12	In	Tributary 12 Tx Input Ring
25	GND	-	Ground

Table A-11:Balanced Tributaries 12-22 — 50-Pin Female D-Type^a



Pin 1

Pin 26

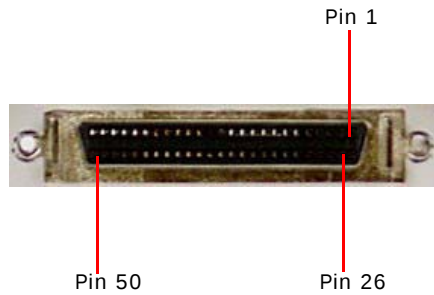
Pin 50

Applies to:

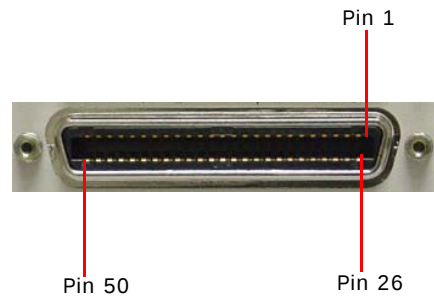
- MUX 902558, 21 E1 + WS
- SDM 902535

Pin	Name	Dir.	Description
26	GND	-	Ground
27	RxTIP22	Out	Tributary 22 Rx Output Tip
28	TxTIP22	In	Tributary 22 Tx Input Tip
29	RxTIP21	Out	Tributary 21 Rx Output Tip
30	TxTIP21	In	Tributary 21 Tx Input Tip
31	RxTIP20	Out	Tributary 20 Rx Output Tip
32	TxTIP20	In	Tributary 20 Tx Input Tip
33	RxTIP19	Out	Tributary 19 Rx Output Tip
34	TxTIP19	In	Tributary 19 Tx Input Tip
35	RxTIP18	Out	Tributary 18 Rx Output Tip
36	TxTIP18	In	Tributary 18 Tx Input Tip
37	GND	-	Ground
38	RxTIP17	Out	Tributary 17 Rx Output Tip
39	TxTIP17	In	Tributary 17 Tx Input Tip
40	RxTIP16	Out	Tributary 16 Rx Output Tip
41	TxTIP16	In	Tributary 16 Tx Input Tip
42	RxTIP15	Out	Tributary 15 Rx Output Tip
43	TxTIP15	In	Tributary 15 Tx Input Tip
44	RxTIP14	Out	Tributary 14 Rx Output Tip
45	TxTIP14	In	Tributary 14 Tx Input Tip
46	RxTIP13	Out	Tributary 13 Rx Output Tip
47	TxTIP13	In	Tributary 13 Tx Input Tip
48	RxTIP12	Out	Tributary 12 Rx Output Tip
49	TxTIP12	In	Tributary 12 Tx Input Tip
50	GND	-	Ground

a. Also referred to as SCSI-1

Table A-12: Balanced Tributaries 1-8 + Wayside — 50-Pin Female SCSI**SCSI-2** Used on:

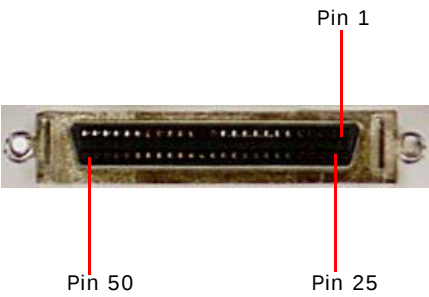
- MUX 902582,
ADM 8 DS1/DS3+WS

**D-Type** Used on:

- SDM 902593, paired with
MUX 902582

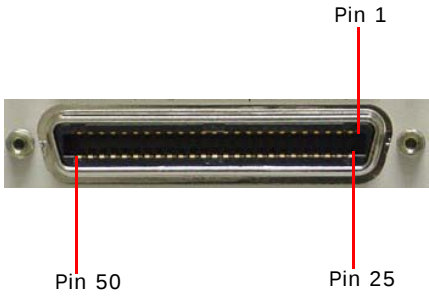
Pin	Name	Dir.	Description
1	WS_RxRING	Out	WS Tributary Rx Output Ring
2	WS_TxRING	In	WS Tributary Tx Input Ring
3	RxRING8	Out	Tributary 8 Rx Output Ring
4	TxRING8	In	Tributary 8 Tx Input Ring
5	GND	-	Ground
6	RxRING7	Out	Tributary 7 Rx Output Ring
7	TxRING7	In	Tributary 7 Tx Input Ring
8	GND	-	Ground
9	RxRING6	Out	Tributary 6 Rx Output Ring
10	TxRING6	In	Tributary 6 Tx Input Ring
11	GND	-	Ground
12	RxRING5	Out	Tributary 5 Rx Output Ring
13	TxRING5	In	Tributary 5 Tx Input Ring
14	GND	-	Ground
15	RxRING4	Out	Tributary 4 Rx Output Ring
16	TxRING4	In	Tributary 4 Tx Input Ring
17	GND	-	Ground
18	RxRING3	Out	Tributary 3 Rx Output Ring
19	TxRING3	In	Tributary 3 Tx Input Ring
20	GND	-	Ground
21	RxRING2	Out	Tributary 2 Rx Output Ring
22	TxRING2	In	Tributary 2 Tx Input Ring
23	GND	-	Ground
24	RxRING1	Out	Tributary 1 Rx Output Ring
25	TxRING1	In	Tributary 1 Tx Input Ring

Table A-12:Balanced Tributaries 1-8+ Wayside — 50-Pin Female SCSI



SCSI-2 Used on:

- MUX 902582,
ADM 8 DS1/DS3+WS



D-Type Use on:

- SDM 902593, paired with
MUX 902582

Pin	Name	Dir.	Description
26	WS_RxTIP	Out	WS Tributary Rx Output Tip
27	WS_TxTIP	In	WS Tributary Tx Input Tip
28	RxTIP8	Out	Tributary 8 Rx Output Tip
29	TxTIP8	In	Tributary 8 Tx Input Tip
30	GND	-	Ground
31	RxTIP7	Out	Tributary 7 Rx Output Tip
32	TxTIP7	In	Tributary 7 Tx Input Tip
33	GND	-	Ground
34	RxTIP6	Out	Tributary 6 Rx Output Tip
35	TxTIP6	In	Tributary 6 Tx Input Tip
36	GND	-	Ground
37	RxTIP5	Out	Tributary 5 Rx Output Tip
38	TxTIP5	In	Tributary 5 Tx Input Tip
39	GND	-	Ground
40	RxTIP4	Out	Tributary 4 Rx Output Tip
41	TxTIP4	In	Tributary 4 Tx Input Tip
42	GND	-	Ground
43	RxTIP3	Out	Tributary 3 Rx Output Tip
44	TxTIP3	In	Tributary 3 Tx Input Tip
45	GND	-	Ground
46	RxTIP2	Out	Tributary 2 Rx Output Tip
47	TxTIP2	In	Tributary 2 Tx Input Tip
48	GND	-	Ground
49	RxTIP1	Out	Tributary 1 Rx Output Tip
50	TxTIP1	In	Tributary 1 Tx Input Tip

Table A-13: Balanced Tributaries 1-8 — 50-Pin Female SCSI

Pin 1

Pin 50

SCSI-2 Used on:

- MUX 902582, Options 502/503/511 Mixed Mode NxDS1/E1 + 2x10/100BASE-T

Pin 1

Pin 50

D-Type Used on:

- SDM 902593, Options 502/503 paired with MUX 902582, Options 502/503

Pin	Name	Dir.	Description
1	P1_NC1	-	No Connection
2	GND	-	Ground
3	RxRING8	Out	Tributary 8 Rx Output Ring
4	TxRING8	In	Tributary 8 Tx Input Ring
5	GND	-	Ground
6	RxRING7	Out	Tributary 7 Rx Output Ring
7	TxRING7	In	Tributary 7 Tx Input Ring
8	GND	-	Ground
9	RxRING6	Out	Tributary 6 Rx Output Ring
10	TxRING6	In	Tributary 6 Tx Input Ring
11	GND	-	Ground
12	RxRING5	Out	Tributary 5 Rx Output Ring
13	TxRING5	In	Tributary 5 Tx Input Ring
14	GND	-	Ground
15	RxRING4	Out	Tributary 4 Rx Output Ring
16	TxRING4	In	Tributary 4 Tx Input Ring
17	GND	-	Ground
18	RxRING3	Out	Tributary 3 Rx Output Ring
19	TxRING3	In	Tributary 3 Tx Input Ring
20	GND	-	Ground
21	RxRING2	Out	Tributary 2 Rx Output Ring
22	TxRING2	In	Tributary 2 Tx Input Ring
23	GND	-	Ground
24	RxRING1	Out	Tributary 1 Rx Output Ring
25	TxRING1	In	Tributary 1 Tx Input Ring

SCSI-2 Used on:

- MUX 902582, Options 502/503/511 Mixed Mode NxDS1/E1 + 2x10/100BASE-T

D-Type Used on:

- SDM 902593, Options 502/503 paired with MUX 902582, Options 502/503

Table A-13: Balanced Tributaries 1-8 — 50-Pin Female SCSI



Pin 1

Pin 25

Pin 50

SCSI-2 Used on:

- MUX 902582, Options 502/503/511 Mixed Mode NxDS1/E1 + 2x10/100BASE-T



Pin 1

Pin 25

Pin 50

D-Type Used on:

- SDM 902593, Options 502/503 paired with MUX 902582, Options 502/503

Pin	Name	Dir.	Description
26	P1_NC2	-	No Connection
27	GND	-	Ground
28	RxTIP8	Out	Tributary 8 Rx Output Tip
29	TxTIP8	In	Tributary 8 Tx Input Tip
30	GND	-	Ground
31	RxTIP7	Out	Tributary 7 Rx Output Tip
32	TxTIP7	In	Tributary 7 Tx Input Tip
33	GND	-	Ground
34	RxTIP6	Out	Tributary 6 Rx Output Tip
35	TxTIP6	In	Tributary 6 Tx Input Tip
36	GND	-	Ground
37	RxTIP5	Out	Tributary 5 Rx Output Tip
38	TxTIP5	In	Tributary 5 Tx Input Tip
39	GND	-	Ground
40	RxTIP4	Out	Tributary 4 Rx Output Tip
41	TxTIP4	In	Tributary 4 Tx Input Tip
42	GND	-	Ground
43	RxTIP3	Out	Tributary 3 Rx Output Tip
44	TxTIP3	In	Tributary 3 Tx Input Tip
45	GND	-	Ground
46	RxTIP2	Out	Tributary 2 Rx Output Tip
47	TxTIP2	In	Tributary 2 Tx Input Tip
48	GND	-	Ground
49	RxTIP1	Out	Tributary 1 Rx Output Tip
50	TxTIP1	In	Tributary 1 Tx Input Tip

SCSI-2 Used on:

- MUX 902582, Options 502/503/511 Mixed Mode NxDS1/E1 + 2x10/100BASE-T

D-Type Used on:

- SDM 902593, Options 502/503 paired with MUX 902582, Options 502/503

Table A-14: Balanced Tributaries 9-16 — 50-Pin Female SCSI



Pin 1

Pin 50

Pin 26

SCSI-2 Used on:

- MUX 902582, Options 502/503/511 Mixed Mode NxDS1/E1 + 2x10/100BASE-T



Pin 1

Pin 50

Pin 26

D-Type Used on:

- SDM 902593, Options 502/503 paired with MUX 902582, Options 502/503

Pin	Name	Dir.	Description
1	P1_NC1	-	No Connection
2	GND	-	Ground
3	RxRING16	Out	Tributary 16 Rx Output Ring
4	TxRING16	In	Tributary 16 Tx Input Ring
5	GND	-	Ground
6	RxRING15	Out	Tributary 15 Rx Output Ring
7	TxRING15	In	Tributary 15 Tx Input Ring
8	GND	-	Ground
9	RxRING14	Out	Tributary 14 Rx Output Ring
10	TxRING14	In	Tributary 14 Tx Input Ring
11	GND	-	Ground
12	RxRING13	Out	Tributary 13 Rx Output Ring
13	TxRING13	In	Tributary 13 Tx Input Ring
14	GND	-	Ground
15	RxRING12	Out	Tributary 12 Rx Output Ring
16	TxRING12	In	Tributary 12 Tx Input Ring
17	GND	-	Ground
18	RxRING11	Out	Tributary 11 Rx Output Ring
19	TxRING11	In	Tributary 11 Tx Input Ring
20	GND	-	Ground
21	RxRING10	Out	Tributary 10 Rx Output Ring
22	TxRING10	In	Tributary 10 Tx Input Ring
23	GND	-	Ground
24	RxRING9	Out	Tributary 9 Rx Output Ring
25	TxRING1	In	Tributary 9 Tx Input Ring

Table A-14: Balanced Tributaries 9-16 — 50-Pin Female SCSI

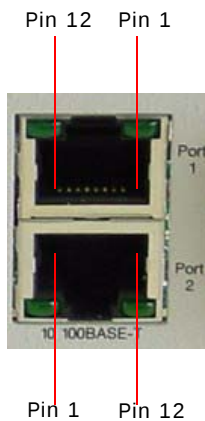
		Pin	Name	Dir.	Description
		26	P1_NC2	-	No Connection
		27	GND	-	Ground
		28	RxTIP16	Out	Tributary 16 Rx Output Tip
		29	TxTIP16	In	Tributary 16 Tx Input Tip
		30	GND	-	Ground
		31	RxTIP15	Out	Tributary 15 Rx Output Tip
		32	TxTIP15	In	Tributary 15 Tx Input Tip
		33	GND	-	Ground
		34	RxTIP14	Out	Tributary 14 Rx Output Tip
		35	TxTIP14	In	Tributary 14 Tx Input Tip
		36	GND	-	Ground
		37	RxTIP13	Out	Tributary 13 Rx Output Tip
		38	TxTIP13	In	Tributary 13 Tx Input Tip
		39	GND	-	Ground
		40	RxTIP12	Out	Tributary 12 Rx Output Tip
		41	TxTIP12	In	Tributary 12 Tx Input Tip
		42	GND	-	Ground
		43	RxTIP11	Out	Tributary 11 Rx Output Tip
		44	TxTIP11	In	Tributary 11 Tx Input Tip
		45	GND	-	Ground
		46	RxTIP10	Out	Tributary 10 Rx Output Tip
		47	TxTIP10	In	Tributary 10 Tx Input Tip
		48	GND	-	Ground
		49	RxTIP9	Out	Tributary 9 Rx Output Tip
		50	TxTIP9	In	Tributary 9 Tx Input Tip

SCSI-2 Used on:

- MUX 902582, Options 502/503/511 Mixed Mode NxDS1/E1 + 2x10/100BASE-T

D-Type Used on:

- SDM 902593, Options 502/503 paired with MUX 902582, Options 502/503

Table A-15: Ports 1 and 2, 10/100BASE-T, RJ-45 *

Pin	Name	Dir.	Description
1	ETHER_RX1_P	In	10/100BASE-T Rx Pos. Input
2	ETHER_RX1_N	In	10/100BASE-T Rx Neg. Input
3	ETHER_TX1_P	Out	10/100BASE-T Tx Pos. Output
4			Tied to chassis via a 75 ohm and cap
5			
6	ETHER_TX1_N	Out	10/100BASE-T Tx Neg. Output
7	SHIELD		Tied to chassis via a 75 ohm and cap
8	GND		
9			Green LED - Rx
10			
11			Green LED - Active
12			
1	ETHER_RX2_P	In	10/100BASE-T Rx Pos. Input
2	ETHER_RX2_N	In	10/100BASE-T Rx Neg. Input
3	ETHER_TX2_P	Out	10/100BASE-T Tx Pos. Output
4			Tied to chassis via a 75 ohm and cap
5			
6	ETHER_TX2_N	Out	10/100BASE-T Tx Neg. Output
7	SHIELD		Tied to chassis via a 75 ohm and cap
8	GND		
9			Green LED - Rx
10			
11			Green LED - Active
12			

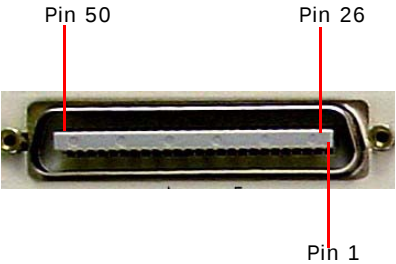
* The 88E6063 include the Auto MDI/MDIX Crossover for each port



We recommend that all external devices support Auto-negotiation, when connected to a TRuepoint® Ethernet port. If not supporting Auto-negotiation, such devices should be configured as 10 Mbps, half-duplex.

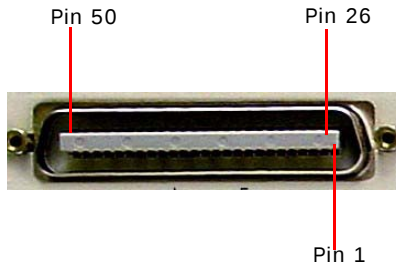
Tributary Interface Units - ANSI

Table A-16:Balanced Tributaries 1-16: 50-Pin Male D-Type^a



Applies to:
• TIU 903050, ANSI
(28 DS1/DS3+WS)

Pin	Name	Dir.	Description
1	TxRING1	In	Tributary 1 Tx Input Ring
2	TxRING2	In	Tributary 2 Tx Input Ring
3	TxRING3	In	Tributary 3 Tx Input Ring
4	TxRING4	In	Tributary 4 Tx Input Ring
5	TxRING5	In	Tributary 5 Tx Input Ring
6	TxRING6	In	Tributary 6 Tx Input Ring
7	TxRING7	In	Tributary 7 Tx Input Ring
8	TxRING8	In	Tributary 8 Tx Input Ring
9	TxRING9	In	Tributary 9 Tx Input Ring
10	TxRING10	In	Tributary 10 Tx Input Ring
11	TxRING11	In	Tributary 11 Tx Input Ring
12	TxRING12	In	Tributary 12 Tx Input Ring
13	TxRING13	In	Tributary 13 Tx Input Ring
14	TxRING14	In	Tributary 14 Tx Input Ring
15	TxRING15	In	Tributary 15 Tx Input Ring
16	TxRING16	In	Tributary 16 Tx Input Ring
17	GND	Gnd	Ground
18	GND	Gnd	Ground
19	GND	Gnd	Ground
20	GND	Gnd	Ground
21	GND	Gnd	Ground
22	GND	Gnd	Ground
23	GND	Gnd	Ground
24	GND	Gnd	Ground
25	GND	Gnd	Ground

Table A-16: Balanced Tributaries 1-16: 50-Pin Male D-Type^a

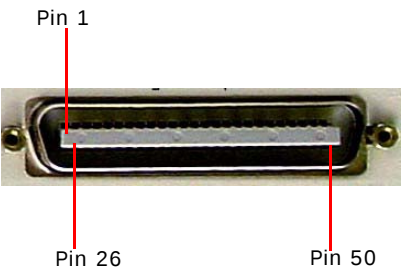
Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
26	TxTIP1	In	Tributary 1 Tx Input Tip
27	TxTIP2	In	Tributary 2 Tx Input Tip
28	TxTIP3	In	Tributary 3 Tx Input Tip
29	TxTIP4	In	Tributary 4 Tx Input Tip
30	TxTIP5	In	Tributary 5 Tx Input Tip
31	TxTIP6	In	Tributary 6 Tx Input Tip
32	TxTIP7	In	Tributary 7 Tx Input Tip
33	TxTIP8	In	Tributary 8 Tx Input Tip
34	TxTIP9	In	Tributary 9 Tx Input Tip
35	TxTIP10	In	Tributary 10 Tx Input Tip
36	TxTIP11	In	Tributary 11 Tx Input Tip
37	TxTIP12	In	Tributary 12 Tx Input Tip
38	TxTIP13	In	Tributary 13 Tx Input Tip
39	TxTIP14	In	Tributary 14 Tx Input Tip
40	TxTIP15	In	Tributary 15 Tx Input Tip
41	TxTIP16	In	Tributary 16 Tx Input Tip
42	GND	Gnd	Ground
43	GND	Gnd	Ground
44	GND	Gnd	Ground
45	GND	Gnd	Ground
46	GND	Gnd	Ground
47	GND	Gnd	Ground
48	GND	Gnd	Ground
49	GND	Gnd	Ground
50	GND	Gnd	Ground

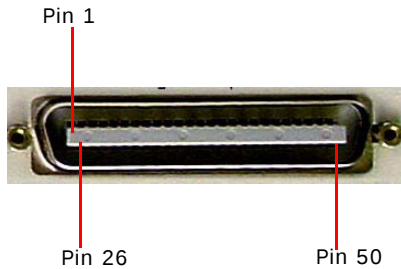
a. Also referred to as SCSI-1

Table A-17:Balanced Tributaries 17-28: 50-Pin Male D-Type^a



Applies to:
• TIU 903050, ANSI
(28 DS1/DS3+WS)

Pin	Name	Dir.	Description
1	TxRING17	In	Tributary 17 Tx Input Ring
2	TxRING18	In	Tributary 18 Tx Input Ring
3	TxRING19	In	Tributary 19 Tx Input Ring
4	TxRING20	In	Tributary 20 Tx Input Ring
5	TxRING21	In	Tributary 21 Tx Input Ring
6	TxRING22	In	Tributary 22 Tx Input Ring
7	TxRING23	In	Tributary 23 Tx Input Ring
8	TxRING24	In	Tributary 24 Tx Input Ring
9	TxRING25	In	Tributary 25 Tx Input Ring
10	TxRING26	In	Tributary 26 Tx Input Ring
11	TxRING27	In	Tributary 27 Tx Input Ring
12	TxRING28	In	Tributary 28 Tx Input Ring
13	GND	Gnd	Ground
14	GND	Gnd	Ground
15	GND	Gnd	Ground
16	GND	Gnd	Ground
17	GND	Gnd	Ground
18	GND	Gnd	Ground
19	GND	Gnd	Ground
20	GND	Gnd	Ground
21	GND	Gnd	Ground
22	GND	Gnd	Ground
23	GND	Gnd	Ground
24	GND	Gnd	Ground
25	GND	Gnd	Ground

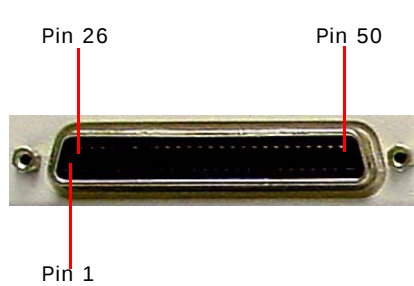
Table A-17: Balanced Tributaries 17-28: 50-Pin Male D-Type^a

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
26	TxTIP17	In	Tributary 17 Tx Input Tip
27	TxTIP18	In	Tributary 18 Tx Input Tip
28	TxTIP19	In	Tributary 19 Tx Input Tip
29	TxTIP20	In	Tributary 20 Tx Input Tip
30	TxTIP21	In	Tributary 21 Tx Input Tip
31	TxTIP22	In	Tributary 22 Tx Input Tip
32	TxTIP23	In	Tributary 23 Tx Input Tip
33	TxTIP24	In	Tributary 24 Tx Input Tip
34	TxTIP25	In	Tributary 25 Tx Input Tip
35	TxTIP26	In	Tributary 26 Tx Input Tip
36	TxTIP27	In	Tributary 27 Tx Input Tip
37	TxTIP28	In	Tributary 28 Tx Input Tip
38	GND	GND	Ground
39	GND	Gnd	Ground
40	GND	Gnd	Ground
41	GND	Gnd	Ground
42	GND	Gnd	Ground
43	GND	Gnd	Ground
44	GND	Gnd	Ground
45	GND	Gnd	Ground
46	GND	Gnd	Ground
47	GND	Gnd	Ground
48	GND	Gnd	Ground
49	GND	Gnd	Ground
50	GND	Gnd	Ground

a. Also referred to as SCSI-1

Table A-18: Balanced Tributaries 1-16: 50-Pin Female D-Type^a


Pin 26

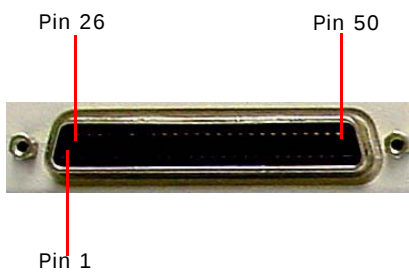
Pin 50

Pin 1

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
1	RxRING1	Out	Tributary 1 Rx Output Ring
2	RxRING2	Out	Tributary 2 Rx Output Ring
3	RxRING3	Out	Tributary 3 Rx Output Ring
4	RxRING4	Out	Tributary 4 Rx Output Ring
5	RxRING5	Out	Tributary 5 Rx Output Ring
6	RxRING6	Out	Tributary 6 Rx Output Ring
7	RxRING7	Out	Tributary 7 Rx Output Ring
8	RxRING8	Out	Tributary 8 Rx Output Ring
9	RxRING9	Out	Tributary 9 Rx Output Ring
10	RxRING10	Out	Tributary 10 Rx Output Ring
11	RxRING11	Out	Tributary 11 Rx Output Ring
12	RxRING12	Out	Tributary 12 Rx Output Ring
13	RxRING13	Out	Tributary 13 Rx Output Ring
14	RxRING14	Out	Tributary 14 Rx Output Ring
15	RxRING15	Out	Tributary 15 Rx Output Ring
16	RxRING16	Out	Tributary 16 Rx Output Ring
17	GND	Gnd	Ground
18	GND	Gnd	Ground
19	GND	Gnd	Ground
20	GND	Gnd	Ground
21	GND	Gnd	Ground
22	GND	Gnd	Ground
23	GND	Gnd	Ground
24	GND	Gnd	Ground
25	GND	Gnd	Ground

Table A-18: Balanced Tributaries 1-16: 50-Pin Female D-Type^a


Pin	Name	Dir.	Description
26	RxTIP1	Out	Tributary 1 Rx Output Tip
27	RxTIP2	Out	Tributary 2 Rx Output Tip
28	RxTIP3	Out	Tributary 3 Rx Output Tip
29	RxTIP4	Out	Tributary 4 Rx Output Tip
30	RxTIP5	Out	Tributary 5 Rx Output Tip
31	RxTIP6	Out	Tributary 6 Rx Output Tip
32	RxTIP7	Out	Tributary 7 Rx Output Tip
33	RxTIP8	Out	Tributary 8 Rx Output Tip
34	RxTIP9	Out	Tributary 9 Rx Output Tip
35	RxTIP10	Out	Tributary 10 Rx Output Tip
36	RxTIP11	Out	Tributary 11 Rx Output Tip
37	RxTIP12	Out	Tributary 12 Rx Output Tip
38	RxTIP13	Out	Tributary 13 Rx Output Tip
39	RxTIP14	Out	Tributary 14 Rx Output Tip
40	RxTIP15	Out	Tributary 15 Rx Output Tip
41	RxTIP16	Out	Tributary 16 Rx Output Tip
42	GND	Gnd	Ground
43	GND	Gnd	Ground
44	GND	Gnd	Ground
45	GND	Gnd	Ground
46	GND	Gnd	Ground
47	GND	Gnd	Ground
48	GND	Gnd	Ground
49	GND	Gnd	Ground
50	GND	Gnd	Ground

Pin 26

Pin 50

Pin 1

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

a. Also referred to as SCSI-1

Table A-19:Balanced Tributaries 17-28: 50-Pin Female D-Type^a



Pin 1

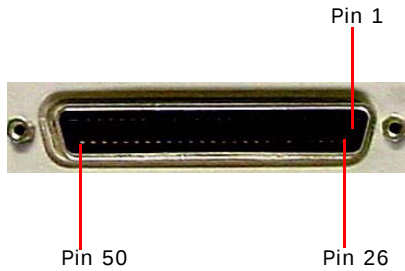
Pin 26

Pin 50

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
1	RxRING17	Out	Tributary 17 Rx Output Ring
2	RxRING18	Out	Tributary 18 Rx Output Ring
3	RxRING19	Out	Tributary 19 Rx Output Ring
4	RxRING20	Out	Tributary 20 Rx Output Ring
5	RxRING21	Out	Tributary 21 Rx Output Ring
6	RxRING22	Out	Tributary 22 Rx Output Ring
7	RxRING23	Out	Tributary 23 Rx Output Ring
8	RxRING24	Out	Tributary 24 Rx Output Ring
9	RxRING25	Out	Tributary 25 Rx Output Ring
10	RxRING26	Out	Tributary 26 Rx Output Ring
11	RxRING27	Out	Tributary 27 Rx Output Ring
12	RxRING28	Out	Tributary 28 Rx Output Ring
13	GND	Gnd	Ground
14	GND	Gnd	Ground
15	GND	Gnd	Ground
16	GND	Gnd	Ground
17	GND	Gnd	Ground
18	GND	Gnd	Ground
19	GND	Gnd	Ground
20	GND	Gnd	Ground
21	GND	Gnd	Ground
22	GND	Gnd	Ground
23	GND	Gnd	Ground
24	GND	Gnd	Ground
25	GND	Gnd	Ground

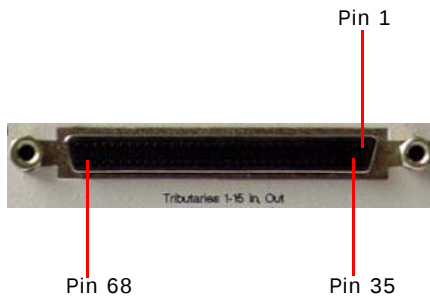
Table A-19: Balanced Tributaries 17-28: 50-Pin Female D-Type^a

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
26	RxTIP17	Out	Tributary 17 Rx Output Tip
27	RxTIP18	Out	Tributary 18 Rx Output Tip
28	RxTIP19	Out	Tributary 19 Rx Output Tip
29	RxTIP20	Out	Tributary 20 Rx Output Tip
30	RxTIP21	Out	Tributary 21 Rx Output Tip
31	RxTIP22	Out	Tributary 22 Rx Output Tip
32	RxTIP23	Out	Tributary 23 Rx Output Tip
33	RxTIP24	Out	Tributary 24 Rx Output Tip
34	RxTIP25	Out	Tributary 25 Rx Output Tip
35	RxTIP26	Out	Tributary 26 Rx Output Tip
36	RxTIP27	Out	Tributary 27 Rx Output Tip
37	RxTIP28	Out	Tributary 28 Rx Output Tip
38	GND	Gnd	Ground
39	GND	Gnd	Ground
40	GND	Gnd	Ground
41	GND	Gnd	Ground
42	GND	Gnd	Ground
43	GND	Gnd	Ground
44	GND	Gnd	Ground
45	GND	Gnd	Ground
46	GND	Gnd	Ground
47	GND	Gnd	Ground
48	GND	Gnd	Ground
49	GND	Gnd	Ground
50	GND	Gnd	Ground

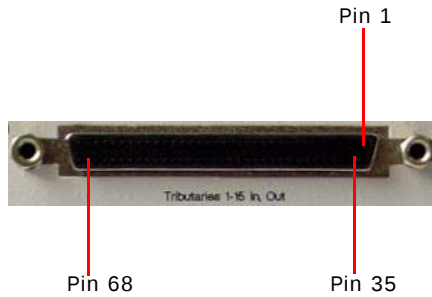
a. Also referred to as SCSI-1

Table A-20: Balanced Tributaries 1-15: 68-Pin Female SCSI-3

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

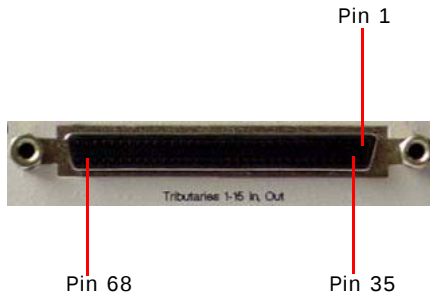
Pin	Name	Dir.	Description
1	RxTIP15	In	Tributary 15 Rx Input Tip
2	TxTIP15	Out	Tributary 15 Tx Output Tip
3	RxTIP14	In	Tributary 14 Rx Input Tip
4	TxTIP14	Out	Tributary 14 Tx Output Tip
5	RxTIP13	In	Tributary 13 Rx Input Tip
6	TxTIP13	Out	Tributary 13 Tx Output Tip
7	GND	GND	Ground
8	RxTIP12	In	Tributary 12 Rx Input Tip
9	TxTIP12	Out	Tributary 12 Tx Output Tip
10	RxTIP11	In	Tributary 11 Rx Input Tip
11	TxTIP11	Out	Tributary 11 Tx Output Tip
12	RxTIP10	In	Tributary 10 Rx Input Tip
13	TxTIP10	Out	Tributary 10 Tx Output Tip
14	GND	GND	Ground
15	RxTIP9	In	Tributary 9 Rx Input Tip
16	TxTIP9	Out	Tributary 9 Tx Output Tip
17	RxTIP8	In	Tributary 8 Rx Input Tip
18	TxTIP8	Out	Tributary 8 Tx Output Tip
19	RxTIP7	In	Tributary 7 Rx Input Tip
20	TxTIP7	Out	Tributary 7 Tx Output Tip
21	GND	GND	Ground
22	RxTIP6	In	Tributary 6 Rx Input Tip
23	TxTIP6	Out	Tributary 6 Tx Output Tip
24	RxTIP5	In	Tributary 5 Rx Input Tip
25	TxTIP5	Out	Tributary 5 Tx Output Tip
26	RxTIP4	In	Tributary 4 Rx Input Tip
27	TxTIP4	Out	Tributary 4 Tx Output Tip
28	GND	GND	Ground
29	RxTIP3	In	Tributary 3 Rx Input Tip
30	TxTIP3	Out	Tributary 3 Tx Output Tip
31	RxTIP2	In	Tributary 2 Rx Input Tip
32	TxTIP2	Out	Tributary 2 Tx Output Tip
33	RxTIP1	In	Tributary 1 Rx Input Tip
34	TxTIP1	Out	Tributary 1 Tx Output Tip

Table A-20: Balanced Tributaries 1-15: 68-Pin Female SCSI-3 (continued)

Applies to:

- TIU 903050, ANSI
(28 DS1/DS3+WS)

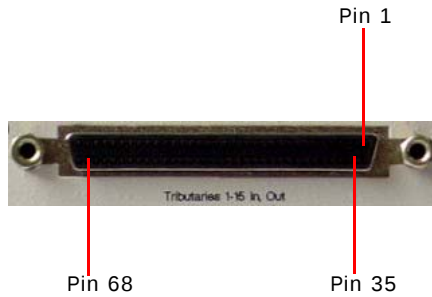
Pin	Name	Dir.	Description
35	RxRING15	In	Tributary 15 Rx Input Ring
36	TxRING15	Out	Tributary 15 Tx Output Ring
37	RxRING14	In	Tributary 14 Rx Input Ring
38	TxRING14	Out	Tributary 14 Tx Output Ring
39	RxRING13	In	Tributary 13 Rx Input Ring
40	TxRING13	Out	Tributary 13 Tx Output Ring
41	GND	GND	Ground
42	RxRING12	In	Tributary 12 Rx Input Ring
43	TxRING12	Out	Tributary 12 Tx Output Ring
44	RxRING11	In	Tributary 11 Rx Input Ring
45	TxRING11	Out	Tributary 11 Tx Output Ring
46	RxRING10	In	Tributary 10 Rx Input Ring
47	TxRING10	Out	Tributary 10 Tx Output Ring
48	GND	GND	Ground
49	RxRING9	In	Tributary 9 Rx Input Ring
50	TxRING9	Out	Tributary 9 Tx Output Ring
51	RxRING8	In	Tributary 8 Rx Input Ring
52	TxRING8	Out	Tributary 8 Tx Output Ring
53	RxRING7	In	Tributary 7 Rx Input Ring
54	TxRING7	Out	Tributary 7 Tx Output Ring
55	GND	GND	Ground
56	RxRING6	In	Tributary 6 Rx Input Ring
57	TxRING6	Out	Tributary 6 Tx Output Ring
58	RxRING5	In	Tributary 5 Rx Input Ring
59	TxRING5	Out	Tributary 5 Tx Output Ring
60	RxRING4	In	Tributary 4 Rx Input Ring
61	TxRING4	Out	Tributary 4 Tx Output Ring
62	GND	GND	Ground
63	RxRING3	In	Tributary 3 Rx Input Ring
64	TxRING3	Out	Tributary 3 Tx Output Ring
65	RxRING2	In	Tributary 2 Rx Input Ring
66	TxRING2	Out	Tributary 2 Tx Output Ring
67	RxRING1	In	Tributary 1 Rx Input Ring
68	TxRING1	Out	Tributary 1 Tx Output Ring

Table A-21: Balanced Tributaries 16-29: 68-Pin Female SCSI-3

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
1	GND	GND	Ground
2	GND	GND	Ground
3	RxTIP29	In	Tributary 29 Rx Input Tip
4	TxTIP29	Out	Tributary 29 Tx Output Tip
5	RxTIP28	In	Tributary 28 Rx Input Tip
6	TxTIP28	Out	Tributary 28 Tx Output Tip
7	GND	GND	Ground
8	RxTIP27	In	Tributary 27 Rx Input Tip
9	TxTIP27	Out	Tributary 27 Tx Output Tip
10	RxTIP26	In	Tributary 26 Rx Input Tip
11	TxTIP26	Out	Tributary 26 Tx Output Tip
12	RxTIP25	In	Tributary 25 Rx Input Tip
13	TxTIP25	Out	Tributary 25 Tx Output Tip
14	GND	GND	Ground
15	RxTIP24	In	Tributary 24 Rx Input Tip
16	TxTIP24	Out	Tributary 24 Tx Output Tip
17	RxTIP23	In	Tributary 23 Rx Input Tip
18	TxTIP23	Out	Tributary 23 Tx Output Tip
19	RxTIP22	In	Tributary 22 Rx Input Tip
20	TxTIP22	Out	Tributary 22 Tx Output Tip
21	GND	GND	Ground
22	RxTIP21	In	Tributary 21 Rx Input Tip
23	TxTIP21	Out	Tributary 21 Tx Output Tip
24	RxTIP20	In	Tributary 20 Rx Input Tip
25	TxTIP20	Out	Tributary 20 Tx Output Tip
26	RxTIP19	In	Tributary 19 Rx Input Tip
27	TxTIP19	Out	Tributary 19 Tx Output Tip
28	GND	GND	Ground
29	RxTIP18	In	Tributary 18 Rx Input Tip
30	TxTIP18	Out	Tributary 18 Tx Output Tip
31	RxTIP17	In	Tributary 17 Rx Input Tip
32	TxTIP17	Out	Tributary 17 Tx Output Tip
33	RxTIP16	In	Tributary 16 Rx Input Tip
34	TxTIP16	Out	Tributary 16 Tx Output Tip

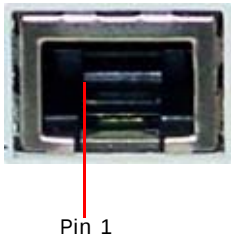
Table A-21: Balanced Tributaries 16-29: 68-Pin Female SCSI-3

Applies to:

- TIU 903050, ANSI (28 DS1/DS3+WS)

Pin	Name	Dir.	Description
35	GND	GND	Ground
36	GND	GND	Ground
37	RxRING29	In	Tributary 29 Rx Input Ring
38	TxRING29	Out	Tributary 29 Tx Output Ring
39	RxRING28	In	Tributary 28 Rx Input Ring
40	TxRING28	Out	Tributary 28 Tx Output Ring
41	GND	GND	Ground
42	RxRING27	In	Tributary 27 Rx Input Ring
43	TxRING27	Out	Tributary 27 Tx Output Ring
44	RxRING26	In	Tributary 26 Rx Input Ring
45	TxRING26	Out	Tributary 26 Tx Output Ring
46	RxRING25	In	Tributary 25 Rx Input Ring
47	TxRING25	Out	Tributary 25 Tx Output Ring
48	GND	GND	Ground
49	RxRING24	In	Tributary 24 Rx Input Ring
50	TxRING24	Out	Tributary 24 Tx Output Ring
51	RxRING23	In	Tributary 23 Rx Input Ring
52	TxRING23	Out	Tributary 23 Tx Output Ring
53	RxRING22	In	Tributary 22 Rx Input Ring
54	TxRING22	Out	Tributary 22 Tx Output Ring
55	GND	GND	Ground
56	RxRING21	In	Tributary 21 Rx Input Ring
57	TxRING21	Out	Tributary 21 Tx Output Ring
58	RxRING20	In	Tributary 20 Rx Input Ring
59	TxRING20	Out	Tributary 20 Tx Output Ring
60	RxRING19	In	Tributary 19 Rx Input Ring
61	TxRING19	Out	Tributary 19 Tx Output Ring
62	GND	GND	Ground
63	RxRING18	In	Tributary 18 Rx Input Ring
64	TxRING18	Out	Tributary 18 Tx Output Ring
65	RxRING17	In	Tributary 17 Rx Input Ring
66	TxRING17	Out	Tributary 17 Tx Output Ring
67	RxRING16	In	Tributary 16 Rx Input Ring
68	TxRING16	Out	Tributary 16 Tx Output Ring

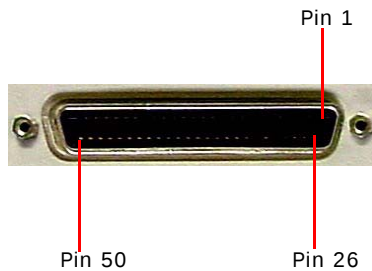
Table A-22:DS1 Wayside Balanced Interface, (RJ-48) — On TIU 903050



Pin	Name	Dir.	Description
1	RxRING29	In	Tributary 29 Rx Input Ring
2	RxTIP29	In	Tributary 29 Rx Input Tip
3	GND	—	Ground
4	TxRING29	Out	Tributary 29 Tx Output Ring
5	TxTIP29	Out	Tributary 29 Tx Output Tip
6	GND	—	Ground
7	GND	—	Ground
8	GND	—	Ground

Tributary Interface Units - CEPT

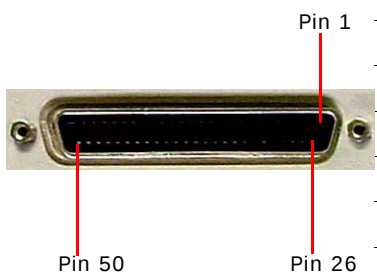
Table A-23: Unbalanced Tributaries 1-11: 50-Pin Female D-Type^a



Applies to:

- TIU 903070, CEPT (21 E1+WS)

Pin	Name	Dir.	Description
1	GND	GND	Ground
2	RxRING11	GND	Tributary 11 Rx Input Ring, Grounded
3	TxRING11	GND	Tributary 11 Tx Output Ring, Grounded
4	RxRING10	GND	Tributary 10 Rx Input Ring, Grounded
5	TxRING10	GND	Tributary 10 Tx Output Ring, Grounded
6	RxRING9	GND	Tributary 9 Rx Input Ring, Grounded
7	TxRING9	GND	Tributary 9 Tx Output Ring, Grounded
8	RxRING8	GND	Tributary 8 Rx Input Ring, Grounded
9	TxRING8	GND	Tributary 8 Tx Output Ring, Grounded
10	RxRING7	GND	Tributary 7 Rx Input Ring, Grounded
11	TxRING7	GND	Tributary 7 Tx Output Ring, Grounded
12	GND	GND	Ground
13	RxRING6	GND	Tributary 6 Rx Input Ring, Grounded
14	TxRING6	GND	Tributary 6 Tx Output Ring, Grounded
15	RxRING5	GND	Tributary 5 Rx Input Ring, Grounded
16	TxRING5	GND	Tributary 5 Tx Output Ring, Grounded
17	RxRING4	GND	Tributary 4 Rx Input Ring, Grounded
18	TxRING4	GND	Tributary 4 Tx Output Ring, Grounded
19	RxRING3	GND	Tributary 3 Rx Input Ring, Grounded
20	TxRING3	GND	Tributary 3 Tx Output Ring, Grounded
21	RxRING2	GND	Tributary 2 Rx Input Ring, Grounded
22	TxRING2	GND	Tributary 2 Tx Output Ring, Grounded
23	RxRING1	GND	Tributary 1 Rx Input Ring, Grounded
24	TxRING1	GND	Tributary 1 Tx Output Ring, Grounded
25	GND	GND	Ground

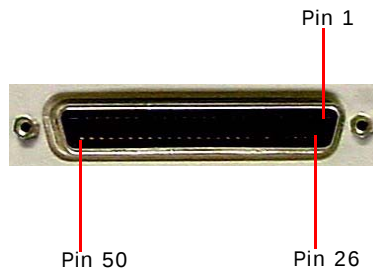
Table A-23: Unbalanced Tributaries 1-11: 50-Pin Female D-Type^a


Pin	Name	Dir.	Description
26	GND	GND	Ground
27	RxTIP11	In	Tributary 11 Rx Input Tip
28	TxTIP11	Out	Tributary 11 Output Tip
29	RxTIP10	In	Tributary 10 Rx Input Tip
30	TxTIP10	Out	Tributary 10 Output Tip
31	RxTIP9	In	Tributary 9 Rx Input Tip
32	TxTIP9	Out	Tributary 9 Output Tip
33	RxTIP8	In	Tributary 8 Rx Input Tip
34	TxTIP8	Out	Tributary 8 Output Tip
35	RxTIP7	In	Tributary 7 Rx Input Tip
36	TxTIP7	Out	Tributary 7 Output Tip
37	GND	GND	Ground
38	RxTIP6	In	Tributary 6 Rx Input Tip
39	TxTIP6	Out	Tributary 6 Output Tip
40	RxTIP5	In	Tributary 5 Rx Input Tip
41	TxTIP5	Out	Tributary 5 Output Tip
42	RxTIP4	In	Tributary 4 Rx Input Tip
43	TxTIP4	Out	Tributary 4 Output Tip
44	RxTIP3	In	Tributary 3 Rx Input Tip
45	TxTIP3	Out	Tributary 3 Output Tip
46	RxTIP2	In	Tributary 2 Rx Input Tip
47	TxTIP2	Out	Tributary 2 Output Tip
48	RxTIP1	In	Tributary 1 Rx Input Tip
49	TxTIP1	Out	Tributary 1 Output Tip
50	GND	GND	Ground

Applies to:

- TIU 903070, CEPT (21 E1+WS)

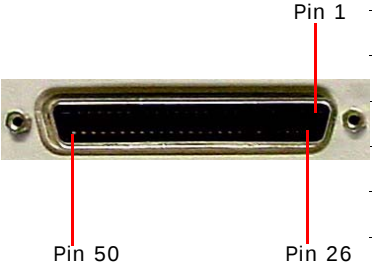
a. Also referred to as SCSI-1

Table A-24: Unbalanced Tributaries 12-22: 50-Pin Female D-Type^a

Applies to:

- TIU 903070, CEPT (21 E1+WS)

Pin	Name	Dir.	Description
1	GND	GND	Ground
2	RxRING22	GND	Tributary 22 Rx Input Ring, Grounded
3	TxRING22	GND	Tributary 22 Tx Output Ring, Grounded
4	RxRING21	GND	Tributary 21 Rx Input Ring, Grounded
5	TxRING21	GND	Tributary 21 Tx Output Ring, Grounded
6	RxRING20	GND	Tributary 20 Rx Input Ring, Grounded
7	TxRING20	GND	Tributary 20 Tx Output Ring, Grounded
8	RxRING19	GND	Tributary 19 Rx Input Ring, Grounded
9	TxRING19	GND	Tributary 19 Tx Output Ring, Grounded
10	RxRING18	GND	Tributary 18 Rx Input Ring, Grounded
11	TxRING18	GND	Tributary 18 Tx Output Ring, Grounded
12	GND	GND	Ground
13	RxRING17	GND	Tributary 17 Rx Input Ring, Grounded
14	TxRING17	GND	Tributary 17 Tx Output Ring, Grounded
15	RxRING16	GND	Tributary 16 Rx Input Ring, Grounded
16	TxRING16	GND	Tributary 16 Tx Output Ring, Grounded
17	RxRING15	GND	Tributary 15 Rx Input Ring, Grounded
18	TxRING15	GND	Tributary 15 Tx Output Ring, Grounded
19	RxRING14	GND	Tributary 14 Rx Input Ring, Grounded
20	TxRING14	GND	Tributary 14 Tx Output Ring, Grounded
21	RxRING13	GND	Tributary 13 Rx Input Ring, Grounded
22	TxRING13	GND	Tributary 13 Tx Output Ring, Grounded
23	RxRING12	GND	Tributary 12 Rx Input Ring, Grounded
24	TxRING12	GND	Tributary 12 Tx Output Ring, Grounded
25	GND	GND	Ground

Table A-24: Unbalanced Tributaries 12-22: 50-Pin Female D-Type^a


Pin	Name	Dir.	Description
26	GND	GND	Ground
27	RxTIP22	In	Tributary 22 Rx Input Tip
28	TxTIP22	Out	Tributary 22 Tx Output Tip
29	RxTIP21	In	Tributary 21 Rx Input Tip
30	TxTIP21	Out	Tributary 21 Tx Output Tip
31	RxTIP20	In	Tributary 20 Rx Input Tip
32	TxTIP20	Out	Tributary 20 Tx Output Tip
33	RxTIP19	In	Tributary 19 Rx Input Tip
34	TxTIP19	Out	Tributary 19 Tx Output Tip
35	RxTIP18	In	Tributary 18 Rx Input Tip
36	TxTIP18	Out	Tributary 18 Tx Output Tip
37	GND	GND	Ground
38	RxTIP17	In	Tributary 17 Rx Input Tip
39	TxTIP17	Out	Tributary 17 Tx Output Tip
40	RxTIP16	In	Tributary 16 Rx Input Tip
41	TxTIP16	Out	Tributary 16 Tx Output Tip
42	RxTIP15	In	Tributary 15 Rx Input Tip
43	TxTIP15	Out	Tributary 15 Tx Output Tip
44	RxTIP14	In	Tributary 14 Rx Input Tip
45	TxTIP14	Out	Tributary 14 Tx Output Tip
46	RxTIP13	In	Tributary 13 Rx Input Tip
47	TxTIP13	Out	Tributary 13 Tx Output Tip
48	RxTIP12	In	Tributary 12 Rx Input Tip
49	TxTIP12	Out	Tributary 12 Tx Output Tip
50	GND	GND	Ground

Applies to:

- TIU 903070, CEPT (21 E1+WS)

a. Also referred to as SCSI-1

Table A-25: Coaxial 1.0 / 2.3, 75 Ω Connectors


	Trib.	Name	Description
Trib x In	1 In	TxTIP1	Tributary 1 Tx Input Tip
	1 Out	RxTIP1	Tributary 1 Rx Output Tip
	2 In	TxTIP2	Tributary 2 Tx Input Tip
	2 Out	RxTIP2	Tributary 2 Rx Output Tip
	3 In	TxTIP3	Tributary 3 Tx Input Tip
	3 Out	RxTIP3	Tributary 3 Rx Output Tip
Trib x Out	4 In	TxTIP4	Tributary 4 Tx Input Tip
	4 Out	RxTIP4	Tributary 4 Rx Output Tip
	5 In	TxTIP5	Tributary 5 Tx Input Tip
	5 Out	RxTIP5	Tributary 5 Rx Output Tip
	6 In	TxTIP6	Tributary 6 Tx Input Tip
	6 Out	RxTIP6	Tributary 6 Rx Output Tip
	7 In	TxTIP7	Tributary 7 Tx Input Tip
	7 Out	RxTIP7	Tributary 7 Rx Output Tip
	8 In	TxTIP8	Tributary 8 Tx Input Tip
	8 Out	RxTIP8	Tributary 8 Rx Output Tip
	9 In	TxTIP9	Tributary 9 Tx Input Tip
	9 Out	RxTIP9	Tributary 9 Rx Output Tip
	10 In	TxTIP10	Tributary 10 Tx Input Tip
	10 Out	RxTIP10	Tributary 10 Rx Output Tip
	11 In	TxTIP11	Tributary 11 Tx Input Tip
	11 Out	RxTIP11	Tributary 11 Rx Output Tip
	12 In	TxTIP12	Tributary 12 Tx Input Tip
	12 Out	RxTIP12	Tributary 12 Rx Output Tip

Applies to:

- TIU 903070, CEPT (21 E1+WS)

Table A-25:Coaxial 1.0 / 2.3, 75 Ω Connectors

 Applies to: • TIU 903070, CEPT (21 E1+WS)	Trib.	Name	Description
	13 In	TxTIP13	Tributary 13 Tx Input Tip
	13 Out	RxTIP13	Tributary 13 Rx Output Tip
	14 In	TxTIP14	Tributary 14 Tx Input Tip
	14 Out	RxTIP14	Tributary 14 Rx Output Tip
	15 In	TxTIP15	Tributary 15 Tx Input Tip
	15 Out	RxTIP15	Tributary 15 Rx Output Tip
	16 In	TxTIP16	Tributary 16 Tx Input Tip
	16 Out	RxTIP16	Tributary 16 Rx Output Tip
	17 In	TxTIP17	Tributary 17 Tx Input Tip
	17 Out	RxTIP17	Tributary 17 Rx Output Tip
	18 In	TxTIP18	Tributary 18 Tx Input Tip
	18 Out	RxTIP18	Tributary 18 Rx Output Tip
	19 In	TxTIP19	Tributary 19 Tx Input Tip
	19 Out	RxTIP19	Tributary 19 Rx Output Tip
	20 In	TxTIP20	Tributary 20 Tx Input Tip
	20 Out	RxTIP20	Tributary 20 Rx Output Tip
	21 In	TxTIP21	Tributary 21 Tx Input Tip
	21 Out	RxTIP21	Tributary 21 Rx Output Tip
	22 In	TxTIP22	Tributary 22 (WS) Tx Input Tip
	22 Out	RxTIP22	Tributary 22 (WS) Rx Output Tip
		Ref_Clk_In	Reference Clock Input
		Ref_Clk_Out	Reference Clock Output

The Controller Ports

Table A-26: HDLC (RJ-45), MicroStar® / Constellation® Net_Comm Port



Pin	Name	Dir.	Description
1	NWTXCLKP	Controller to Equipment	Net West clock transmit, positive
2	NWTXCLKN	Controller to Equipment	Net West clock transmit, negative
3	NWTXP	Controller to Equipment	Net West transmit signal, positive
4	NWTXN	Controller to Equipment	Net West transmit signal, negative
5	NWRXCKP	Equipment to Controller	Net West clock receive, positive
6	NWRXCKN	Equipment to Controller	Net West clock receive, negative
7	NWRXP	Equipment to Controller	Net West receive signal, positive
8	NWRXN	Equipment to Controller	Net West receive signal, negative

Table A-27: Port 1 (RJ-45), Data and Local Communications



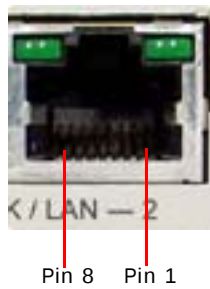
Pin	Name	Dir.	Description
1			NO CONNECTION
2			NO CONNECTION
3			NO CONNECTION
4	GND	GND to GND	Ground
5	RX_DAT	Controller to PC	RS232, data receive
6	TX_DAT	PC to Controller	RS232, data transmit
7			NO CONNECTION
8			NO CONNECTION

Table A-28:Port 2 (RJ-45), HHT and VT-100 Terminals



Pin	Name	Dir.	Description
1	DISPLAY_+5V	HHT/VT-100 to CTL	HHT Power Input
2			NO CONNECTION
3			NO CONNECTION
4	GND	GND-GND	Ground
5	RX_DAT	CTL to HHT/VT-100	RS232, data receive
6	TX_DAT	HHT/VT-100 to CTL	RS232, data transmit
7			NO CONNECTION
8			NO CONNECTION

Table A-29:NTWRK / LAN, (RJ-45), Repeater and Network Management



Pin	Name	Dir.	Description
1	ETHER_RXA_P	In	10/100BASE-T Input
2	ETHER_RXA_N	In	10/100BASE-T Input
3	ETHER_TXA_P	Out	10/100BASE-T Output
4			Tied to chassis via a 75 ohm and cap
5			
6	ETHER_TXA_N	Out	10/100BASE-T Output
7			Tied to chassis via a 75 ohm and cap
8			
1	ETHER_RXB_P	In	10/100BASE-T Input
2	ETHER_RXB_N	In	10/100BASE-T Input
3	ETHER_TXB_P	Out	10/100BASE-T Output
4			Tied to chassis via a 75 ohm and cap
5			
6	ETHER_TXB_N	Out	10/100BASE-T Output
7			Tied to chassis via a 75 ohm and cap
8			
* The 88E6052 include the Auto MDI/MDIX Crossover for each port			

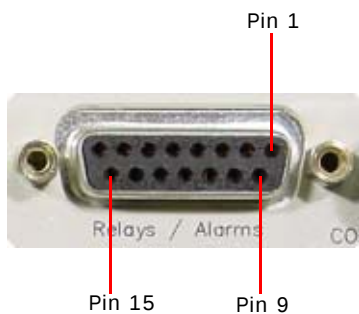


We recommend that all external devices support Auto-negotiation, when connected to a TRuepoint® Ethernet port. If not supporting Auto-negotiation, such devices should be configured as 10 Mbps, half-duplex.



In [Table A-30](#), each relay linked to an alarm is **de-energized** when the alarm is **active** and **energized** when alarm is **inactive**. When linked to a control, the relay is **energized** when the control is **set**, and **de-energized** when the control is **cleared**.

Table A-30: Relays / Alarms, (Female DB-15)



Use Cable 087-903151-xxx
(Wire Color Coding per
[Table A-31](#))

Relay	Contacts		Condition for:	
	Pin	Status ^a	Alarm	Control
Programmable Relay/Alarm 1	1	Open	Inactive	Set
	9	Closed		
	2	Common 1		
Programmable Relay/Alarm 2	10	Open	Inactive	Set
	3	Closed		
	11	Common 2		
Programmable Relay/Alarm 3	4	Open	Inactive	Set
	12	Closed		
	5	Common 3		
Programmable Relay/Alarm 4	13	Open	Inactive	Set
	6	Closed		
	14	Common 4		
External Alarms	7	External Alarm Input 1		
	15	External Alarm Input 2		
	8	Ground		

a. Relative to the Common contact

Table A-31: Wire Colour Coding, Cable 087-903151

Pin	Wire Colour	Remarks
1	Black	Twisted together
2	Red	
3	Black	Twisted together
4	White	
5	Black	Twisted together
6	Green	
7	Black	Twisted together
8	Blue	
9	Black	Twisted together
10	Yellow	
11	Red	Twisted together
12	White	
13	Red	Twisted together
14	Green	
15	Orange	

Table A-32: Orderwire, 4W (RJ-45), External Auxiliary Channels Interface

Pin 1

Pin	Name	Dir.	Description
1	GND		Ground connection
2	GND		Ground connection
3	IN	In_P	Differential positive analog input
4	OUT	Out_P	Differential positive analog output
5	OUT	Out_N	Differential negative analog output
6	IN	In_N	Differential negative analog input
7	GND		Ground connection
8	GND		Ground connection

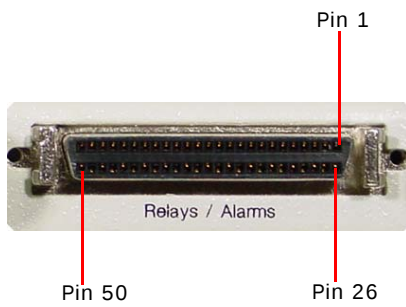
Table A-33: Orderwire, 2W (RJ-11) Voice

Pin 1

Pin	Name	Dir.	Description
1	GND		Ground connection
2	TIP	In	2-Wire Input Tip
3	RING	In	2-Wire Input Ring
4	GND		Ground connection

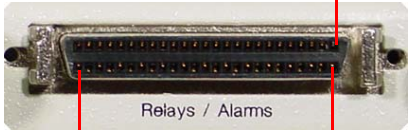


Status of pins in Tables A-34 and A-35: each relay linked to an alarm is **de-energized** when the alarm is **active** and **energized** when alarm is **inactive**. When linked to a control, the relay is **energized** when the control is **set**, and **de-energized** when the control is **cleared**.

Table A-34: Relays / Alarms, (SCSI-50) — Option 1

Relay	Contacts		Condition for	
	Pin	Status ^a	Alarm	Control
Programmable Relay/Alarm 12	1	GND		
	26	GND		
	33	Open	Inactive ^b	Set ^c
	8	Closed		
Programmable Relay/Alarm 11	9	Common 12		
	35	Open	Inactive	Set
	10	Closed		
	34	Common 11		
Programmable Relay/Alarm 10	36	Open	Inactive	Set
	11	Closed		
	12	Common 10		
Programmable Relay/Alarm 9	38	Open	Inactive	Set
	13	Closed		
	37	Common 9		
Programmable Relay/Alarm 8	39	Open	Inactive	Set
	14	Closed		
	15	Common 8		
Programmable Relay/Alarm 7	41	Open	Inactive	Set
	16	Closed		
	40	Common 7		
Programmable Relay/Alarm 6	42	Open	Inactive	Set
	17	Closed		
	18	Common 6		
Programmable Relay/Alarm 5	44	Open	Inactive	Set
	19	Closed		
	43	Common 5		
Programmable Relay/Alarm 4	45	Open	Inactive	Set
	20	Closed		
	21	Common 4		
Programmable Relay/Alarm 3	47	Open	Inactive	Set
	22	Closed		
	46	Common 3		

Table A-34: Relays / Alarms, (SCSI-50) — Option 1(continued)

		Relay		Contacts		Condition for					
				Pin	Status ^a	Alarm	Control				
	Programmable Relay/Alarm 2	48	Open		Inactive		Set				
		23	Closed								
		24	Common 2								
	Programmable Relay/Alarm 1	50	Open		Inactive		Set				
		25	Closed								
		49	Common 1								
External Alarms		27	External Alarm Input 0								
		2	External Alarm Input 1								
		28	External Alarm Input 2								
		3	External Alarm Input 3								
		29	External Alarm Input 4								
		4	External Alarm Input 5								
		30	External Alarm Input 6								
		5	External Alarm Input 7								
		31	External Alarm Input 8								
		6	External Alarm Input 9								
		32	External Alarm Input 10								
		7	External Alarm Input 11								

- a. Relative to the Common contact
 b. When Alarm is inactive
 c. When Control is set

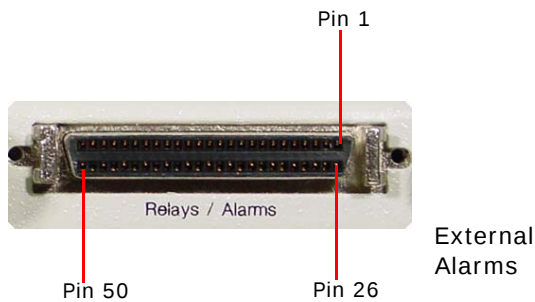


Table A-35:Relays / Alarms, (SCSI-50) — Option 2

Relay	Contacts		Condition for	
	Pin	Status ^a	Alarm	Control
	1	GND		
	26	GND		
	42	Open	Inactive ^b	Set ^c
	17	Closed		
Programmable Relay/Alarm 6	18	Common 6		
	44	Open	Inactive	Set
	19	Closed		
	43	Common 5		
Programmable Relay/Alarm 5	45	Open	Inactive	Set
	20	Closed		
	21	Common 4		
	47	Open	Inactive	Set
	22	Closed		
	46	Common 3		
Programmable Relay/Alarm 3	48	Open	Inactive	Set
	23	Closed		
	24	Common 2		
Programmable Relay/Alarm 2	50	Open	Inactive	Set
	25	Closed		
	49	Common 1		

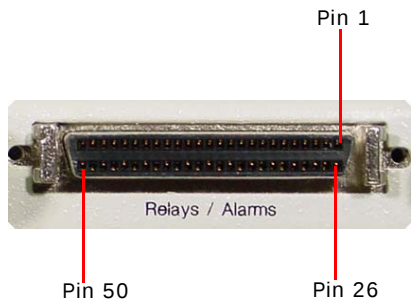
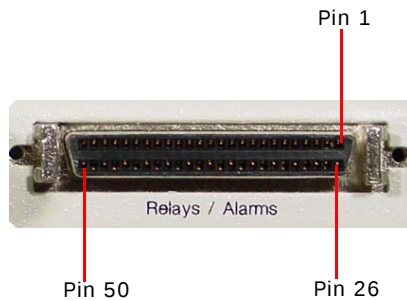


Table A-35: Relays / Alarms, (SCSI-50) — Option 2 (continued)

Relay	Contacts		Condition for	
	Pin	Status ^a	Alarm	Control
External Alarms	27	External Alarm Input 0		
	2	External Alarm Input 1		
	28	External Alarm Input 2		
	3	External Alarm Input 3		
	29	External Alarm Input 4		
	4	External Alarm Input 5		
	30	External Alarm Input 6		
	5	External Alarm Input 7		
	31	External Alarm Input 8		
	6	External Alarm Input 9		
	32	External Alarm Input 10		
	7	External Alarm Input 11		
	33	External Alarm Input 12		
	8	External Alarm Input 13		
	34	External Alarm Input 14		
	9	External Alarm Input 15		
	35	External Alarm Input 16		
	10	External Alarm Input 17		
	36	External Alarm Input 18		
	11	External Alarm Input 19		
	37	External Alarm Input 20		
	12	External Alarm Input 21		
	38	External Alarm Input 22		
	13	External Alarm Input 23		
	39	External Alarm Input 24		
	14	External Alarm Input 25		
	40	External Alarm Input 26		
	15	External Alarm Input 27		
	41	External Alarm Input 28		
	16	External Alarm Input 29		

a. Relative to the Common contact

b. When Alarm is inactive

c. When Control is set

Table A-36: 64 kbps Data, DB-9 — G.703, Co-directional



Pin 1

Pin 9

Module: 902527

Pin	Name	Dir.	Description
1	TX_DATA(+)	In	Data Tx Pos. Input
2	—		—
3	Ch. Ground		Chassis Ground
4	RX_DATA(-)	Out	Data Rx Neg. Output
5	—		—
6	TX_DATA(-)	In	Data Tx Neg. Input
7	—		—
8	RX_DATA(+)	Out	Data Rx Pos. Output
9	—		—

Table A-37: 64 kbps Data, DB-9 — G.703, Contra-directional



Pin 1

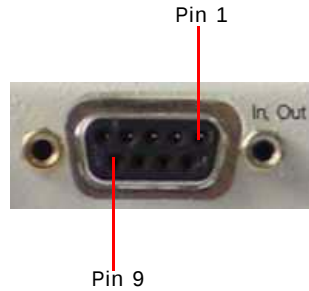
Pin 9

Module: 902527

Pin	Name	Dir.	Description
1	TX_DATA(+)	In	Data Tx Pos. Input
2	TX_CLK(+)	Out	Clock Tx Pos. Output
3	Ch. Ground		Chassis Ground
4	RX_DATA(-)	Out	Data Rx Neg. Output
5	RX_CLK(-)	Out	Clock Rx Neg. Output
6	TX_DATA(-)	In	Data Tx Neg. Input
7	TX_CLK(-)	Out	Clock Tx Neg. Output
8	RX_DATA(+)	Out	Data Rx Pos. Output
9	RX_CLK(+)	Out	Clock Rx Pos. Output

Table A-38: 64 kbps Data, DB-9 — V11, Co-directional

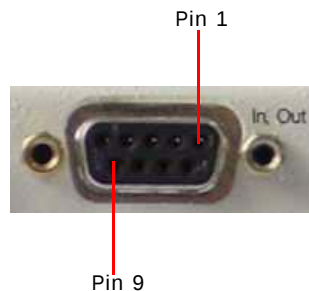
Pin	Name	Dir.	Description
1	TX_DATA(+)	In	Data Tx Pos. Input
2	TX_CLK(+)	Out	Clock Tx Pos. Output
3	Ch. Ground		Ch. Ground
4	RX_DATA(-)	Out	Data Rx Neg. Output
5	RX_CLK(-)	Out	Clock Rx Neg. Output
6	TX_DATA(-)	In	Data Tx Neg. Input
7	TX_CLK(-)	Out	Clock Tx Neg. Output
8	RX_DATA(+)	Out	Data Rx Pos. Output
9	RX_CLK(+)	Out	Clock Rx Pos. Output



Module: 902527

Table A-39: 64 kbps Data, DB-9 — V11, Contra-directional

Pin	Name	Dir.	Description
1	TX_DATA(+)	In	Data Tx Pos. Input
2	TX_CLK(+)	In	Clock Tx Pos. Input
3	Ch. Ground		Ch. Ground
4	RX_DATA(-)	Out	Data Rx Neg. Output
5	RX_CLK(-)	Out	Clock Rx Neg. Output
6	TX_DATA(-)	In	Data Tx Neg. Input
7	TX_CLK(-)	In	Clock Tx Neg. Input
8	RX_DATA(+)	Out	Data Rx Pos. Output
9	RX_CLK(+)	Out	Clock Rx Pos. Output



Module: 902527

B

CONNECTIVITY

Scope

This appendix provides the connection and wiring information requirements for connecting TRuepoint® radios to other MCD radios.

For each radio combination, this appendix provides a

- Connection Summary, identifying the radio **ports** and the **Cables/Adaptors** required to carry the respective **Signal**, and a
- Wiring Details' section, describing pinout correspondence for all terminations.

Safety Considerations

- All cabling must comply to the fire-resistance requirements for communication cables of the **local** National Electrical Code. For Canada: CSA C22.2 0.3M, FT4 classification/UL1581 CM (CMG) classification. When riser or plenum cables are required, follow the requirements of the Nation's Electrical Code for the applicable rating.
- In locations where fire-resistant jacket on the SPU to RFU cable is required, use Andrews LDF2RN-50
- It should be clear that all cabling is intended to be shielded. The one exception is the 2W cable.



Once connected to the TRuepoint® radio, some radios require further software configurations. Always refer to the respective radio's manual in the [Related Instruction Manuals](#) section for such information.

Definitions of Signal Types

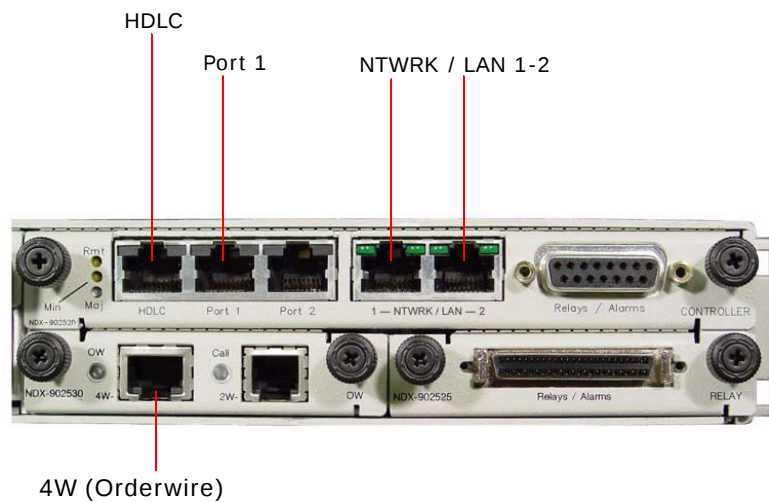
Signal	User	Description
SCAN	FarScan™	This <i>System Control and Alarm Network</i> is a Harris' proprietary protocol that allows a SCAN/SNMP proxy (FarScan™) to monitor and control Harris' microwave radio alarms directly through a standard serial communications port.
DATA	Customer	Refers to data handled through an asynchronous data channel, carried over RS-232 data communications ports. This channel transports foreign network management protocols through a Harris Microwave network.
VF	Customer	<i>Voice frequency</i> , refers to orderwire signals carried between radios, using 4W ports, or through 2W ports for telephone (voice) services.
WS	Customer	<i>Wayside</i> , refers to an E1 or DS1 portion of the bandwidth that is set aside for functions other than user data transmission, i.e., network management, orderwire or other functions.

Related Instruction Manuals

MicroStar®			
Manual P / N	IDU	Freq., GHz	Capacities
IMN-901500-E06	Type-I	23/26/38	2/4 E1, 4 DS1, DS3
IMN-902150-E03	Type-I	10.5/13/15/18	
IMN-902425-E03	Type-I	13/15/18	2/4 E1, DS3
IMN-902100-E05	Type-II	23/26/38	2/4/8/16 E1/DS1, DS3
IMN-902220-E05	Type-II	7/8/13/15/18	
IMN-902421-E04	Type-II	13/15/18	
IMN-901555-E04	Type-III	23/26/38	4/8/16 E1, E3+2E1, DS3
IMN-901600-E08	Type-III	7/8/13/15/18	
IMN-902423-E03	Type-III	13/15/18	
Constellation®			
IMN-112871-E11	——	6/7/8/10/11	8 DS1 to 4 DS3
Control / Alarm Unit (CAU)			
IMN-099945-06	——	——	——

TRuepoint® to TRuepoint® Radios

Figure B-1: Locating the Referenced Ports



Connections Summary

Table B-1: TRuepoint® to TRuepoint® Radios

Signal	TRuepoint® to		TRuepoint®		
	Port	Type	Port	Type	Cable
SCAN, Data, or VF (600 Ω) ^a	NTWRK	RJ-45F	NTWRK	RJ-45F	087-020193-7xx^b (Table B-2 , Table B-3)
	LAN	RJ-45F	LAN	RJ-45F	

- a. Orderwire
- b. Standard 10-100BASE-T straight cable M-M. P/N 087-020193-702/703/704, length per Table 5-1. Cross-over CAT5 cable 087-020193-706/707/708 can also be used.

Wiring Details

Table B-2: TRuepoint® to TRuepoint®

TRuepoint®:		to Cable, M-M:		to TRuepoint®:	
NTWRK (RJ-45F)		087-020193-7xx		NTWRK (RJ-45F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin	Descr.
1	ETH_RXA_P	1	1	1	ETH_RXA_P
2	ETH_RXA_N	2	2	2	ETH_RXA_N
3	ETH_TXA_P	3	3	3	ETH_TXA_P
4	NC	4	4	4	NC
5	NC	5	5	5	NC
6	ETH_TXA_N	6	6	6	ETH_TXA_N
7	NC	7	7	7	NC
8	NC	8	8	8	NC

Table B-3: TRuepoint® to TRuepoint®

TRuepoint®:		to Cable, M-M:		to TRuepoint®:	
LAN (RJ-45F)		087-020193-7xx		LAN (RJ-45F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin	Descr.
1	ETH_RXB_P	1	1	1	ETH_RXB_P
2	ETH_RXB_N	2	2	2	ETH_RXB_N
3	ETH_TXB_P	3	3	3	ETH_TXB_P
4	NC	4	4	4	NC
5	NC	5	5	5	NC
6	ETH_TXB_N	6	6	6	ETH_TXB_N
7	NC	7	7	7	NC
8	NC	8	8	8	NC

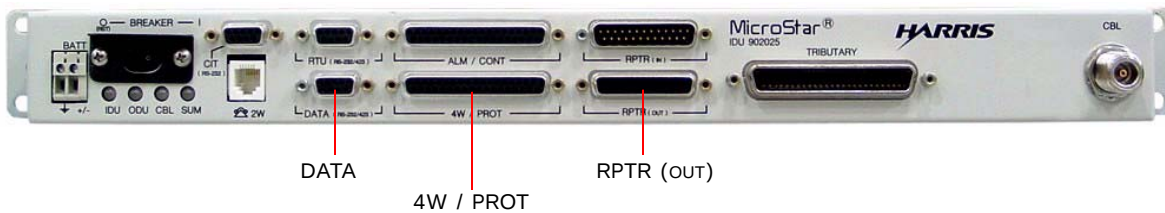
Legend for Tables B-2 and B-3

- | | | | |
|-------------|---------------------------|-------------|----------------------------|
| • ETH_RXA_P | Ethernet receive positive | • ETH_TXA_P | Ethernet transmit positive |
| • ETH_RXB_P | | • ETH_TXB_P | |
| • ETH_RXA_N | Ethernet receive negative | • ETH_TXA_N | Ethernet transmit negative |
| • ETH_RXB_N | | • ETH_TXB_N | |

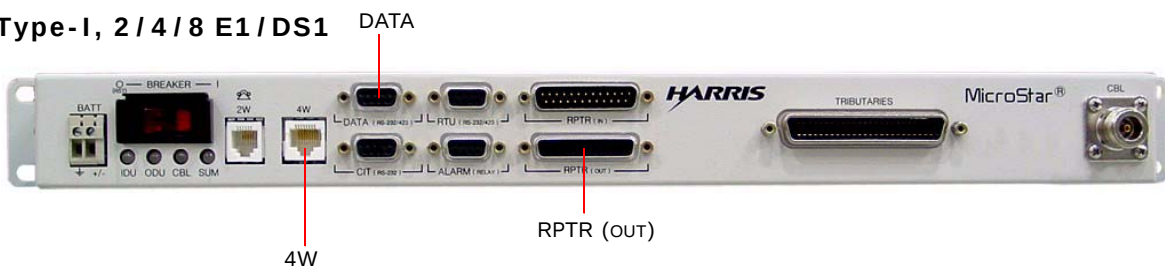
TRuepoint® to MicroStar® Radios

Figure B-2: Locating the MicroStar® Ports

Type-I, 2 / 4 E1



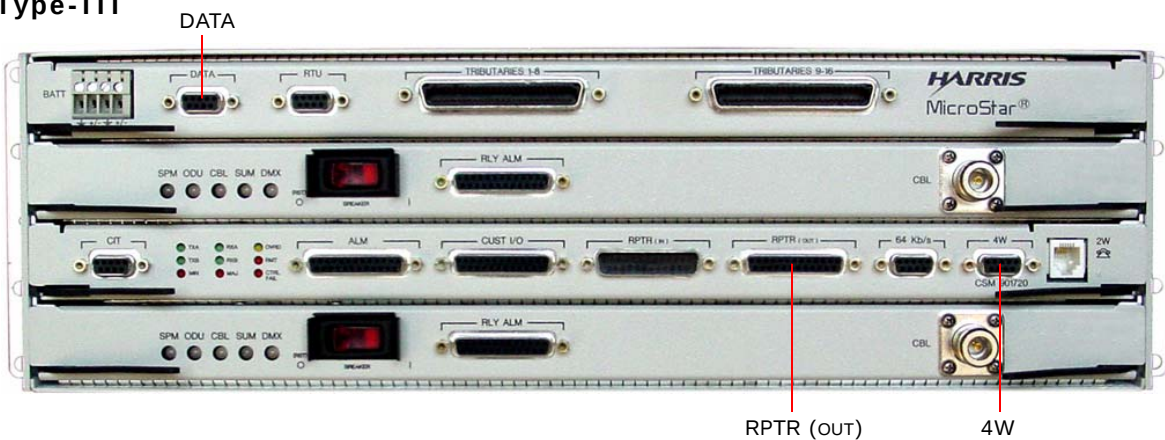
Type-I, 2 / 4 / 8 E1 / DS1



Type-II



Type-III



Connections Summary

Table B-4: TRuepoint® to MicroStar® Type-I Radios

Signal	TRuepoint®		MicroStar® Type-I, 2 / 4 E1			
	Port	Type	Port	Type	Cable	Adaptor
SCAN (RS-422)	HDLC	RJ-45F	RPTR (Out)	DB-25F	087-902907-7xx^a (Table B-8)	042-020065-700, Jack-M, male end to MicroStar®
Data (RS-232)	PORT 1	RJ-45F	DATA	DB-9F	087-902875-001^b (Table B-9)	087-115590-025 ^c , M-M
VF (600 Ω)	4W	RJ-45F	4W/PROT	DB-37F	087-020193-7xx^d (Table B-10)	087-902216-001, Jack-M, male end to MicroStar®
Signal	TRuepoint®		MicroStar® Type-I, 2 / 4 / 8 E1 / DS1			
	Port	Type	Port	Type	Cable	Adaptor
SCAN (RS-422)	HDLC	RJ-45F	RPTR (Out)	DB-25F	087-902907-7xx (Table B-8)	042-020065-700, Jack-M, male end to MicroStar®
Data (RS-232)	PORT 1	RJ-45F	DATA	DB-9F	087-902875-001 (Table B-9)	087-115590-025, M-M
VF (600 Ω)	4W	RJ-45F	4W	RJ-45F	087-902215-001, M-Jack	087-020193-7xx to MicroStar® (Table B-11)

a. Standard 10-100BASE-T cable, twisted pairs, double shielded with drain wire, P/N 087-902907-xxx, length per Table 5-1

b. Cable-adaptor assembly, RJ-45 male / female connectors, straight type.

c. Cable-adaptor assembly, RJ-45 male / DB-9 male connectors. 1-pair shielded.

d. Standard 10-100BASE-T straight cable, P/N 087-020193-702/703/704, length per Table 5-1.

Table B-5: TRuepoint® to MicroStar® Type-II Radios

Signal	TRuepoint® to		MicroStar®			
	Port	Type	Port	Type	Cable	Adaptor
SCAN, Data, or VF (600 Ω)	NTWRK or LAN	RJ-45	ETHERNET	RJ-45F	087-020193-7xx^a (Table B-7)	Not applicable

a. Standard 10-100BASE-T straight cable M-M. P/N 087-020193-702/703/704, length per Table 5-1.

Table B-6: TRuepoint® to MicroStar® Type-III Radios

Signal	TRuepoint®		MicroStar®		Cable	Adaptor
	Port	Type	Port	Type		
SCAN (RS-422)	HDLC	RJ-45F	RPTR (Out)	DB-25F	087-902907-7xx ^a (Table B-8)	042-020065-700, Jack-M, male end to MicroStar®
Data (RS-232)	PORT 1	RJ-45F	DATA	DB-9	087-902875-001 ^b (Table B-9)	087-115590-025 ^c
VF (600 Ω)	4W	RJ-45F	4W	DB-9	087-020193-7xx (Table B-12)	042-902214-703

a. Standard 10-100BASE-T cable, twisted pairs, double shielded with drain wire, P/N 087-902907-xxx, length per Table 5-1

b. Cable-adaptor assembly, RJ-45 male / female connectors, straight type.

c. Cable-adaptor assembly, RJ-45 male / DB-9 male connectors, 1-pair shielded.

Wiring Details

SCAN / Data / VF Connections

Table B-7: TRuepoint® to MicroStar® Type-II

TRuepoint®:		to Cable, M-M:		to MicroStar®:	
NTWRK (RJ-45F)		087-020193-7xx		ETHERNET (RJ-45F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin	Descr.
1	ETH_RXA_P	1	1	1	TXD+
2	ETH_RXA_N	2	2	2	TXD-
3	ETH_TXA_P	3	3	3	RXD+
4	NC	4	4	4	GND
5	NC	5	5	5	GND
6	ETH_TXA_N	6	6	6	RXD-
7	NC	7	7	7	GND
8	NC	8	8	8	GND

Legend for Table B-7

ETH_RXA_P	• Eth. Receive positive	TXD+	• Transmit data positive
ETH_RXA_N	• Eth. Receive negative	TXD-	• Transmit data negative
ETH_TXA_P	• Eth. Transmit positive	RXD+	• Receive data positive
ETH_TXA_N	• Eth. Transmit negative	RXD-	• Receive data negative

SCAN Connection

Table B-8: TRuepoint® to MicroStar® Type-I and III

TRuepoint® (RJ-45F):		to Cable M-M:		to Adaptor F-M:		to MicroStar® (DB-25F):	
HDLC		087-902907-7xx		042-020065-700		RPTR OUT	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	TX_CLKP	1	1	1	4	4 ^a	NSRX_CKP
2	TX_CLKN	2	2	2	17	17	NSRX_CKN
3	TX_P	3	3	3	5	5 ^a	NSRX_DTP
4	TX_N	4	4	4	18	18	NSRX_DTN
5	RX_CKP	5	5	5	6	6	NSTX_CKP
6	RX_CKN	6	6	6	19	19	NSTX_CKN
7	RX_P	7	7	7	7	7	NSTX_DTP
8	RX_N	8	8	8	20	20	NSTX_DTN

a. When not using the 042-020065-700 F-M Adaptor, use a jumper between Pins 4 and 5 on the RPTR OUT port (DB-25F)

Legend for Table B-8

- | | | | |
|-----------|-------------------------|------------|----------------------------------|
| • TX_CLKP | Transmit clock positive | • NSRX_CKP | Net spur receive clock positive |
| • TX_CLKN | Transmit clock negative | • NSRX_CKN | Net spur receive clock negative |
| • TX_P | Transmit clock positive | • NSRX_DTP | Net spur receive data positive |
| • TX_N | Transmit clock negative | • NSRX_DTN | Net spur receive data negative |
| • RX_CKP | Receive clock positive | • NSTX_CKP | Net spur transmit clock positive |
| • RX_CKN | Receive clock negative | • NSTX_CKN | Net spur transmit clock negative |
| • RX_P | Receive positive | • NSTX_DTP | Net spur transmit data positive |
| • RX_N | Receive negative | • NSTX_DTN | Net spur transmit data negative |

Data Connection

Table B-9: TRuepoint® to MicroStar® Type-I and III

TRuepoint®:		to Cable M-F:		to Adaptor M-M:		to MicroStar®:	
PORT 1 (RJ-45F)		087-902875-001		087-115590-025		DATA (DB-9F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	NC	1					NC
2	NC	2					NC
3	NC	3					NC
4	GND	4	2	2	5	5	GND
5	RX_DAT	5	5	5	3	3	TX_DATA1
6	TX_DAT	6	4	4	2	2	RX_DATA1
7	NC	7					NC
8	NC	8					NC

Legend for Table B-9

- NC No connection • TX_DATA1 Transmit data (from DTE)
- GND Ground • RX_DATA1 Receive data (to DTE)

VF Connection

Table B-10: TRuepoint® to MicroStar® Type-I, 2 / 4 E1

TRuepoint®:		to Cable, M-M:		to Adaptor F-M:		to MicroStar®:	
4W (RJ-45F)		087-020193-7xx ^a		087-902216-001		4W / PROT (DB-37F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	GND	1	1				
2	GND	2	2				
3	DPA_IN	3	3	3	2	2	VF_RXP
4	DPA_OUT	4	4	4	1	1	VF_TXP
5	DNA_OUT	5	5	5	20	20	VF_TXN
6	DNA_IN	6	6	6	21	21	VF_RXN
7	GND	7	8				
8	GND	8	7				

a. Standard 10-100BASE-T straight cable M-M. P/N 087-020193-702/703/704, length per Table 5-1

**Table B-11: TRuepoint® to MicroStar® Type-I,
2 / 4 / 8 E1 / DS1**

TRuepoint®:		to Adaptor, M-F:		to Cable, M-M:		to MicroStar®:	
4W (RJ-45F)		087-902215-001		087-020193-7xx ^a		4W (RJ-45F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	GND					1	
2	GND					2	
3	DPA_IN	3	4	4	4	4	LCLVF_RXP
4	DPA_OUT	4	3	3	3	3	LCLVF_TXP
5	DNA_OUT	5	6	6	6	6	LCLVF_TXN
6	DNA_IN	6	5	5	5	5	LCLVF_RXN
7	GND					7	
8	GND					8	

a. Cross-over cable/adaptor assembly with RJ-45 M-F connectors, P/N 087-902215-001

Table B-12: TRuepoint® to MicroStar® Type-III

TRuepoint®:		to Cable, M-M:		to Adaptor, F-M:		to MicroStar®:	
4W (RJ-45F)		087-020193-7xx		042-902214-703		4W (DB-9F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	GND						
2	GND						
3	DPA_IN	3	3	3	4	4	VF_RXP
4	DPA_OUT	4	4	4	3	3	VF_TXP
5	DNA_OUT	5	5	5	6	6	VF_TXN
6	DNA_IN	6	6	6	5	5	VF_RXN
7	GND						
8	GND						

Legend for Tables B-10 through B-12

- DPA_IN Differential pos. analog input
- DPA_OUT Differential pos. analog output
- DNA_OUT Differential neg. analog output
- DNA_IN Differential neg. analog input
- LCLVF_TXP (Local) voice freq. transmit positive
- LCLVF_RXP (Local) voice freq. receive positive
- LCLVF_RXN (Local) voice freq. receive negative
- LCLVF_TXN (Local) voice freq. transmit

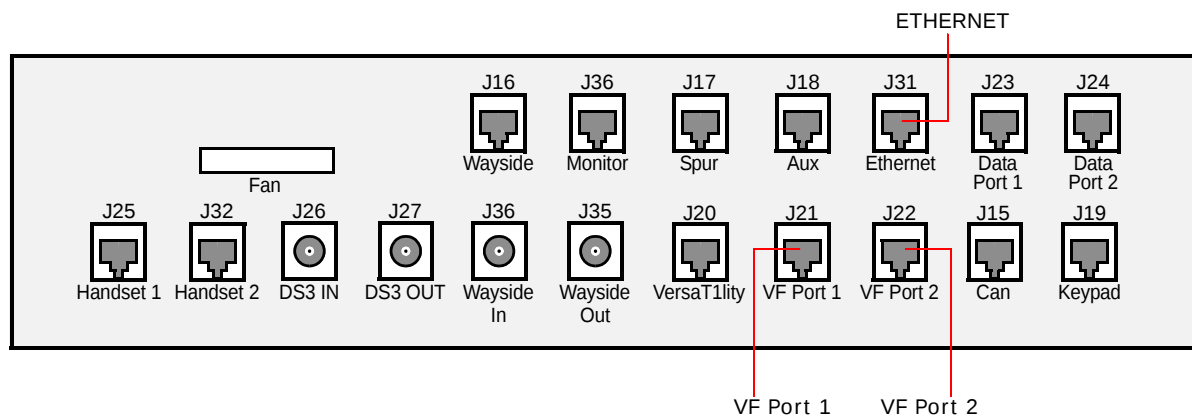
TRuepoint[®] to Constellation[®] Radios

Figure B-3: Constellation[®] — General View



Cabinet doors open

Figure B-4: Constellation[®] — Partial View of the Backplane



Connections Summary

Table B-13: TRuepoint® to Constellation® Radios

Signal	TRuepoint® to		Constellation®		Cable	Adaptor
	Port	Type	Port	Type		
SCAN, Data, or	NTWRK or LAN	RJ-45F	ETHERNET	RJ-45F	087-020193-7xx^a (Table B-14)	Not applicable
VF (600 Ω)	4W	RJ-45F	VF Port 1 or VF Port 2	RJ-45F	087-115595-xxx (Table B-15)	Not applicable

a. Standard 10-100BASE-T straight cable M-M. P/N 087-020193-702/703/704, length per Table 5-1.

Wiring Details

SCAN and Data Connections

Table B-14: TRuepoint® to Constellation®

TRuepoint®:		to Cable, M-M:		to Constellation®:	
NTWRK (RJ-45F)		087-020193-7xx		ETHERNET (RJ-45F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin	Descr.
1	ETH_RXA_P	1	1	1	RX DATA ENET_P
2	ETH_RXA_N	2	2	2	RX DATA ENET_N
3	ETH_TXA_P	3	3	3	TX DATA ENET_P
4	NC	4	4	4	NC
5	NC	5	5	5	NC
6	ETH_TXA_N	6	6	6	TX DATA ENET_N
7	NC	7	7	7	NC
8	NC	8	8	8	NC

Legend for Table B-14

ETH_RXA_P	• Eth. Receive positive	RX DATA ENET_P	• Receive data positive
ETH_RXA_N	• Eth. Receive negative	RX DATA ENET_N	• Receive data negative
ETH_TXA_P	• Eth. Transmit positive	TX DATA ENET_P	• Transmit data positive
ETH_TXA_N	• Eth. Transmit negative	TX DATA ENET_N	• Transmit data negative

VF Connection

Table B-15: TRuepoint® to Constellation®

TRuepoint®:		to Cable, M-M:		to Constellation®:	
4W (RJ-45F)		087-115595-xxx		VF Port 1 or 2 (RJ-45F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin	Descr.
1	GND	1	1	1	
2	GND	2	2	2	
3	DPA_IN	3	5	5	RX SC VF P1 T
4	DPA_OUT	4	4	4	TX SC VF P1 T
5	DNA_OUT	5	3	3	TX SC VF P1 R
6	DNA_IN	6	6	6	RX SC VF P1 R
7	GND	7	7	7	
8	GND	8	8	8	

Legend for Table B-15

- DPA_IN Differential pos. analog input TX SC VF P1 R • Transmit serv. ch. voice freq. ring
- DPA_OUT Differential pos. analog output TX SC VF P1 T • Transmit serv. ch. freq. tip
- DNA_OUT Differential neg. analog output RX SC VF P1 T • Receive serv. ch. voice freq. tip
- DNA_IN Differential neg. analog input RX SC VF P1 R • Receive serv. ch. voice freq. ring

TRuepoint® to CAU



This section provides general information on connecting the TRuepoint® radio to the CAU. For more detailed information on the features and functions of the CAU, refer to the latest version of manual IMN-099945-Exx.

Connections Summary

Table B-16: TRuepoint® to CAU — Data Connection

Signal	TRuepoint®		CAU		Use	
	Port	Type	Port	Type	Cable	Adaptor
Data (RS-232)	PORT 1	RJ-45F	COMM 1, 2 or 3	DB-9F	087-902875-001 ^a (Table B-9)	087-115590-025, M-M ^b

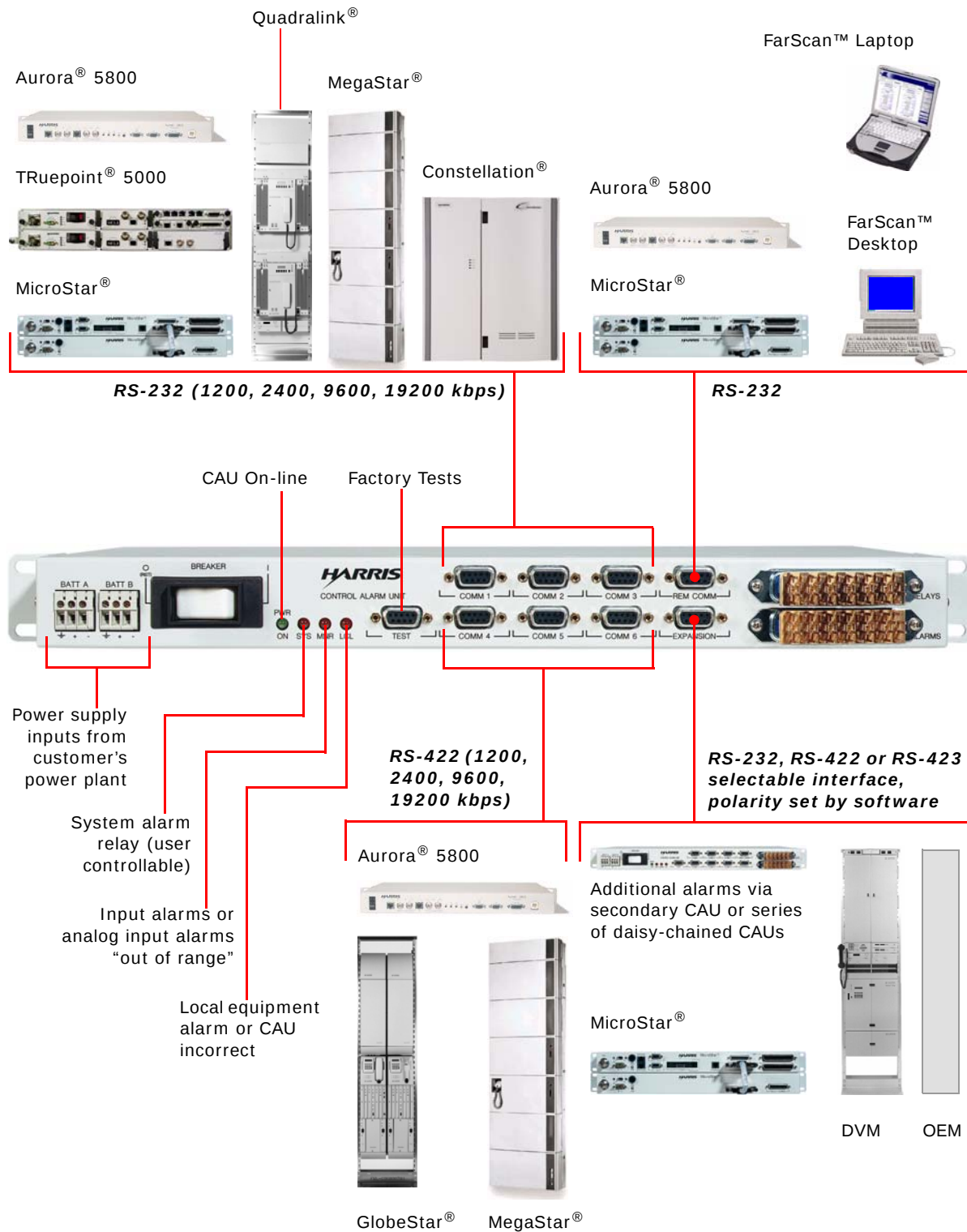
a. Cable-adaptor assembly, RJ-45 male / female connectors, straight type

b. Cable-adaptor assembly, RJ-45 male / DB-9 male connectors. 1-pair shielded.

Wiring Details

Table B-17: TRuepoint® to CAU

TRuepoint®:		to Cable M-F:		to Adaptor M-M:		to CAU:	
PORT 1 (RJ-45F)		087-902875-001		087-115590-025		COMM 1,2, 3	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	NC	1					NC
2	NC	2					NC
3	NC	3					NC
4	GND	4	2	2	5	5	GND
5	RX_DAT	5	5	5	3	3	TX_DATA1
6	TX_DAT	6	4	4	2	2	RX_DATA1
7	NC	7					NC
8	NC	8					NC

Figure B-5: CAU Connection Diagram (Reference)

TRuepoint® to MegaStar® Radios

Connections Summary

Table B-18: TRuepoint® to MegaStar® — SCAN Connection

Signal	TRuepoint®		MegaStar®		Use	
	Port	Type	Port	Type	Cable	Adaptor
SCAN (RS-232)	PORT 1	RJ-45F	SPUR (J11)	DB-9F	087-902875-001 (Table B-19)	087-115590-025

Wiring Details

SCAN Connection

Table B-19: TRuepoint® to MegaStar®

TRuepoint®:		to Cable M-F:		to Adaptor M-M:		to MegaStar®:	
PORT 1 (RJ-45F)		087-902875-001		087-115590-025		SPUR (DB-9F)	
Pin	Descr.	Pin (in)	Pin (out)	Pin (in)	Pin (out)	Pin	Descr.
1	NC	1					NC
2	NC	2					NC
3	NC	3					NC
4	GND	4	2	2	5	5	GND
5	RX_DAT	5	5	5	3	3	SPUR_RXD
6	TX_DAT	6	4	4	2	2	SPUR_TXD
7	NC	7					NC
8	NC	8					NC

Legend for Table B-19

- NC No connection
- GND Ground
- SPUR_TXD Transmit data (to DTR)
- SPUR_RXD Receive data (from DCD)

Special Cables and Adaptor Assemblies

Table B-20: Cable / Adaptor Assemblies Summary, Grouped by Signal Type

Signal	To Connect	To	Use		Description ^a
			Cable and / or	Adaptor Assy ¹	
DATA	TRuepoint [®]	TRuepoint [®]	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	MicroStar [®] Type-I and III	087-902875-001	087-115590-025	C = RJ-45 M-F A = RJ-45/DB-9
	TRuepoint [®]	MicroStar [®] Type-II	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	Constellation [®]	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	CAU	087-902875-001	087-115590-025	C = RJ-45 M-F A = RJ-45/DB-9
SCAN	TRuepoint [®]	TRuepoint [®]	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	MicroStar [®] Type-I and III	087-902907-7xx	042-020065-700	C = RJ-45 A = RJ-45F/DB-9
	TRuepoint [®]	MicroStar [®] Type-II	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	Constellation [®]	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	MegaStar [®]	087-902875-001	087-115590-025	C = RJ-45 A = RJ-45F/DB-9
VF	TRuepoint [®]	TRuepoint [®]	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	MicroStar [®] Type-I, 2/4 E1	087-020193-702 /703/704	087-902216-001	C = RJ-45 A = RJ-45F/DB-37
	TRuepoint [®]	MicroStar [®] Type-I, 2/4/8 E1/DS1	087-020193-706/707/708	087-902215-001	RJ-45
	TRuepoint [®]	MicroStar [®] Type-II	087-020193-702 /703/704	—	RJ-45
	TRuepoint [®]	MicroStar [®] Type-III	087-020193-702 /703/704	042-902214-703	C = RJ-45 A = RJ-45F/DB-9
	TRuepoint [®]	Constellation [®]	087-115595-xxx	—	RJ-45

a. All cables and adaptors' connectors are Male-Male unless noted otherwise;
(C = Cable, A = Adaptor)

C

APPLICATION NOTES

Foreword

This Appendix provides reference information on specific topics related to *Typical* radio setups and configurations. It is subject to updates and additions, as needed. Such configurations are as follows:

Typical Terminal Configuration C-2

Typical Repeater C-4

Typical Repeater with Spur C-5

Optional Orderwire C-6

Network Control with SNMP C-9

Typical Terminal Configuration

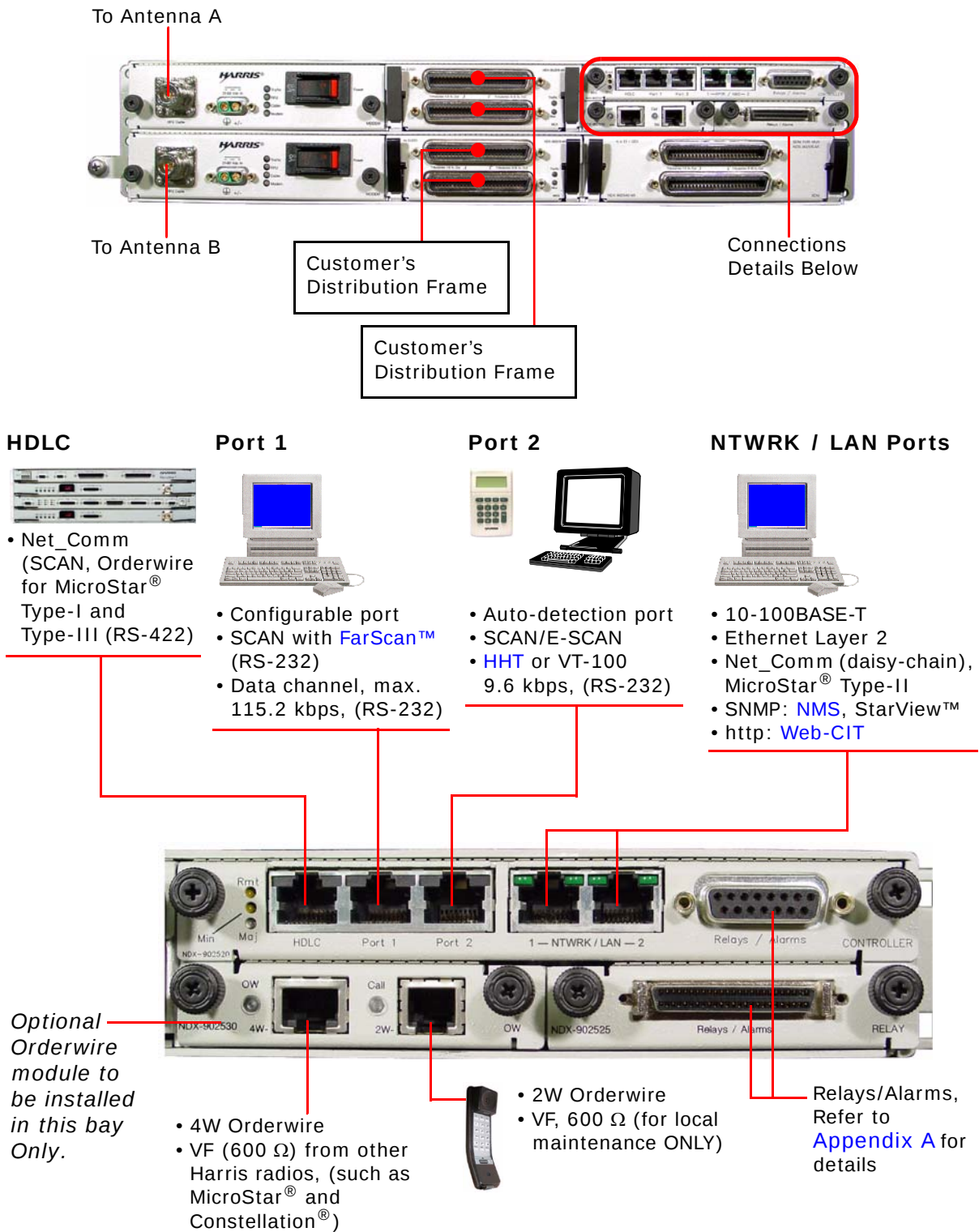
Figure C-1 shows the typical TRuepoint[®] connectivity and functions.

In this example, 16 balanced E1 signals connect between the TRIBUTARIES ports on the radio's faceplate and the [Customer's Distribution Frame](#). A computer running FarScan[™] and connecting to [Port 1](#) allows the operator to monitor and control TRuepoint[®] radios throughout the network.

Another computer connects to either one of the [NTWRK / LAN Ports](#). Through [Web-CIT](#), the operator is able to control and monitor other equipment connected to the data channel: a [DACS](#) or an RTU for example. Also, connecting to any one of the [NTWRK / LAN Ports](#), a different computer (a remote [NMS](#)) running SNMP/FTP/IP software, such as StarView[™], can allow for FTP software downloads.



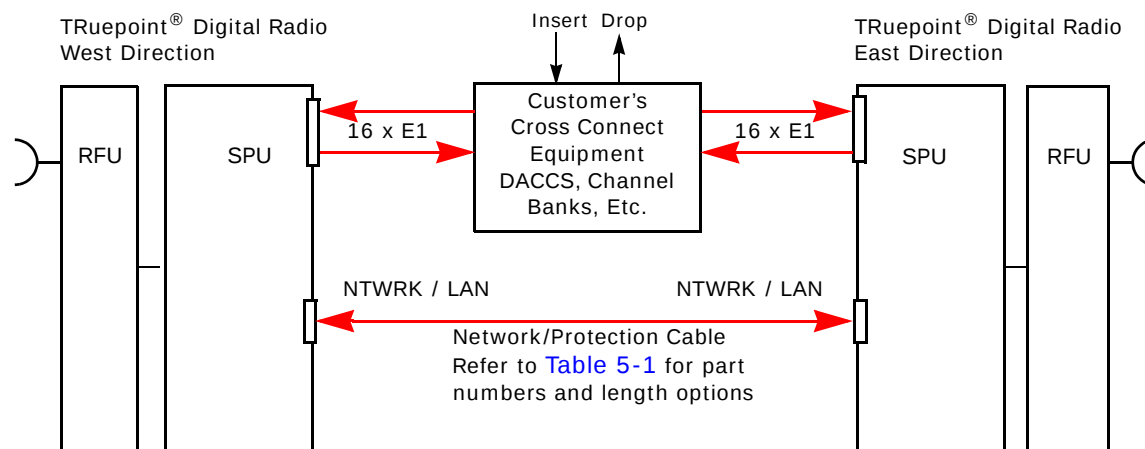
Refer to [Appendix B](#) for detailed information on connecting TRuepoint[®] radios to other Harris' radios for accessing data channel services and other functions.

Figure C-1: Typical Terminal Connection Diagram

Typical Repeater

Figure C-2 shows a typical repeater configuration. Here E1 tributaries are connected between header connectors on two back to back radios by means of cross connect equipment supplied by the customer or an OEM. The cross connect equipment, a DACCS, back to back channel banks, etc., allows channels to be dropped and inserted. The line between the NTWRK / LAN ports carries orderwire, data channel, and network control signals between the radios.

Figure C-2: Typical Repeater Block Diagram

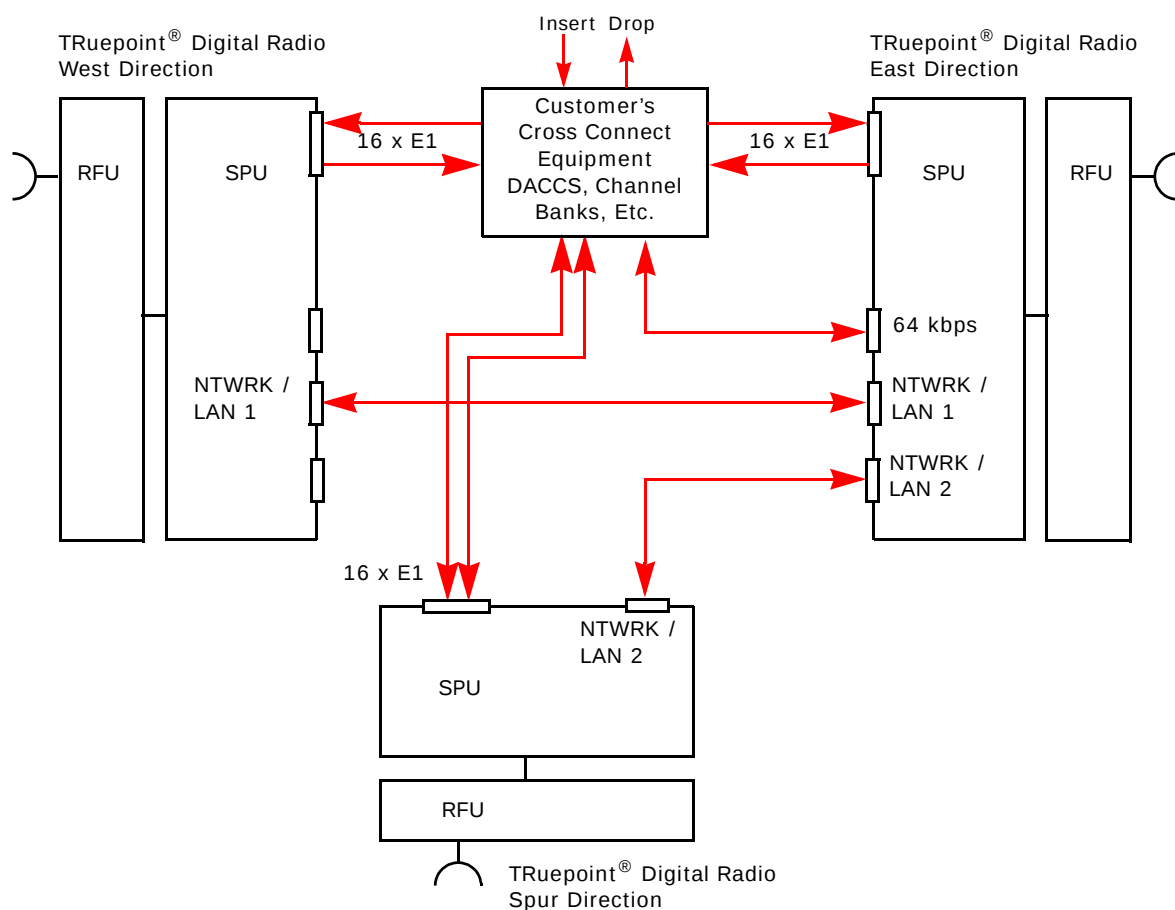


Typical Repeater with Spur

Figure C-3 shows three TRuepoint® radios connected as repeater with a spur. A DACCS, back to back channel banks or other cross connect equipment, (supplied by the customer or an OEM), connects the tributaries between the radios and drops and inserts signals.

An [Optional Orderwire](#) card provides voice and data communications with other sites in the network. If intelligent cross-connect equipment is used, it can be controlled by means of the data channel on the [64 kbps](#) port. (A [Synchronous 64 kbps Data Module](#) is also offered as an option.)

Figure C-3: Typical Repeater with Spur Block Diagram



Optional Orderwire

Features

The TRuepoint® [Orderwire Module](#) provides the following functions:

- Voice communications using a [DTMF](#) standard handset connected to the 2W port (RJ-45), and a
- VF (voice frequency) channel through the 4W port (RJ-45) for interfacing with Harris' legacy equipment, such as MicroStar® Type-I or Type-II service channel modules.

Functions

The [DTMF](#) telephone connected to the 2W port (RJ-45) allows the operator to make voice communications by calling one specific site or all sites in the network. Signalling can be selective with 3 digits dialling, or “*all call*”. The site address decoding is done by the controller and is represented by the associated Network Element address.



Requirement: Each group of 3 DTMF tones entered by the user or received from an analog interface must be separated by at least 0.5 second to be properly recognized by the TRuepoint® system.

The VF signals received from both the 4W input and the handset are combined, PCM coded, and assembled into service channel packet data. This digitally combined signal is transmitted to all sites connected on the network.

At a repeater site with spur, the PCM-encoded VF data at that site is added linearly to the incoming orderwire data in a [VF Bridge](#) before being transmitted.

At a repeater site without spur, when no VF data is to be inserted in the packet data, the [VF Bridge](#) is bypassed to minimize the VF latency in a network containing a large number of links.



Only one orderwire module is required per site, regardless of how many radio terminals are on the site. Also, if 2 ends of an in-line multi-hop network are equipped with orderwire modules, all intermediate sites need **not** be equipped with orderwires.

One of the four relays in the [Controller Module](#) can be programmed to be the E-lead for the orderwire ringing indication.

Figure C-4: Orderwire Module



Figure C-5: Synchronous 64 kbps Data Module

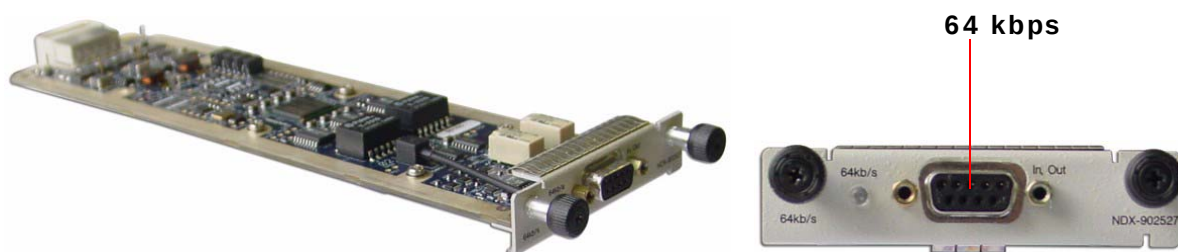
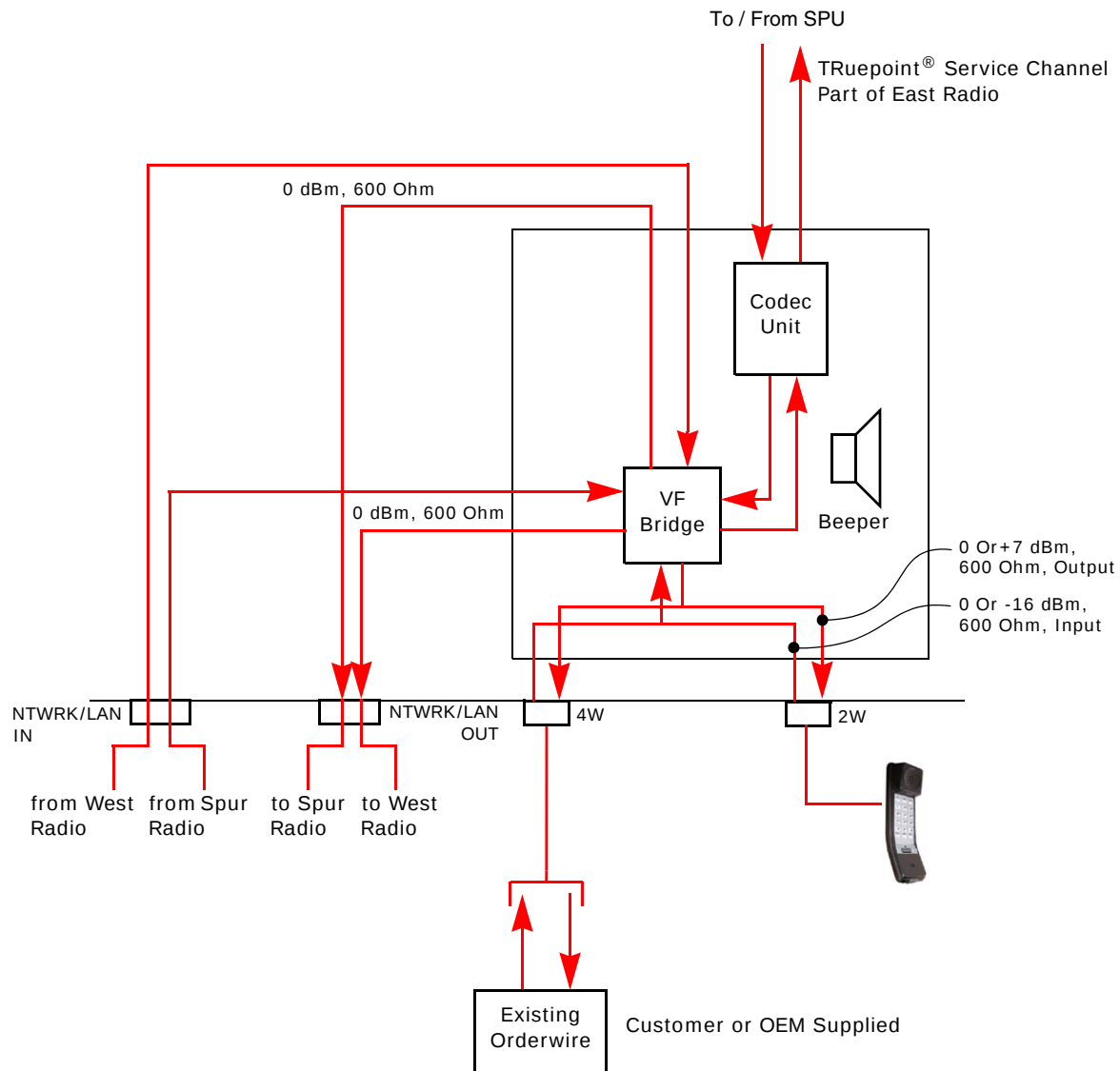


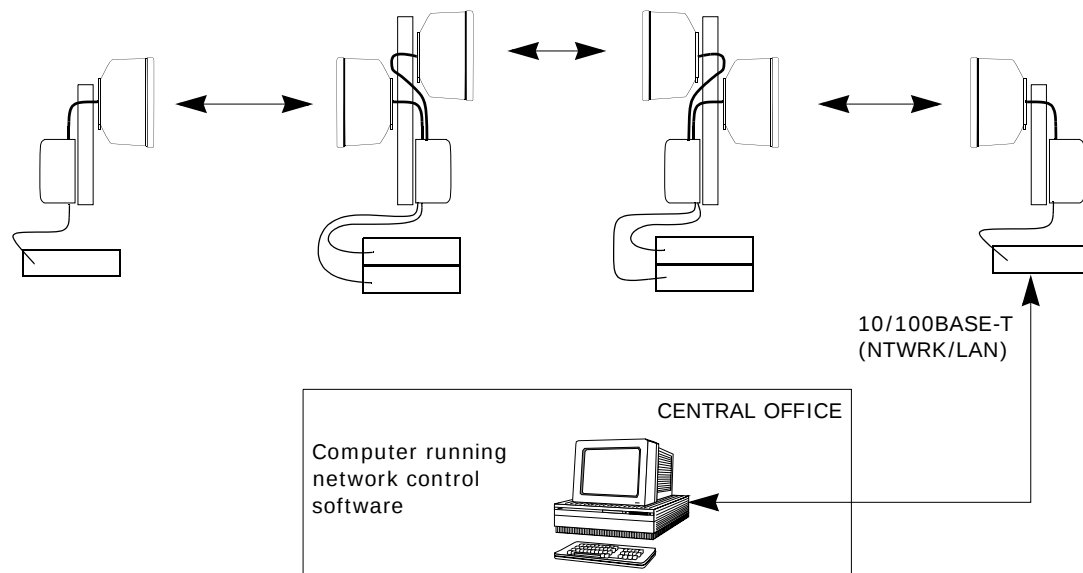
Figure C-6: Typical Orderwire Block Diagram

Network Control with SNMP

To take advantage of the SNMP agent in the TRuepoint[®] radio, you must have a network management system (such as the StarView[™] from Harris), or other NMS that supports the SNMP application protocol along with the UDP/IP transport, addressing and routing protocols.

Figure C-7 shows a simple application. In this example, the control software communicates with one TRuepoint[®] radio by means of a direct connection. That radio becomes the router for a sub-network that consists of other TRuepoint[®] radios.

Figure C-7: Network Control Through a Direct Connection

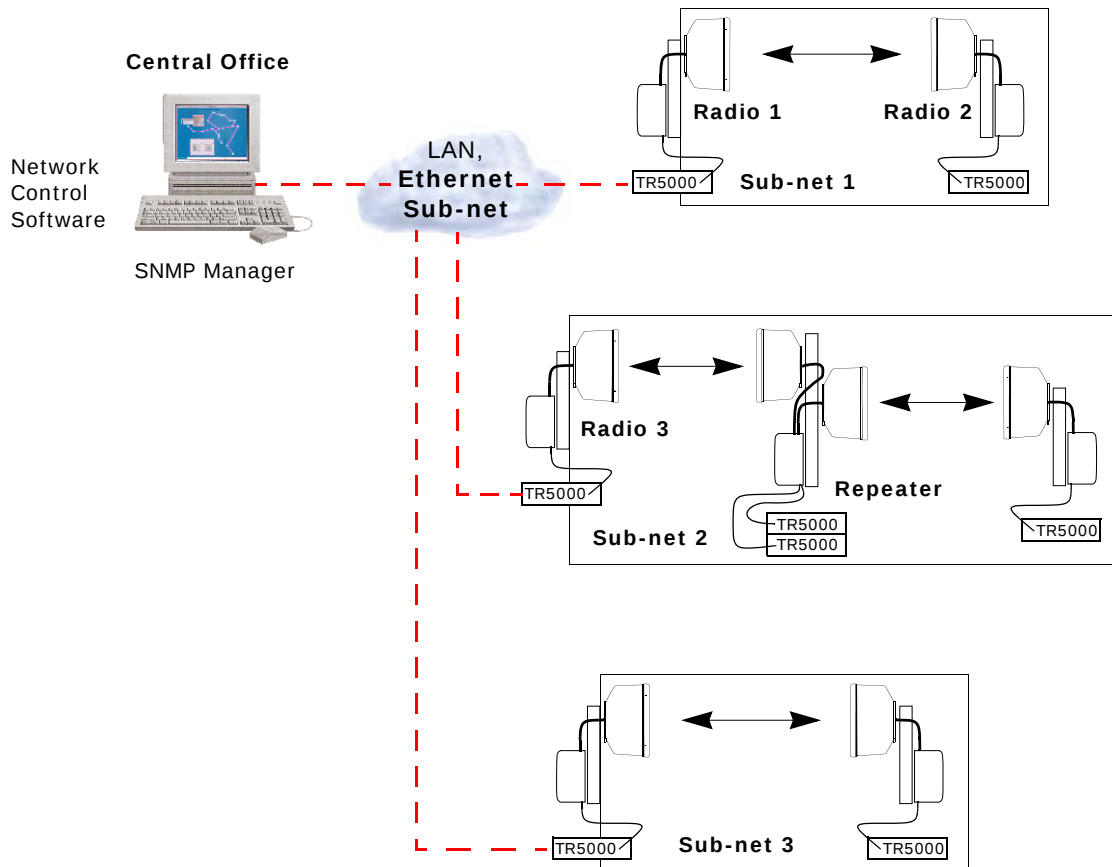


In Internet terminology, the computer running the control software is referred to as the NMS (network manager system) and the TRuepoint[®] radios are referred to as NEs (Network Elements). There are two data link layers:

- the **Ethernet link layer**, linking the NMS and the NEs (over the LAN), where each NE has an IP address and a mask generated *automatically*, by default, through the ETHERNET INTERFACE; and
- the **Net link layer**, linking the NEs over the TRuepoint[®] internal network channel NETCOM, (where each NE has an IP address and a mask generated *automatically*, by default, through the NETCOM INTERFACE).

Figure C-8 shows a sample network where the NMS connects to several sub-networks by means of a LAN (**Ethernet Sub-net**). All TRuepoint[®] radio routers located at the entrance of these sub-nets connect also through the LAN.

Figure C-8: A System Using Sub-Nets



Configurations shown represent three different roles of a radio in a TRuepoint[®] network from the network management perspective, using SNMP capabilities.

Assumptions

- **SNMP Manager** (computer located at the Central Office running a Network Control Software), in Web-CIT under Security > SNMP Managers;
- All IP addresses/masks assigned using the **Manual** mode, in Web-CIT under Configuration (IP Routing) > Network Interfaces.
- Radio types (1, 2 and 3) identified according to function.

Radio 1 is the router in **Sub-net 1** and **Ethernet Sub-net**, and is directly linked to the terminal server (here, an SNMP Manager). Configuration is as follows:

Security	SNMP Manager IP Address	137.237.233.176
Configuration (IP Routing)	Network Interfaces > Netcom IP Address	192.168.19.129
	Network Interfaces > Netcom IP MASK	255.255.255.248
	Network Interfaces > Ethernet IP Address	137.237.233.10
	Network Interfaces > Ethernet IP Mask	255.255.255.0

Radio 2 plays an ordinary role in the network and has a simple configuration:

Security	SNMP Manager IP Address	137.237.233.176
Configuration (IP Routing)	Network Interfaces > Netcom IP Address	192.168.19.130
	Network Interfaces > Netcom IP MASK	255.255.255.248

Radio 3 is the router in the **Sub-net 2** and **Ethernet Sub-net**; it is connected to the Central Office through the LAN. Configuration is as follows:

Security	SNMP Manager IP Address	137.237.233.176
Configuration (IP Routing)	Network Interfaces > Netcom IP Address	172.24.2.1
	Network Interfaces > Netcom IP MASK	255.240.0.0
	Network Interfaces > Ethernet IP Address	137.237.233.11
	Network Interfaces > Ethernet IP Mask	255.255.255.0

The DHCP Server

The TRuepoint® DHCP server feature allows the direct connection of a PC to a TRuepoint® radio. The PC must be configured to get its IP address through a DHCP server; in Web-CIT:

Configuration (IP Routing) Network Interfaces > Ethernet > DHCP Enable will allow the TRuepoint® radio to lease IP address (within a range set by the user) to the PC for the duration of the connection. Also, the Ethernet IP Address and the IP Address assigned by the DHCP Server to the PC must be in the same sub-net.

Thus, the radio's Ethernet IP Address must be configured to be in a sub-net other than that of the radio's Netcom Sub-net.

FarScan™

FarScan™ is an economical, user-friendly Windows® based SCAN/SNMP proxy that monitors and controls Harris' microwave radio alarms directly through [Port 1](#) (standard RS-232), using Harris' proprietary SCAN (System Control and Alarm Network) protocol or SNMP protocol.

Advantages of the SNMP agent:

- Complete compatibility with Harris' StarView™ Element Management System, which provides enhanced graphical interface for most Harris' radios or any SNMP-based [NMS](#).
- Provides the ability to transfer FarScan™ edited messages to StarView™. These edited messages provide meaningful labels to external alarms. FarScan™ can also interface through Harris' CAU (Control and Alarm Unit) with radios of other manufacturers to provide all attributes of a conventional alarm system, including extensive internal diagnostics.

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