CRS-311

1:1 Redundancy Switch
Installation and Operation Manual

Accessory Product for use only with
Comtech EF Data CDM-Qx/QxL AND SLM-5650/5650A Modems
(Modem Firmware and Hardware Requirements Apply)

Part Number MN/CRS311.IOM
Revision 4

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

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Comtech EF Data is an
AS9100 Rev B / ISO9001:2000
Registered Company

Part Number MN/CRS311.IOM
Revision 4
October 28, 2008

Comtech EF Data, 2114 West 7th Street, Tempe, Arizona 85281 USA, 480.333.2200, FAX: 480.333.2161

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Customer Support

Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- Reporting comments or suggestions concerning manuals
- Information on upgrading or returning a product

A Customer Support representative may be reached at:

Comtech EF Data
Attention: Customer Support Department
2114 West 7th Street
Tempe, Arizona 85281 USA

480.333.2200 (Main Comtech EF Data number)
480.333.4357 (Customer Support Desk)
480.333.2161 FAX

To return a Comtech EF Data product (in-warranty and out-of-warranty) for repair or replacement:

- **Contact** the Comtech EF Data Customer Support Department. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.
- **Request** a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support representative.
- **Pack** the product in its original shipping carton/packaging to ensure that the product is not damaged during shipping.
- **Ship** the product back to Comtech EF Data. (Shipping charges should be prepaid.)

For Online Customer Support:

An RMA number request can be requested electronically by contacting the Customer Support Department through the online support page at **www.comtechefdata.com/support.asp**:

- **Click** on "**Service**" for detailed instructions on our return procedures.
- **Click** on the "**RMA Request Form**" hyperlink, then fill out the form completely before sending.
- **Send e-mail** to the Customer Support Department at **service@comtechefdata.com**.

For information regarding this product's warranty policy, refer to the Warranty Policy, p. xv.

About this Manual

This manual provides installation and operation information for the Comtech EF Data CRS-311 1:1 Redundancy Switch. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the CRS-311.

Related Documents

- *Comtech EF Data CDM-Qx Multi-Channel Satellite Modem Installation and Operation Manual*
- *Comtech EF Data SLM-5650 Satellite Modem Installation and Operation Manual*
- *Comtech EF Data SLM-5650A Satellite Modem Installation and Operation Manual*

Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual are appreciated. To submit comments, please contact the Comtech EF Data Technical Publications department: TechnicalPublications@comtechefdata.com

Conventions and References

Cautions and Warnings

IMPORTANT or NOTE indicates a statement that is associated with the task being performed or information critical for proper equipment function.

CAUTION indicates a hazardous situation that, if not avoided, may result in minor or moderate injury. CAUTION may also be used to indicate other unsafe practices or risks of property damage.

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

Metric Conversion

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-Metric to Metric conversions.

Recommended Standard Designations

Recommended Standard (RS) Designations are interchangeable with the designation of the Electronic Industries Association (EIA).

Trademarks

Windows is a trademark of the Microsoft Corporation.

Other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

Electromagnetic Compatibility (EMC) Compliance

This is a Class A product. In a domestic environment, it may cause radio interference that requires the user to take adequate protection measures.

EN55022 - 1997 Compliance

This equipment meets the radio disturbance characteristic specifications for information technology equipment as defined in EN55022.

EN55024 - 1998 Compliance

This equipment meets the EMC/immunity characteristics for the limits and methods of measurement for information technology equipment per EN55024-1998.

Federal Communications Commission (FCC)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference; in which case, users are required to correct the interference at their own expense.

To ensure compliance, properly shielded cables for DATA I/O shall be used. More specifically, these cables shall be shielded from end to end, ensuring a continuous shield.

Safety Compliance

EN 60950

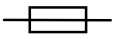
Applicable testing is routinely performed as a condition of manufacturing on all units to ensure compliance with safety requirements of EN60950.This equipment meets the Safety of Information Technology Equipment specification as defined in EN60950.

Low Voltage Directive (LVD)

The following information is applicable for the European Low Voltage Directive (EN60950):

<HAR>	Type of power cord required for use in the European Community.
	**CAUTION:** Double-pole/Neutral Fusing **ACHTUNG:** Zweipolige bzw. Neutralleiter-Sicherung

International Symbols:

Symbol	Definition
~	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth / Safety Ground
	Chassis Ground

NOTE

For additional symbols, refer to* Cautions and Warnings *listed earlier in this Preface.

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a period of two years from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Chapter 1. INTRODUCTION

1.1 Overview

The CRS-311 is an accessory product designed specifically for the Comtech EF Data CDM-Qx/QxL or SLM-5650/5650A modems, and must not be used with any other equipment.

Figure 1-1. CRS-311 1:1 Redundancy Switch

The CRS-311 1:1 Redundancy Switch – shown here in and referred to throughout this manual as "the Switch" – is a companion product for use with the Comtech EF Data CDM-Qx/QxL or SLM-5650/5650A Satellite Modems. Designed to continuously monitor a pair of modems in a redundant configuration, the CRS-311 automatically switches data and IF signals from a failed Traffic Modem to the Redundant Modem in the event of an equipment failure or undesired traffic condition. Traffic paths are fully protected, and the system operator can have increased confidence that equipment failures will not adversely affect system availability.

Accordingly, a 1:1 system comprises a Traffic Modem, a Redundant Modem, and the CRS-311 1:1 Redundancy Switch.

***For the CRS-311 to operate correctly, the Traffic Modem and the Redundant Modem must be of the same model and firmware revision. Permitted firmware revisions are discussed in* Chapter 4. MODEM AND SWITCH CONFIGURATION.**

A key feature of the CRS-311 architecture is its ability to allow the Redundant Modem to 'bridge' the Traffic Modem. The Switch automatically configures the Redundant Modem to match the configuration of the Traffic Modem. The Switch also copies the Traffic Modem's terrestrial transmit clock/data and routes it to the Redundant Modem, along with the Traffic's Modem's Rx IF (via use of the CRS-281x IF Switch Module) – see **Sect. 1.4.5 CRS-311 IF Switch Module Assemblies**) in this chapter. Because of this, no external test equipment is needed to determine the health of the Redundant Modem – live traffic is used at all times to verify performance.

Construction Features: The CRS-311 is modular in construction. All replaceable modules insert into slots in the back panel. This includes the controller, Traffic Modem Interface (TMI), Redundant Modem Interface (RMI), Overhead Module, IF Modules, and Power Supply Units (PSUs).

Because power consumption is below 25 watts for a fully populated Switch, no fan cooling is required.

Key Reliability Features: The CRS-311 incorporates the following key reliability features:

- Twin, independent, AC or DC power supplies
- Primary traffic paths are maintained, error-free, when power is removed.
- The TMI can be completely removed from the CRS-311, with cables still attached, and traffic is not interrupted or affected.

Ease of Connection: Connection to the Traffic and Redundant Modems is remarkably simple. One cable connected to the HD-15 port on the TMI or RMI carries the Switch-to-Modem communications, fault indications and remote control.

For the CDM-Qx/QxL: These modems require an additional RS-485 multi-drop cable from the Switch to all modems to provide remote control interface capability.

For RS-232/485 M&C User connections: A direct user-to-modem serial RS-232/485 communication connection is not permissible when connected to the CRS-311. The user must instead connect to the DB-9 "Remote" connector on the CRS-230 System Controller (installed on the CRS-311). For detailed information on remote addressing schemes, refer to **Appendix B. ADDRESSING SCHEME INFORMATION**.

TMI Monitoring: Terrestrial user clock and data signals to and from a Traffic Modem are routed through the TMI via a set of relays. This is arranged so that the de-energized (unpowered) state connects the data signals directly through to the Traffic Modem. If the power supplies to the system are lost, or if the TMI carrying traffic is removed, no interruption of the traffic will take place. It should also be noted that, in normal circumstances where the Redundant Modem is not in service, no data is carried through the CRS-311 backplane - all data is routed via the TMI.

Interfaces: The CRS-311 supports all of the interface types available on the CDM-Qx/QxL or the SLM-5650/5650A modems via the following TMIs:

- EIA-530 or Ethernet (via Ethernet Bridge Mode) – CRS-316
- G.703 (Balanced or Unbalanced) – CRS-325
- HSSI or Ethernet (via Ethernet Bridge Mode) – CRS-336
- Quad E1 – CRS-365
- 4-Port Ethernet (via Ethernet Bridge Mode or Router Mode) – CRS-515

Refer to **Sect. 1.4.3.2 TMI Cards** and **Sect. 1.5.1 CRS-311 Specifications** for more information on these interface modules and their specifications.

CRS-281x Selection: The CRS-281x switch module connects the online modulator's Tx IF signal to the RF up-converter. It also passively splits the Rx IF signal to provide both demodulators with the same IF signal coming from the LNB, thus reducing switching time.

Three CRS-281x switch modules are compatible for use with the CDM-Qx/QxL modem:

- The CRS-281 (70/140 MHz IF) with Type ‘BNC’ (50Ω) connectors;
- The CRS-281 (70/140 MHz IF) with Type ‘BNC’ (75Ω) connectors;
- The CRS-281L (L-Band IF) with Type ‘N’ (50Ω) connectors.

Two CRS-281x switch modules are compatible for use with the SLM-5650/5650A modem:

- The CRS-281 (70/140 MHz IF) with Type 'TNC' (50Ω) connectors;
- The CRS-281L (L-Band IF) with Type 'N' (50Ω) connectors.

IMPORTANT

The SLM-5650/5650A modem permits simultaneous operation of the Tx IF and Rx IF bands at 70/140 MHz and L-Band frequencies, independent of one another. If the user wants the Tx and Rx to be of different IF bands, the CRS-281x module must be selected based on the Tx IF band. An external splitter is then used for the Rx IF band when that side differs from the Tx IF band – refer to* Figure 3-17 *and* Figure 3-18 *in* Sect. 3.3.5 IF Connections – User to CRS-281x to Modems *for configuration examples.

Refer to **Sect. 1.4.5 CRS-281x IF Switch Module Assemblies** for more information on these switch modules and their use.

CRS-351 Option: Where protection of the overhead signals (backward alarms, audio ESC, data ESC, etc.) is desired, the CRS-351 Overhead Module may be added.

1.2 CRS-311 Compatibility

Table 1-1 shows the Comtech EF Data modems that are compatible for use with the CRS-311 1:1 Redundancy Switch:

Table 1-1. CRS-311 Switch/Modem Compatibility

Modem	Optional Switch Modules
CDM-Qx	CRS-281 IF Switch Module (70/140 MHz) - 50Ω or 75Ω BNC NOTE ***Up to one modulator and one demodulator allowed per CDM-Qx/QxL.***
CDM-QxL	CRS-281A IF Switch Module (L-Band) NOTE ***Up to one modulator and one demodulator allowed per CDM-Qx/QxL.***
SLM-5650/5650A	CRS-281 IF Switch Module (70/140 MHz) - 50Ω TNC CRS-281L IF Switch Module (L-Band) CRS-351 ESC Switch Module (IDR Overhead)

Compatibility Note: The CiM-25, Comtech EF Data's low-cost Internet Protocol (IP) Monitor & Control (M&C) interface for existing CEFD modems, is not compatible for use on modems operating within a CRS-311 1:1 redundancy system. Taking this prohibition of use under further consideration, the CiM-25 should **not**, *under any circumstances*, be connected to the Remote port on the CRS-311's CRS-230 Controller card for control of the Switch and modems.

1.3 System-Level Block Diagram

Figure 1-2 shows the system-level block diagram of the CRS-311 1:1 Redundancy Switch, including the CRS-281 IF Switch.

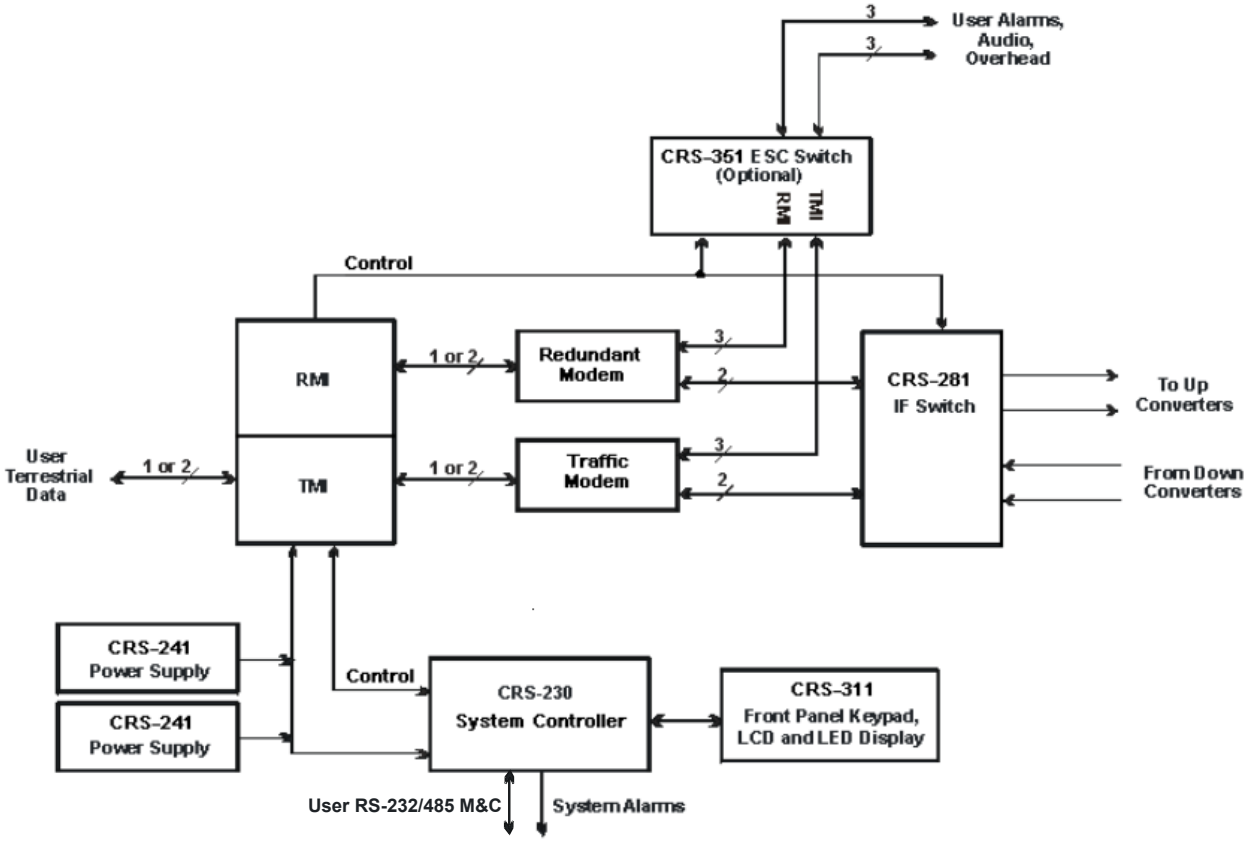


Figure 1-2. System-Level Block Diagram

1.4 Description of CRS-311 Features

1.4.1 Front Panel

Figure 1-3 shows the CRS-311 front panel. The CRS-311 is constructed as a 2RU-high, rack-mounting chassis that can be freestanding if desired. It is provided with rack handles at the front for easy removal from and placement into a rack.

Figure 1-3. CRS-311 Front Panel

1.4.2 Rear Panel

Figure 1-4 shows the back panel of a typical CRS-311 chassis configuration.

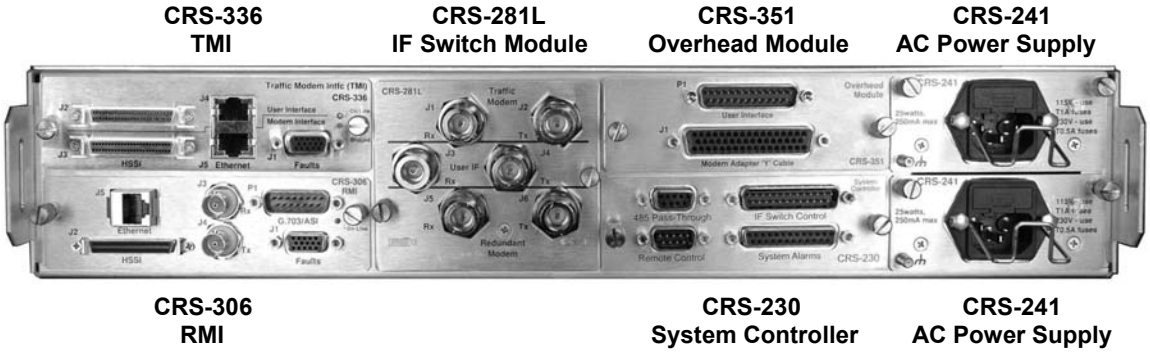


Figure 1-4. CRS-311 Rear Panel Configuration Example

1.4.3 CDM-Qx/QxL, SLM-5650/5650A Modem Interface Cards

The following tables indicate which TMI (Traffic Modem Interface) and which RMI (Redundant Modem Interface) should be used with each modem and data type:

CDM-Qx/QxL Modem		
Data Type	**TMI Type**	**RMI Type**
EIA-530/422/V.35, EIA-232	CRS-316	CRS-305
G.703 T1/E1 Bal D&I , Unbal	CRS-325	
HSSI	CRS-336	
Quad E1	CRS-365	

SLM-5650/5650A Modem		
Data Type	**TMI Type**	**RMI Type (See note 3)**
MIL-STD-188-114, EIA-530/422 or GigE	CRS-316	CRS-307
G.703 Bal/UnBal	CRS-325	CRS-306
HSSI or GigE	CRS-336	CRS-306/307
4-Port Ethernet	CRS-515	CRS-505

1.4.3.1 RMI Cards

Figure 1-5. CRS-305 RMI (PL/11494-1)

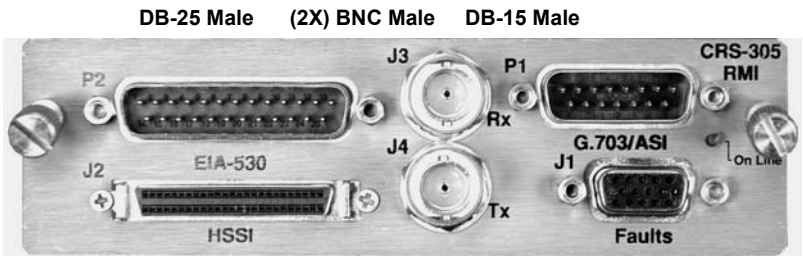


Figure 1-6. CRS-306 RMI (PL/11494-2)

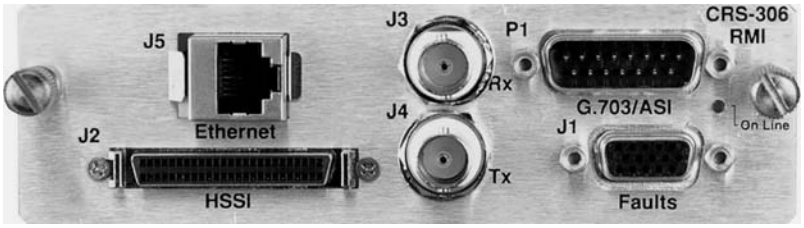


Figure 1-7. CRS-307 RMI (PL/11494-3)

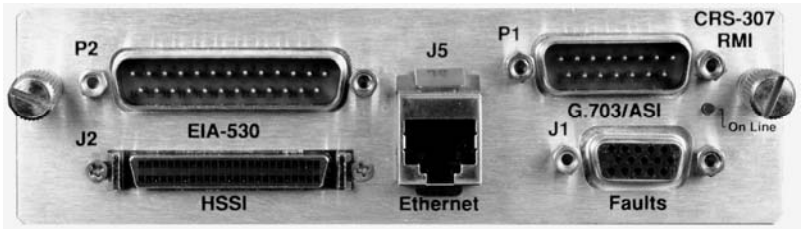
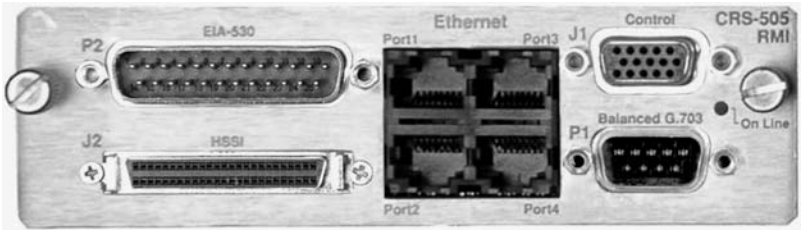


Figure 1-8. CRS-505 RMI (PL-0000293)



1.4.3.2 TMI Cards

Figure 1-9. CRS-316 TMI RS422 / GigE (PL/12498-1)

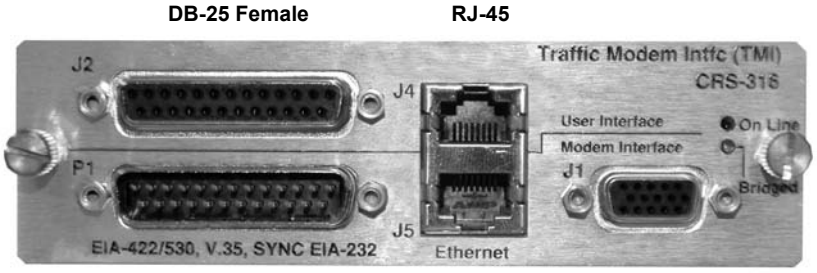


Figure 1-10. CRS-325 TMI G.703 (PL/11492-1)

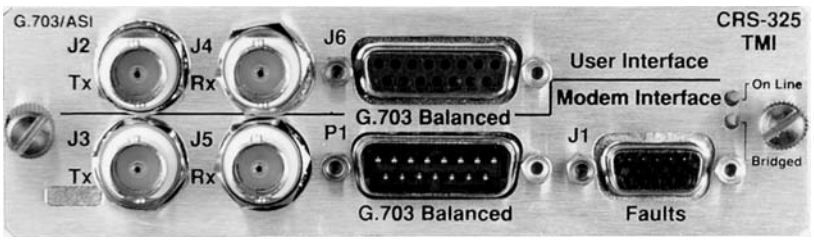


Figure 1-11. CRS-336 TMI HSSI / GigE (PL/12499-1)

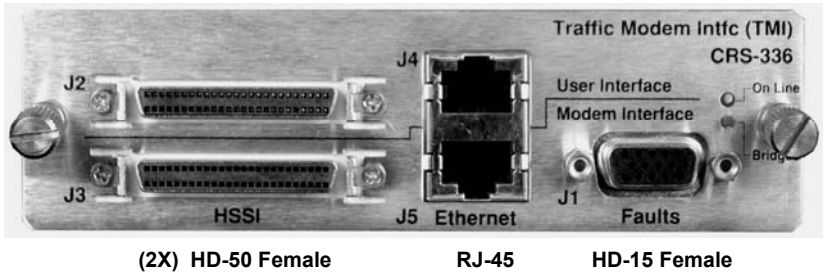


Figure 1-12. CRS-365 TMI Quad E1 (1-4 ports) (PL/12985-1)

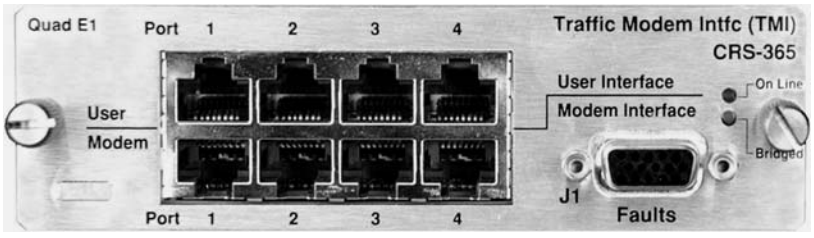
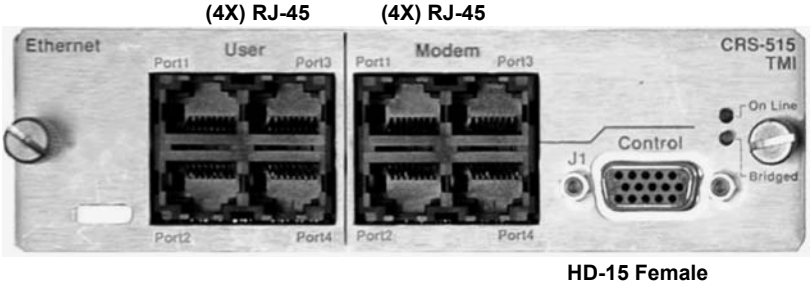


Figure 1-13. CRS-515 TMI 4-Port Ethernet (PL-0000294)



1.4.4 CRS-311 System Controller and Power Supply Card Assemblies

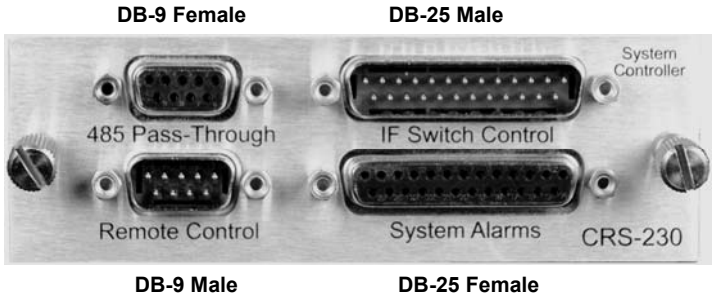


Figure 1-14. CRS-230 System Controller (AS/0377)

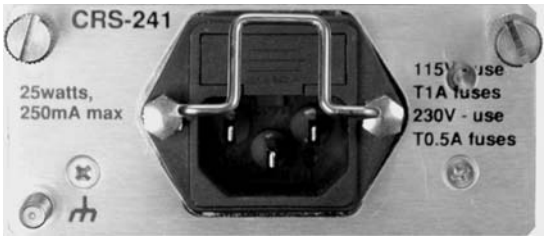


Figure 1-15. CRS-241 AC Power Supply (PL/12067-1)

Figure 1-16. CRS-251 DC Power Supply (PL-0000157)

1.4.5 CRS-281x IF Switch Module Assemblies

The CRS-281/281x are the IF Switch Module Assemblies for the CRS-311. Each module connects the Tx IF signal on the up-converter to the appropriate online modulator, and passively splits the Rx IF signal to provide both demodulators with the same IF signal from the LNB, thus reducing switching time.

Additionally, the CRS-281A switch module switches all of the BUC and LNB interface signals that are multiplexed onto the Tx and Rx coaxial cables:

- Tx and Rx L-Band signals
- 10 MHz reference to BUC and LNB
- DC Power to BUC and LNB
- FSK signaling to the BUC.

1.4.5.1 CRS-281x Switch Modules for the CDM-Qx/QxL

- CRS-281 (70/140 MHz IF) with Type 'BNC' (75Ω or 50Ω) connectors (**Figure 1-17**);
- CRS-281A (L-Band IF) with Type 'N' (50Ω) connectors (**Figure 1-18**).

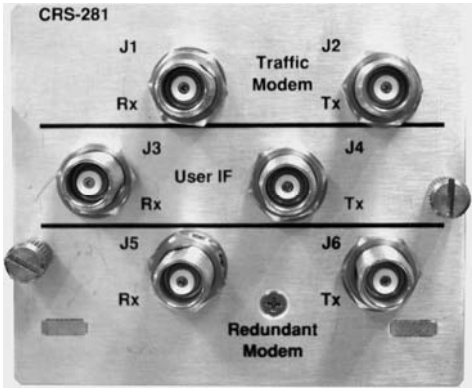


Figure 1-17. CRS-281 IF Switch Module: 70/140 MHz Type 'BNC' (PL/12040-3 [75Ω] or PL/12040-4 [50Ω])

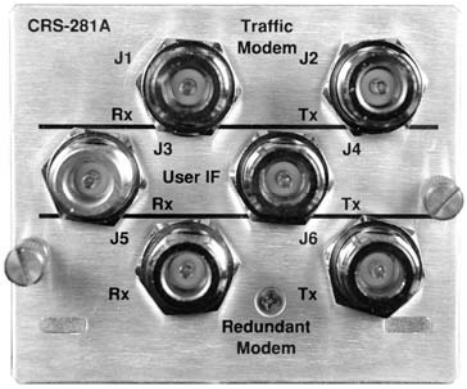


Figure 1-18. CRS-281A IF Switch Module: L-Band Type 'N' 50Ω (PL/13017-1)

1.4.5.2 CRS-281x Switch Modules for the SLM-5650/5650A

- The CRS-281 (70/140 MHz IF) with Type 'TNC' (50Ω) connectors (**Figure 1-19**);
- The CRS-281L (L-Band IF) with Type 'N' connectors (**Figure 1-20**).

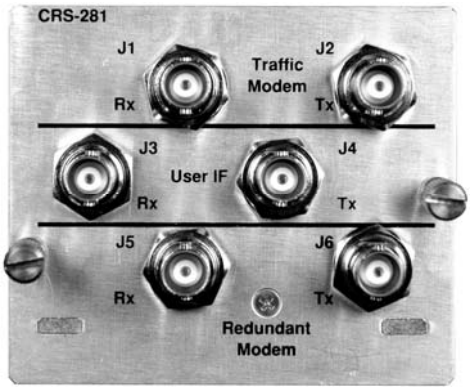


Figure 1-19. CRS-281 IF Switch Module: Type 'TNC' 50Ω (PL/12040-2)

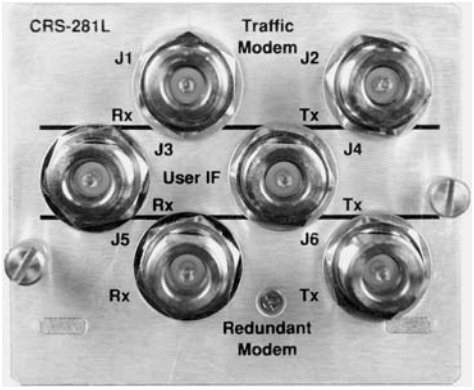
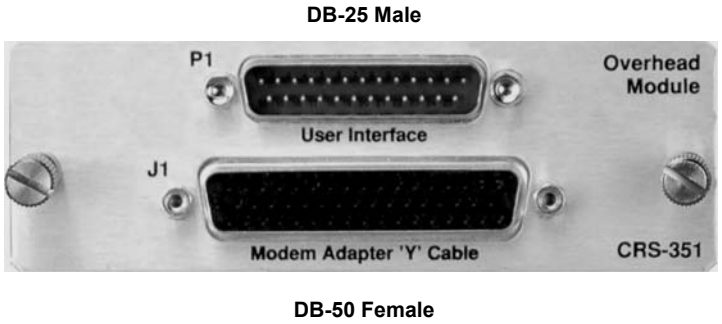


Figure 1-20. CRS-281L IF Switch Module: L-Band Type 'N' 50Ω (PL/12040-1)

1.4.6 CRS-351 Overhead Switch Module Assembly

As explained in detail in the pertinent modem sections of **CHAPTER 3. CABLES AND CONNECTIONS**, the User's equipment should be connected directly to the P1 User Interface port on the CRS-351 Overhead Switch Module (**Figure 1-21**) instead of connecting directly to the SLM-5650/5650A traffic modem's P1 Overhead Data port.

Figure 1-21. CRS-351 Overhead Switch Module (PL/13154-1)



1.5 Summary of Specifications

1.5.1 CRS-311 Specifications

Characteristic	Requirement		
Switch Type	• 1:1 Redundancy Switch system • Bridging architecture • C161 control processor		
Compatible Modems	• SLM-5650/5650A • CDM-Qx/QxL		
Operating Modes	• Fully automatic or manual • Force Traffic Modem to Redundant Modem • Programmable holdoff-to-backup and holdoff-to-restore times (from 1 to 99 seconds)		
Switching Conditions	Switch to Redundant Modem following a Unit fault, Tx traffic fault, or Rx traffic fault		
Switching Time	6 seconds max. (Delay interval set to minimum, 1 sec)		
IF Switching	CRS-311 with CRS-281 IF Module: all modems outputs ON all the time.		
Temperature	• 0 to +50°C (32 to 122°F) Operating • 50 to 100°C (122 to 212°F) Storage		
Humidity	95% at +50°C (122°F), Non-condensing		
Environmental	Operating temperature range 0° to 50°C (32° to 122°F)		
Redundant Modem Signal Source	The traffic paths (bridge mode) (both Rx IF and Tx data)		
Front Panel	• Vacuum Fluorescent Display (VFD): 2 lines @ 24 characters/line. • 6-button Keypad: ENTER, CLEAR, (4X) navigation • LED system status display showing: o Operational status indicators: Unit, Remote, Stored Event o Online status indicators: Traffic or Redundant Modem		
Audible Alarm	Programmable to activate following various changes of state		
Common faults	Dry relay contacts		
AC Prime Power	Two independent inputs: 90 to 264 VAC, 50/60 Hz, at 25 Watts		
DC Power	Two independent inputs: -48 VDC, at 25 Watts		
Dimensional Envelope	19W x 11.2D x 3.75H inch (2RU) (48.26W x 28.4D x 8.9H cm)		
Weight	~ 10 lbs (~ 9.07kg)		
CE Mark	EMC and Safety		
Supported User Data Interfaces (by TMI)	**TMI**	**Connector**	**Data Type**
	CRS-316	DB-25M	EIA-530/422/V.35, EIA-232
		RJ-45	GigE
	CRS-325	DB-15F	G.703 Balanced
		(2X) BNC	G.703 Unbalanced/ASI
	CRS-336	HD-50F	HSSI
		RJ-45	GigE
	CRS-365	(4X) RJ-45	E1 Bal (only)
	CRS-515	(4X) RJ-45	10/100/1000 Ethernet

Characteristic	Requirement			
Supported User Data Interfaces (To TMI/RMI, by Modem)	**Modem**	**Data Interface**	**TMI**	**RMI**
	CDM-Qx/QxL	EIA-530/422/V.35, EIA-232	CRS-316	CRS-305
		G.703 Bal / Unbal	CRS-325	CRS-305
		HSSI	CRS-336	CRS-305
		Quad E1	CRS-365	CRS-305
	SLM-5650/5650A	MIL-STD-188-114, EIA-530	CRS-316	CRS-307
		GigE	CRS-316 *or* CRS-336	CRS-306 *or* CRS-307
		G.703 Bal / UnBal	CRS-325	CRS-306
		HSSI	CRS-336	CRS-306 *or* CRS-307
		4-Port Ethernet	CRS-515	CRS-505

1.5.2 CRS-281x IF Switch Module Specifications

Characteristic	Requirement CRS-281 (70/140MHz)	Requirement CRS-281A/CRS-281L (L-Band)
Tx/Rx Operating Freq	50 to 180 MHz	950-2000 MHz
Tx/Rx Connectors	• TNC (female) with 50Ω path • BNC (female) with 50Ω or 75Ω path	N-Type (female) with 50Ω path
Return Loss	18 dB	> 10 dB on external IF ports
Transmit IF Loss/Flatness: Tx In To Tx Uplink Out BU In To Any Uplink Out	 < 1.5 dB over operating freq < 1.5 dB over operating freq	Tx IF note: Switched by RF relay (1.5 dB max loss, 40 dB min ON/OFF isolation)
Receive IF Loss/Flatness: Rx Downlink In To Rx Out Any Downlink In To BU Out	 < 5 dB over operating freq < 5 dB over operating freq	Rx IF note: Passive power splitting (7 dB max loss)
Tx to Tx Channel Isolation	> 50 dB	> 50 dB
Tx to Rx Channel Isolation	> 60 dB	90dB min
IF Switch Power	From CRS-311 chassis	From CRS-311 chassis
IF, BUC/LNB DC, 10 MHz and BUC FSK Switching	N/A	CRS-281A (CDM-QxL only)

1.6 Dimensional Envelopes

Figure 1-22 shows the dimensional envelope for the CRS-311 1:1 Redundancy Switch.

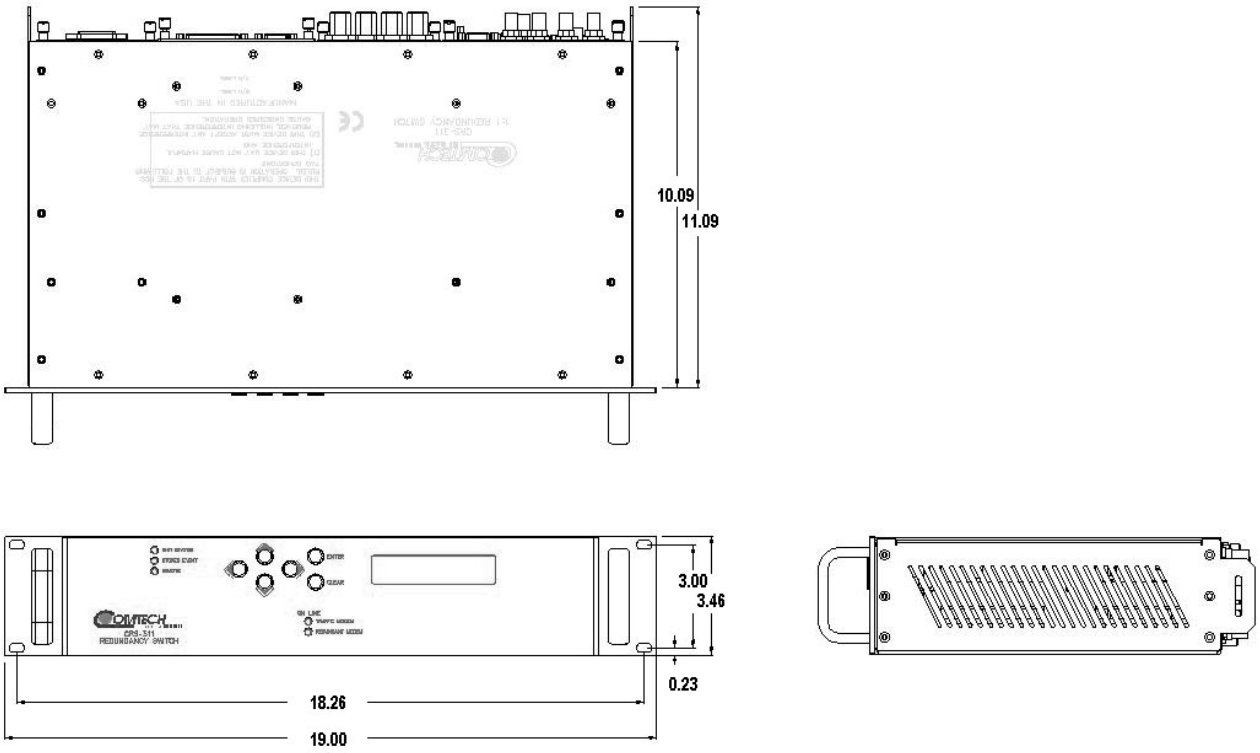


Figure 1-22. CRS-311 Dimensional Envelope

Notes:

Chapter 2. INSTALLATION

2.1 Unpacking and Inspection

Be sure to keep all shipping materials for the carrier's inspection.

Step	Procedure
1	Inspect shipping containers for damage.
2	If shipping containers are damaged, keep them until the contents of the shipment have been carefully inspected and checked for normal operation.
3	Remove the packing list from the outside of the shipping carton.
4	Open the carton and remove the contents.
5	Check the contents against the packing list to verify completeness of the shipment.
6	If damage is evident, contact the carrier and Comtech EF Data immediately and submit a damage report.
7	If the unit needs to be returned to Comtech EF Data, use the original shipping container.

2.2 Rack Mounting

The CRS-311 is constructed as a 2RU-high, rack-mounting chassis. Rack handles are provided to facilitate removal and placement into a rack.

Mount the Switch in the rack using the mounting holes on the front panel. Use the front panel screw holes **only**. DO NOT install rack slides to the side of the CRS-311 chassis – contact Comtech EF Data if there are questions about rack supports.

Figure 2-1 provides a “cut-away” side view of a typical rack configuration for modems combined with the CRS-311. Since the Switch itself is relatively passive, no additional clearance is needed between it and either modem.

It is important to ensure that there is adequate clearance for ventilation in the rack – in rack systems where there is high heat dissipation, provide forced-air cooling by installing top- or bottom-mounted fans or blowers.

IMPORTANT

Do not allow the internal rack temperature to exceed 50°C (122° F).

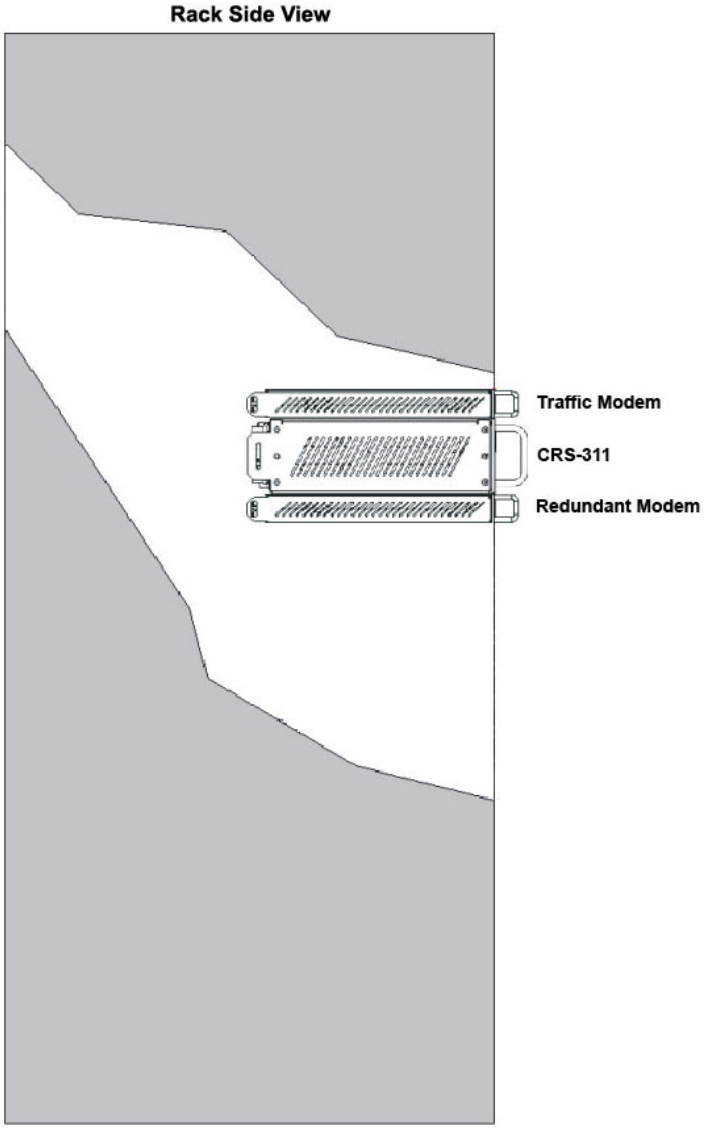


Figure 2-1. Typical Rack-mounted Configuration

Chapter 3.
CABLES AND CONNECTIONS

3.1 Overview

All cables for connecting the CRS-311 1:1 Redundancy Switch to the CDM-Qx/QxL and SLM-5650/5650A modems or within the system are available from Comtech EF Data. These cables can be ordered at the same time the order is placed for the CRS-311.

If fabricated by the customer, the cables required between each modem and Switch plug-in RMI or TMI card should be of shielded, twisted-pair construction, with the grounded shield bonded to the back shell. All data cables should be wired correctly using the pinout and connection information as specified in **Appendix A. CABLE DRAWINGS**.

Leave the Switch and all modems powered off until all connections are ready.

Once the Switch and all the modems have been mounted, the User must properly attach all required cabling. In most cases the modem accepts the male end of the cable, while connectors on the RMI or TMI card accepts the female end of the cable in the section of the card labeled "Modem Interface."

Refer to the subsections in **Sect. 1.4 Description of CRS-311 Features** for detailed information on these interfaces. Illustrations featured throughout this chapter provide cabling configuration examples for RMI or TMI interfaces – i.e., the interconnection of a Redundant Modem to a Switch RMI card, or the interconnection between a Switch TMI card and a Traffic Modem. The step-by-step process for connecting a variety of Switch and modem configurations is also illustrated in this chapter.

Notes:

3.2 CDM-Qx/QxL Modem Connections

- **RS-485 Connections – CRS-311 to Modems**
- **Control 'Y' Cable Connections – CRS-311 to Modems**
- **Traffic Data Connections – CRS-311 to Modems**
- **User Data Connections – CRS-311 to User**
- **IF Connections – User to CRS-281x Module to Modems**

3.2 CDM-Qx/QxL Modem Connections

If adding a modem to an ***operating*** 1:1 system, care needs to be taken to not interfere with the existing *traffic*. The cabling, power-up sequence and COMMs connections must be correct to avoid contention in the system from the modem Tx carrier.

As shown in **Figure 3-2** through **Figure 3-6**, the CA-0000009 Control 'Y' Cable provides fault information from the modem and IF-Mute to the modem, and is therefore always required.

3.2.1 RS-485 Connections – CRS-311 to Modems

The DB-9 RS-485 Multi-drop Cable provides the communication path between the Switch and the modems. There are two RS-485 cables types available: the standard CA-0000096 shielded cable to guard against EMC (Electromagnetic Compatibility) concern, or the optional CA-0000095 ribbon cable. Both are available from Comtech EF Data.

Refer to **Figure 3-1** to connect the standard CA-0000096 or optional CA-0000095 RS-485 Multi-drop Cable between the CRS-311 and each CDM-Qx/QxL as follows:

- Connect and secure (1) each CA/WR11418-1 RS-485 Terminator on each far-end of the RS-485 Multi-drop Cable.
- Connect and secure one end of the CA/WR11419-1 9-pin Null Modem Cable to the DB-9F connector labeled "485 Pass-Through" on the CRS-311's CRS-230 System Controller.
- Connect and secure the appropriate RS-485 Multi-drop Cable to the CDM-Qx/QxL and to the DB-9M connector on the Null Modem Cable.

3.2.2 Control 'Y' Cable Connections – CRS-311 to Modems

All traffic data configurations require the CA-0000009 Control 'Y' Cable connected between the CRS-311 RMI and TMI and to each CDM-Qx/QxL as follows:

- HD-15F connector labeled "J1" on the RMI or TMI, to
- DB-15M connectors labeled "Alarms" on the CDM-Qx/QxL modulator and demodulator cards (located on the modem chassis rear panel):
    - Control 'Y' Cable connector labeled "J1" goes to the modulator "Alarms" connector.
    - Control 'Y' Cable connector labeled "J2" goes to the demodulator "Alarms" connector.

3.2.3 Traffic Data Connections – CRS-311 to Modems

Connect and secure the cables between the CRS-311 and each CDM-Qx/QxL:

If EIA-530 V.35/EIA-232 is the traffic data type, refer to **Figure 3-2** to connect and secure the CA/WR0066-4 25-pin Control and Data Cable as follows:

- DB-25M connector labeled "P2" on the RMI or "P1" on the TMI, to
- DB-25F connector labeled "EIA-530" on the demodulator.

If balanced G.703 is the traffic data type, refer to **Figure 3-3** to connect and secure the CA/WR9038-4 15-pin Data Cable as follows:

- DB-15M connector labeled "P1" on the RMI or TMI, to
- DB-15F connector labeled "G.703" on the demodulator.

If Unbalanced G.703 is the traffic data type, refer to **Figure 3-4** to first connect and secure the CA/WR0813-4 BNC Tx Cable as follows:

- BNC connector labeled "J4" on the RMI or "J3" on the TMI, to
- BNC connector labeled "Tx" on the demodulator.

Next, connect and secure the CA/WR0813-4 BNC Rx Cable as follows:

- BNC connector labeled "J3" on the RMI or "J5" on the TMI, to
- BNC connector labeled "Rx" on the demodulator.

If HSSI is the traffic data type, refer to **Figure 3-5** to connect and secure the CA/WR9189-4 HSSI Data Cable as follows:

- HSSI connector labeled "J2" on the RMI or "J3" on the TMI, to
- HSSI connector labeled "HSSI" on the demodulator.

If Quad E1 is the traffic data type, refer to **Figure 3-6** to first connect and secure the

CA/WR13018-2 Quad E1 RMI Data Cable as follows:

- DB-15M connector labeled "P1" on the RMI, to
- <4X> RJ-48 connectors labeled "Port 1" through "Port 4" on the Redundant Modem.

Next, connect and secure the <4X> PP/CAT5FF3FTGY Quad E1 TMI Data Cables as follows:

- RJ-48 connectors labeled "Port 1" through "4" on the TMI, to
- RJ-48 connectors labeled "Port 1" through "Port 4" on the Traffic Modem.

3.2.4 User Data Connections – CRS-311 to User

The User's traffic data from multiplexing equipment or a test data generator should connect to the connectors on the TMI labeled "User Data Interface". This interface replaces the direct connection to the Traffic Modem's "Data Interface" connectors.

Because the Redundant Modem's function is to replace a faulted terrestrial modem, the RMI does not have a User Data Interface.

Refer to **Sect. 1.4.3 CDM-Qx/QxL, SLM-5650/5650A Modem Interface Cards** for detailed information on the RMI and TMI cards available for use with the CDM-Qx/QxL modem.

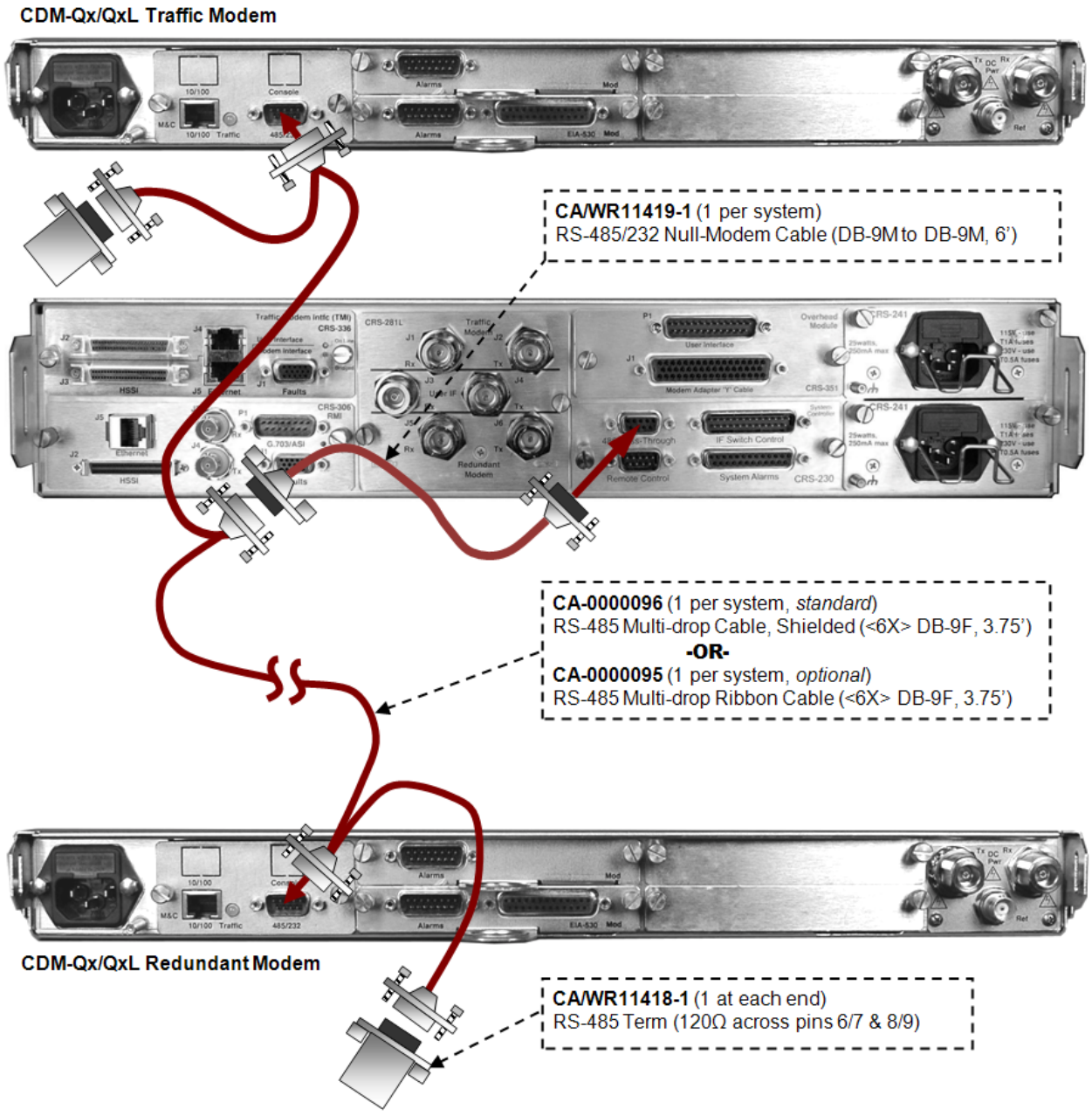


Figure 3-1. CDM-Qx/QxL Cabling Example – RS-485 Multi-drop Cable

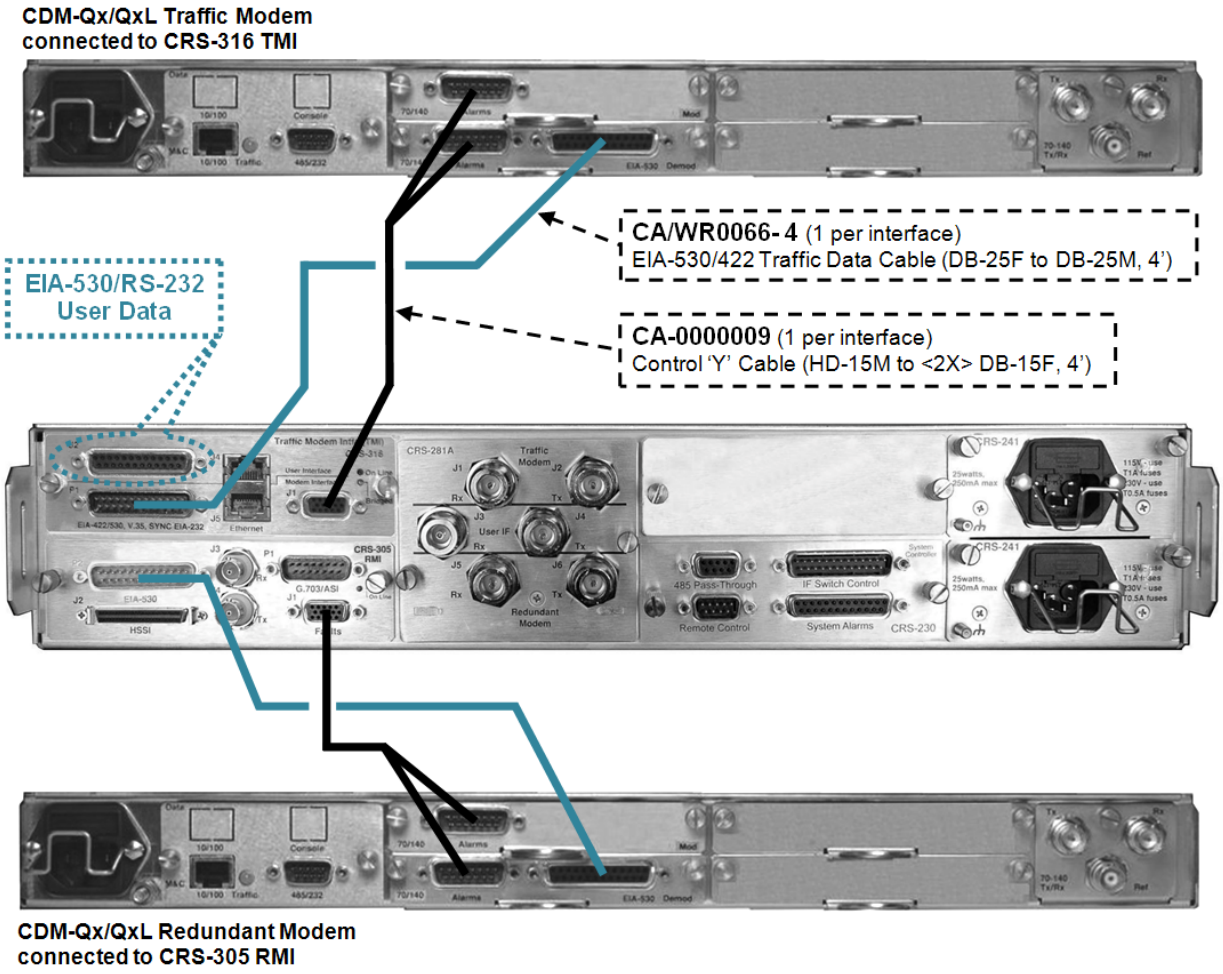


Figure 3-2. CDM-Qx/QxL Control 'Y' and EIA-530/RS-232 Traffic Data Cables

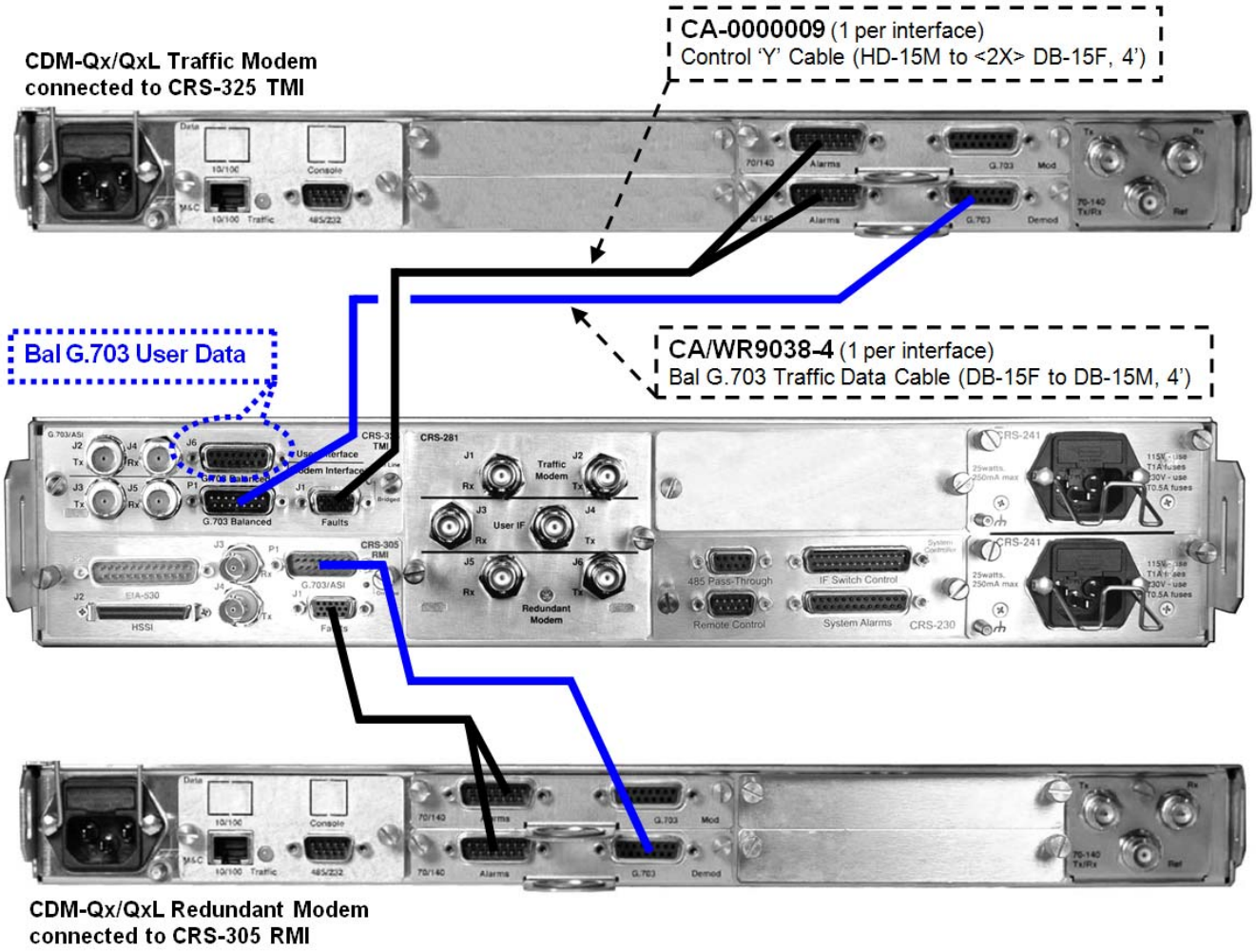


Figure 3-3. CDM-Qx/QxL Control 'Y' and Balanced G.703 Traffic Data Cables

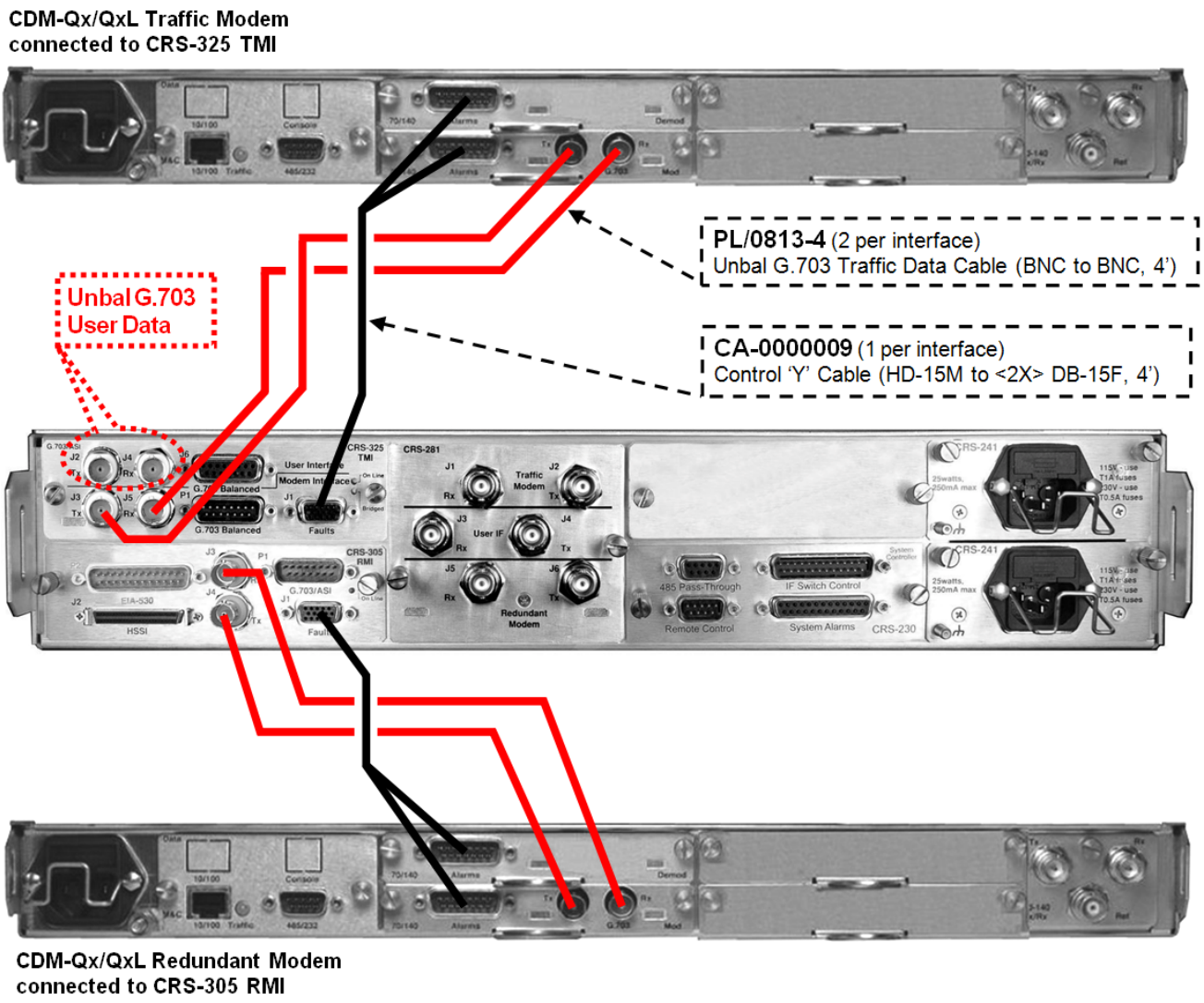


Figure 3-4. CDM-Qx/QxL Control 'Y' and Unbalanced G.703 Traffic Data Cables

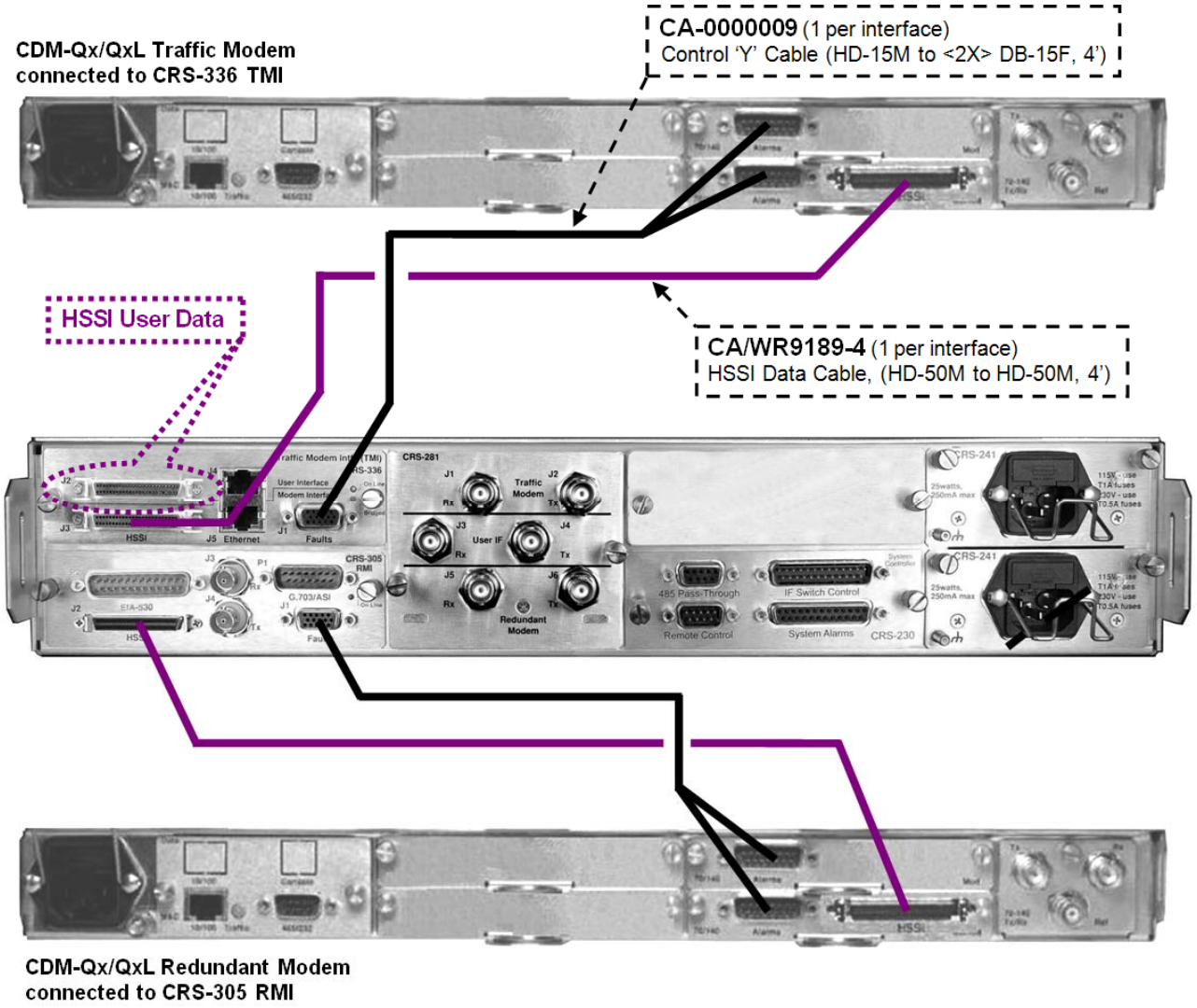


Figure 3-5. CDM-Qx/QxL Control and HSSI Traffic Data Cables

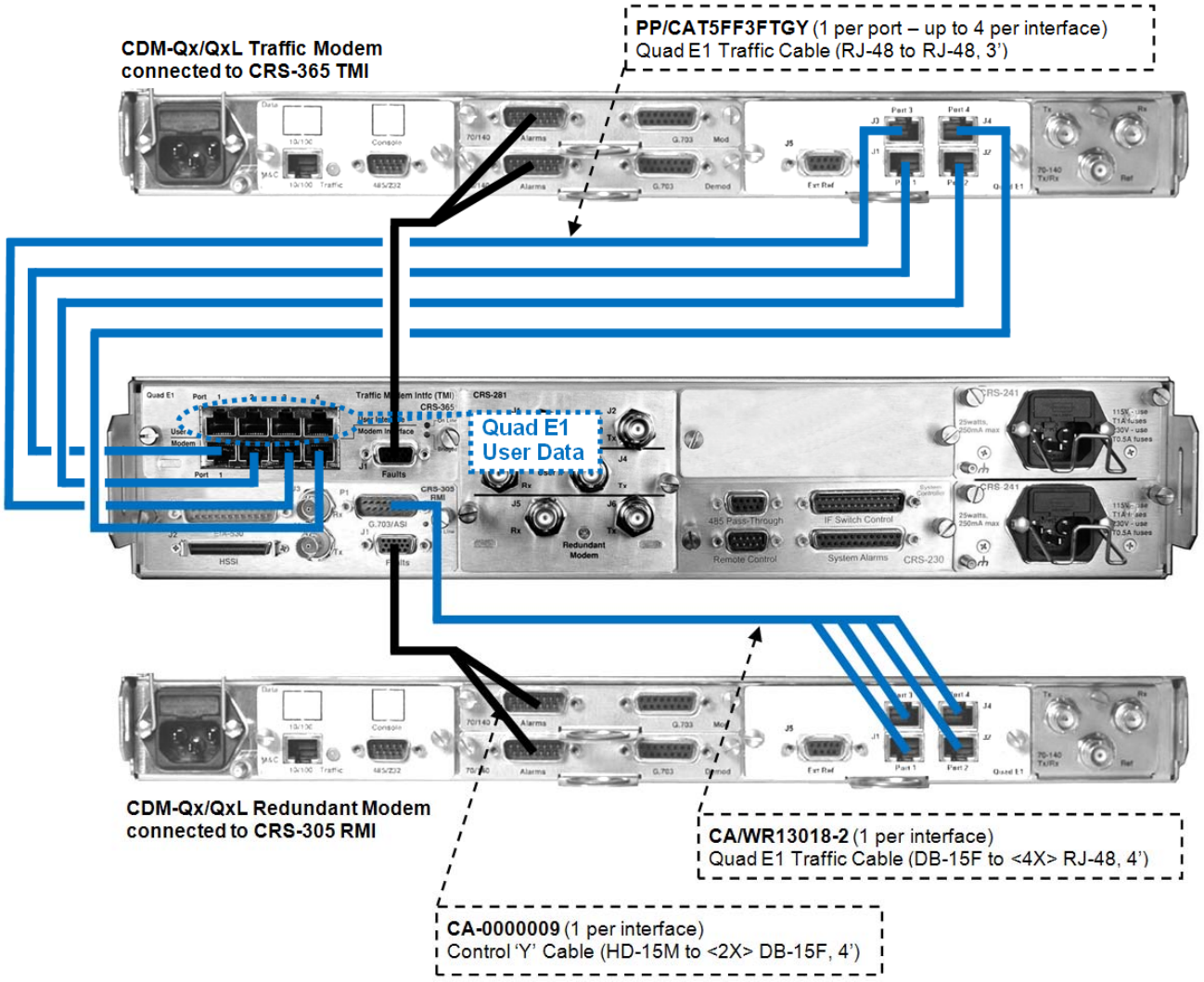


Figure 3-6. CDM-Qx/QxL Control and Quad E1 Traffic Data Cables

3.2.5 IF Connections – User to CRS-281x Module to Modems

The CRS-281x module connects the online modulator's Tx IF signal to the User's RF up-converter. It also passively splits the receive IF signal to provide both demodulators with the same IF signal coming from the LNB, thus reducing switching time.

For 70/140MHz IF switching, the CDM-Qx uses the CRS-281 IF Switch Module with either 50Ω or 75Ω BNC connectors (**Figure 3-7)**.

The CRS-281A IF Switch Module is intended for use with the CDM-QxL for L-Band with Type 'N' connectors (**Figure 3-8**). This model also switches all of the BUC and LNB interface signals that are multiplexed onto the transmit and receive coaxial cables, including:

- Tx and Rx L-Band signals
- 10 MHz reference to BUC and LNB
- DC Power to BUC and LNB
- FSK signaling to the BUC

IMPORTANT

To prevent problems resulting from an impedance mismatch, ensure that the impedance for the modem's cables and combiner are the same.

Refer to **Figure 3-7** and **Figure 3-8** to connect and secure the IF cable pairs –PL/0946-1 50Ω or PL/0813-4 75Ω Type 'BNC' or CA/RF10453-4 Type 'N' – between the User's up-/down-converters, CRS-311, and CDM-Qx/QxL modems as follows:

Traffic Modem Connections:

- From the "Rx" connector on the CDM-Qx/QxL to the connector labeled "J1 Rx" on the CRS-281x Switch Module, and
- From the "Tx" connector on the CDM-Qx/QxL to the connector labeled "J2 Tx" on the CRS-281x Switch Module.

User Connections:

- From the User's down-converter to the connector labeled "J3 Rx" on the CRS-281x Switch Module, and
- From the User's up-converter to the connector labeled "J4 Tx" on the CRS-281x Switch Module.

Redundant Modem Connections:

- From the "Rx" connector on the CDM-Qx/QxL to the connector labeled "J5 Rx" on the CRS-281x Switch Module, and
- From the "Tx" connector on the CDM-Qx/QxL to the connector labeled "J6 Tx" on the CRS-281x Switch Module.

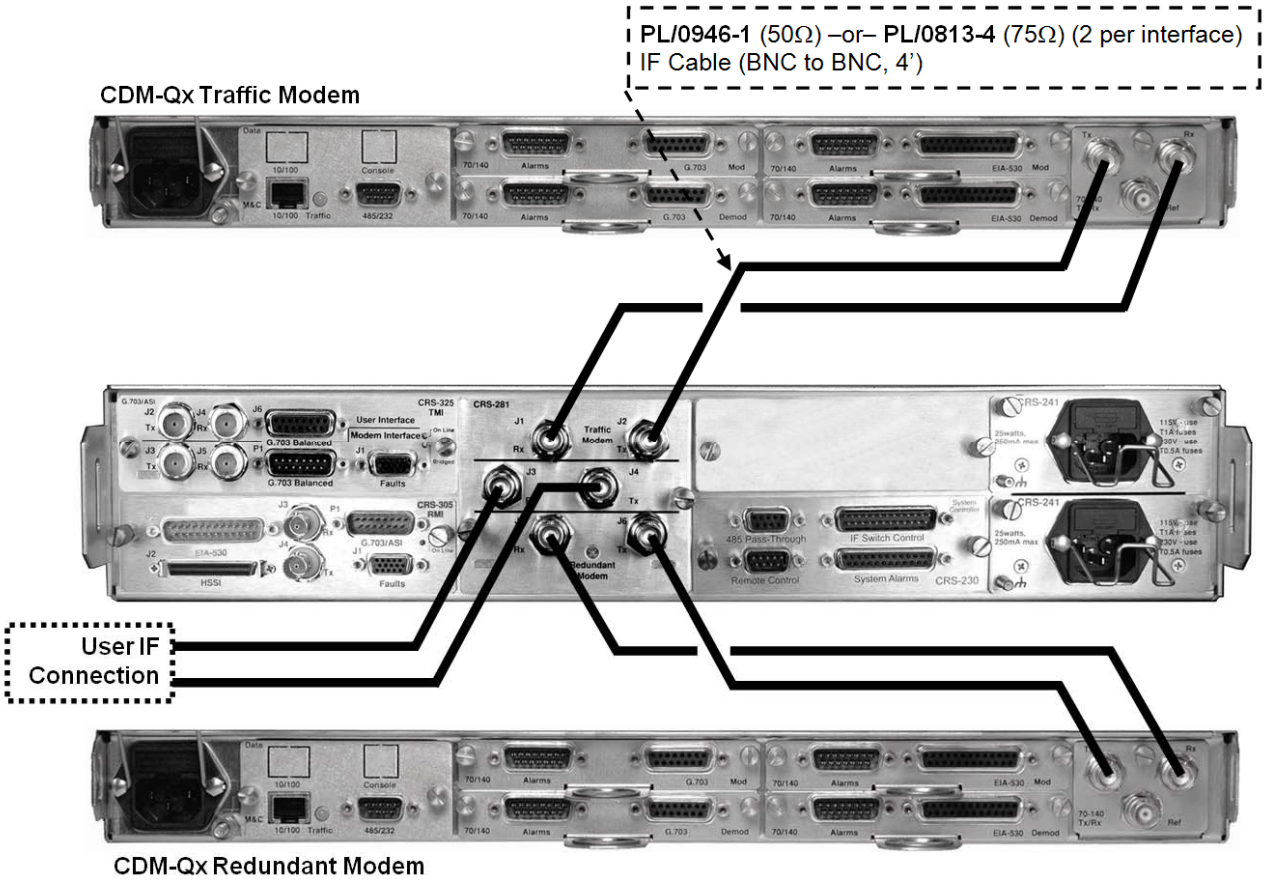


Figure 3-7. CDM-Qx IF Cabling Example – CRS-281 (70/140 MhZ, 50Ω or 75Ω BNC)

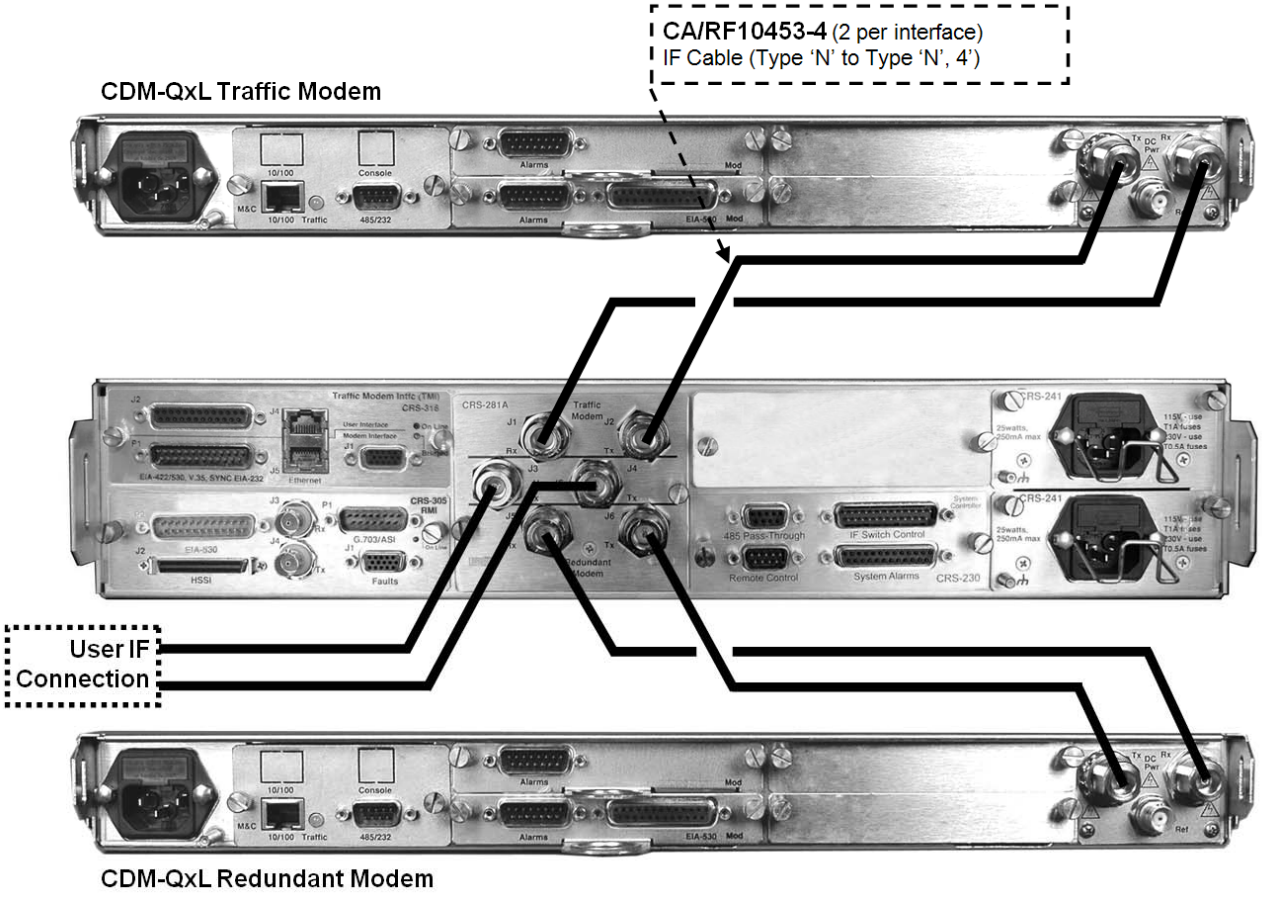


Figure 3-8. CDM-QxL IF Cabling Example – CRS-281A (L-Band)

3.3 SLM-5650/5650A Modem Connections

- **Control Cable Connections – CRS-311 to Modems**
- **Serial Traffic Data Connections – CRS-311 to Modems**
- **Ethernet Traffic Data Connections – CRS-311 to Modems**
- **User Data Connections – CRS-311 to User**
- **Overhead Data Connections – CRS-351 Module to User**
- **IF Cable Connections – User to CRS-281x Module to Modems**

3.3 SLM-5650/5650A Modem Connections

If adding a modem to an ***operating*** 1:1 system, care needs to be taken to not interfere with the existing Traffic Modem. The cabling, power-up sequence, and communication connections must be correct to avoid contention in the system from the modem Tx carrier.

3.3.1 Control Cable Connections – CRS-311 to Modems

The CA/WR12136-2 Control Cable provides the serial communication path between the Switch and the modems and controls the modem's external Tx IF-mute control line, and is therefore always required.

To provide User access to the AGC and I&Q outputs of the modem, the CA/WR12842-4 (4' length) and CA/WR12842-6 (6' length) Control 'Y' Cables, sold separately, are available for use in place of the CA/WR12136-2 Control Cable. See **Appendix A. CABLE DRAWINGS** for detailed information about these optional cable assemblies.

Refer to **Figure 3-9**, **Figure 3-10**, and **Figure 3-11** to connect and secure the CA/WR12136-2 Control Cable (or the CA/WR12842-4 Control 'Y' Cables, if used) as follows:

- HD-15F connector labeled "J1" on the RMI or TMI, and
- HD-15F connector labeled "J9 Auxiliary" on the SLM-5650/5650A.

3.3.2 Serial Traffic Data Connections – CRS-311 to Modems

If HSSI is the traffic data type, refer to **Figure 3-9** to connect and secure the CA/WR9189-4 HSSI Data Cable as follows:

- HSSI (HD-50F) connector labeled "J2" on the RMI or "J3" on the TMI, and
- HSSI (HD-50F) connector labeled "J7 HSSI" on the SLM-5650/5650A.

Referring to **Figure 3-10*:***

If balanced G.703 is the traffic data type (when available via the optional G.703 Interface Module), connect and secure the CA/WR9038-4 Balanced G.703 Data Cable as follows:

- DB-15M connector labeled "P1" on the RMI or TMI, and
- DB-15F connector labeled "J1 Bal Data" on the SLM-5650/5650A.

If Unbalanced G.703 is the traffic data type (when available via the optional G.703 Interface Module), connect and secure the pair of PL/0813-4 Data Cables between the SLM-5650/5650A and the CRS-311 as follows:

- BNC connectors labeled "J4 Tx" on the RMI or "J3 Tx"on the TMI to BNC connectors labeled "J3 Rx" on the SLM-5650/5650A, and
- BNC connectors labeled "J3 Rx" on the RMI or "J5 Rx"on the TMI to BNC connectors labeled "J2 Tx" on the SLM-5650/5650A.

If EIA-530 is the traffic data type, refer to **Figure 3-11** to connect and secure the A/WR0066-4 Data Cable as follows:

- DB-25M connector labeled "P2" on the RMI or "P1" on the TMI, and
- DB-25F connector labeled "J6 EIA530" on the SLM-5650/5650A.

When Ethernet is the traffic data type, refer to **Figure 3-9**, **Figure 3-12**, or **Figure 3-13** to connect and secure all Cat5 Data Cables PP/CAT5FF3FTGY as follows:

- **For single-port Ethernet in Bridge Mode (when available via the optional GigE Interface card)**, as shown in **Figure 3-9**:
  - RJ-45 connector labeled "J5" on the RMI or TMI, to
  - RJ-45 connector labeled "J1" on the optional GigE Interface card.
- **For multi-port Ethernet in Bridge Mode (when available via the optional Network Processor Interface Module)**, as shown in **Figure 3-12**:
  - RJ-45 connector labeled "Port 2" through "Port 4" on the RMI or TMI, to
  - RJ-45 connector labeled "Port 2" through "Port 4" on the optional Network Processor Interface Module.

Do not connect to Port 1 on the RMI, TMI, or optional Network Processor Interface Module when operating in Ethernet Bridge Mode.

- **For multi-port Ethernet in Router Mode (when available via the optional Network Processor Interface Module)**, as shown in **Figure 3-13**:
  - RJ-45 connector labeled "Port 1" through "Port 4" on the RMI or TMI, to
  - RJ-45 connector labeled "Port 1" through "Port 4" on the optional Network Processor Interface Module.

3.3.3 User Data Connections – CRS-311 to User

The User's traffic data from an external router, multiplexing equipment or test data generator should connect to the connectors on the TMI labeled "User Data Interface". This interface replaces the direct connection to the Traffic Modem's "Data Interface" connectors.

Because the Redundant Modem's function is to replace a faulted Traffic Modem, the RMI does not have a User Data Interface.

Refer to **Sect. 1.4.3 CDM-Qx/QxL, SLM-5650/5650A Modem Interface Cards** for detailed information on the RMI and TMI cards available for use with the SLM-5650/5650A modem.

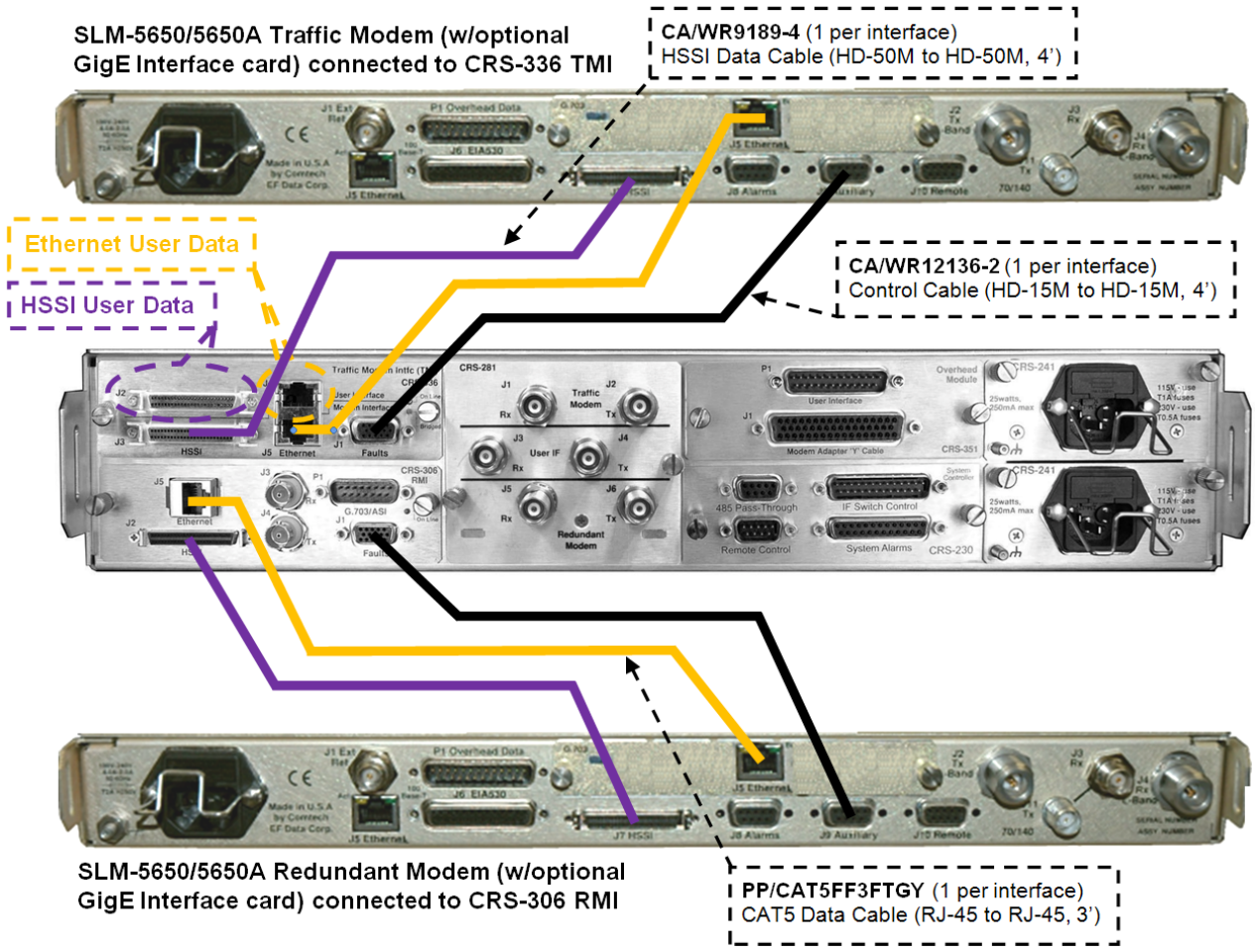


Figure 3-9. SLM-5650/5650A Control and HSSI, Ethernet Traffic (Single Port Bridge Mode) Data Cables

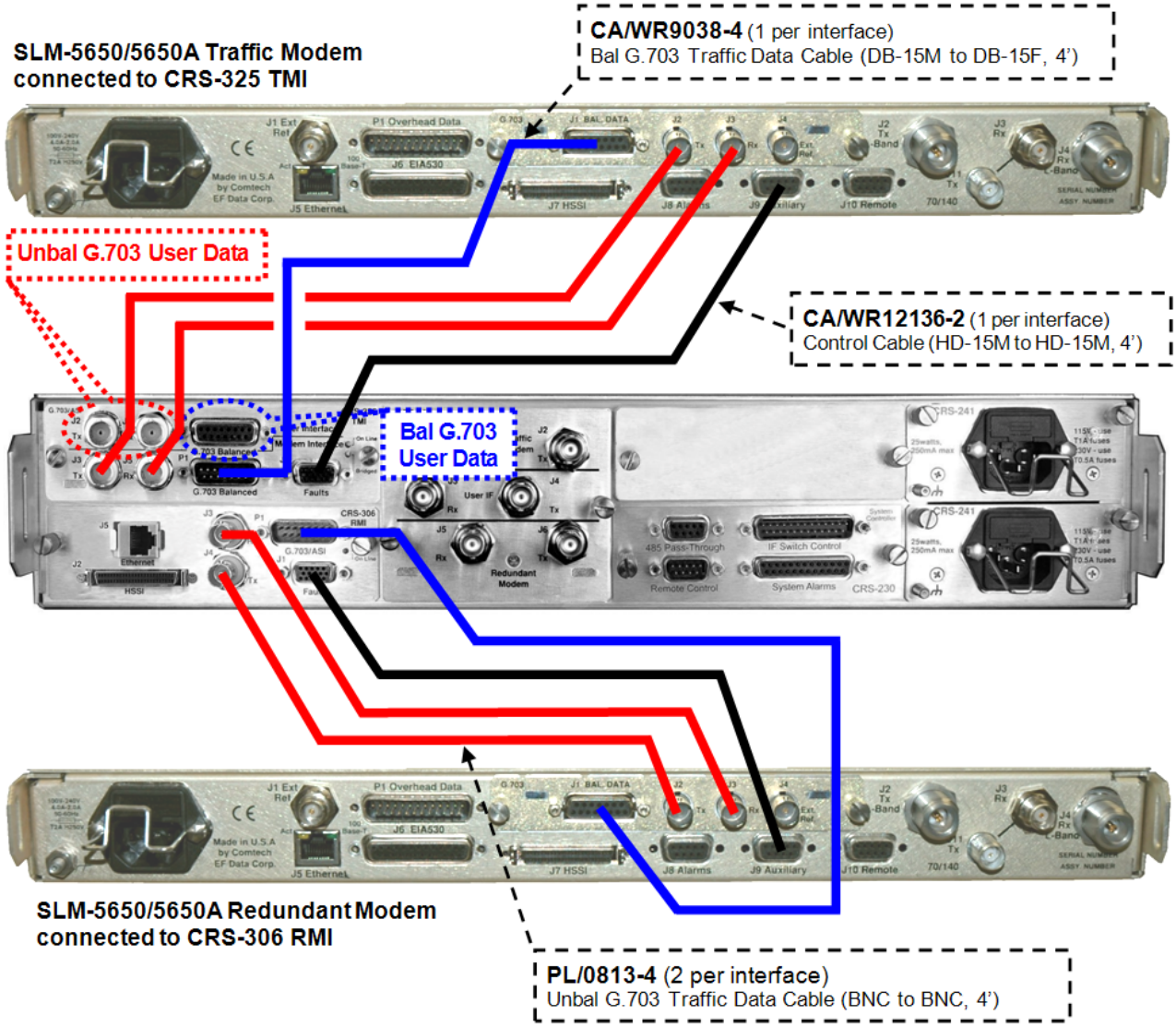


Figure 3-10. SLM-5650/5650A Control and G.703 Traffic Data Cables

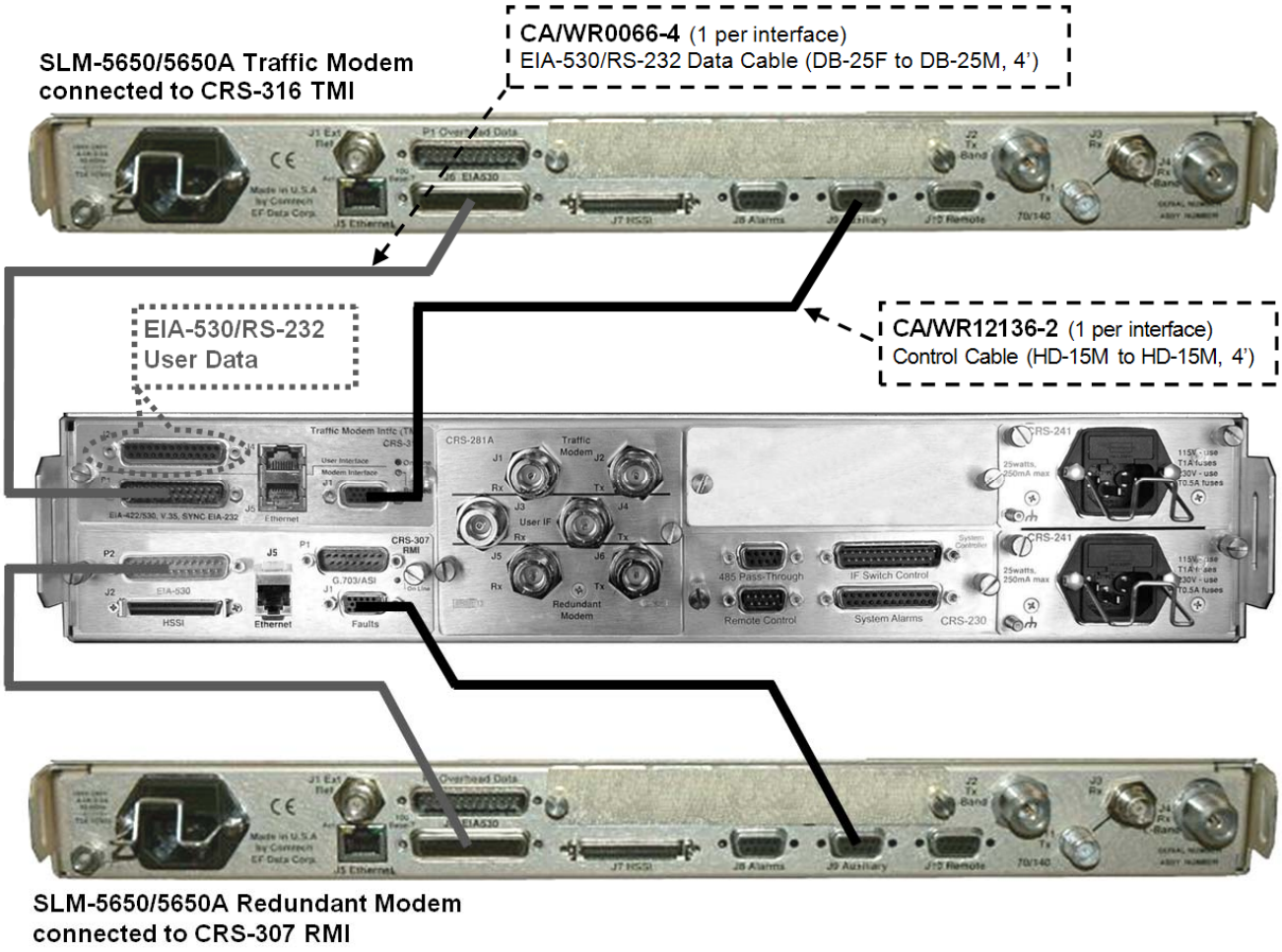


Figure 3-11. SLM-5650/5650A Control and EIA-530 Traffic Data Cables

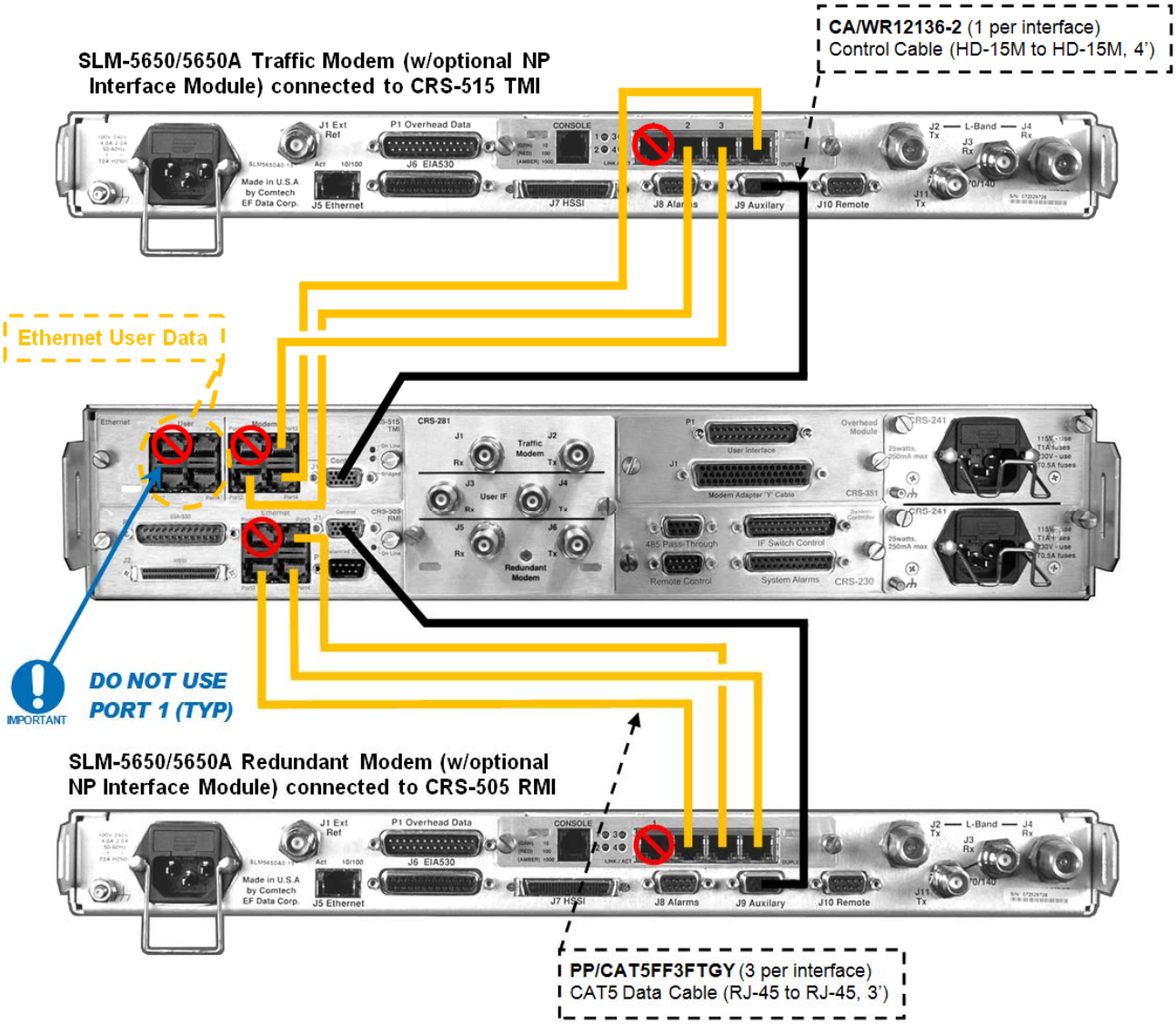


Figure 3-12. SLM-5650/5650A Control and Ethernet Traffic (Multi-Port Bridge Mode) Data Cables

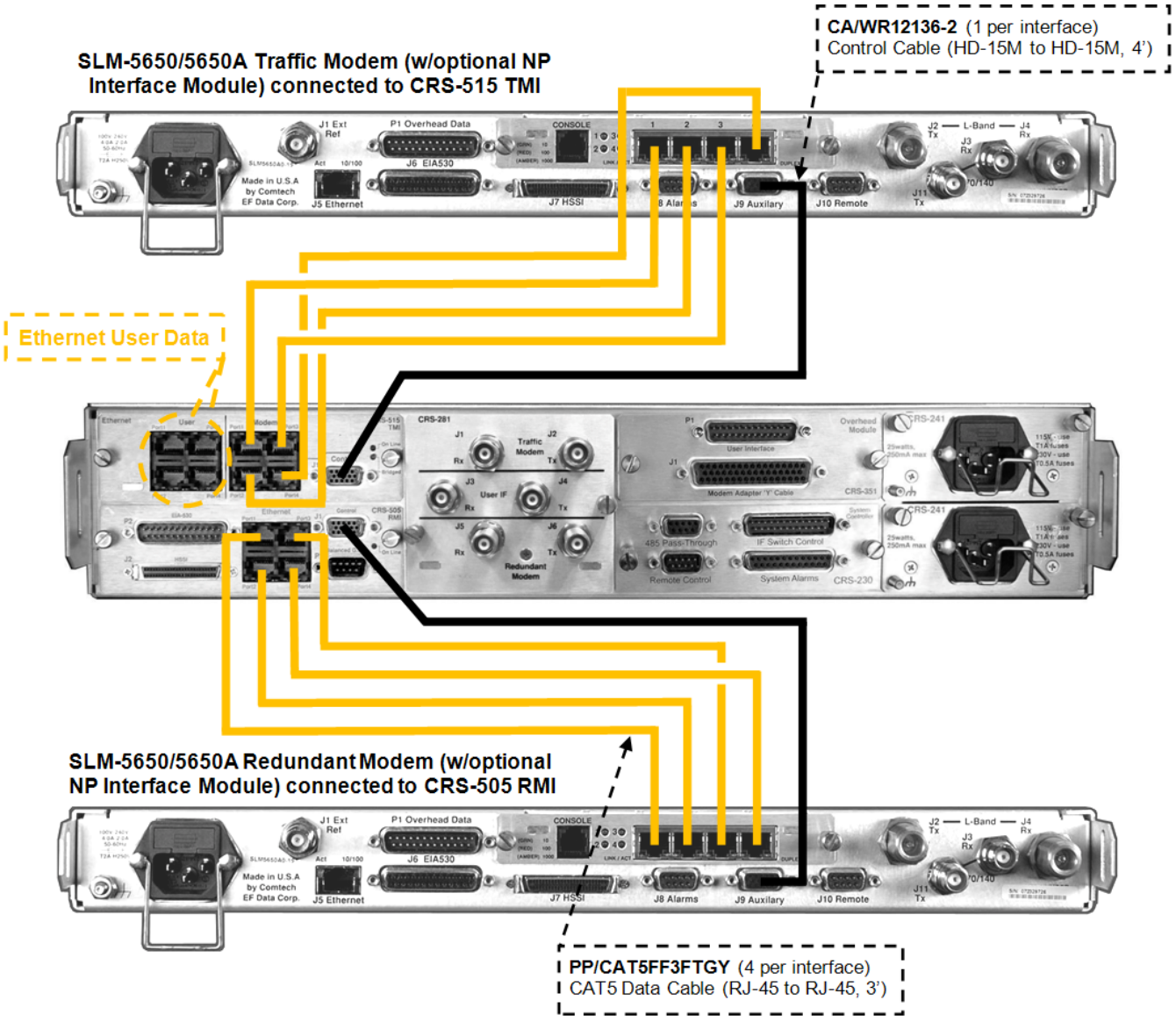


Figure 3-13. SLM-5650/5650A Control and Ethernet Traffic (Multi-Port Router Mode) Data Cables

3.3.4 Overhead Data Connections – CRS-351 Module to Modems

The User's equipment should be connected to the "P1 User Interface" port on the CRS-351 module. This replaces the direct connection to the Traffic Modem's "P1 Overhead Data" port.

Refer to **Figure 3-14** to connect and secure the CA-0000006 Control 'Y' Cable between the CRS-351 module and the SLM-5650/5650A modems as follows:

- DB-50F connector labeled "J1 Modem Adapter "Y" Cable" on the CRS-351 module, and
- DB-25M "P1 Overhead Data" connectors on the SLM-5650/5650A Traffic and Redundant modems.

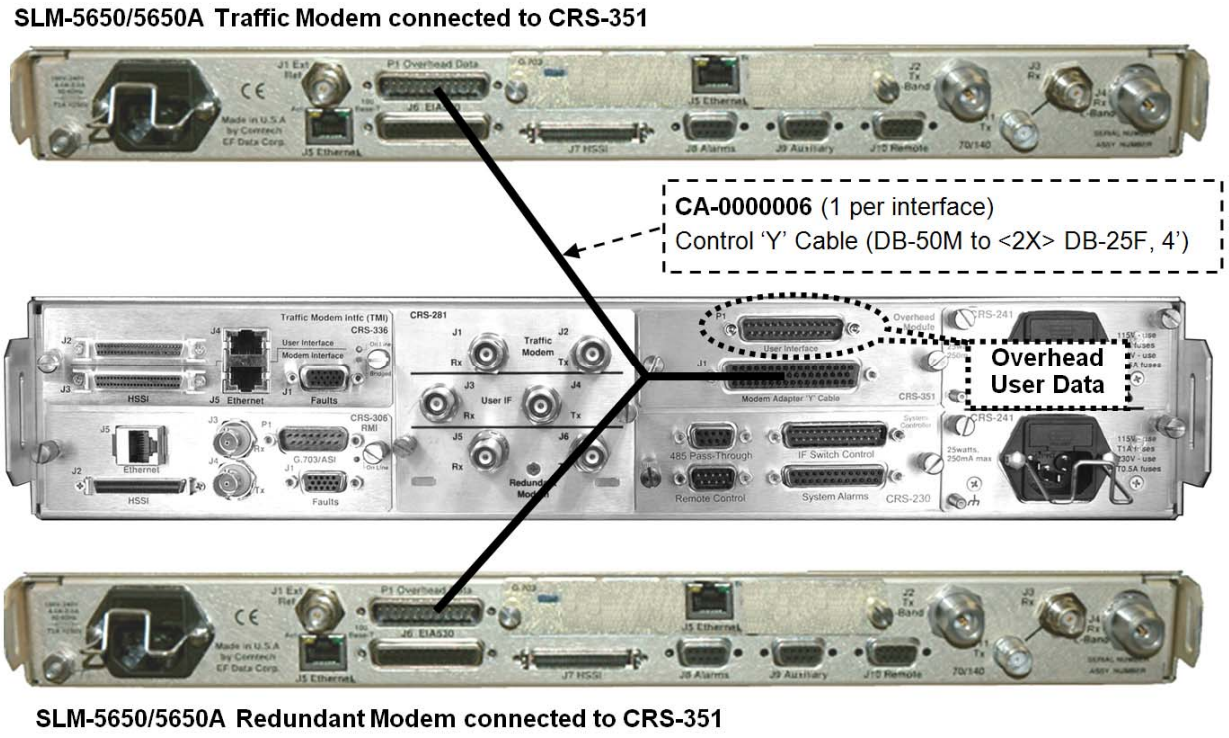


Figure 3-14. SLM-5650/5650A Overhead Data Cables

3.3.5 IF Connections – User to CRS-281x to Modems

The CRS-281x modules connect the online modulator's Tx IF signal to the User's RF up-converter. It also passively splits the receive IF signal to provide both demodulators with the same IF signal coming from the LNB, thus reducing switching time.

For 70/140MHz IF switching, the SLM-5650/5650A uses the CRS-281 IF Switch Module with 50Ω TNC connectors (**Figure 3-15**).

The CRS-281L IF Switch Module is intended for use with the SLM-5650/5650A for L-Band with N-type connectors (**Figure 3-16**).

Refer to **Figure 3-15** and **Figure 3-16** to connect and secure the IF cable pairs – CA/3005-3 TNC or CA/RF10453-4 Type-N – between the User's up-/down-converters, CRS-311, and SLM-5650/5650A modems as follows:

Traffic Modem Connections:

- From the "J3 Rx" (70/140 MHz) or "J4 Rx" (L-Band) connector on the SLM-5650/5650A, to the connector labeled "J1 Rx" on the CRS-281x Switch Module, and
- From the "J1 Tx" (70/140 MHz) or "J2 Tx" (L-Band) connector on the SLM-5650/5650A to the connector labeled "J2 Tx" on the CRS-281x Switch Module.

User Connections:

- From the User's down-converter to the connector labeled "J3 Rx" on the CRS-281x Switch Module, and
- From the User's up-converter to the connector labeled "J4 Tx" on the CRS-281x Switch Module.

Redundant Modem Connections:

- From the "J3 Rx" (70/140 MHz) or "J4 Rx" (L-Band) connector on the SLM-5650/5650A to the connector labeled "J5 Rx" on the CRS-281x Switch Module, and
- From the "J1 Tx" (70/140 MHz) or "J2 Tx" (L-Band) connector on the SLM-5650/5650A to the connector labeled "J6 Tx" on the CRS-281x Switch Module.

Mixed IF Bands for Tx/Rx:

IMPORTANT

The SLM-5650/5650A modem permits simultaneous operation of the Tx IF and Rx IF bands at 70/140 MHz and L-Band frequencies, independent of one another. If the user wants the Tx and Rx to be of different IF bands, the CRS-281x module must be selected based on the Tx IF band. An external splitter is then used for the Rx IF band when that side differs from the Tx IF band – refer to* Figure 3-17 *and* Figure 3-18 *for these mixed-use configuration examples.

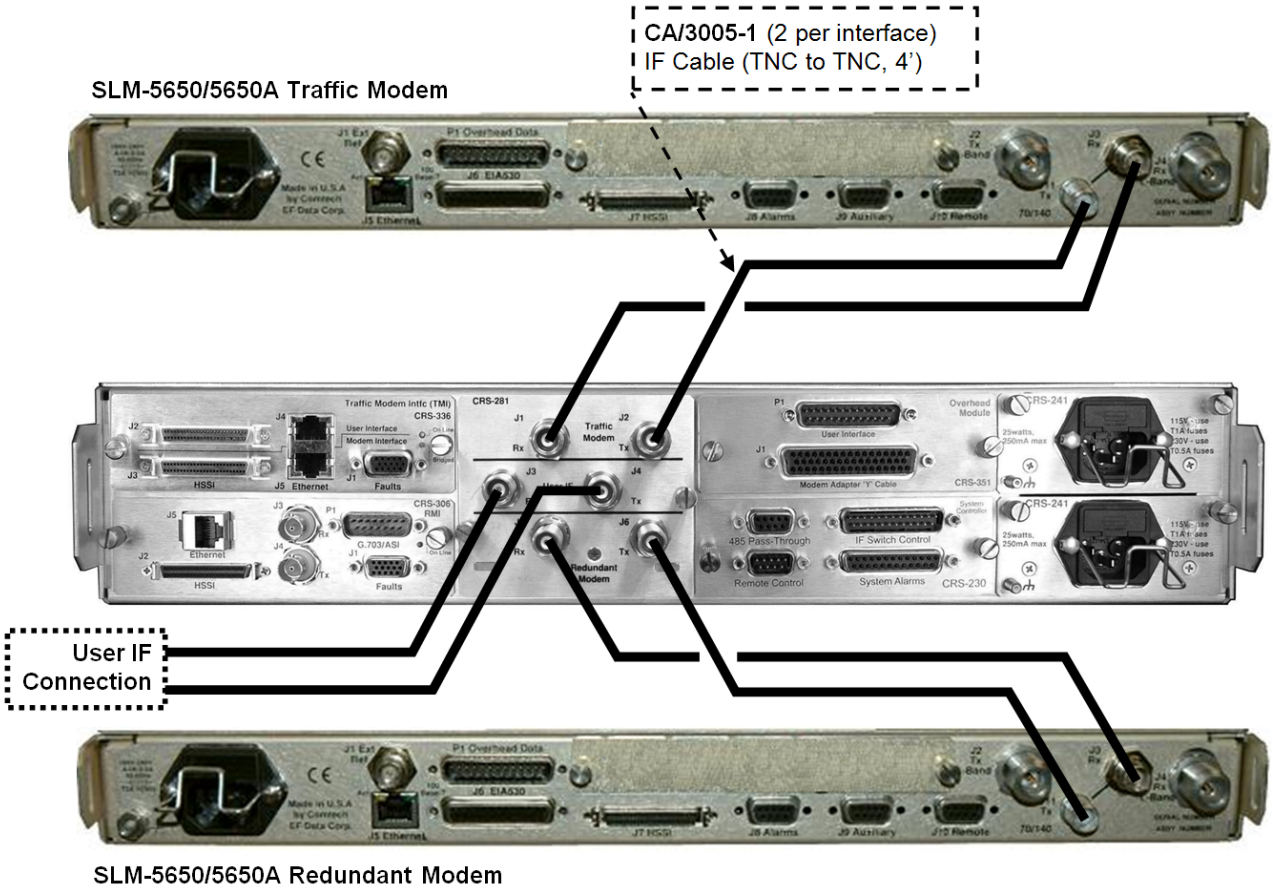


Figure 3-15. SLM-5650/5650A IF Cabling Example – CRS-281 (70/140 MHz)

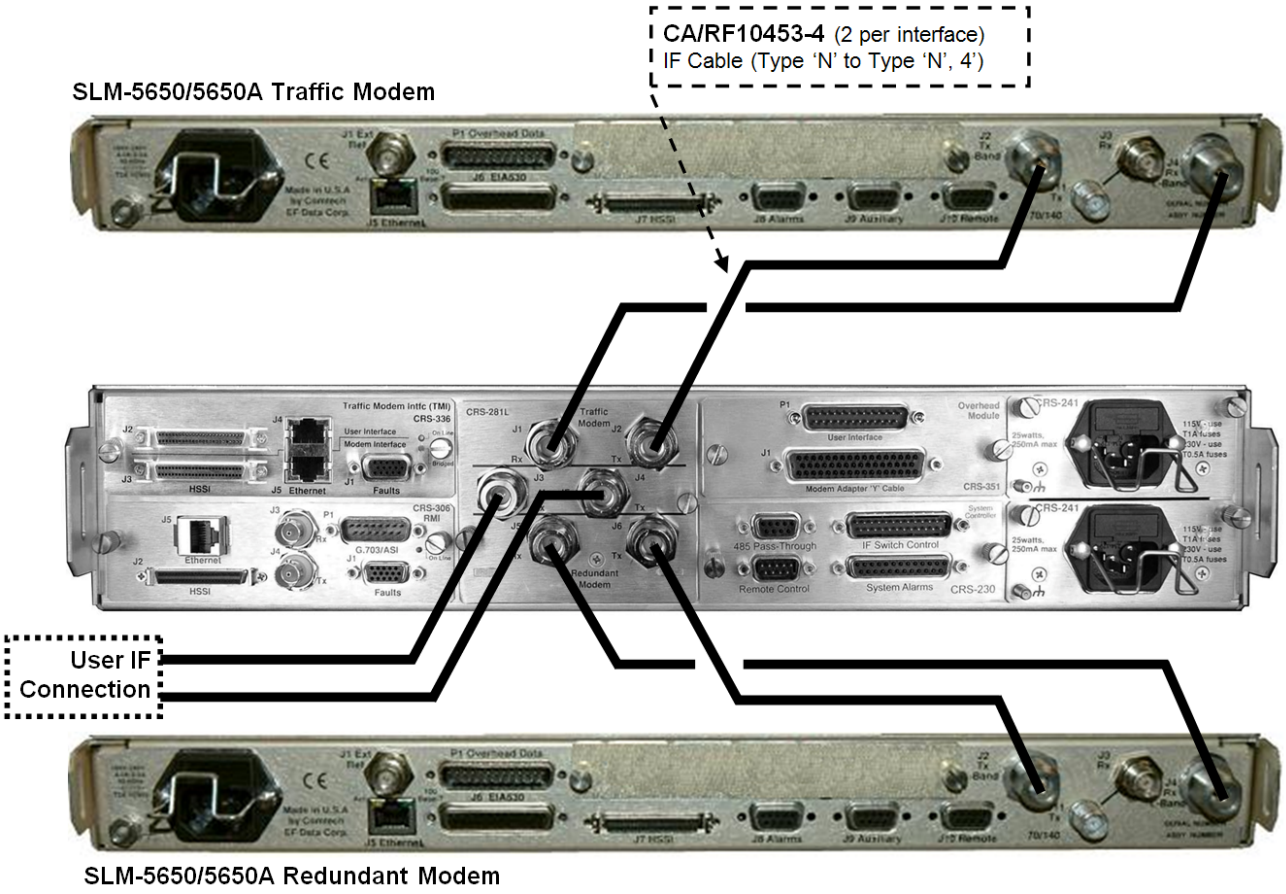


Figure 3-16. SLM-5650/5650A IF Cabling Example – CRS-281L (L-Band)

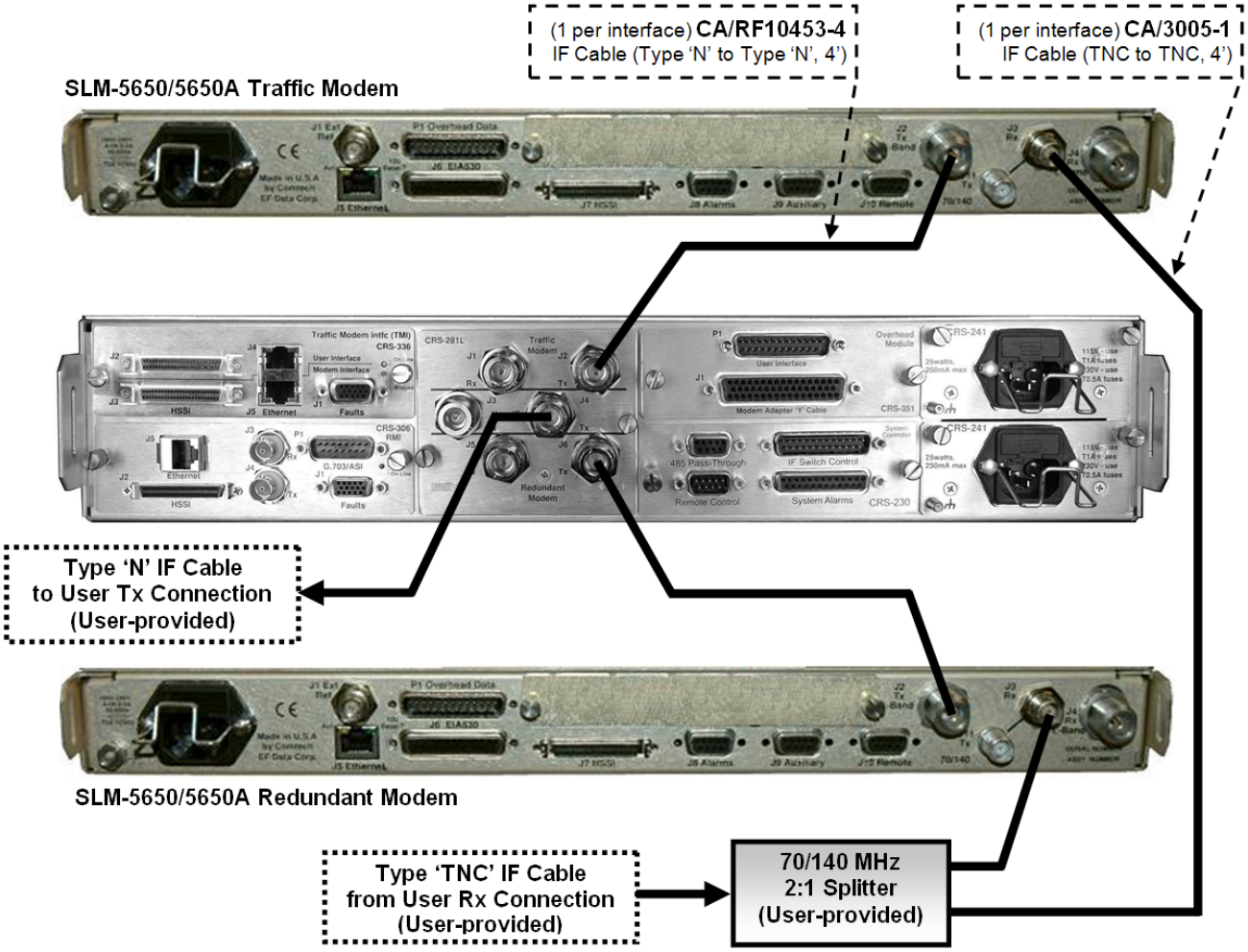


Figure 3-17. SLM-5650/5650A Mixed IF Band Cabling Example – CRS-281 'TNC' (70/140 MHz Tx, L-Band Rx)

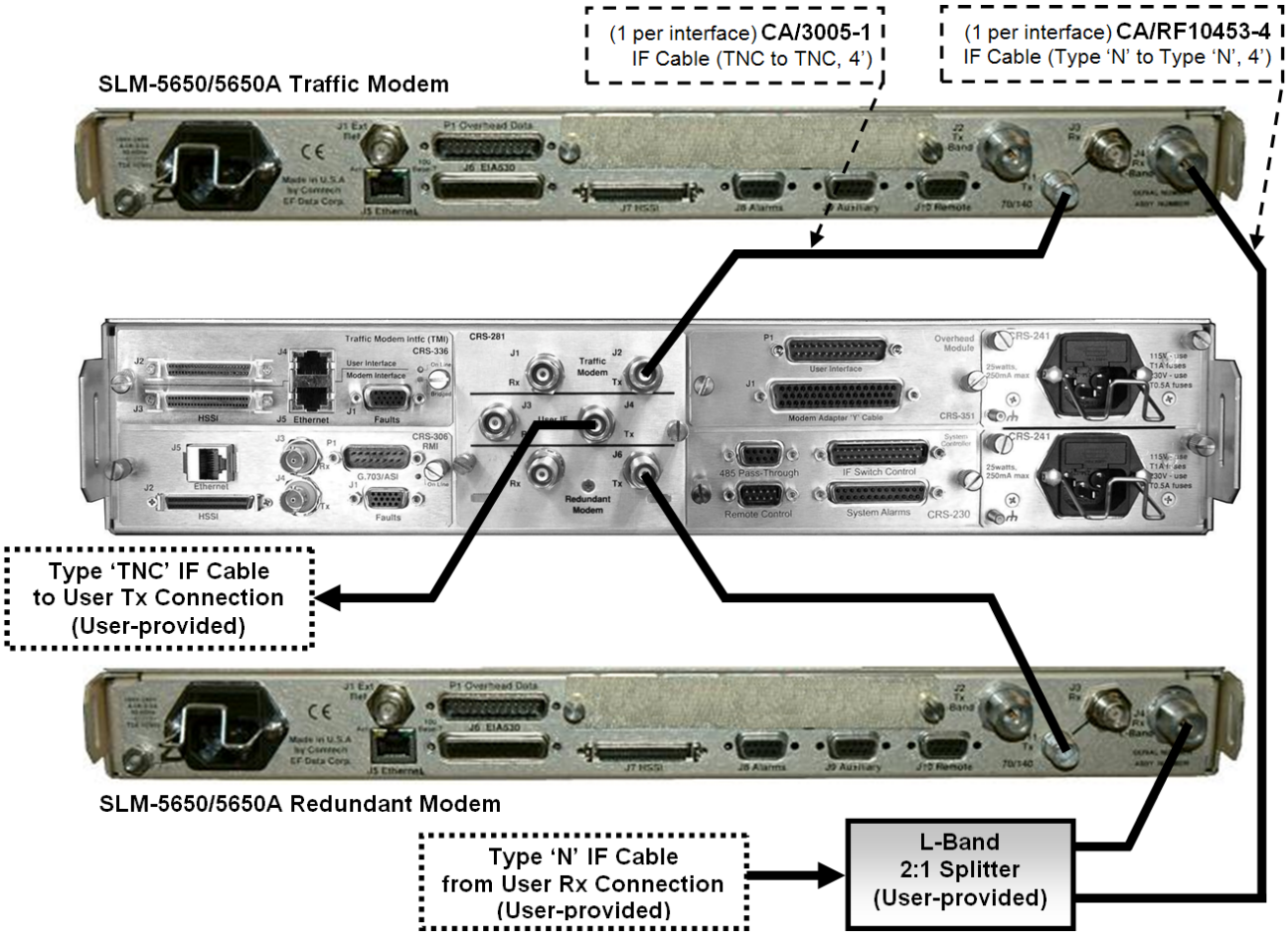


Figure 3-18. SLM-5650/5650A Mixed IF Band Cabling Example – CRS-281L (70/140 MHz Tx, L-Band Rx)

Chapter 4. MODEM AND SWITCH CONFIGURATION

4.1 Modem Configuration

4.1.1 Modem Power

Connect the power cords of each modem to a power supply and turn both modems **ON**.

4.1.2 Modem Firmware and Hardware Requirements

For the CRS-311 1:1 Redundancy Switch to operate correctly, it is important that the Traffic Modem and the Redundant Modem must be of the same model. In addition to matching hardware requirements, the Redundant Modem must have the same firmware revision and installed options so that the it can properly mimic operation of the Traffic Modem.

Permitted modem models and firmware versions are as follows:

Modem	Modem Firmware Version	GigE Firmware Version
CDM-Qx/QxL	1.1.4 or later	N/A
SLM-5650	1.4.2 or later	1.1.2
SLM-5650A	1.1.2 or later	1.1.2

For operation of the SLM-5650/5650A with the optional 4-Port Ethernet Network Processor (NP) Module:

Modem	Modem Firmware Version	NP Firmware Version
SLM-5650	1.5.1 or later	1.5.1
SLM-5650A	1.1.8 or later	1.5.1

IMPORTANT

If the modem does not meet these listed requirements, contact Comtech EF Data. Flash firmware upgrades are free and may be downloaded from the CEFD Web page. Hardware revision upgrades must be performed at CEFD.

4.1.2.1 Flash Upgrading

For detailed instructions on upgrading modem firmware via flash upgrade, refer to the pertinent modem's *Installation and Operation Manual*.

4.1.3 Modem Operational Configuration

This chapter assumes user familiarity with the menu navigation and configuration parameter selection methods using the individual modems' front panel menu. For detailed instructions on changing configuration settings using the front panel keypad and menus, refer to the *Front Panel Operation* chapter in the pertinent modem's *Installation and Operation Manual*.

Using the modem's manual, configure the Traffic Modem for the proper Rx and Tx IF, power settings, modulation, code rates, and traffic data settings.

For User-to-Switch or User-to-Modem addressing schemes, see **Appendix B. Addressing Scheme Information**.

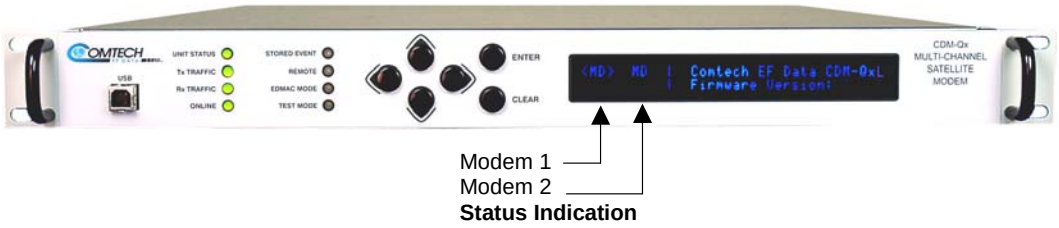
4.1.4 Modem Redundancy Configuration

4.1.4.1 Switch to CDM-Qx/QxL Redundancy Configuration

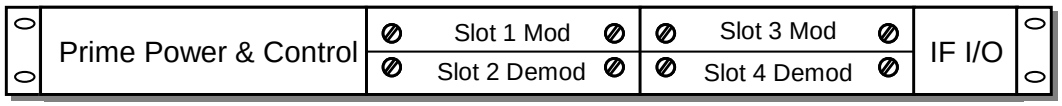
The CRS-311-to-CDM-Qx/QxL redundancy configuration uses an external RS-485 multi-drop communication cable.

The CDM-Qx/QxL can be configured in many different ways, but for a CRS-311 application, the CDM-Qx/QxL should be configured only as one modem – i.e., containing one modulator and one demodulator card, which must be ***grouped*** to act as a modem. See the *CDM-Qx/QxL Installation and Operation Manual* for more information.

As shown in **Figure 4-1**, Modem 1 resides in Slots 1 and 2. Modem 2 is contained in Slots 3 and 4. The Switch can use either modem.



(a) Front Panel



(b) Real Panel Schematic

Figure 4-1. CDM-Qx/QxL Serial Communication Configuration

The CDM-Qx/QxL chassis has a configurable RS-485 base address – which applies for Modem 1 – and an offset, which is added to the base-address if addressing Modem 2. The RS-485 addresses are selected via the front panel menu: **CONFIG → REMOTE**.

The Switch addresses each CDM-Qx/QxL modem based on which TMI it is attached to, with addresses at increments of 100. For example, with a Switch with address 0, the Qx/QxL Traffic Modem has address 0100, and the Redudant Modem uses address 1100. See **Figure 4-2** and **Appendix B. Addressing Scheme Information** for more information.

Once the addressing scheme is understood, proceed as follows:

Step	Procedure
1	Configure COMMs on each modem via the ***modem*** front panel menu as follows: **CONFIG → REMOTE: RS-485-4W, 9600 baud, format 8-N-1**.
2	Set the RS-485 base address and offset, per **Appendix B. Addressing Scheme Information**.

Refer to the *CDM-Qx Installation and Operation Manual* for detailed configuration information.

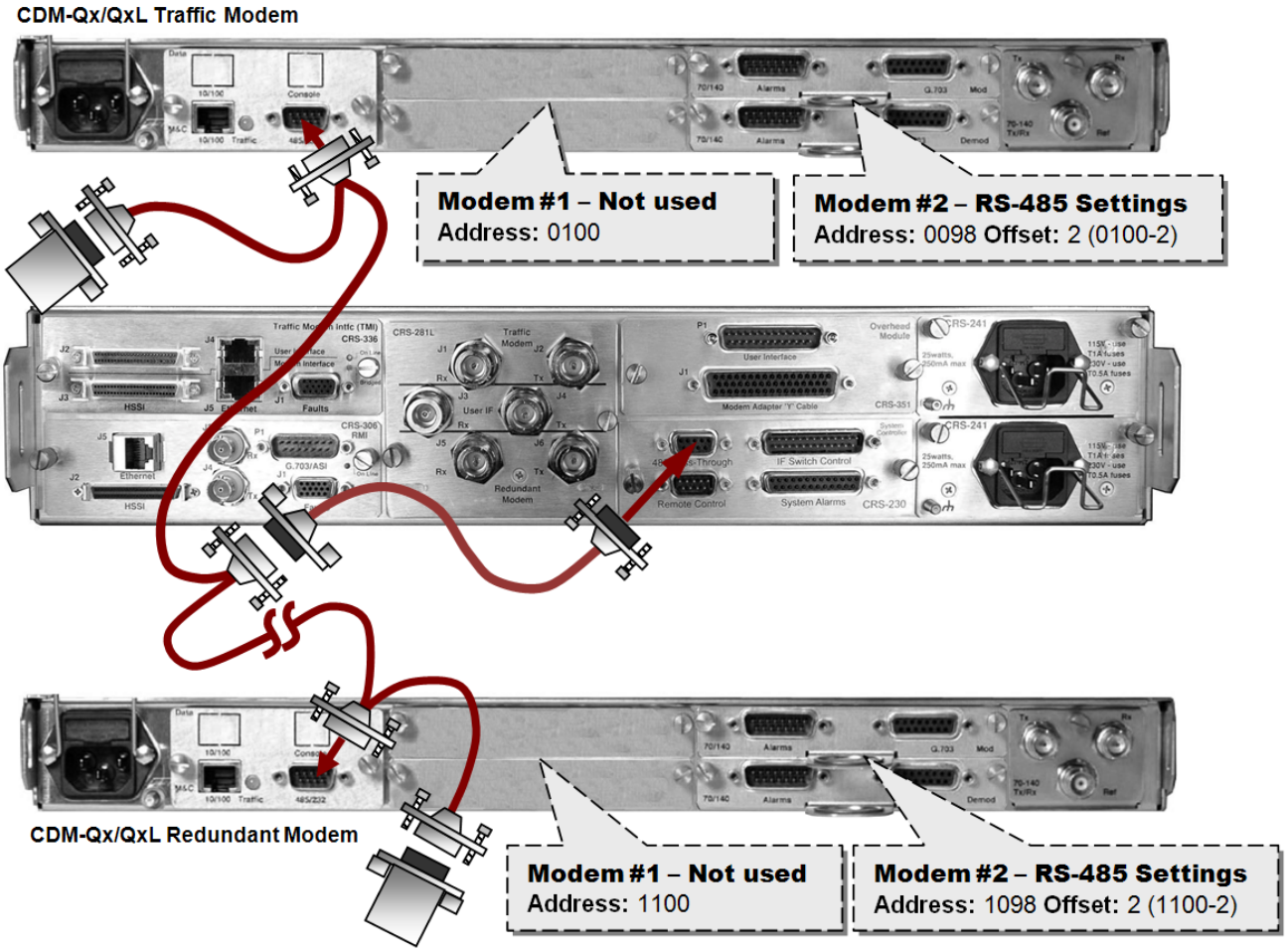


Figure 4-2. CDM-Qx/QxL / CRS-311 RS-485 Scheme

Note: In this example, the RS-485 offset address does not effect Modem #1, so the offset can be 1-99 without affecting other Modem's RS-485 addresses.

4.1.4.2 Switch to SLM-5650/5650A Redundancy Configuration

The CRS-311 communicates to the Redundant and Traffic modems via a serial TTL bus contained within the HD-15 "J9 Auxiliary" connector on the modem's rear panel. An HD-15M to HD-15F Control cable connects each modem to the CRS-311.

To configure SLM-5650/5650A and CRS-311 for 1:1 redundancy:

Step	Procedure
1	If the terrestrial data type is Ethernet, for each modem, enter a unique IP Address for the optional GigE Interface card that is on the same subnet: **CONFIG → MODE → INTERFACE → GIGABIT ETHERNET**
2	The SLM -5650/5650A must have the COMMs configured to redundancy. Configure the COMMS of each of the modems via the ***modem*** front panel menu: • Select the interface for operation with the CRS-311: **SELECT: Configure → Config: Remote →** **Remote Control: SerialConfig → Remote Control:Interface →** **M&C Bus Interface: TTL (Switch) →** The active local M&C Bus Address should now be displayed.
3	**Power down** both SLM-5650/5650As.
4	**Power up** both SLM-5650/5650As. Verify that the Traffic Modem is **ONLINE**.

Refer to the *SLM-5650* or *SLM-5650A Installation and Operation Manual* for detailed configuration information.

4.2 Switch Configuration

4.2.1 Switch Power

Connect the power cords as follows:

Step	Procedure
1	Each CRS-311 is supplied with two power cords. Connect the female end of the supplied power cords (one to each power supply power input).
2	Plug both power cords into the power source(s). The CRS-311 will power **ON**. ***Note**: The auto-sensing power supplies do not require any adjustments.*

If only one power supply card is used, mask the fault for the unused power supply as follows:

Step	Procedure
1	Go to the **CONFIG: MASKS → SW-ALARMS** menu.
2	Select to mask the unused power supply.

Note: The power supplies contain two fuses, one each for line and neutral connections (or L1, L2 where appropriate). These are contained within the body of the connector, behind the small plastic flap.

For continued operator safety, always replace the fuses with the correct type and rating. For 115/230 volt AC operation, use T1A (slow-blow) 20 mm fuses.

4.2.2 Flash Updating

The CRS-311 eliminates the need for updating firmware by physically replacing EPROMs. Instead, the CRS-311 uses 'flash memory' technology internally. This makes software upgrading very simple, and updates can now be sent via the Internet (**Figure 4-3**), E-mail, or on disk. The upgrade can be performed without opening the unit by simply connecting the Switch to the serial port of a computer. New firmware can be uploaded to the unit from an external PC via the Internet as follows:

1. **Go online to:** www.comtechefdata.com
2. **Click on: Support**
3. **Click on: Software Downloads**
4. **Click on: Flash Update Files**
5. **Click on:** <dir> **CRS311**
6. **Select: For_CD-Qx** or **For_SLM-5650***

(***Note:** Choices shown are representative of upgrades available via the Web as of 10/2008. These selections are updated periodically. Contact Comtech EF Data Customer Support for questions regarding the availability of support files for your specific product.)

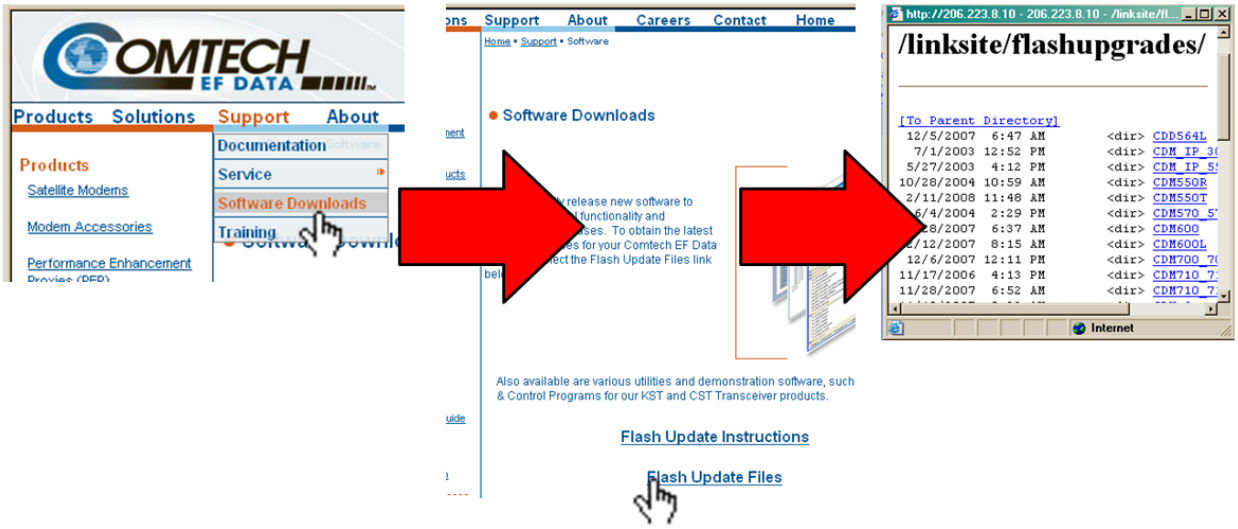


Figure 4-3. Flash Update via Internet

The latest two releases of firmware code and the Uploader are available in a Zip file. The Upload utility is a free software utility designed to run under Windows 95/98/2000® or Windows NT®.

The Zip file should be downloaded to the User's computer hard disk, and then unzipped:

- The utility program is called **CCCFLASH.EXE**
- The firmware file is called, for example, **fw-0069-.ccc**

The User should connect an RS-232 serial cable (details are shown in the cable details box on the Uploader screen, as well as in **Appendix A. CABLE DRAWINGS**) from the computer to the remote control port of the Switch.

Run the **Upload** utility. The User should follow the instructions presented on the screen, and the upload will take place automatically.

Following the successful upload process, the Switch will automatically re-start, running the new version of firmware. During this process, the non-volatile RAM storing the configuration of the Switch will be erased, so the User is then required to re-enter the desired configuration.

4.2.2.1 Flash Update Help

Full on-line help is provided with CCCFLASH.EXE. Additionally, a reference guide is available by selecting the **Flash Update Instructions** link on the *Software Upgrade* Web page (**Figure 4-3**). Please contact Comtech EF Data Customer Support if you have questions or need additional assistance.

4.2.3 CRS-311 Front Panel Configuration

The CRS-311 should show a **GREEN** "Unit Status" LED. If it is **RED**, go to **MONITOR → SW-ALARM** to view the faults. Ensure that the preceding Redundant Modem setup is complete and that it is operating correctly before proceeding. Use the front panel keypad and display to configure the Switch as described in this section.

The **Switch Status** LED will turn **RED**, until the Switch has polled the Traffic Modem and correctly programmed the Traffic Modem configuration into the Redundant Modem. Once the programming is completed successfully, the **RED** LED will turn **GREEN**.

The Redundant Modem may take several seconds to configure. If the LED remains **RED**, check the communication status using the menus to investigate the problem:

MONITOR → COMMS or **MONITOR → SW-ALARM**

Another option is to view the I/O using **MONITOR → IO.** This menu will show the actual messages to and from the modem. If there are no responses from a modem, check the addressing scheme carefully and verify correct modem communication setups. Communication is slowed to aid viewing.

For modems: Use the **INFO** and **MONITOR** menus to view the status of the modems, in addition to viewing the LEDs.

For Switch: Use **MONITOR → COMMS** to verify the modems that are responding via remote control.

For real-time monitoring: Use **MONITOR → IO** to verify the modems that are responding via remote control. Communication is slowed to aid viewing.

IMPORTANT

Do not leave the CRS-311 in this view.

4.2.3.1 Set Operation Mode

The CRS-311 was shipped in the Auto-Off (i.e. Manual) operating mode. This setting causes the Stored Event LED to blink. The system is operational; however, it is still operating in **Manual** mode. In the menu, this manual mode is called **Auto-off**. While in **Manual** mode, the User can manually select which modem (Traffic Modem or Redundant Modem) will be bridged or backed up.

While in **Manual** mode, the Switch does not *automatically* react to Traffic Modem failures it detects. Comtech EF Data recommends that an unattended system be configured to operate in **Auto On** mode.

When **Auto On** mode is enabled, when a fault occurs, the online modem is first bridged by the offline modem, and then backed up.

To enable **Auto On** mode:

Step	Procedure
1	Go to the **CONFIG → AUTO** menu and select **AUTO ON** mode.
2	Verify that the Stored Event LED stops blinking.

4.2.3.2 Set Holdoff Period

A *holdoff period* prevents unwarranted backups due to an intermittent fault. When in **Auto** mode, additional delays may be introduced to the backup procedure by setting the number of seconds for "holdoff" before the faulted Traffic Modem cedes operation to the Redundant Modem (*backup*), or operation is returned from the Redundant Modem back to the Traffic Modem (*restore*).

The process is further explained:

If a fault occurs in the Traffic Modem, and the Redundant Modem operation is fault-free, *backup* is initiated once the configured **Backup Holdoff Period** lapses. However, if the fault clears within the holdoff's configured timeframe, no transfer of operation occurs.

Similarly, if a fault occurs in the Redundant Modem while it is online, and the Traffic Modem's operation is fault-free, *restore* is initiated once the configured **Restore Holdoff Period** lapses.

The default holdoff period is 10 seconds (a minimum of 1 second and a maxium of 99 seconds is allowed).

4.2.3.2.1 Set Backup Holdoff Period

If the Traffic Modem fails, the Switch waits for the backup holdoff time to determine two things:

1) Does the Traffic Modem remain faulted?

and

2) Is the Redundant Modem not exhibiting the same fault?

If the answer is *yes* to both questions for the entire Backup Holdoff Period, then the Switch first bridges the faulted Traffic Modem with the Redundant Modem. If the fault is sustained, then the switchover to the Redundant Modem is completed and the Redundant Modem carries the traffic.

There will be no switchover if the Redundant Modem is faulted. Ensure that the Holdoff times are long enough (default 10 seconds) for the Redundant Modem to be configured and to lock onto the signal.

Note: If the CDM-Qx/QxL configuration includes Carrier-in-Carrier® this holdoff time should be no less than 8 seconds.

To set the **Backup Holdoff Period**:

Step	Procedure
1	Go to the **CONFIG → HOLDOFFS** menu.
2	Change the **BACKUP HOLDOFF** to any number in the range of 1 to 99 seconds.

4.2.3.2.2 Set Restore Holdoff Period

The "**Restore Holdoff**" setting, which is also programmable from 1 to 99 seconds, determines the Switch's ability to automatically put the backed up Traffic Modem online again if its fault clears.

Normally, the failed Traffic Modem taken offline remains offline indefinitely. If the fault clears, traffic will be returned to the unit (in **Auto** mode) only if the Redundant Modem fails.

To set the **Restore Holdoff Period**:

Step	Procedure
1	Go to the **CONFIG → HOLDOFFS** menu.
2	Change the **RESTORE HOLDOFF** to any number in the range of 1 to 99 seconds.

4.2.3.3 Set Alarm Masking

Another way to adjust the Switch's reaction in Auto mode is to mask modem faults. The User may disable modem Rx, Tx or both fault types so that the Switch does not react to them. This masking prevents the Switch from taking automatic action and prevents the logging of the faults in the stored events list. These masks are global to all the modems attached to the Switch.

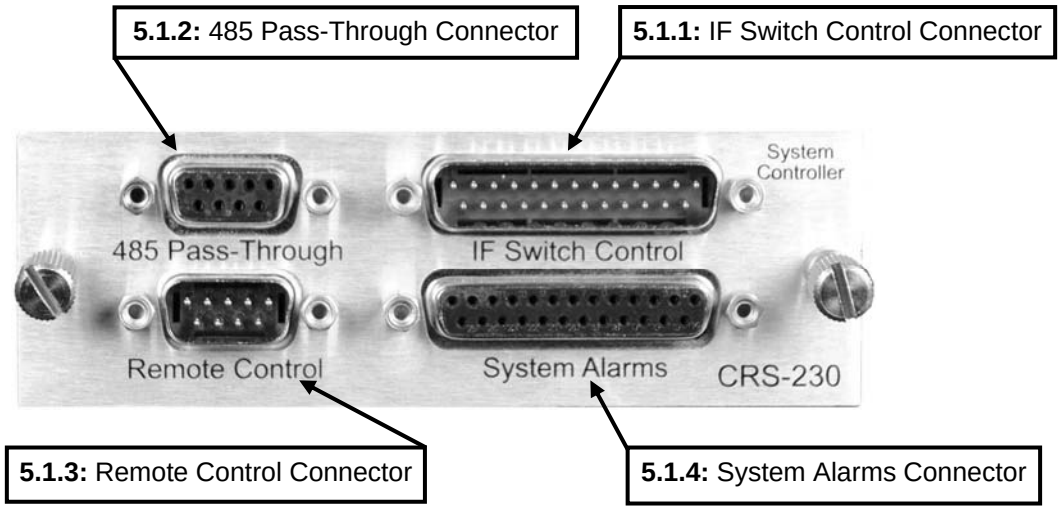
To set **Alarm Masks**:

Step	Procedure
1	Go to **CONFIG → MASKS → MODEM ALARMS**.
2	Set the mask parameters as desired.

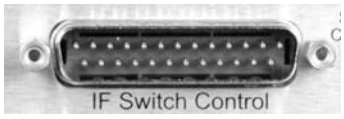
Notes:

Chapter 5. CONNECTOR PINOUTS

5.1 CRS-230 Controller Connectors



5.1.1 IF Switch Control – DB-25M Connector



The IF Switch Control connector is not used on the CRS-311.

5.1.2 485 Pass-Through – DB-9F Connector

Table 5-1 indicates the pinout for the 485 Pass-Through connector, used only with the CDM-Qx/QxL modems.

Table 5-1. 485 Pass-Through User Data Connector

Pin	Description	Direction
1	Ground	
2	RS-232 Transmit Data	Out
3	RS-232 Receive Data	In
4	Reserved - do not connect to this pin	
5	Ground	
6	RS-485 Receive Data B **(see note)**	In
7	RS-485 Receive Data A **(see note)**	In
8	RS-485 Transmit Data B	Out
9	RS-485 Transmit Data A	Out

Note: Use for 2-wire RS-485 operation.

5.1.3 Remote Control – DB-9M Connector

The DB-9M Remote Control Connector provides access to the remote control ports of the Switch for both RS-232 and RS-485. **Table 5-2** provides the pinout information.

Table 5-2. Remote Control User Data Connector

Pin	Description	Direction
1	Ground	
2	RS-232 Transmit Data	Out
3	RS-232 Receive Data	In
4	Reserved - do not connect to this pin	
5	Ground	
6	RS-485 Receive Data B **(see note)**	In
7	RS-485 Receive Data A **(see note)**	In
8	RS-485 Transmit Data B	Out
9	RS-485 Transmit Data A	Out

Note: Use for 2-wire RS-485 operation.

5.1.4 System Alarms – DB-25F Connector

Table 5-3 indicates the pinout for the DB-25F TMI System Alarms connector.

Table 5-3. System Alarms User Data Connector

Pin	Description
1	Traffic Modem Online Status – Common for pin 6 (Note 2)
14	Not used
2	Not used
15	Not used
3	Not used
16	Not used
4	Not used
17	Not used
5	Not used
18	Not used
6	Traffic Modem Online Status – Normally Open (Note 2)
19	No Connection
7	Ground
20	Audio Indicator (Gnd = Auto On / Float = Audio Off)
8	Form C Fault Relay – Common Common for pins 9-12 and 21-24
21	Switch Unit Fault – Normally Closed
9	Switch Unit Fault – Normally Open
22	Modem Summary Unit Fault –Normally Closed
10	Modem Summary Unit Fault – Normally Open
23	Modem Summary Tx Traffic Fault – Normally Closed
11	Modem Summary Tx Traffic Fault – Normally Open
24	Modem Summary Rx Traffic Fault – Normally Closed
12	Modem Summary Rx Traffic Fault – Normally Open
25	Not Used
13	Not Used

Notes:

1. "Normally" refers to the NON-FAILED state.
2. Traffic Modem Online Status (Open = Online, Closed = Backup)

5.2 TMI User Data Connectors

5.2.1 RS-232/422/V.35 – DB-25F Connector (CRS-316)

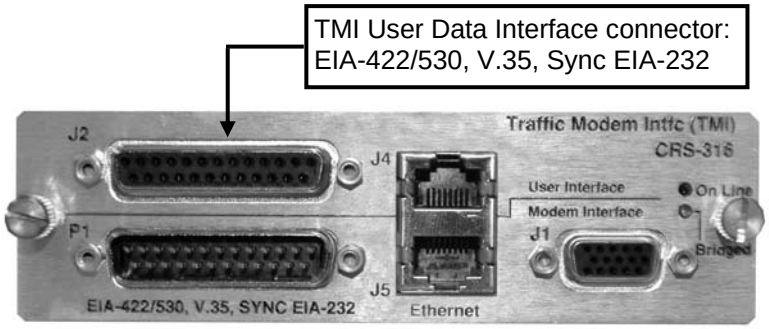


Table 5-4 indicates the pinout for the DB-25F TMI User Data Interface connector (RS232/422/V.35): J2 on the CRS-316.

Table 5-4. EIA-422/530 / V.35 / Sync EIA-232 User Data Connector

Pin	Generic Signal Description	Direction	RS-422/ RS 530	V.35	RS-232	Circuit No.
1	Shield	-	Shield	FG	AA	101
2	Transmit Data A	DTE to Modem	SD A	SD A	BA	103
3	Receive Data A	Modem to DTE	RD A	RD A	BB	104
4	Request to Send A / Ready for Receiving A	DTE to Modem	RS A	RS A		
6	DCE Ready A	Modem to DTE	DM_A	DM_A		
7	Signal Ground	-	SG	SG	AB	102
8	Receiver Ready A	Modem to DTE	RR A	RLSD *	CF	109
9	Receive Clock B	Modem to DTE	RT B	SCR B	-	115
10	Receiver Ready B	Modem to DTE	RR	B	-	109
11	Transmit Clock B	DTE to Modem	TT B	SCTE B	-	113
12	Internal Transmit Clock B	Modem to DTE	ST B	SCT B	-	114
14	Transmit Data B	DTE to Modem	SD B	SD B	-	103
15	Internal Transmit Clock A	Modem to DTE	ST A	SCT A	DB	114
16	Receive Data B	Modem to DTE	RD B	RD B	-	104
17	Receive Clock A	Modem to DTE	RT A	SCR A	DD	115
19	Request to Send B / Ready for Receiving B	DTE to Modem	RS B	RS B		
22	DCE Ready B	Modem to DTE	DM_B	DM_B		
23	Not Used					
24	Transmit Clock A	DTE to Modem	TT A	SCTE A	DA	113

Notes:

1. Receiver-Ready is an RS-232-level control signal on a V.35 interface.
2. 'B' signal lines are not used for RS-232 applications.
3. For X.21 operation, use the RS-422 pins, but ignore Receive Clock if the modem is DTE, and ignore Transmit clocks if the modem is DCE.

5.2.2 Balanced G.703 – DB-15F Connector (CRS-325)

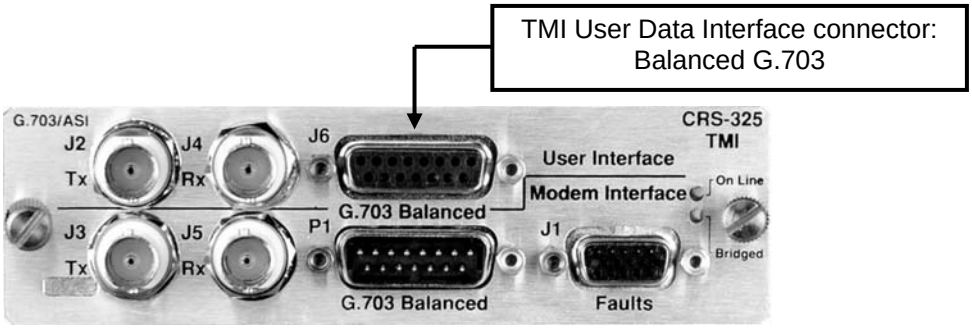


Table 5-5 indicates the pinout for the DB-15F Balanced G.703 User Data Interface connector: "J6" on the CRS-325 TMI.

Table 5-5. Balanced G.703 User Data Connector

Pin	Signal Description	Name	Direction
1*	Tx, Drop Data Input (-)	DDI–	In
9*	Tx, Drop Data Input (+)	DDI+	In
2	Ground	GND	
10	Not Used		
3*	Rx, Insert Data Output (-)	IDO–	Out
11*	Rx, Insert Data Output (+)	IDO+	Out
4	Ground	GND	
12	Drop Data Output (-)	DDO–	Out
5	Drop Data Output (+)	DDO+	Out
13	Insert Data Input (-)	IDI–	In
6	Insert Data Input (+)	IDI+	In
14	Not Used		
7	Not Used		
15	Not Used		
8	Not Used		

*** Use for all non-Drop and Insert and T2/E2 balanced applications.**

5.2.3 Unbalanced G.703 – BNC Connectors (CRS-325)

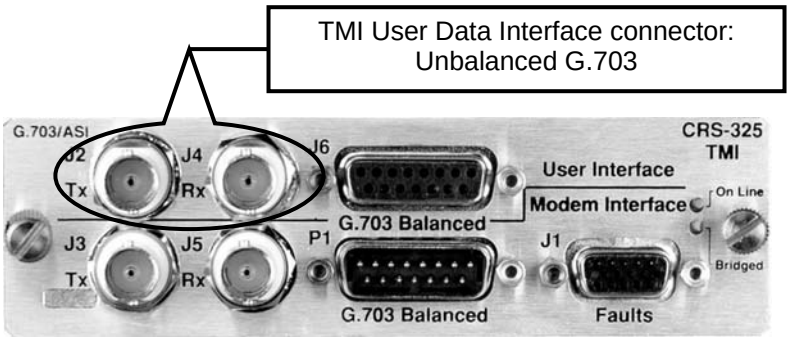


Table 5-6 indicates the Unbalanced G.703 User Data Interface BNC connectors: "J2" and "J4" on the CRS-325 TMI.

Table 5-6. Unbalanced G.703 User Data Connectors

BNC Connector	TMI CRS-325 Ref Des	Description	Direction
Rx-IDO	J4	Rx, G.703	Out
Tx-IDI	J2	Tx, G.703	In
IDI	—	Insert data input	In
DDO	—	Drop data output	Out

5.2.4 HSSI – HD-50F Connector (CRS-336)

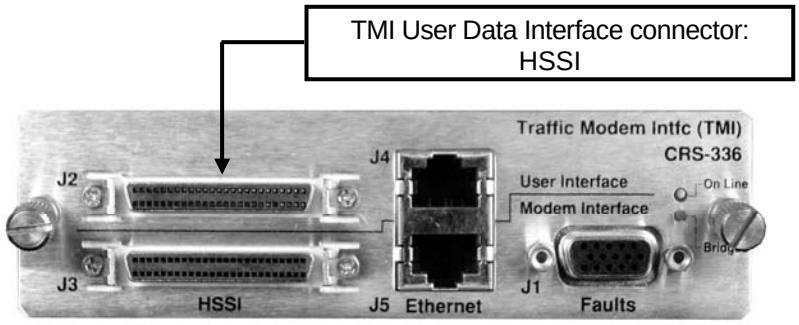


Table 5-7 indicates the HD-50F Mini-D/SCSI-II HSSI User Data Interface connector: "J2" on the CRS-336 TMI.

Table 5-7. HSSI User Data Connector

Pin # (+, -)	Signal Function	HSSI Signal	RS613 Circuit	Circuit Direction
1, 26	Signal Ground	SG	102	
2, 27	Receive Timing	RT	115	from DCE
3, 28	DCE Available	CA	107	from DCE
4, 29	Receive Data	RD	104	from DCE
5, 30	N/A	N/A	N/A	N/A
6, 31	Send Timing	ST	114	from DCE
7, 32	Signal Ground	SG	102	
8, 33	DTE Available	TA	108/2	to DCE
9, 34	Terminal Timing	TT	113	to DCE
10, 35	N/A	N/A	N/A	N/A
11, 36	Send Data	SD	103	to DCE
12, 37	N/A	N/A	N/A	N/A
13, 38	Signal Ground	SG	102	
14,15,17, 18, 39-43	Reserved (to DCE)			not used
16	Tx_Carrier_Off_L [1, 3]	CO	undefined	from DTE
19, 44	Signal Ground	SG	102	
20	Carrier Detect (lock) [1, 2]	CD	undefined	from DCE
21-24, 46-49	Reserved (to DTE)		undefined	not used
25, 50	Signal Ground	SG	102	

Notes:

1. Noted signal function names are non-HSSI defined signals. On Cisco™ routers, there is no connection to those pins.
2. TTL - output.
3. TTL or RS-232 (active low) input.

5.2.5 Gigabit Ethernet (GigE) – RJ-45F Connector (CRS-316/336)

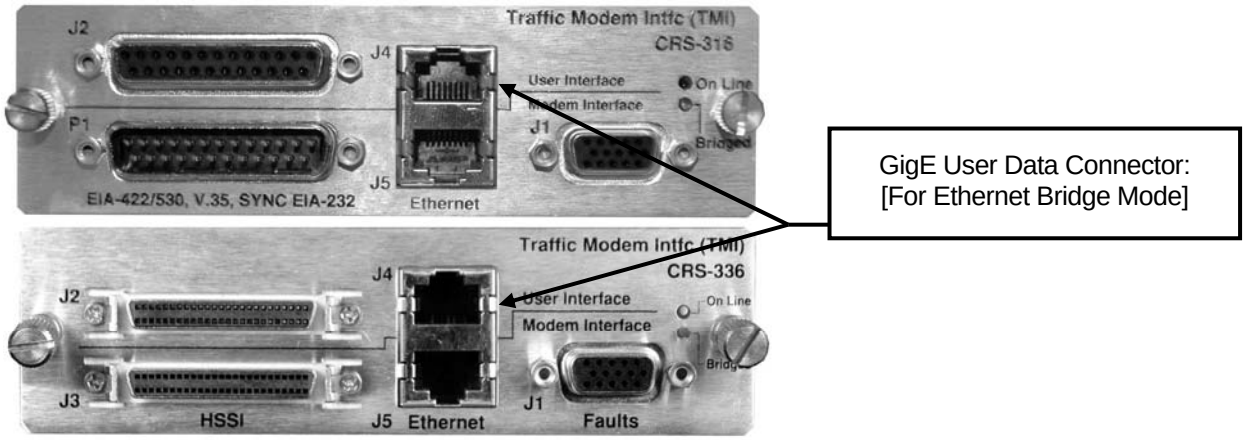


Table 5-8 indicates the pinout for the RJ-45F TMI User Data Interface connector (Gigabit Ethernet): "J4" on the CRS-316 and the CRS-336 TMIs.

Table 5-8. GigE Connector

Pair No.	Pin No.
1	5
	4
2	1
	2
3	3
	6
4	7
	8

5.2.6 Quad E1 – RJ-48F Connectors (CRS-365)

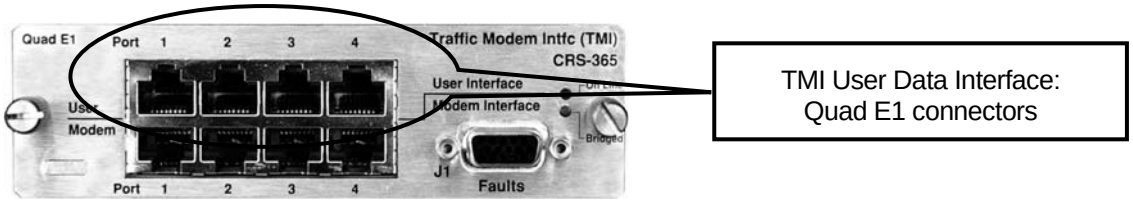


Table 5-9 indicates the pinout for the four (4) RJ-48F TMI User Data Interface connectors (Quad E1): Ports 1 through 4 on the CRS-365.

Table 5-9. Quad E1 Connector (Typical Ports 1 through 4)

Pin #	**Name** (*where* Port # = Port 1, 2, 3 or 4)	Direction
1	Port # Tx+	In
2	Port # Tx–	In
3	Gnd	--
4	Port # Rx+	Out
5	Port # Rx–	Out
6	Gnd	--
7	NC	--
8	NC	--

5.2.7 Gigabit Ethernet (GigE) – (4X) RJ-45F Connectors (CRS-515)

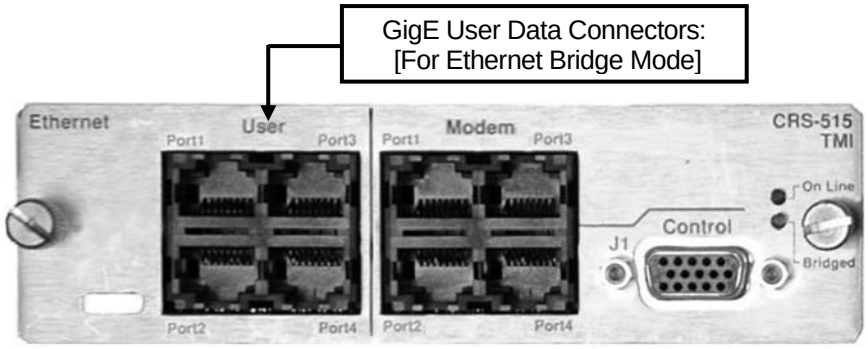


Table 5-10 indicates the pinout for the RJ-45F TMI User Data Interface connectors Gigabit Ethernet (GigE) connectors: “Port1” through “Port4” on the CRS-515 TMI.

Table 5-10. GigE Connector (Typical Port 1 through Port 4)

Pair No.	Pin No.
1	5
	4
2	1
	2
3	3
	6
4	7
	8

5.2.8 Overhead – DB-25M Connector (CRS-351)

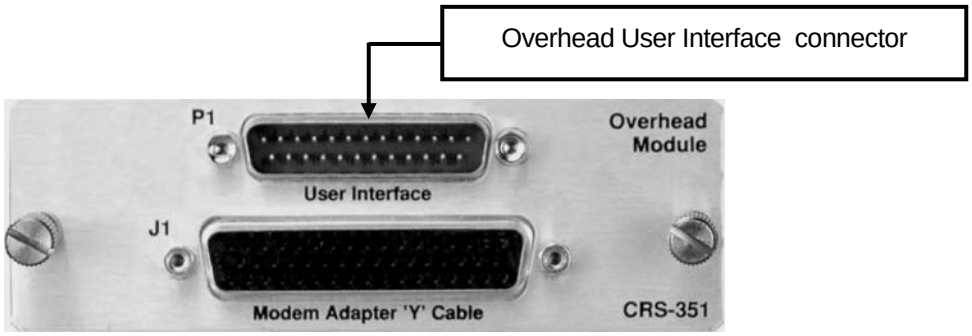


Table 5-11 indicates pinout for the DB-25M Overhead User Data Interface connector: "P1" on the CRS-351 Overhead Module. This connector allows for connection of EIA-422, EIA-485 and EIA-232 data interfaces for use with overhead framing. It also supports signaling for tactical applications.

Table 5-11. Overhead User Data Connector

Pin #	Signal Function	Name
1	EIA-422 Transmit Data "A", Input	Tx Data A
14	EIA-422 Transmit Data "B", Input	Tx Data B
2	EIA-422 Transmit Clock "A", Output	Tx Clk A
15	EIA-422 Transmit Clock "B", Output	Tx Clk B
3	EIA-422 Transmit Byte Sync "A", Output	Tx Sync A
16	EIA-422 Transmit Byte Sync "B", Output	Tx Sync B
4	EIA-422 Receive Data "A", Output	Rx Data A
17	EIA-422 Receive Data "B", Output	Rx Data B
5	EIA-422 Receive Clock "A", Output	Rx Clk A
18	EIA-422 Receive Clock "B", Output	Rx Clk B
6	EIA-422 Receive Byte Sync "A", Output	Rx Sync A
19	EIA-422 Receive Byte Sync "B", Output	Rx Sync B
7	Shield	Ground
20	EIA-485 Transmit Data "-"	485 Tx Data -
8	EIA-485 Transmit Data "+"	485 Tx Data +
21	EIA-422 Transmit Handover Sync "A", Input	THS A
9	EIA-485 Receive Data "-"	485 Rx Data -
22	EIA-485 Receive Data "+"	485 Rx Data +
10	EIA-422 Transmit Handover Sync "B", Input	THS B
23	EIA-232 Clear to Send	232 CTS
11	EIA-232 Receive Data	232 Rx Data
24	EIA-232 Request to Send	232 RTS
12	EIA-232 Transmit Data	232 Tx Data
25	EIA-422 Transmit Handover Control "A", Input	THC A
13	EIA-422 Transmit Handover Control "B", Input	THC B

*For EIA-485 2-Wire Operation:

- Only two wires are required.
- Tie pins 8 and 22 together (both +).
- Tie pins 9 and 20 together (both -).

Notes:

Chapter 6. FRONT PANEL OPERATION

6.1 Introduction

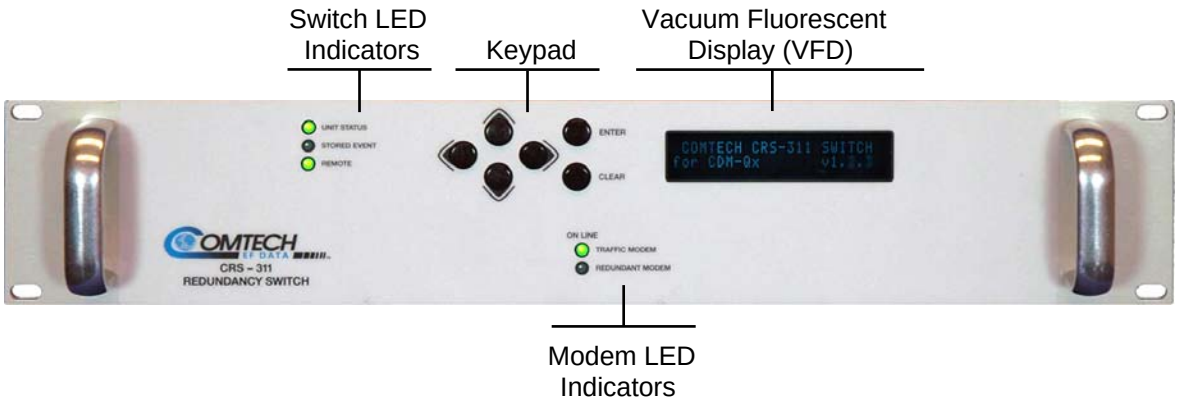


Figure 6-1. CRS-311 Front Panel

The user can fully control and monitor the operation of the CRS-311 from the front panel (shown in **Figure 6-1**), using the keypad and display. Nested menus are used, which display all available options, and prompt the user to carry out a required action.

6.1.1 Front Panel LED Indicators

6.1.1.1 Switch Status LED Indicators

The three LEDs positioned at the top left of the front panel reflect the condition of the Switch itself. The function of these LEDs is as follows:

LED	Color	Condition
UNIT STATUS	**Red**	A Switch Fault exists. **Example: PSU** fault or **COMMS** failure
	Green	No Switch Faults
STORED EVENT	**Off**	No Stored Events
	Orange	Stored Events exist for the Switch.
	Orange (Flashing)	**CAUTION:** Switch is in Manual mode.
	Orange (Flashing 2X rate)	**CAUTION:** Switch is in Independent Mode.
REMOTE	**Off**	Switch is in Local Mode. Remote monitoring is possible, remote configuration control is not allowed.
	Orange	Switch is in Remote Mode. Configuration changes are disabled via the front panel keypad

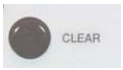
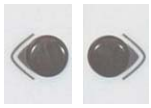
6.1.1.2 Modem Online Status LED Indicators

The two LEDs positioned at the lower center of the front panel reflect the online status of the Traffic or Redundant modems.

6.1.2 Front Panel Keypad

The keypad on the front panel contains six individual key switches with a positive "click" action for tactile feedback.

The function of these keys, and their reference throughout this chapter, is as follows:

Key	Mnemonic	Functional Description
	**ENTER**	This key is used to select a displayed function or to execute a modem configuration change.
	**CLEAR**	This key is used to back out of a selection or to cancel a configuration change which has not been executed using **ENTER**. Pressing **CLEAR** generally returns the display to the previous selection.
	**◄ ►** **(Left, Right)**	These arrows are used to move to the next selection or to move the cursor position. Space permitting, most of the menus include arrow key hints to guide the user.
	**▲ ▼** **(Up, Down)**	These arrows are used primarily to change configuration data (numbers), at the current cursor position. Occasionally they may be used to scroll through a number of choices at the current cursor position. Space permitting, most of the menus include arrow key hints to guide the user.

IMPORTANT

The keypad has an auto-repeat feature. If a key is held down for more than 1 second, the key action will repeat, automatically, at the rate of 15 keystrokes per second. This is particularly useful when editing numeric fields, with many digits, such as frequency or data rate.

6.1.3 Front Panel Vacuum Fluorescent Display (VFD)

This screen is displayed whenever power is first applied to the unit. The display has two lines each of 24 characters. The second line identifies the modem for which the CRS-311 is configured (e.g., SLM-5650, CDM-Qx, etc.), and the CRS-311's installed firmware version.

Press any key to go to the top-level Select menu.

On most menu screens, users will see a flashing, solid-block cursor. This indicates the currently selected item, digit, or field:

```
CONFIG:  MANUAL  AUTO[ON]
HOLDOFFS   MASKS   REMOTE
```

Where this solid block cursor would obscure the item being edited (for example, a numeric field), the cursor will automatically change to an underline cursor:

```
BACKUP HOLDOFF SEC:  05
RESTORE HOLDOFF SEC: 04
```

To prevent the display from becoming burnt by a constant image, the unit employs a screen saver feature, which activates after one hour and constantly scrolls a message across the screen. The top line of the display shows the Switch ID (which can be entered by the user); the bottom line shows the current status of the Switch followed by the message '**Press any key…**' as shown:

```
---------------
Press any key...
```

Press any key to restore the previous screen.

6.2 CRS-311 Menu Structure

Figure 6-2 shows the menu structure of the CRS-311. The screens and menus are described individually in the chapter sections that follow.

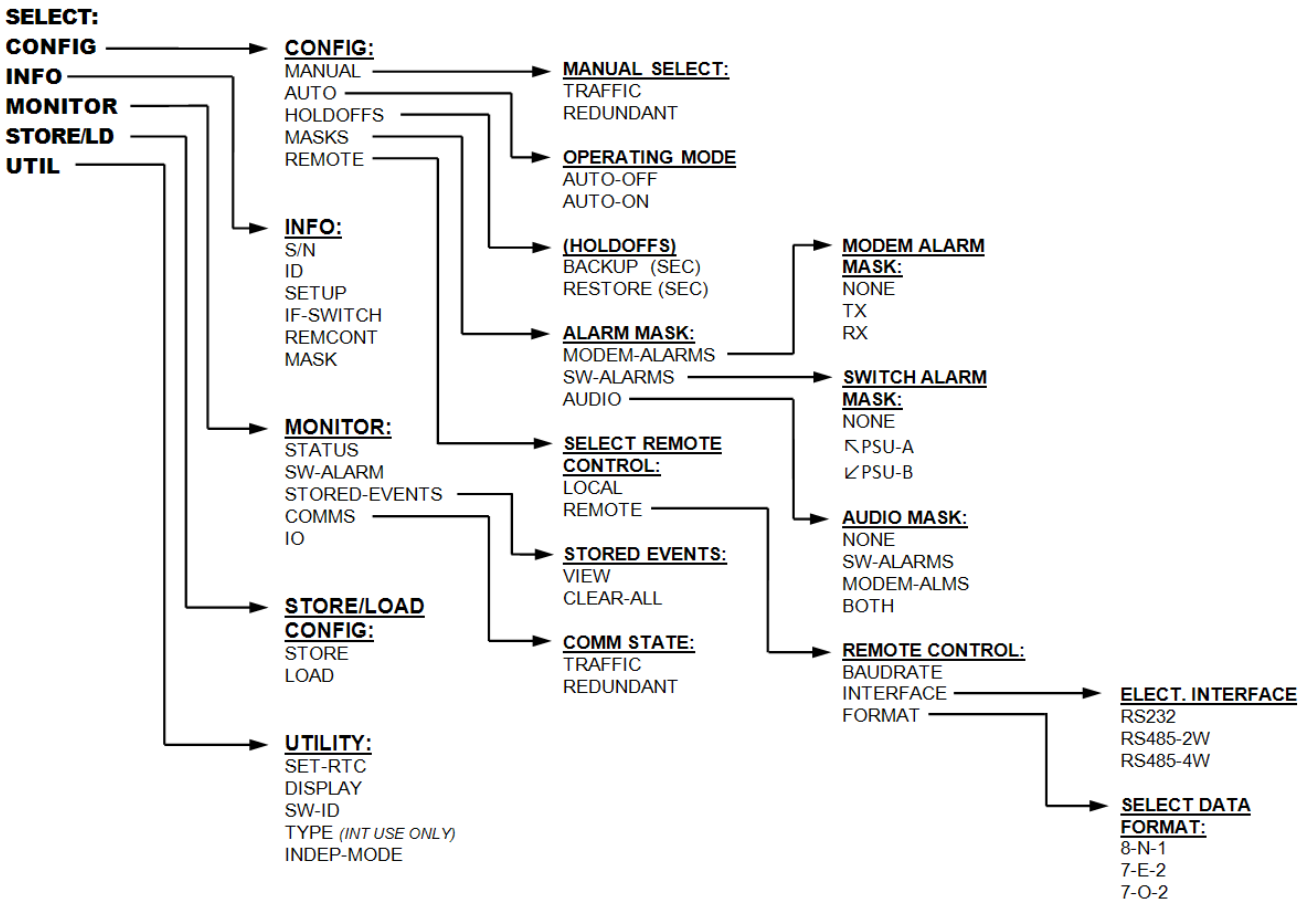


Figure 6-2. CRS-311 Menu Tree

6.3 Main Select Menu

```
SELECT:   CONFIG  INFO
MONITOR  STORE/LD  UTIL
```

Move the cursor to the desired choice using the ◄ ► arrow keys, then press **ENTER**.

Branch Selection (Sect.)	Description
CONFIG (Sect. 6.4)	**(Configuration)** This menu branch permits the user to fully configure the Switch.
INFO (Sect. 6.5)	**(Information)** This menu branch permits the user to view information on the Switch, without having to go into configuration screens.
MONITOR (Sect. 6.6)	This menu branch permits the user to monitor the status of the Switch and view the log of stored events for both the Switch and its attached modems.
STORE/LD (Sect. 6.7)	**(Store/Load)** This menu branch permits the user to store and to retrieve up to 10 different Switch configurations.
UTIL (Sect. 6.8)	**(Utility)** This menu branch permits the user to perform miscellaneous functions, such as setting the Real-time clock, adjusting the display brightness, etc.

6.4 CONFIG (Configuration)

```
CONFIG:  MANUAL  AUTO[OFF]
 HOLDOFFS   MASKS   REMOTE
```

Move the cursor to the desired choice using the ◄ ► arrow keys, then press **ENTER**.

The available submenus are:

Submenu Selection (Sect.)	Function
MANUAL (Sect. 6.4.1)	This submenu permits the user to select which Traffic Modem the Switch should bridge or backup.
AUTO [ON / OFF] (Sect. 6.4.2)	This submenu permits the user to turn **AUTO** mode to **OFF** or **ON**. The currently selected state is always shown on this menu
HOLDOFFS (Sect. 6.4.3)	This submenu permits the user to set several operating parameters of the Switch that pertain to enabling or disabling the availability of Traffic Modems, the reporting of faults and time delays for responding to faults.
MASKS (Sect. 6.4.4)	This submenu permits the user to set several operating parameters of the Switch that pertain to enabling or disabling the availability of Traffic Modems, the reporting of faults and time delays for responding to faults.
REMOTE (Sect. 6.4.5)	This submenu permits the user to define the remote control settings.

IMPORTANT

The Switch may be monitored over the remote control bus at any time. When in Local mode, however, configuration parameters may only be changed through the front panel. Conversely, when in Remote mode, the unit may be monitored from the front panel, but configuration parameters via may only be changed remote control bus.

6.4.1 (CONFIG:) MANUAL

```
ONLINE:
TRAFFIC  REDUNDANT  (ENT)
```

When the Switch is in Manual mode (**AUTO** is **OFF**), the user may select which modem is to be online. Use the ◄ ► arrow keys to select between **Traffic** Modem as online (i.e. bridging) or the **Redundant** Modem as online (ie backing up). Press **ENTER** to configure.

When in **AUTO** mode, the Switch has control, and will automatically backup the Traffic Modem, based on its fault relay activity.

In this case, the **MANUAL SELECT** screen would appear as shown:

```
ONLINE:           (AUTO)
TRAFFIC  REDUNDANT  (ENT)
```

In **AUTO** mode, manual selection is not available.

The Switch learns and retains the configuration of the **Traffic** Modem. This configuration information is used to program the **Redundant** Modem.

6.4.2 (CONFIG:) AUTO [OFF or ON]

```
OPERATING MODE:
AUTO-OFF  AUTO-ON (ENTER)
```

Select **AUTO-OFF** or **AUTO-ON**. When **AUTO-OFF** (manual mode) is selected, the Switch does not respond automatically to any modem faults and simply performs whatever manual setting the user performs via the **MANUAL SELECT** previous menu.

The **STORED EVENT** indicator blinks when in **AUTO-OFF** (manual) mode to alert the user that the Switch is effectively not in use.

6.4.3 (CONFIG:) HOLDOFFS

```
BACKUP HOLDOFF SEC:  05
RESTORE HOLDOFF SEC: 10
```

Set the holdoffs, or delay times, between the Switch's modem alarm detection and its reaction to the event. These holdoffs are only applicable when the Switch is in Auto mode. When an active modem exhibits an unmasked fault, the Switch checks that the Redundant Modem is not also faulted. If there is no fault, the **Backup Holdoff** determines how long the Switch will wait before performing the actual backup, or switchover of traffic to the Redundant Modem.

When the Switch is currently backing up a Traffic Modem, and that offline modem's fault clears, the Switch will continue to back it up unless the active modem becomes faulted. In this case, the **Restore Holdoff** is the length of time that the originally faulted modem must stay unfaulted before the Switch will automatically put it back online. Both holdoffs can be set from 1 to 99 seconds.

6.4.4 (CONFIG:) MASKS

```
ALARM MASK:  MODEM-ALARMS
SW-ALARMS  AUDIO  (ENTER)
```

The Switch logs and reacts to both its own faults and modem faults. Either type of faults may be masked using this submenu. In addition, an audible buzzer can be enabled as an additional indicator.

6.4.4.1 (CONFIG: MASKS) → MODEM ALARM MASK

```
MODEM ALARM MASK:  NONE
TX  RX           (ENTER)
```

Select **TX** or **RX** to mask the pertinent traffic faults from being reacted to by the Switch. This not only prevents the Switch from performing Auto mode functions when these modem faults are sensed, but also keeps the faults from being logged by the Switch.

Note that these selections are global to all the modems. If masking of individual modem faults is desired, it should be done directly on the modem. Unmasked modem faults are logged on active modems only.

6.4.4.2 (CONFIG: MASKS) → SWITCH ALARM MASK

```
SWITCH ALARM MASK: NONE
↖PSU-A    ↙PSU-B  (ENTER)
```

Select which, if either, of the plug-in power supply units should be ignored in case any of their voltage outputs are monitored by the Switch as being out of range, then press **ENTER**.

Only one of the units can be masked at a time. Normally this would be done if the user wishes to run with only one supply, or if a bad supply had been removed for service or replacement.

6.4.4.3 (CONFIG: MASKS) → AUDIO MASK

```
AUDIO MASK:  NONE  SW-ALMS
MODEM-ALMS  BOTH   (ENT)
```

For all Switch or modem alarms that are unmasked, the user may select which alarm types should force the Switch to react with an audible buzzer located behind the front panel. In addition, a relay closure to ground activates on pin 20 of the System Alarms connector so that the user may attach other indicators.

6.4.5 (CONFIG:) REMOTE

```
SELECT REMOTE CONTROL:
LOCAL REMOTE (PRESS ENT)
```

Select **LOCAL** or **REMOTE** using the ◄ ► arrow keys, then press **ENTER**.

6.4.5.1 (CONFIG: REMOTE) → LOCAL

If **LOCAL** is selected, remote control will be disabled. Remote monitoring is always possible.

6.4.5.2 (CONFIG: REMOTE) → REMOTE

```
REMOTE CONTROL: BAUDRATE
INTERFACE   FORMAT  (ENT)
```

When **REMOTE** is selected, select **BAUDRATE**, **INTERFACE**, or **FORMAT** using the ◄ ► arrow keys, then press **ENTER**.

6.4.5.2.1 (CONFIG: REMOTE → REMOTE) BAUDRATE

```
EDIT SWITCH BAUDRATE:
 9600 BAUD  (PRESS ENT)
```

Select **BAUD RATE** to select the baud rate of the remote control bus, connected locally to the M&C computer.

Values of 300, 1200, 2400, 4800, 9600 and 19200 baud are possible. Change the value using the ▲ ▼ arrow keys, then press **ENTER**.

Note: This setting does not affect the internal communications between the Switch and the modems. For the SLM-5650, this is fixed at RS-232, 9600 baud, 8-N-1.

6.4.5.2.2 (CONFIG: REMOTE → REMOTE) INTERFACE

```
ELECT. INTERFACE:  RS232
RS485-2W   RS485-4W (ENT)
```

Select **INTERFACE** to select **RS-232**, **RS485-2W** (2-wire), or **RS485-4W** (4-wire) using the ◄ ► arrow keys. Press **ENTER** to enter the bus address.

```
IN RS232 MODE THE BUS
ADDRESS IS FIXED AT 0000
```

In the above screen, RS-232 mode is used and the bus address is fixed at 0.

```
EDIT SWITCH BUS ADDRESS:
3000       (PRESS ENTER)
```

If in RS-485 mode, the address may be selected. Change the value of the address using the ▲ ▼ arrow keys, then press **ENTER**.

The valid addresses are 1000, 3000, 5000 and 7000 only, as explained in the Remote section of this manual.

6.4.5.2.3 (CONFIG: REMOTE → REMOTE) FORMAT

```
SELECT DATA FORMAT:
8-N-1   7-E-2   7-O-2
```

Note: This setting does not affect the internal communications between the Switch and the modems. For the SLM-5650, this is fixed at RS-232, 9600 baud, 8-N-1.

6.5 INFO (INFORMATION)

```
INFO:  S/N   ID    SETUP
IF-SWITCH  REMCONT  MASK
```

Select **S/N, ID**, **SETUP**, **IF-SWITCH**, **REMCONT**, or **MASK** using the ◄ ► arrow keys, then press **ENTER**. These screens display information on the current configuration of the Switch without risking inadvertent alterations.

6.5.1 (INFO:) S/N

```
Serial Number:
    XXXXXXXXX    (CLEAR)
```

The nine-digit serial number unique to this CRS-311 unit is displayed. Press **CLEAR** to return to the previous menu.

6.5.2 (INFO:) ID

```
SWITCH ID:
------------------------
```

The user-defined Switch ID string is displayed, which is entered via the **UTILITY: SW-ID** screen. Press **ENTER** or **CLEAR** to return to the previous menu.

6.5.3 (INFO:) SETUP

```
TRAFFIC MODEM IS ONLINE.
AUTO:OFF  BKUP:05  REST:04
```

The information on this screen reflects some of the settings as defined in the **CONFIG:** submenus. The online modem is listed on the top line, with Auto mode and the two holdoff times listed on the bottom. Press **ENTER** or **CLEAR** to return to the previous menu.

6.5.4 (INFO) IF-SWITCH

```
TRANSPONDER SWITCH IS
       PRESENT
```

The presence of the CRS-281 IF Transponder Switch is displayed. Press **ENTER** or **CLEAR** to return to the previous menu.

6.5.5 (INFO:) REMCONT (Remote Control Info)

```
REM CNTL: ON     RS232
ADDR:0000  9600 BAUD  8N1
```

This screen shows if the unit is in **LOCAL** or **REMOTE** mode, and gives details of the electrical interface type, the unit address, the baud rate, and data format. Press **ENTER** or **CLEAR** to return to the previous menu.

6.5.6 (INFO:) MASK (Alarms Masked Info)

```
ALARMS MASKED:  MODEM-TX
MODEM-RX  ↖PSU-A  ↙PSU-B
```

This screen shows the alarms that are currently masked. If an alarm is not masked, a blank is displayed in the relevant screen position. Power Supplies A and B cannot be both masked at the same time, but are shown together here to indicate their relative positions on the screen. Press **ENTER** or **CLEAR** to return to the previous menu.

6.6 MONITOR

```
MONITOR:  STATUS  SW-ALARM
STORED-EVENTS  COMMS    IO
```

Select **STATUS**, **SW-ALARM**, **STORED-EVENTS**, **COMMs** (COMM-STATE), or **IO** using the ◄ ► arrow keys, then press **ENTER**.

6.6.1 (MONITOR:) STATUS

```
TRAFFIC MODEM IS ONLINE.
BACKUP HOLDOFF: 05 SEC
```

The status of the Switch is displayed.

If Auto mode is on, it will also show the backup holdoff-time should the bridged TM fail. If Auto mode is off, the second line displays "**OFF**". When the Switch has taken the TM offline and replaced it with the RM (whether done manually or automatically), the screen changes as shown:

```
REDUNDANT IS ONLINE.
RESTORE HOLDOFF:  05 SEC
```

The restore holdoff time is shown on the second line if Auto mode is "**ON**".

6.6.2 (MONITOR:) SW-ALARM

```
SWITCH ALARM:      NONE
```

The above screen shows another example of a Switch's fault status. In this example, *there are no faults*;accordingly, the front panel LED "**Unit Status**" should be **GREEN**.

```
SWITCH ALARM:   -12V PS-B
       ↙ IS UNDERVOLTAGE
```

The above screen shows another example of a Switch's fault status. In this example, *there is a fault* – Power supply "B" is under voltage; accordingly, the front panel LED "**Unit Status**" will be **RED**.

Suggested corrective actions include:

- Ensure power supply power cord is connected and the power switch is **ON;**
- Replace defective power supply module;
- If the second power supply module is not needed, the user can mask this Alarm.

```
SWITCH ALARM: RM PROBLEM
          RM I/O TIMEOUT
```

-OR-

```
SWITCH ALARM: MODEM COMMS
      PROBLEM, TRAFFIC MODEM
```

The above screens shows additional examples of a Switch's fault status. In these examples, *there are faults* – communication has been lost to the Redundant or theTraffic Modem; accordingly, the front panel LED "**Unit Status**" will be **RED**.

Suggested corrective actions include:

- **Check cable connections.** Refer to **Chapter 3. CABLES AND CONNECTIONS**.
- **Check cable operation.** Ensure the cables are OK by swapping them with others. For cable information refer to **Chapter 3. CABLES AND CONNECTIONS** and **Appendix A. CABLE DRAWINGS**.
- **Check modem configurations.** Refer to **Chapter 4. MODEM AND SWITCH CONFIGURATION** and the pertinent modem's *Installation and Operation Manual.*

```
SWITCH ALARM:  RM PROBLEM
MGC refused, cpde: 12 TFT
```

The above screen shows another example of a Switch's fault status. In this example, *there is a fault.* COMMs are good to the Redundant Modem, but the configuration of the Traffic Modem cannot be configured into the Redundant Modem. The front panel LED "Unit Status" will be **RED**.

Suggested corrective actions include:

- Ensure the most capable modem is used as the Redundant Modem, with regard to FAST options, installed options, e.g. Turbo card, firmware version, and hardware revision. The code indicates the parameter within the MGC configuration string that is causing the Redundant Modem to refuse it. The three-letter instruction code is indicated also to assist decoding the problem parameter:

► ***For the CDM-Qx modem***, the code is the decimal number indicating the problem parameter within its MGC configuration code:

00		NO ERROR	01	ITF	Interface
02	LBO	T1 Line Build-Out	03	FRM	Framing mode
04	TFQ	Tx Frequency	05	TFT	Tx FEC Type
06	TMD	Tx Modulation	07	TCR	Tx FEC Code Rate
08	TDR	Tx Data Rate	09	TSI	Tx Spectrum Invert
10	TSC	Tx Scrambler state	11	TPL	Tx Power Level
12	TCK	Tx Clock	13	TDI	Tx Data Invert
14	TXO	Tx Carrier State	15	AUP	AUPC enable
16	APP	AUPC parameters	17	WUD	Warm-Up Delay
18	TXC	Tx common output state	19	TRS	Tx Reed-Solomon
20	TXA	Tx roll-off (alpha) factor	21	TCI	Tx Data Clock Invert
22	RFQ	Rx Frequency	23	RFT	Rx FEC Type
24	RMD	Rx Modulation	25	RCR	Rx FEC Code Rate
26	RDR	Rx Data Rate	27	RSI	Rx Spectrum Invert
28	RDS	Rx DeScrambler state	29	RDI	Rx Data Invert
30	RSW	Rx Sweep Width	31	EBA	Eb/No Alarm point
32	BCS	Rx Buffer clock source	33	RRS	Rx Reed-Solomon
34	RBS	Rx Buffer size/enable	35	RCI	Rx Data Clock Invert
36	ERF	External Reference setting	37	EFM	EDMAC Framing mode
38	ESA	EDMAC Slave Address range	39	TST	Test mode (read-only)
40	MSK	Alarm Masks	41	RTS	Request-To-Send control
42	SSI	Statistics Sample Interval	43	CNM	CnC Mode
44	CFO	CnC Frequency Offset	45	CSD	CnC Min/Max Search Delay
46	CRA	CnC Re-acquisition Time			

6.6.3 (MONITOR:) STORED EVENTS

```
STORED EVENTS:    VIEW
CLEAR-ALL (PRESS ENTER)
```

Select **VIEW** or **CLEAR-ALL** using the ◄ ► arrow keys, then press **ENTER**.

If **CLEAR-ALL** is selected, the event log is cleared and the user is taken directly back to the previous menu. However, if there are faults present on the unit at this time, new log entries will be generated for those faults.

Note that, in accordance with international convention, the date is shown in **DAY-MONTH-YEAR** format.

6.6.3.1 (MONITOR: STORED-EVENTS) → VIEW

```
LOG23: 26/01/00 10:37:32
FT-06 RX ALARM (UP/DN)
```

The user may scroll backwards or forwards through the entries in the event log, using the ▲ ▼ arrow keys. Press **ENTER** or **CLEAR** to return to the previous menu.

The event log can store up to 98 events. When a fault (FT) condition occurs, it is time-stamped and put into the log. Similarly, when the fault condition clears (OK), this is also recorded, as shown:

```
LOG24: 26/01/04 10:37:35
OK-06  RX ALARM  (UP/DN)
```

Next to the **FT/OK** indicator is a code for the faulted unit: the **TM**, (for Traffic Modem), **RM** (for Redundant Modem) or **SW** (for the Switch).

6.6.4 (MONITOR:) COMMS (Communications State)

```
COMMS:      TRAFFIC: OK
          REDUNDANT: FT
```

The above screen indicates that the Switch has good or bad monitoring I/O communications with the modems. This does not indicate fault status.

6.6.5 (MONITOR:) IO

```
T <0000/LRS ?
  >0000/LRS=1
```

The above screen shows actual communication strings between the Switch and the modems. When in this mode, the communication is slowed down to enable viewing of messages. Because of this, it should only be used for troubleshooting purposes.

- **Upper line:** Switch controller's outbound messages
- **Lower line:** Modem responses
- **First character:** Indicates the device being addressed (**T** = Traffic Modem; **R** = Redundant Modem).

6.7 STORE/LD (Store or Load Configuration)

```
STORE/LOAD CONFIG:
STORE  LOAD  (PRESS ENTER)
```

Select **STORE** or **LOAD** using the ◄ ► arrow keys, then to press **ENTER**.

These submenus permit the user to store or load up to 10 different Switch configurations in its non-volatile memory. These are configurations for the Switch itself, not the modems to which attached to it.

IMPORTANT

This feature is operational in LOCAL MODE ONLY. If the User attempts to save or load a configuration while in Remote Mode, the following message displays:

```
THE SWITCH IS CURRENTLY
IN REMOTE MODE!! (CLEAR)
```

6.7.1 (STORE/LD) STORE

```
STORE CONFIGURATION TO
   LOCATION: 10   (ENTER)
```

Select the location to store the current configuration to, using the ▲ ▼ arrow keys, then press **ENTER**. Locations 1 through 10 are available.

If the selected location does not contain a previously stored configuration, the following screen is displayed:

```
YOUR CONFIGURATION HAS
BEEN STORED!    (ENTER)
```

Press **ENTER** or **CLEAR** to return to the previous menu. If, however, the selected location contains a previously stored configuration, the following screen is displayed:

```
WARNING!  LOC 10 CONTAINS
DATA!  OVERWRITE?  NO  YES
```

Select **NO** or **YES** using the ◄ ► arrow keys, then press **ENTER**. Selecting **YES** will overwrite the existing configuration at the selected location.

6.7.2 (STORE/LD) LOAD

```
LOAD CONFIGURATION FROM
   LOCATION: 10  (ENTER)
```

Select the location from which to load a configuration using the ▲ ▼ arrow keys, then press **ENTER**. Locations 1 through 10 are available. If the selected location contains valid data, the following screen is displayed:

```
 THE NEW CONFIGURATION
HAS BEEN LOADED  (ENTER)
```

Press **ENTER** or **CLEAR** to return to the previous menu. If, however, the selected location does not contain valid data, the following screen is displayed:

```
WARNING! LOC 10 CONTAINS
NO DATA!         (ENTER)
```

Press **ENTER** or **CLEAR** to return to the previous menu.

6.8 UTILITY

This submenu permits the user to select from a number of different utility functions, which are described in the following sections.

```
UTILITY: SET-RTC DISPLAY
SW-ID   TYPE  INDEP-MODE
```

Select **SET-RTC**, **DISPLAY**, **SW-ID**, or **INDEP-MODE** using the ◄ ► arrow keys, then press **ENTER**.

IMPORTANT

While* TYPE *is selectable on this menu, it is intended for CEFD internal (factory) test / diagnostic use* only *and provides* no *functional purpose to the User.

6.8.1 (UTILITY:) SET-RTC (Set Real-Time Clock)

```
EDIT REAL TIME CLOCK:
12:00:00  24/04/00  (ENT)
```

Edit the time and date settings of the real-time clock by selecting the digit to be edited using the ◄ ► arrow keys; the value of the digit is then changed using the ▲ ▼ arrow keys.

Note that, in accordance with international convention, the date is shown in **DAY-MONTH-YEAR** format. The user should then press **ENTER**.

6.8.2 (UTILITY:) DISPLAY (Display Brightness)

```
EDIT DISPLAY BRIGHTNESS:
100%       (PRESS ENTER)
```

Brightness levels of 25%, 50%, 75% or 100% are selectable. Edit the display brightness using the ▲▼ arrow keys. Once the desired brightness has been set, press **ENTER**.

6.8.3 (UTILITY:) SW-ID (Switch ID)

```
EDIT SWITCH ID:   (ENTER)
---- THIS IS A TEST ----
```

Edit the Switch ID string using the ▲ ▼ and ◄ ► arrow keys. Only the bottom line is available (24 characters). The cursor selects the position on the bottom line (◄ ► arrow keys) and the character is then edited (▲ ▼ arrow keys).

The following characters are available:

[Space] ( ) * + - , . / 0-9 and **A-Z**.

When finishing composing the string, press **ENTER**.

6.8.4 (UTILITY:) INDEP-MODE (Independent Mode)

IMPORTANT

This feature is for use ONLY with the SLM-5650/5650A.

```
INDEPENDENT MODE:
NORMAL-OP   ENABLE-INDEP
```

In Independent Mode, the modems each operate independently and simultaneously (dual-carrier). In this mode, the CRS-311 is used only to enable control and monitoring of both modems via a single RS-232/RS-485 control line.

Use the ◄ ► arrow keys to select between **NORMAL-OP** (*NORMAL-OP*erations) and **ENABLE-INDEP** (*ENABLE INDEP*endent Mode). Press **ENTER** to configure.

Notes:

Appendix A. CABLE DRAWINGS

A.1 Introduction

This appendix contains drawings of cables used with the CRS-311. These cables are broken into three categories: User / Utility Cables, Control Cables, and Data Cables. Each section provides illustrations of the cables' technical specifications; additionally, the tables featured in Control and Data Cable sections cross-reference to the illustrations found in **Chapter 3. CABLES AND CONNECTIONS**.

A.2 User / Utility Cables

App. A FIG	REF Ch. 3 FIG	CEFD CABLE P/N	DESCRIPTION	USED WITH CRS-311 → …	USED FOR (DATA TYPE)
A-1	N/A	N/A	N/A	User data	RS-530 → RS-422/449 DCE Conversion
A-2	N/A	N/A	N/A	User data	RS-530 → V.35 DCE Conversion
A-3	N/A	N/A	N/A	User RS-232 Switch Programming / Flash Upgrade	CRS-311 Remote → PC Serial Port

A.2.1 RS-530 to RS-422 Data Cable

Figure A-1 shows the cable drawing for RS-530 to RS-422/449 DCE conversion for connections between the Switch and the User data.

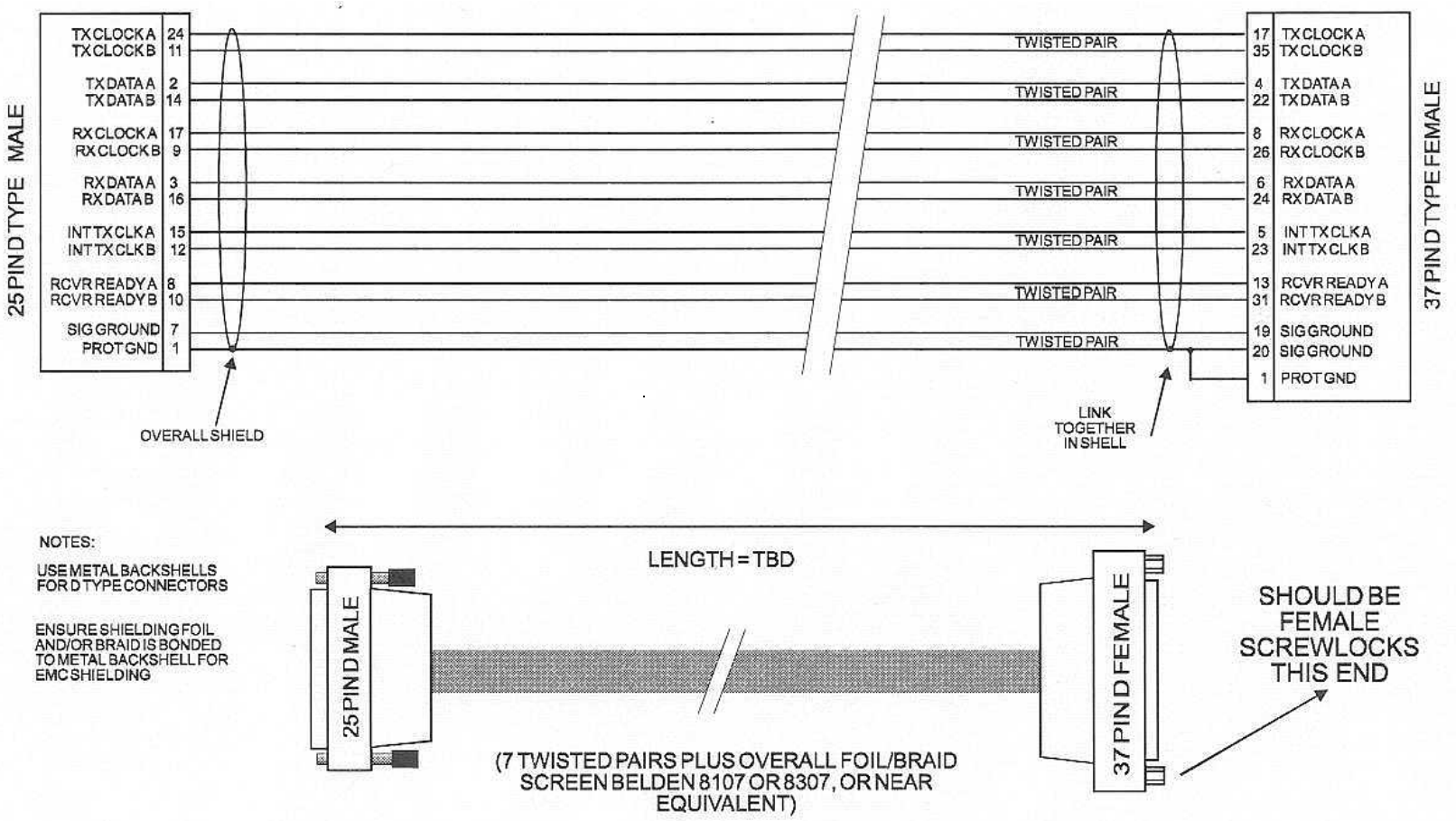


Figure A-1. DCE Conversion Cable: RS-530 to RS-422/449

A.2.2 RS-530 to V.35 Data Cable

Figure A-2 shows the cable drawing for RS-530 to V.35 DCE conversion for connections between the Switch and the User data.

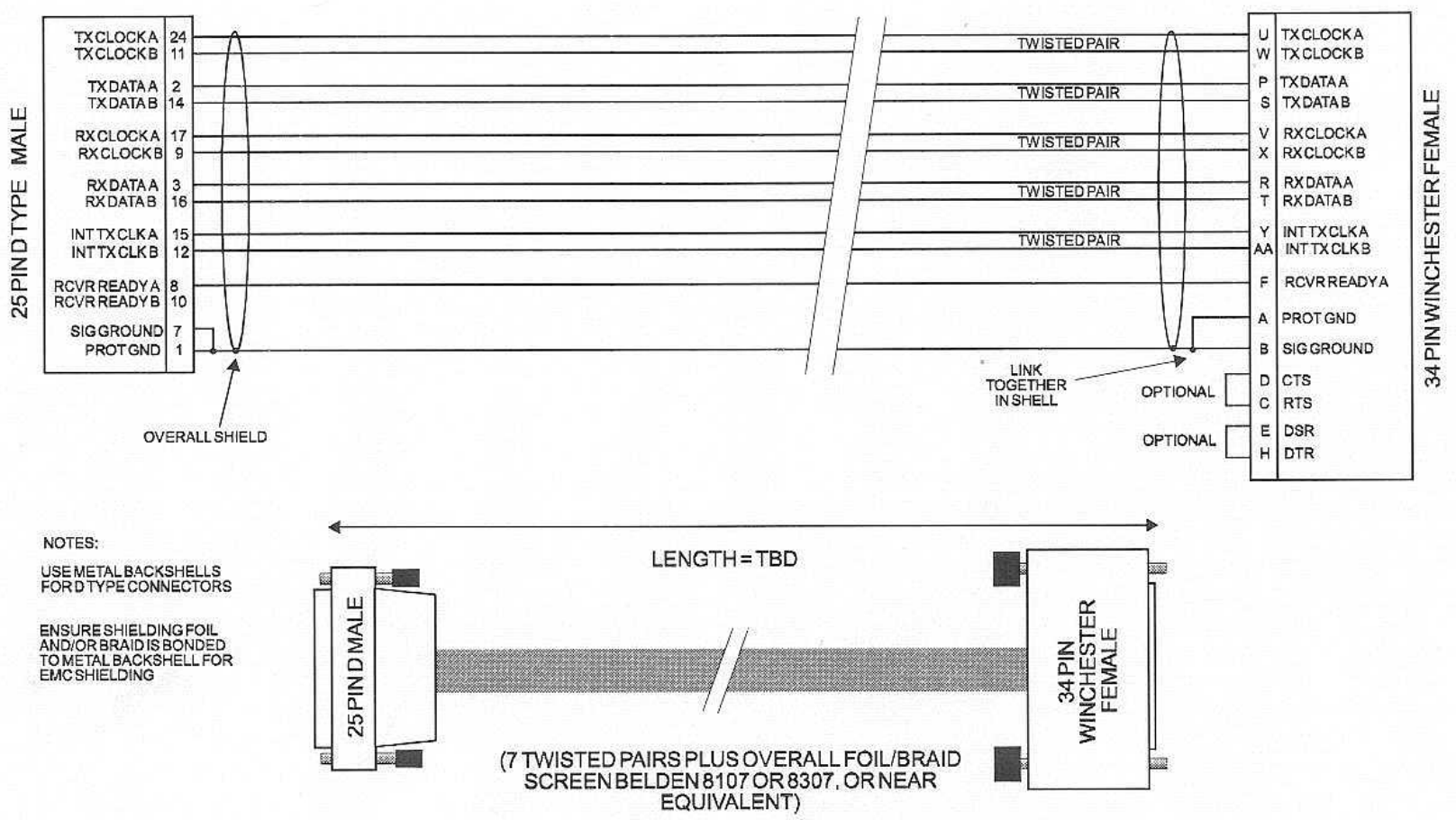


Figure A-2. DCE Conversion Cable: RS-530 to V.35

A.2.3 Switch Programming Cable

Figure A-3 shows the cable required for a simple RS-232 connection between the CRS-311 remote control port and a PC serial port. This cable is needed for Flash upgrading.

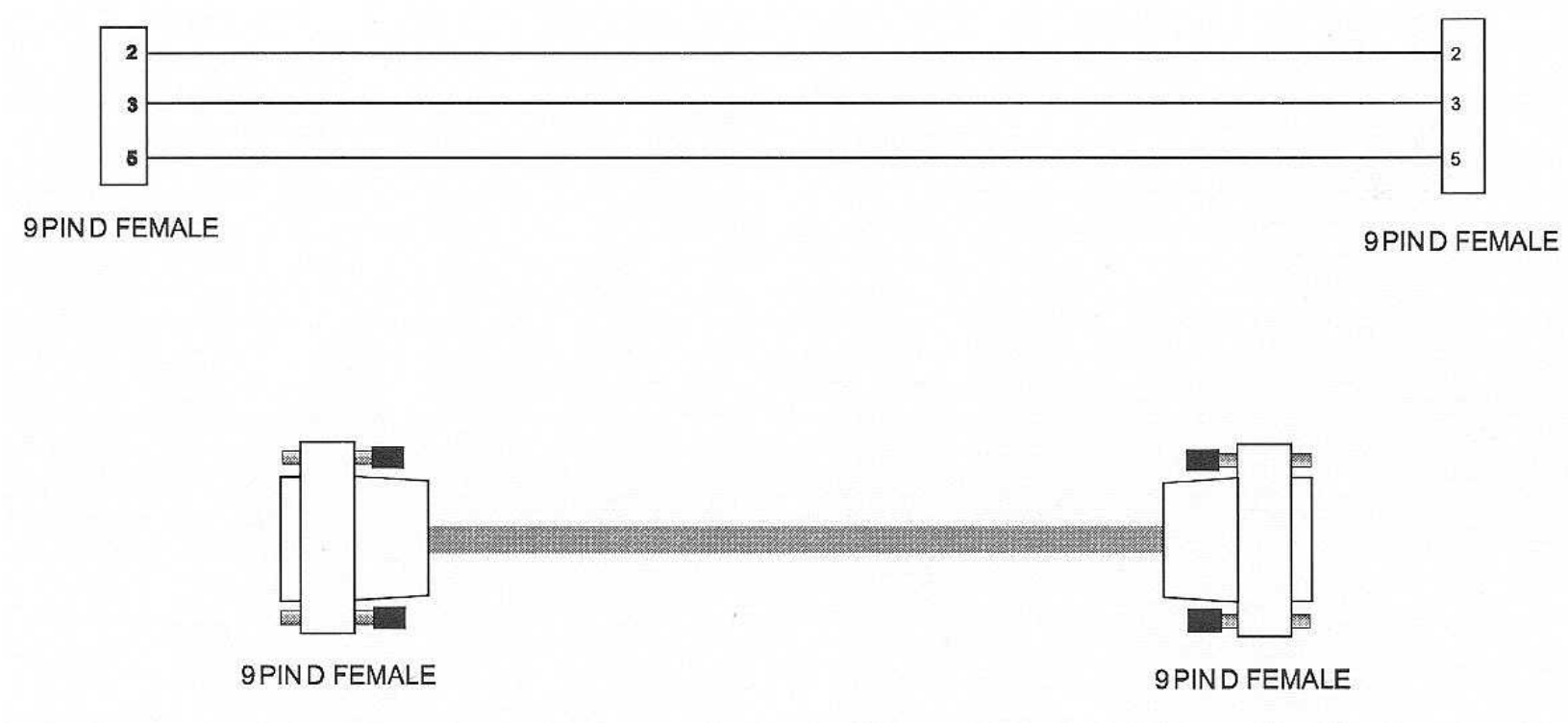


Figure A-3. Switch Programming Cable

A.3 Control Cables

App. A FIG	REF Ch. 3 FIG	CEFD CABLE P/N	DESCRIPTION	USED WITH CRS-311 →	USED FOR (TYPE)
A-4	3-1	CA-0000095	(6X) DB-9F Ribbon	CDM-Qx/QxL	RS-485 Multi-drop (*optional)*
A-5	3-1	CA-0000096	(6X) DB-9F Shielded		RS-485 Multi-drop (*standard*)
A-6	3-1	CA/WR11418-1	Terminal		Terminal
A-7	3-1	CA/WR11419-1	DB-9M → DB-9M, 6”		Null Modem
A-8	3-2 3-3 3-4 3-5 3-6	CA-0000009	HD-15M → (2X) DB-15F, 4’		Control ‘Y’
A-9	3-9 3-10	CA/WR12136-2	HD-15M → HD-15M, 4’	SLM-5650/5650A	Control
A-10	3-13	CA-0000006	DB-50M → (2X) DB-25F, 4’	(CRS-351) → SLM-5650/5650A	Control ‘Y’
A-11	N/A	CA/WR12842-4	HD-15M → DB-9M, HD-15M, 4’	TMI/RMI → SLM-5650/5650A Overhead → User	Control ‘Y’

A.3.1 Optional RS-485 Multi-drop Ribbon Cable, (6X) DB-9 Female

Figure A-4 shows the optional RS-485 Multi-drop Ribbon Cable. This cable is required to daisy-chain the CDM-Qx/QxL modems and Switch together for communications. If Electromagnetic Compatibility (EMC) is a concern, then use the standard RS-485 Multi-Drop Shielded Cable.

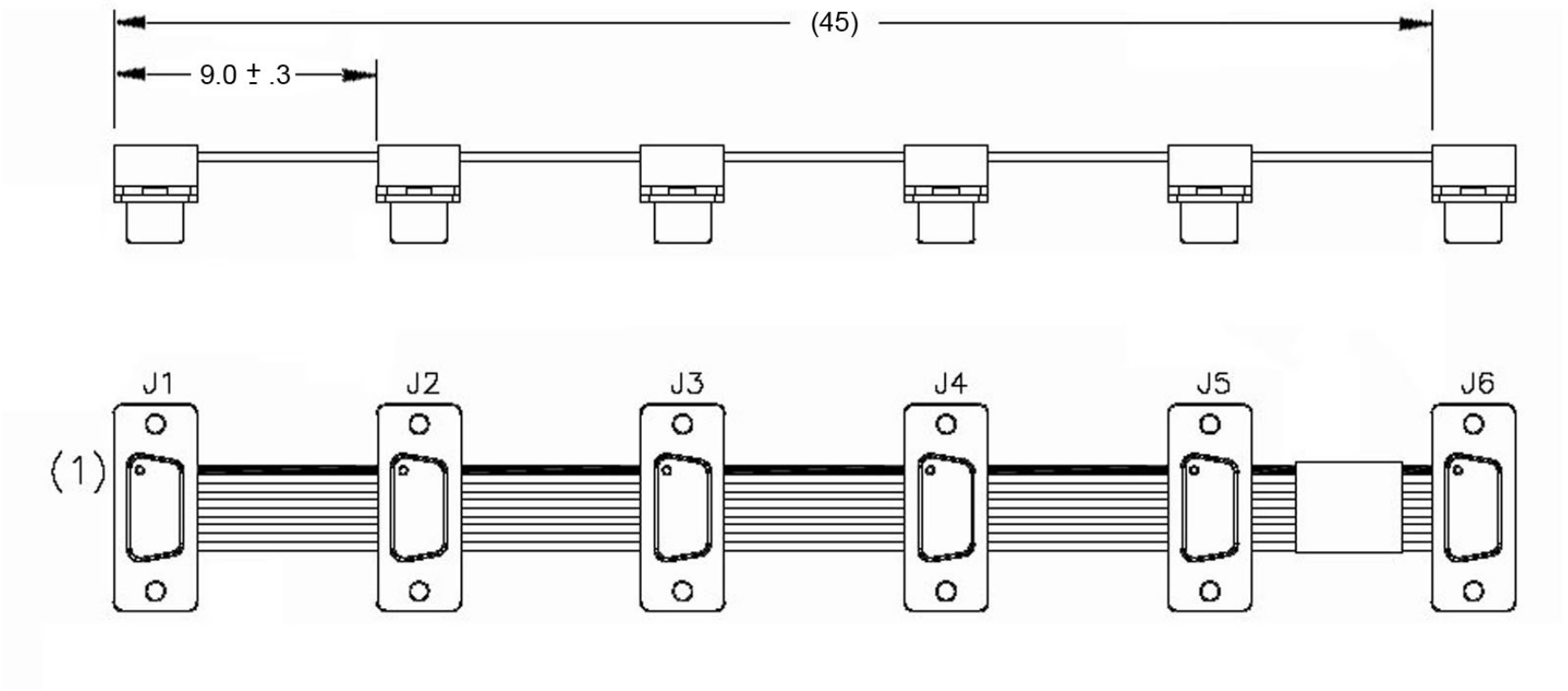
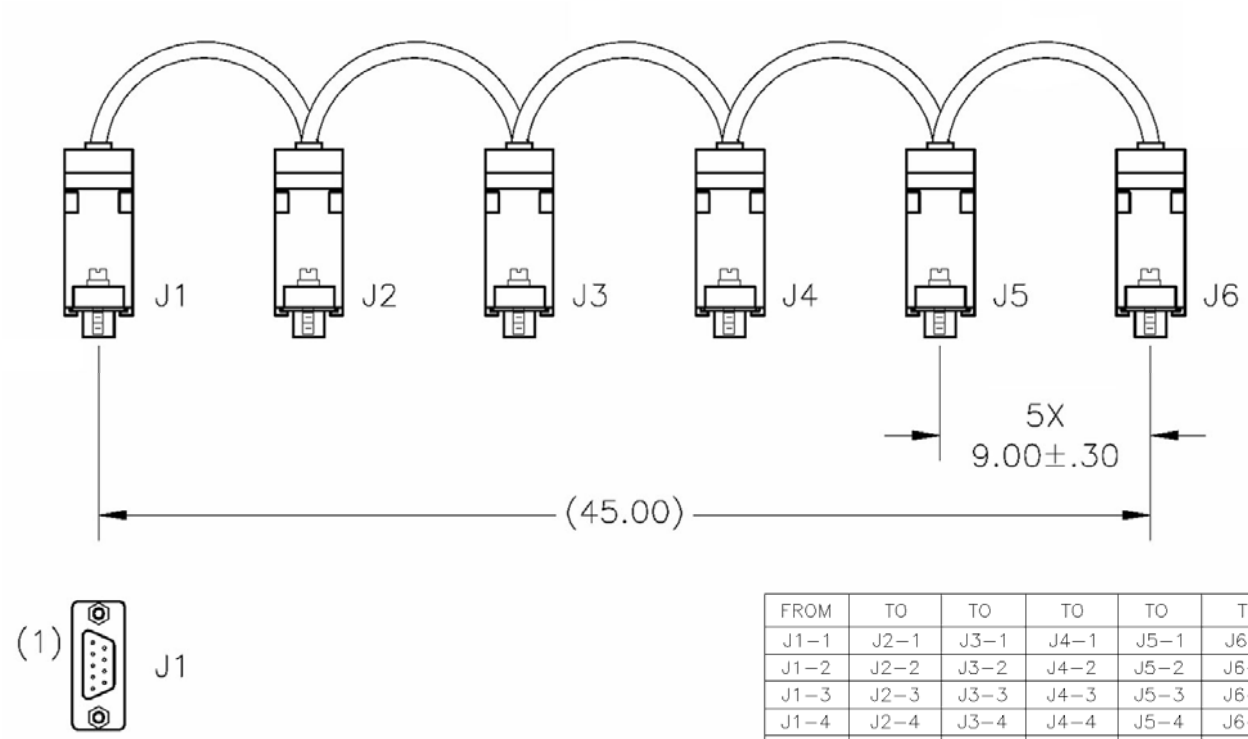


Figure A-4. Optional RS-485 Multi-Drop Ribbon Cable (CA-0000095)

A.3.2 Standard RS-485 Multi-drop Shielded Cable, (6X) DB-9 Female

Figure A-5 shows the standard RS-485 Multi-drop Shielded Cable. This cable is required to daisy-chain the CDM-Qx/QxL modems and Switch together for communications. If Electromagnetic Compatibility (EMC) is not a concern, then use the optional RS-485 Multi-drop Ribbon Cable.



FROM	TO	TO	TO	TO	TO	COLOR	PAIR
J1–1	J2–1	J3–1	J4–1	J5–1	J6–1	DRAIN	N/A
J1–2	J2–2	J3–2	J4–2	J5–2	J6–2	RED	X
J1–3	J2–3	J3–3	J4–3	J5–3	J6–3	BLK	
J1–4	J2–4	J3–4	J4–4	J5–4	J6–4	BLU	X
J1–5	J2–5	J3–5	J4–5	J5–5	J6–5	BLK	
J1–6	J2–6	J3–6	J4–6	J5–6	J6–6	GRN	X
J1–7	J2–7	J3–7	J4–7	J5–7	J6–7	BLK	
J1–8	J2–8	J3–8	J4–8	J5–8	J6–8	WHT	X
J1–9	J2–9	J3–9	J4–9	J5–9	J6–9	BLK	

Figure A-5. Standard RS-485 Multi-Drop Shielded Cable (CA-0000096)

A.3.3 RS-485 Cable Termination, (15X) DB-9 Male

Figure A-6 shows the RS-485 Cable Termination required for terminating the ends of the optional RS-485 Multi-Drop Ribbon Cable (CA-0000095) or standard RS-485 Multi-Drop Shielded Cable (CA-0000096).

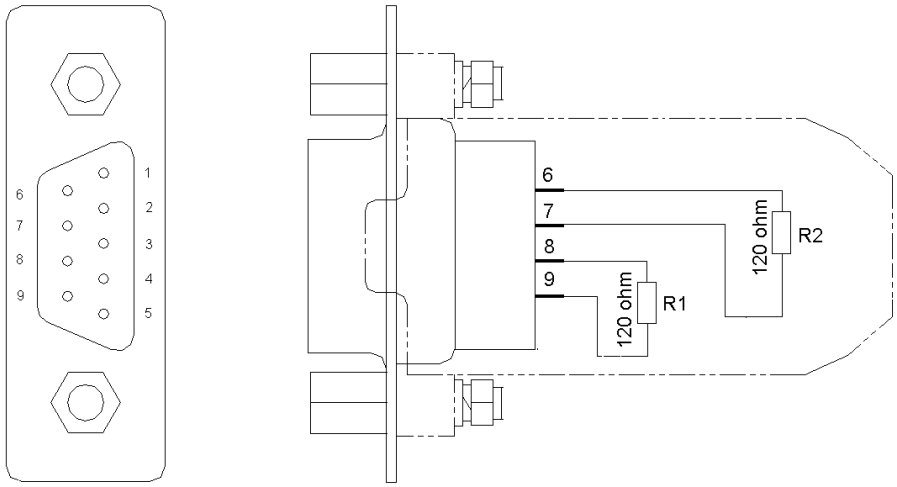


Figure A-6. RS-485 Cable Termination (CA/WR11418-1)

A.3.4 RS-485 Null Modem Cable, DB-9 Male

Figure A-7 shows the RS-485 Null Modem Cable required for the RS-485 multi-drop for the CDM-Qx/QxL modems. This attaches to the DB-9F "485 Pass-through" connector on the CRS-230 controller module.

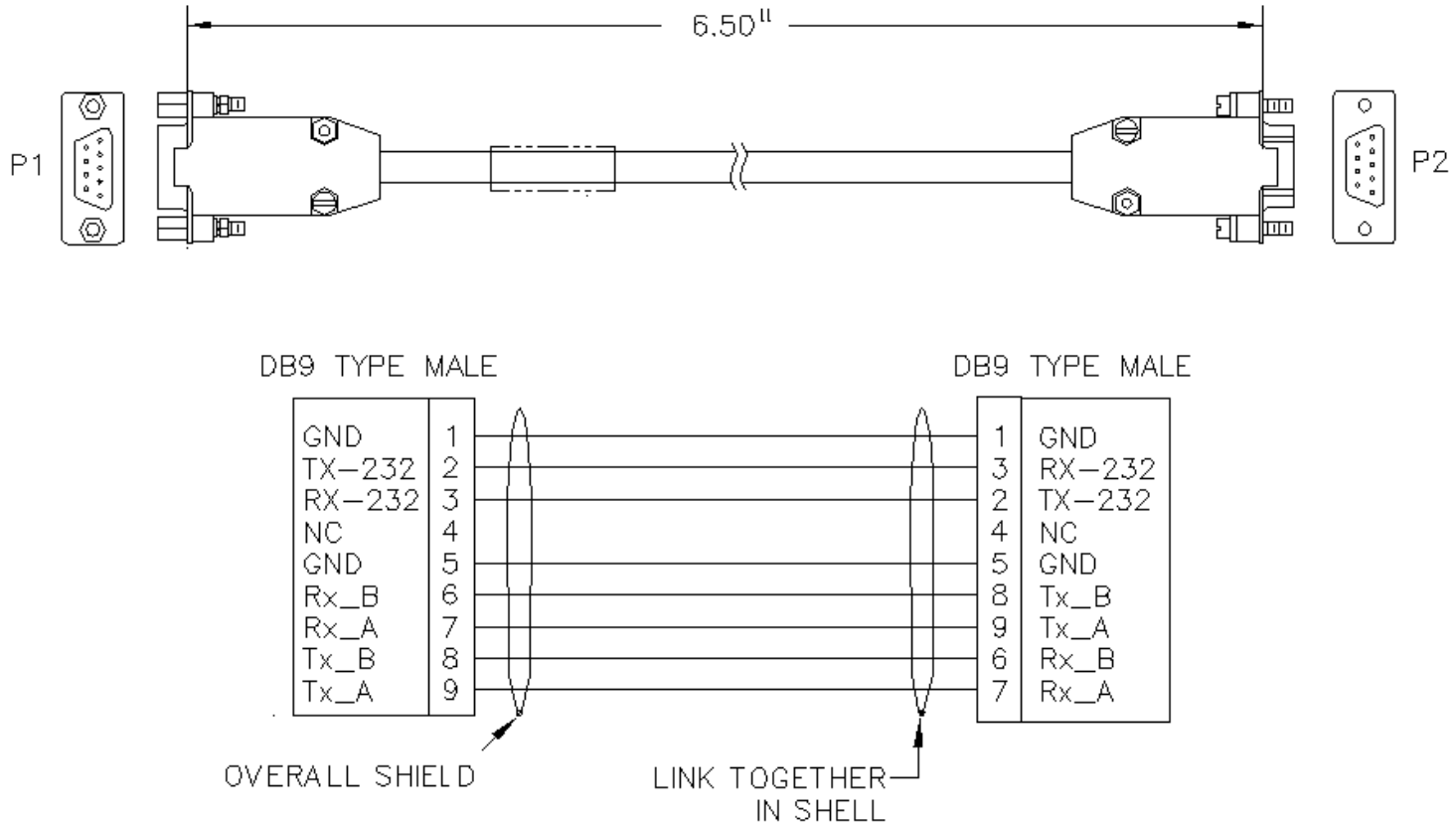
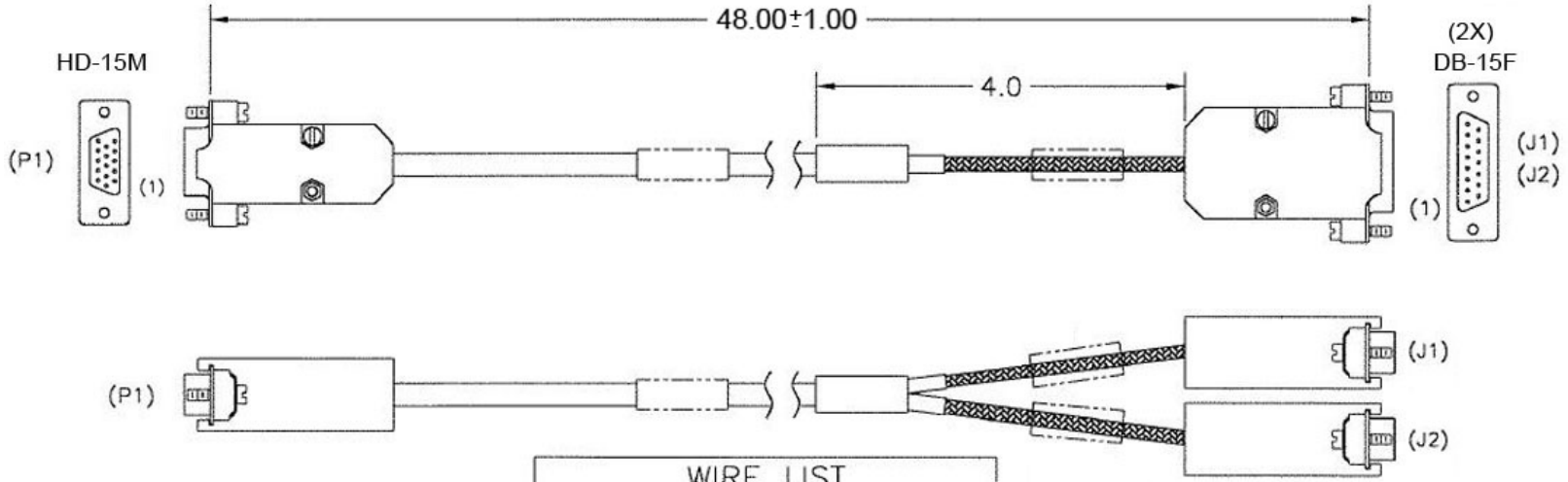


Figure A-7. RS-485 Null Modem Cable (CA/WR11419-1)

A.3.5 Control 'Y' Cable for CDM-Qx and CDM-QxL with CnC®

Figure A-8 shows one of the two types of control cables required for the CDM-Qx/QxL modems. This cable adapts from both mod and demod DB-15 Alarm connectors on the modem to a HD-15 Fault connector on the Switch TMI/RMI. These interfaces are capable of CnC® support.

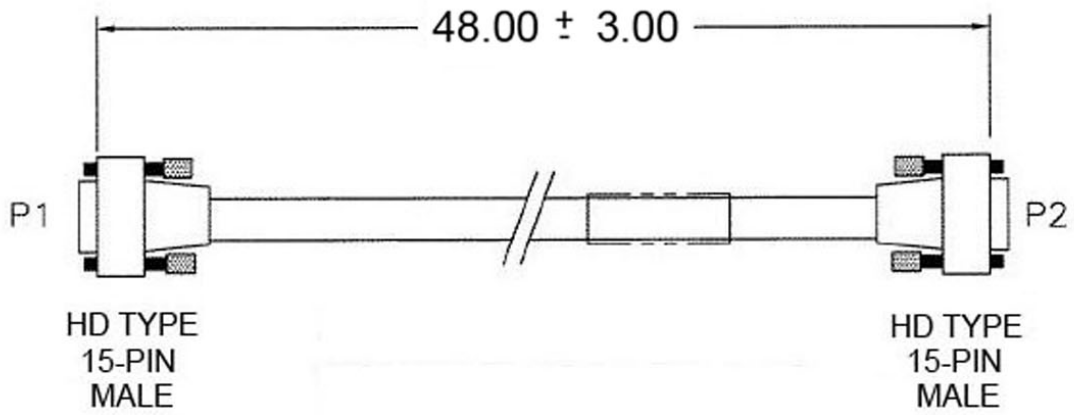


WIRE LIST			
FROM	TO	SIGNAL	PAIR
P1-3	J1-11	PAIR1_A	X
P1-5	J1-1	PAIR1_B	
P1-8	J1-3	PAIR2_A	X
P1-5	J1-1	PAIR2_B	
P1-2	J2-11	PAIR3_A	X
P1-5	J2-4	PAIR3_B	
P1-7	J2-3	PAIR4_A	X
P1-5	J2-4	PAIR4_B	
P1-4	J2-12	PAIR5_A	X
P1-14	J2-15	PAIR5_B	
P1-13	J2-6	PAIR6_A	X
P1-10	J2-9	PAIR6_B	
J2-4	J2-7	JUMPER	
J2-7	J2-13	JUMPER	
J2-13	J2-1	JUMPER	

Figure A-8. Control 'Y' Cable for CDM-QxL with CnC® (CA-0000009)

A.3.6 Control Cable for SLM-5650/5650A

Figure A-9 shows the control cable that connects the SLM-5650/5650A to the CRS-311.

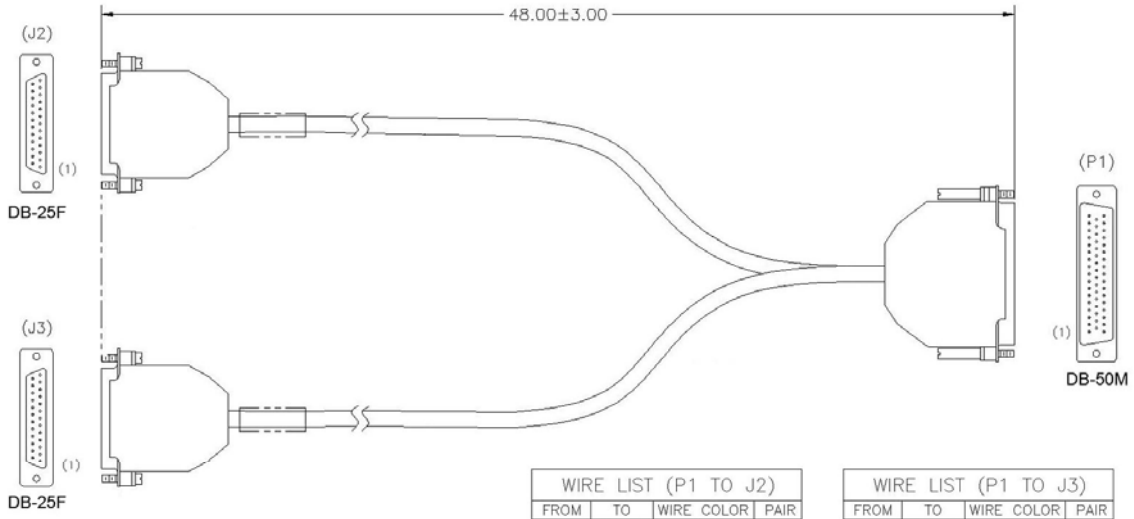


WIRE LIST		
FROM	TO	TWISTED PAIR
P1–1 P1–6	P2–1 P2–6	X
P1–2 P1–7	P2–2 P2–7	X
P1–3 P1–8	P2–3 P2–8	X
P1–4 P1–5 P1–9 P1–10 P1–11 P1–12 P1–13 P1–14 P1–15	P2–4 P2–5 P2–9 P2–10 P2–11 P2–12 P2–13 P2–14 P2–15	

Figure A-9. SLM-5650/5650A Control Cable (CA/WR12136-2)

A.3.7 Control 'Y' Overhead Cable for CRS-351 → SLM-5650/5650A

Figure A-10 shows the control cable that connects the SLM-5650/5650A Redundant and Traffic "P1 Overhead Data" ports to the CRS-351 Overhead Module on the CRS-311. This cable is used where protection of the overhead signals (backward alarms, audio ESC, data ESC, etc.) is desired.



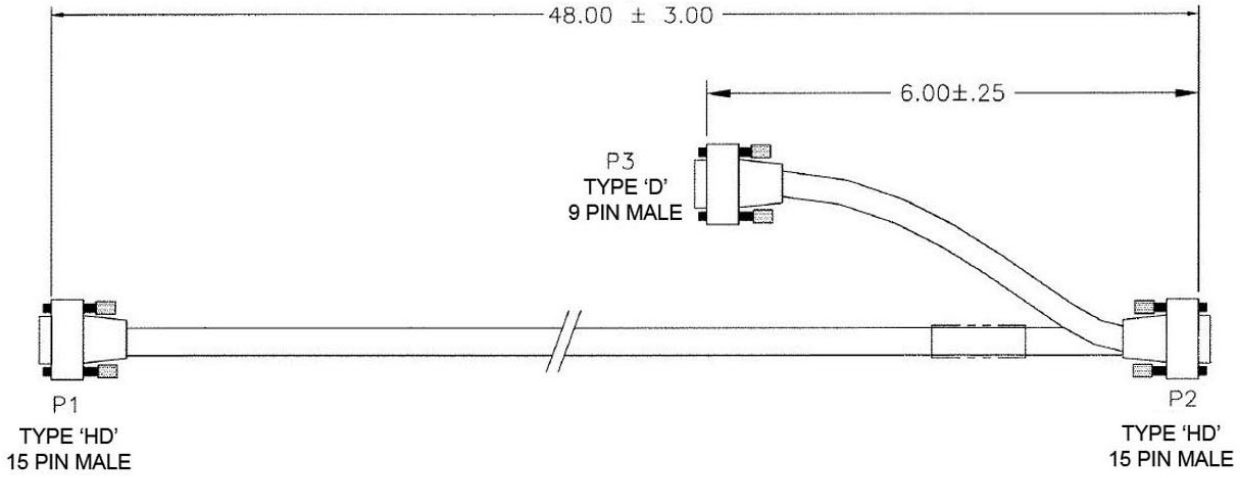
WIRE LIST (P1 TO J2)			
FROM	TO	WIRE COLOR	PAIR
P1-1	J2-1	RED	X
P1-34	J2-14	WHT	
P1-18	J2-2	GRN	X
P1-2	J2-15	RED	
P1-35	J2-3	RED	X
P1-19	J2-16	BLK	
P1-3	J2-4	RED	X
P1-36	J2-17	BLU	
P1-20	J2-5	WHT	X
P1-4	J2-18	BLK	
P1-37	J2-6	YLW	X
P1-21	J2-19	RED	
P1-38	J2-20	BLU	X
P1-22	J2-8	BLK	
P1-6	J2-21	YLW	X
P1-7	J2-10	BLK	
P1-39	J2-9	BRN	X
P1-23	J2-22	RED	
P1-40	J2-23	BLK	X
P1-8	J2-24	BRN	
P1-24	J2-11	BLK	X
P1-41	J2-12	GRN	
P1-25	J2-25	ORN	X
P1-9	J2-13	BLK	
P1-25	J2-7	SHIELD	
	P1-46	ITEM 9	

WIRE LIST (P1 TO J3)			
FROM	TO	WIRE COLOR	PAIR
P1-42	J3-1	RED	X
P1-26	J3-14	WHT	
P1-10	J3-2	GRN	X
P1-43	J3-15	RED	
P1-27	J3-3	RED	X
P1-11	J3-16	BLK	
P1-44	J3-4	RED	X
P1-28	J3-17	BLU	
P1-12	J3-5	WHT	X
P1-45	J3-18	BLK	
P1-29	J3-6	YLW	X
P1-13	J3-19	RED	
P1-30	J3-20	BLU	X
P1-14	J3-8	BLK	
P1-47	J3-21	YLW	X
P1-48	J3-10	BLK	
P1-31	J3-9	BRN	X
P1-15	J3-22	RED	
P1-32	J3-23	BLK	X
P1-49	J3-24	BRN	
P1-16	J3-11	BLK	X
P1-33	J3-12	GRN	
P1-17	J3-25	ORN	X
P1-50	J3-13	BLK	
P1-46	J3-7	SHIELD	

Figure A-10. SLM-5650/5650A Control 'Y' Overhead Cable (CA-0000006)

A.3.8 Control 'Y' Cable for SLM-5650/5650A to CRS-311

Figure A-11 shows the Control 'Y' Cable that connects the SLM-5650/5650A to the CRS-311 RMI/TMI. This is an optional cable, purchased separately, used in place of the CA/WR12136-2 cable (see Figure A-9) to give the User access to the AGC and I&Q outputs of the modem.



WIRE LIST		
FROM	TO	TWISTED PAIR
P1–1 P1–6	P2–1/P3–8 P2–6/P3–3	X
P1–2 P1–7	P2–2 P2–7/P3–1	X
P1–3 P1–8	P2–3 P2–8	X
P1–4 P1–5 P1–9 P1–10 P1–11 P1–12 P1–13 P1–14 P1–15	P2–4 P2–5/P3–5 P2–9 P2–10 P2–11 P2–12 P2–13 P2–14 P2–15	

DB-9 (P3) User Access Pinout	
Pin Number	Signal Name
1	AGC Monitor
3	DeMod Q
5	Ground
8	DeMod I

Figure A-11. SLM-5650/5650A Control 'Y' Cable (CA/WR12842-4)

A.4 Data Cables

App. A FIG	REF Ch. 4 FIG	CEFD CABLE P/N	DESCRIPTION	USED WITH CRS-311 → … [(CRS-XXX) denotes installed module]	USED FOR (TYPE)
A-12	3-2 3-11	CA/WR0066-4	DB-25M → DB-25F, 4’	CDM-Qx/QxL (CRS-351) → SLM-5650/5650A	RS-422 Data “ “ , EIA-530/RS-232
A-13	3-3 3-10	CA/WR9038-4	DB-15M → DB-15F, 4’	CDM-Qx/QxL SLM-5650/5650A	Bal G.703 Data
A-14	3-4 3-7 3-10	PL/0813-4	75Ω BNC → 75Ω BNC, 4’	CDM-Qx/QxL (CRS-281) → CDM-Qx SLM-5650/5650A	Unbal G.703 Data IF Unbal G.703 Data
A-15	3-5 3-9	CA/WR9189-4	HD-50M → HD-50M, 4’	CDM-Qx/QxL SLM-5650/5650A	HSSI Data
A-16	3-6	CA/WR13018-2	DB-15F → (4X) RJ45, 6’	CDM-Qx/QxL	Quad E1 Data
A-17	3-6 3-9 3-12	PP/CAT5FF3FTGY	RJ45 → RJ45, 3’	CDM-Qx/QxL SLM-5650/5650A	Quad E1Data Cat5 Ethernet
A-18	3-7	PL/0946-1	50Ω BNC → 50Ω BNC, 4’	(CRS-281) → CDM-Qx	IF
A-19	3-8 3-15	CA/RF10453-4	Type ‘N’ → Type ‘N’, 4’	(CRS-281A) → CDM-QxL (CRS-281L) → SLM-5650/5650A	IF
A-20	3-14	CA/3005-1	50Ω TNC → 50Ω TNC, 4’	(CRS-281) → SLM-5650/5650A	IF

A.4.1 RS-232/422, EIA-530 Control and Data Cable, DB-25

Figure A-12 shows the RS-232/422, EIA-530 Data cable for connection between the Switch and Modem or between the Switch and the User data.

INDICATORS		
25M	NOTES	25F
1	TO	1
2	TO	2
3	TO	3
4	TO	4
5	TO	5
6	TO	6
7	TO	7
8	TO	8
9	TO	9
10	TO	10
11	TO	11
12	TO	12
13	TO	13
14	TO	14
15	TO	15
16	TO	16
17	TO	17
18	TO	18
19	TO	19
20	TO	20
21	TO	21
22	TO	22
23	TO	23
24	TO	24
25	TO	25

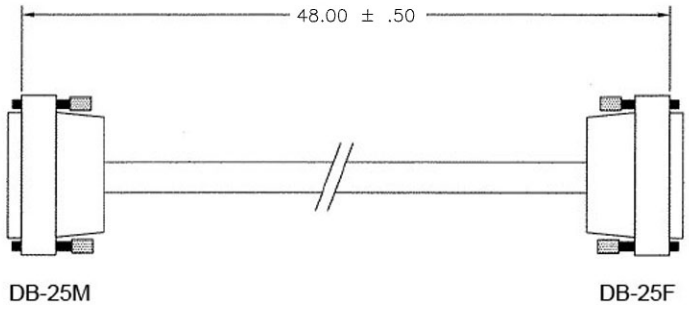


Figure A-12. RS-232/422, EIA-530 Control and Data Cable (CA/WR0066-4)

A.4.2 Balanced G.703 Data Cable, DB-15

Figure A-13 shows the Balanced G.703 Data cable for connection between the Switch and Modem or between the Switch and the User data.

INDICATORS		
15M	NOTES	15M
1	TO	1
2	TO	2
3	TO	3
4	TO	4
5	TO	5
6	TO	6
7	TO	7
9	TO	9
11	TO	11
12	TO	12
13	TO	13
15	TO	15

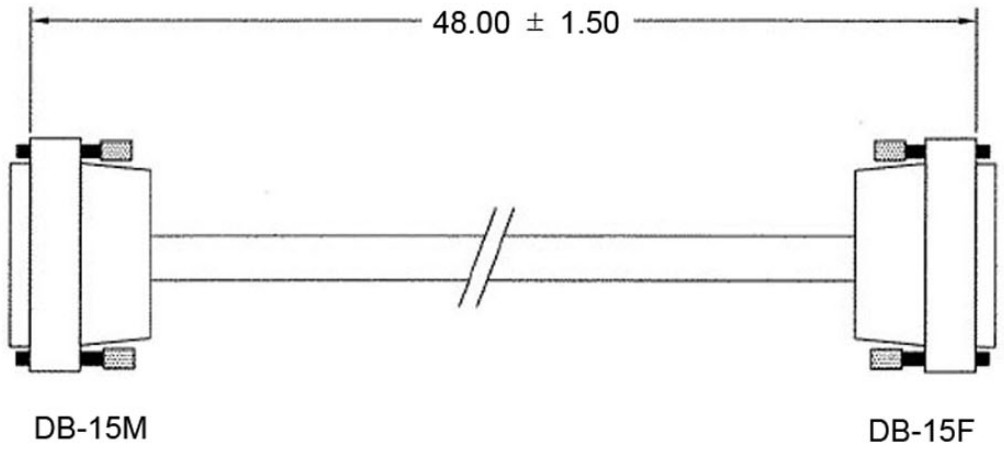


Figure A-13. Balanced G.703 Data Cable (CA/WR9038-4)

A.4.3 Balanced G.703 / IF Cable, BNC, 75Ω

Figure A-14 shows the 75Ω BNC cable used for the Balanced G.703 data connections between the CRS-311 and Modem. It is also used for connecting the Modem to the CRS-281 (70/140 MHz) IF Switch.

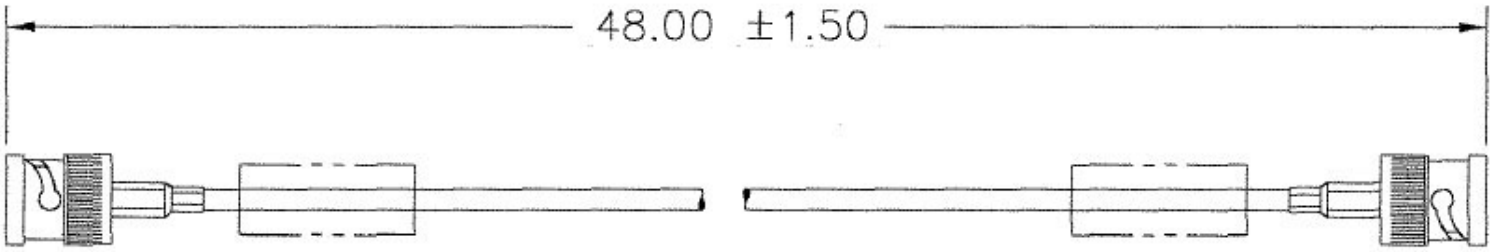


Figure A-14. Balanced G.703 / IF Cable, BNC 75Ω (PL/0813-4)

A.4.4 HSSI Data Cable

Figure A-15 shows the HSSI data cable used for connections between the Switch and the Modem.

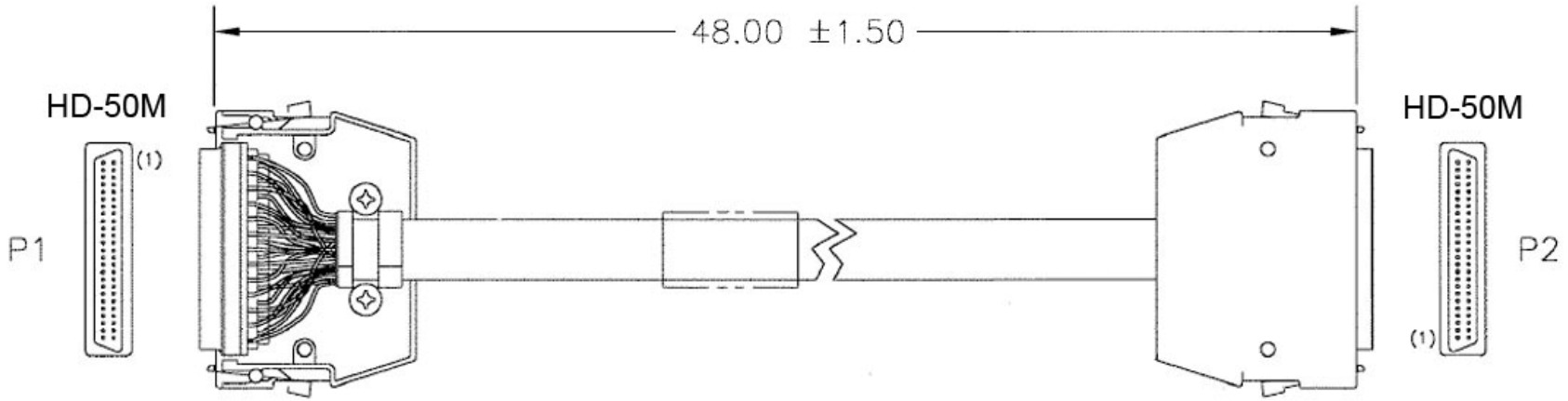


Figure A-15. HSSI Data Cable (CA/WR9189-4)

A.4.5 Quad E1 Data Cable for CDM-Qx/QxL

Figure A-16 shows the cable used to connect the Switch RMI (CRS-305) to the redundant CDM-Qx/QxL Quad E1 interface.

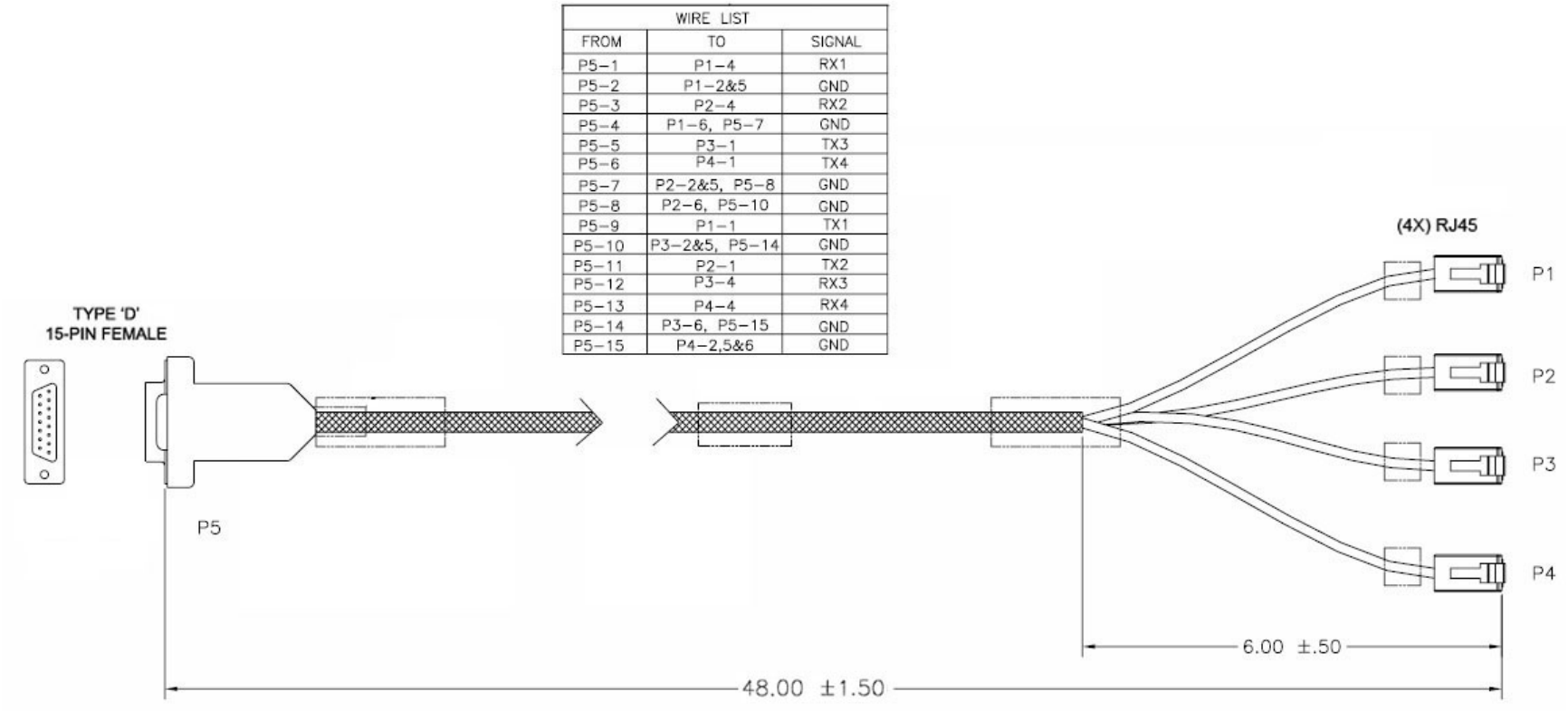
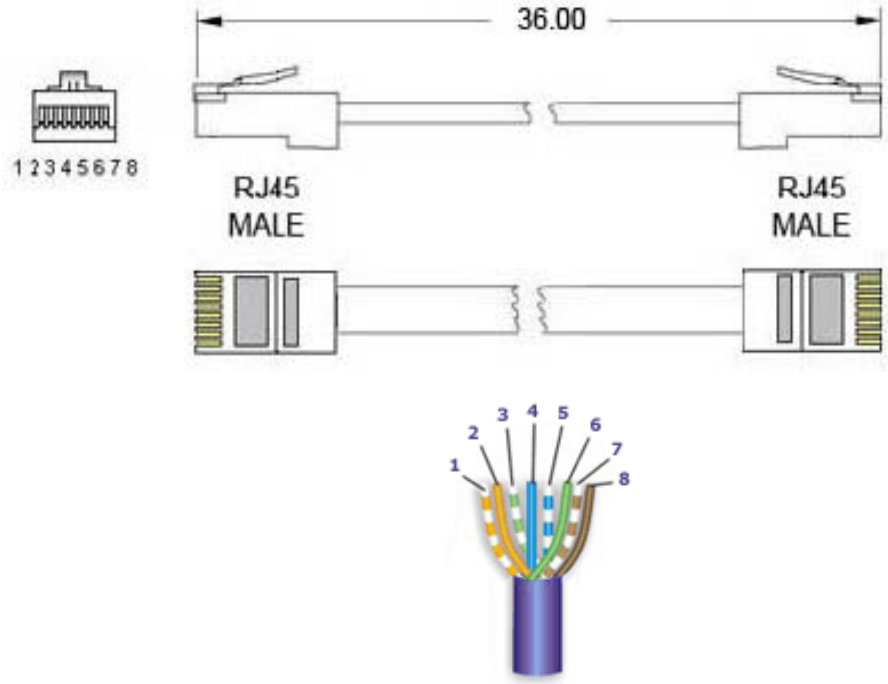


Figure A-16. CDM-Qx/QxL Quad E1 Data Cable (CA/WR13018-2)

A.4.6 Quad E1 / Gigabit Ethernet Connector Cable

Figure A-17 shows the cable used for the CDM-Qx/QxL Quad E1 data connections, and Gigabit Ethernet connections for the SLM-5650/5650A modems.



T568B Wiring Diagram		
Pair No.	**Wire**	**Pin No.**
1	Blue/White tracer	5
	Blue	4
2	Orange/White tracer	1
	Orange	2
3	Green/White tracer	3
	Green	6
4	Brown/White tracer	7
	Brown	8

350 MHz Category 5E Patch Cable Specs:

- EIA/TIA TSB-40A ETL Verified
- Contact Gold Plating 50µ" (Short body)
- Assembly Strain Relief
- Stranded 50dB
- RoHS Compliant
- Length: 3 ft.

Figure A-17. Quad E1 / GigE Connector Cable (PP/CAT5FF3FTGY)

A.4.7 IF Cable, BNC, 50Ω

Figure A-18 shows the 50Ω BNC cable used for connecting the Modem to the CRS-281 (70/140 MHz) IF Switch.

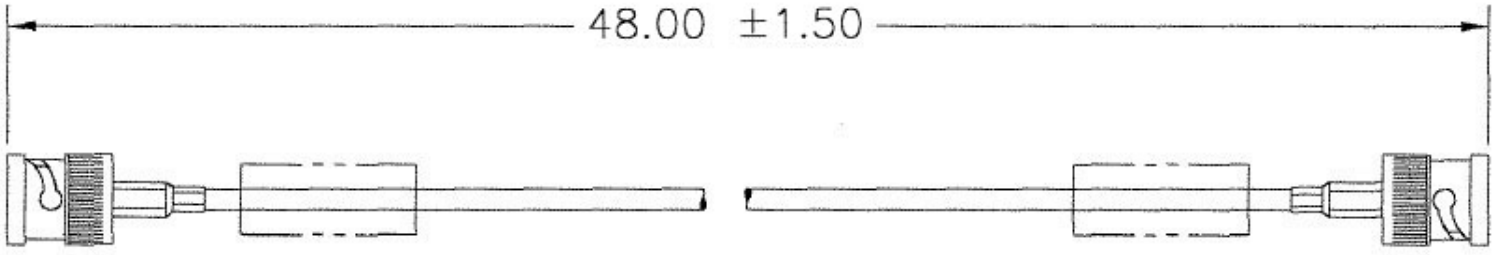


Figure A-18. IF Cable, BNC 50Ω for CRS-281 (70/140 MHz) IF Switch (PL/0946-1)

A.4.8 IF Cable, Type 'N', 50Ω

Figure A-19 shows the 50Ω Type 'N' cable used for connecting the Modem to the CRS-281L and CRS-281A IF Switches.

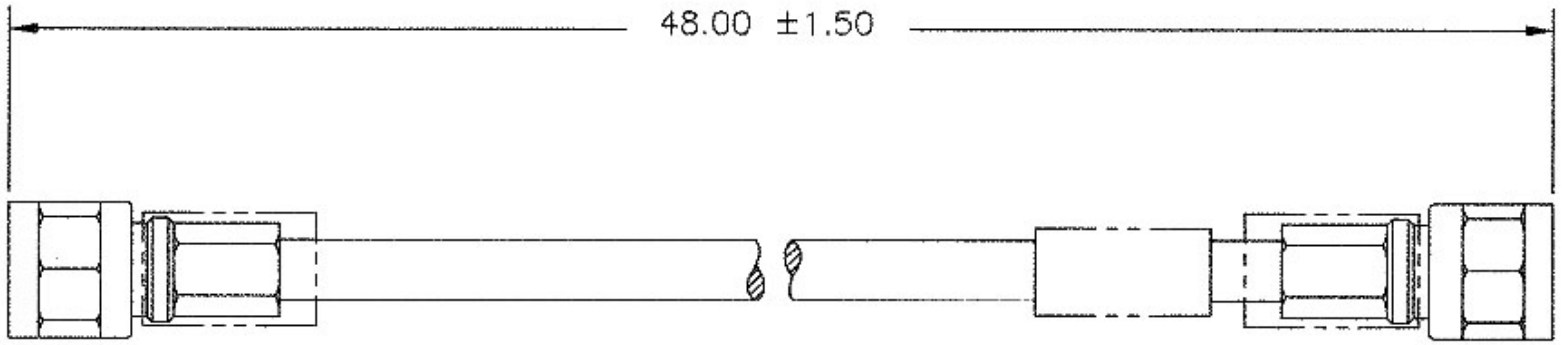


Figure A-19. IF Cable, Type 'N' 50Ω for CRS-281A / CRS-281L (L-Band) IF Switches (CA/RF10453-4)

A.4.9 IF Cable, TNC, 50Ω

Figure A-20 shows the 50Ω TNC cable used for connecting the Modem to the CRS-281 (70/140 MHz) IF Switch.

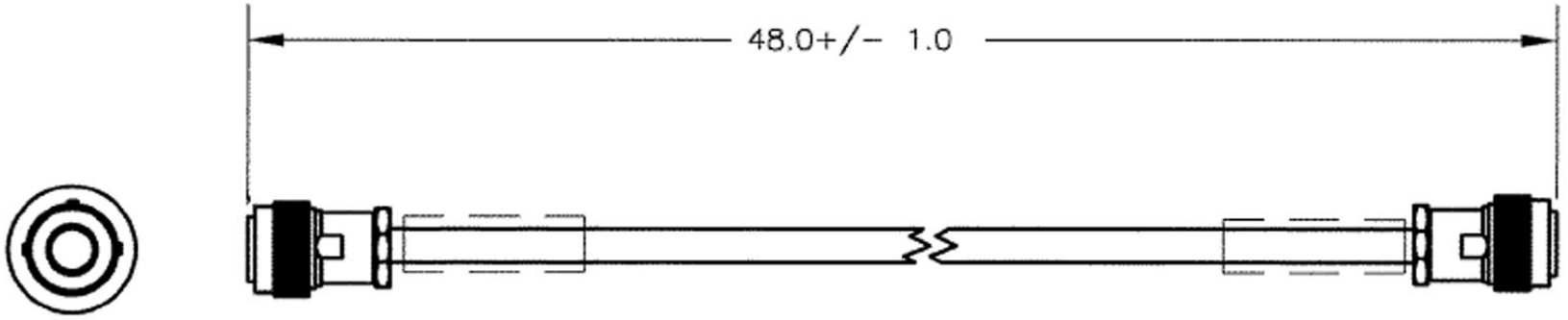


Figure A-20. IF Cable, TNC 50Ω for CRS-281 (70/140 MHz) IF Switch (CA/3005-1)

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Appendix B. ADDRESSING SCHEME INFORMATION

B.1 Introduction to Addressing

A CRS-311 1:1 Redundancy Switch provides 1:1 modem redundancy; that is, it is capable of controlling one Traffic Modem and one Redundant Modem.

The user can remotely communicate to the Switch or either of the modems, using the appropriate addresses, via RS-232 or RS-485 using the DB-9M "Remote Control" connector on the CRS-230 Switch Controller card (installed in the CRS-311).

For Switch to modem communications using SLM-5650/5650A modems, the Switch uses serial communication via a the HD-15 Control Cable that is connected between each TMI/RMI and the modems.

For Switch to modem communications using CDM-Qx/QxL modems, the Switch uses RS-485 communications via a DB-9 multi-drop cable that is connected from the "485 Pass-Through" connector on the CRS-230, then daisy-chained to each of the modems.

If the modems are configured for EDMAC framing, Monitor & Control (M&C) information may be communicated to the modems and transceivers at the distant-end of the link. In order for an M&C application to be able to communicate with the various modems connected to the Switch, the correct addresses must be used.

This appendix provides details of the address requirements to allow M&C of the Switch and the various modems that may be included in a CRS-311 1:1 Redundancy Switch system.

B.2 Switch Address

The permitted Switch remote control addresses are limited:

- **For RS-485** connections, the only permitted addresses are 1000, 3000, 5000, and 7000.
- **For RS-232**, the only permitted address is 0000.

Note: The Switch settings for external communications are totally independent from the internal communication between Switch and traffic modems.

B.3 Modem and Transceiver Addresses

To monitor and control modems and transceivers at the distant-end of the communication link, EDMAC must be enabled, via the modem front panel, in local mode. Set the Tx and Rx parameters to establish the link on the modems on each end of the link. Then an M&C application can be used.

Examples of RS-232 and RS-485 addressing schemes are shown in the diagrams that follow. Included in these diagrams is the following terminology:

Abbreviation	Explanation
MCA	Monitor & Control Address, to be entered as the address of a unit into an M&C application, e.g., SatMac. Modem addresses are automatically assigned by the TMI/RMI slot positions to which they are associated within a Switch. When using RS-485 multi-drop, the Switch bus address be changed on the Switch by the User to 1000, 3000, 5000, 7000, or 9000 (7000 is shown in the figures in this appendix as an example only).
RCA	Remote Control Address, to be configured, via the unit front panel (CONFIG:REMOTE)
ESA	• EDMAC Slave Address (Range) • Local modem is configured as EDMAC master • Distant-end modem is an EDMAC slave

The SLM-5650/5650A modems utilize a point-to-point internal serial communications bus to the Switch within the HD-15 cable. **Figure B-1** illustrates an external RS-232 addressing scheme for these modems; **Figure B-2** depicts an external RS-485 connection.

The CDM-Qx/QxL modems require an external multi-drop RS-485 connection. **Figure B-3** illustrates the external RS-232 addressing scheme for a system comprising these modems with a Switch; **Figure B-4** depicts the external RS-485 connection for this configuration. For a distant-end CRS-300/Qx/QxL Switch using Traffic modems in EDMAC Slave mode, refer to **Figure B-5.**

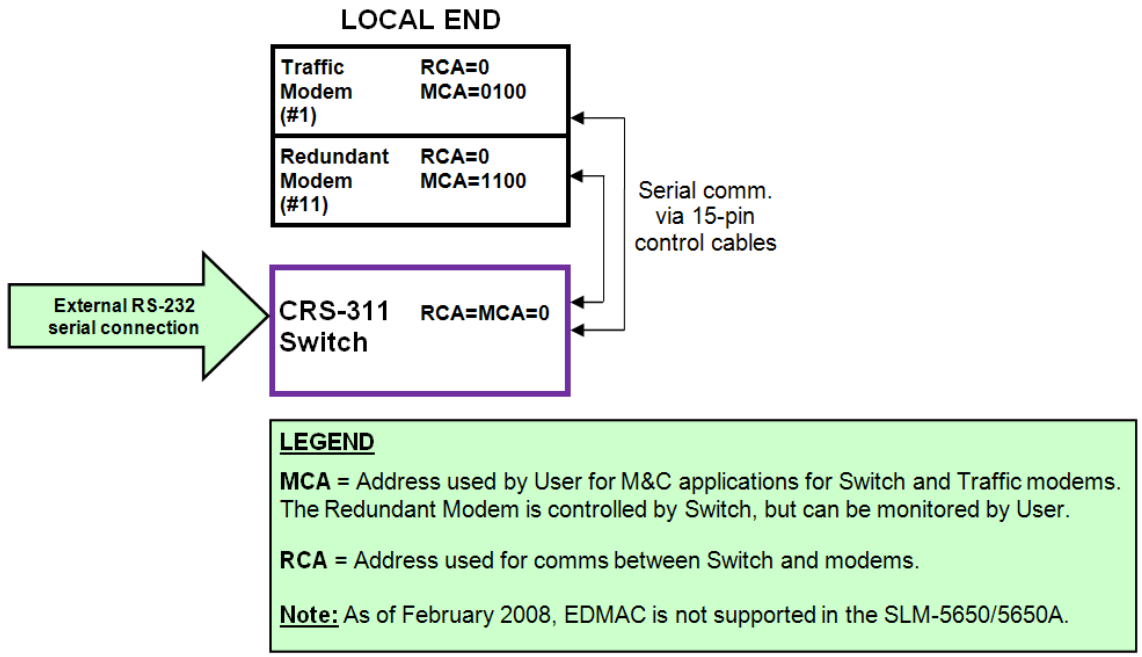

Figure B-1. CRS-311 Addressing Scheme Example: External RS-232 with SLM-5650/5650A Modems

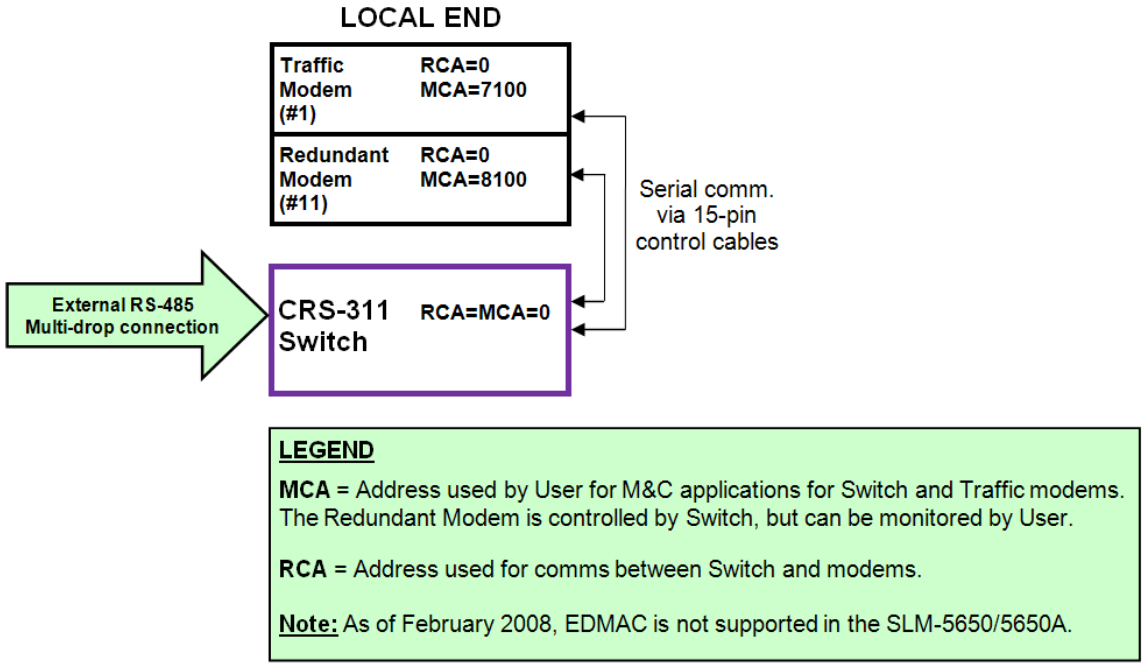

Figure B-2. CRS-311 Addressing Scheme Example: External RS-485 with SLM-5650/5650A Modems

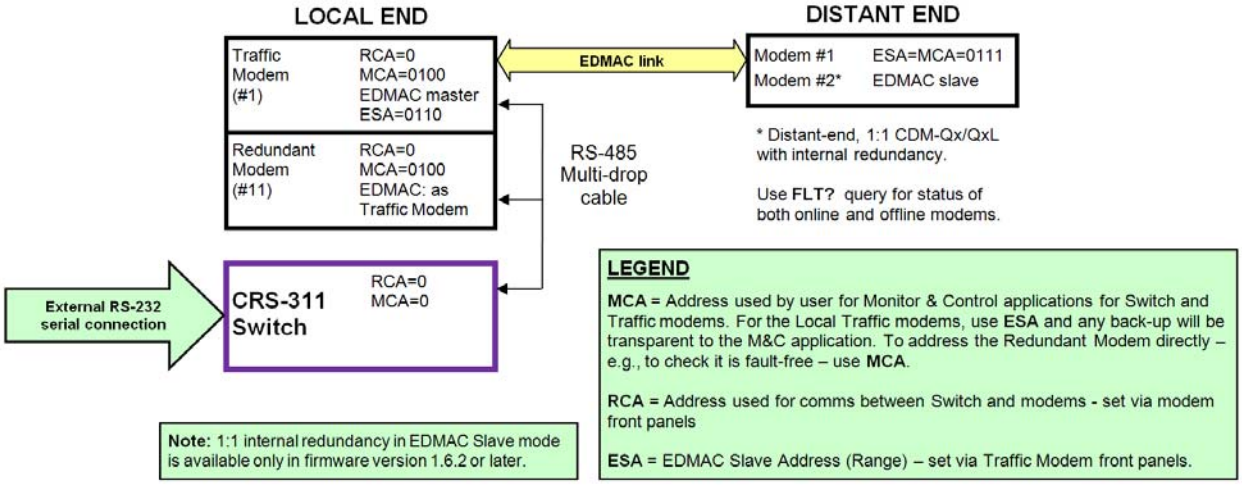

Figure B-3. CRS-311 Addressing Scheme Example: External RS-232 with CDM-Qx/QxL Modems

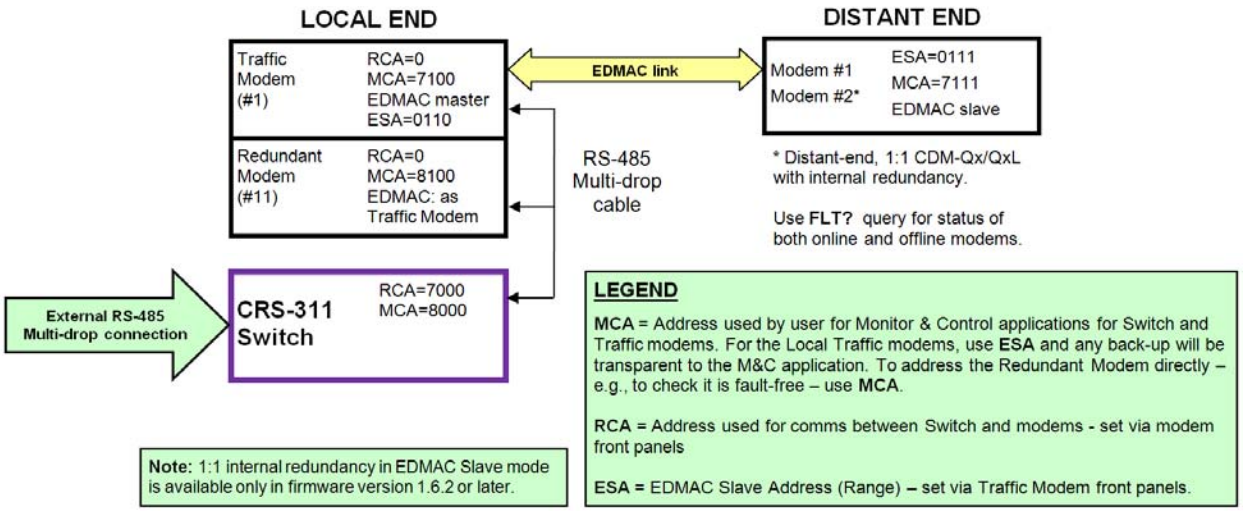

Figure B-4. CRS-311 Addressing Scheme Example: External RS-485 with CDM-Qx/QxL Modems

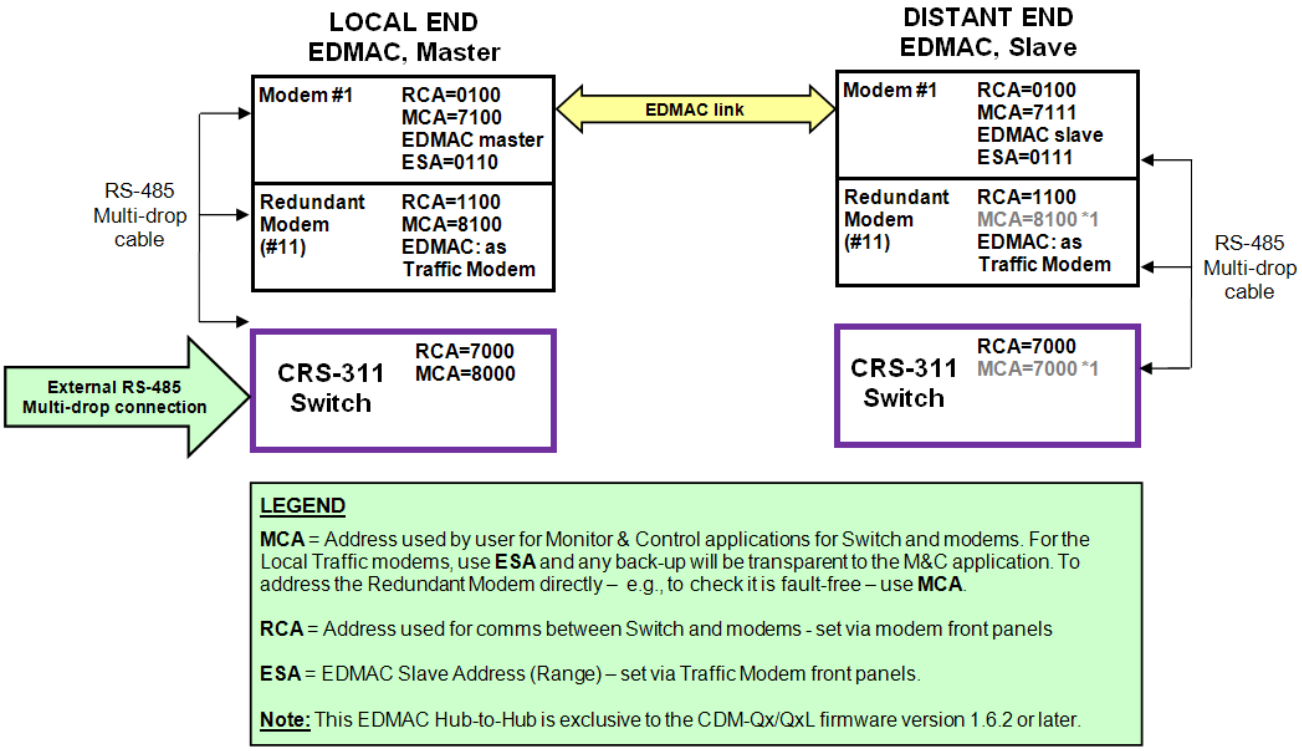

Figure B-5. CRS-311 Addressing Scheme Example: External RS-485 with CDM-Qx/QxL Modems, EDMAC CRS-311 to CRS-311

B.3.1 Setting Up Modems (CDM-Qx/QxL only)

- **Local Traffic Modem** on Switch:
  - MCA = (Switch RCA) + (100)
  - Set EDMAC Framing on.
  - Set as EDMAC master.
  - Set with EDMAC Slave Address Range, ESA = (Modem RCA) + 10
- **Distant Modem 1** (attached to the Distant end of link to Traffic Modem):
  - Remote control address: no setting required (Remote control not used).
  - Set EDMAC Framing on.
  - Set as an EDMAC slave.
  - Set Slave Address, ESA = (Master ESA) + 1
  - MCA = ESA
- **Two Distant Modems** in a 1:1 configuration:

  Set up the on-line modem as for Distant Modem 1, described previously in this section. The offline modem is automatically configured to match the on-line modem. M&C can only be achieved to the online modem.

Notes:

1. 1:1 internal redundancy in EDMAC Slave mode is available only in firmware version 1.6.2 or later.

2. It is not possible for the offline modem of a 1:1 pair to respond to EDMAC messages directly as it is not transmitting. Using the internal 1:1 link, the online modem polls and retains the off-line modem status. Depending on the modem, this information can be obtained as follows:

Use **FLT (Fault**s and Status) – **FLT?** for queries. This command/query is available in available in firmware versions 1.6.2 or later.

Refer to the *Comtech EF Data CDM-Qx Multi-Channel Satellite Modem Installation and Operation Manual* for additional information.

B.4 M&C Application

The system is set up such that it may be communicated to by an Monitor & Control (M&C) application, e.g., SatMac or CMCS. In the SatMac application, go to the **Link Edit Mode** screen to enter the Monitor & Control Addresses (MCA).

Appendix C. REMOTE CONTROL

C.1 Introduction

This appendix describes the protocol and message command set for remote monitor and control of the CRS-311 1:1 Redundancy Switch.

The electrical interface is either an RS-485 multi-drop bus (for the control of many devices) or an RS-232 connection (for the control of a single device), and data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets of variable length, in accordance with the structure and protocol defined in later sections.

The Remote Control pinout is shown in* Chapter 5.1.3 Remote Control – DB-9M Connector *for RS-232 and RS-485.

C.2 RS-485

For applications where multiple devices are to be monitored and controlled, a full-duplex (4-wire plus ground) RS-485 is preferred. Half-duplex (2-wire plus ground) RS-485 is possible, but is not preferred. In full-duplex RS-485 communication, there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions.

It is assumed that a 'Controller' device (a PC or dumb terminal) transmits data in a broadcast mode via one of the pairs. Many 'Target' devices are connected to this pair, and all simultaneously receive data from the Controller. The Controller is the only device with a line-driver connected to this pair; the Target devices have only line-receivers connected.

In the other direction: On the other pair, each Target has a tri-state line driver connected; the Controller has a line-receiver connected. All the line drivers are held in high-impedance mode until one – and *only* one – Target transmits back to the Controller. Each Target has a unique address; each time the Controller transmits, the address of the intended recipient Target is included in a framed 'packet' of data. All of the Targets receive the packet, but only one (the intended) will reply. The Target enables its output line driver and transmits its return data packet back to the Controller in the other direction on the physically separate pair.

RS-485 (full duplex) summary:

- Two differential pairs - one pair for Controller-to-Target, one pair for Target-to-Controller.
- Controller-to-Target pair has one line driver (Controller), and all Targets have line-receivers.
- Target-to-Controller pair has one line receiver (Controller), and all Targets have tri-state drivers.

C.3 RS-232

This is a much simpler configuration in which the Controller device is connected directly to the Target via a two-wire-plus-ground connection. Controller-to-Target data is carried, via RS-232 electrical levels, on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor.

C.4 Basic Protocol

Whether in RS-232 or RS-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. The asynchronous character format may be selected from 8-N-1 (8 data bits, no parity, one stop bit), 7-E-2 (7 data bits, even parity, 2 stop bits) or 7-O-2 (7 data bits, odd parity, 2 stop bits). The baud rate may vary between 300 and 19,200 baud.

All data is transmitted in framed packets. The Controller is assumed to be a PC or ASCII dumb terminal that is in charge of the process of monitor and control. The Controller is the only device that is permitted to initiate, at will, the transmission of data. Targets are only permitted to transmit when they have been specifically instructed to do so by the Controller.

All bytes within a packet are printable ASCII characters, less than ASCII code 127. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from Controller-to-Target require a response, with one exception: This will be either to return data that has been requested by the Controller, or to acknowledge reception of an instruction to change the configuration of the Target. The exception to this is when the Controller broadcasts a message (such as Set Time/Date) using Address 0, when the Target is set to RS-485 mode.

C.4.1 Rules for Remote Serial Communications with the CRS-311

1. Always wait for a response (or up to 15 seconds) from the CRS-311 before sending the next query or command.
2. If a “time-out” response (‘~’) is sent from the CRS-311, the User must resend the previous command.

   The ‘~’ response indicates that a pass-through command to a modem/transceiver attached to the CRS-311 has "timed-out" and there was no response from the other device. During this wait, do not communicate with the CRS-311. After the '~' response is sent by the CRS-311, it is now ready to receive a message again. The CRS-311 knows to wait different times for the different messages it is sending to modems:

- Status queries (no commands) are fast (typically less than 333 ms).
- Configuration changes (commands) take longer and vary by modem type.
- Individual command responses are faster than those to global commands (MGC). More parameters require more time.
- A pass-through command is passed with little inspection by the Switch but, remember, the modem being addressed may be at the distant end of an EDMAC link!

  Types of pass-through commands:

  - To a local modem;
  - To a modem at the distant end (EDMAC);
  - To a local BUC or transceiver connected to a local modem;
  - To a distant end BUC or transceiver through the distant end modem.

C.5 Packet Structure

Controller-to-Target						
Start of Packet	**Target Address**	**Address De-limiter**	**Instruction Code**	**Code Qualifier**	**Optional Arguments**	**End of Packet**
< ASCII code 60 (1 character)	(4 characters)	/ ASCII code 47 (1 character)	(3 characters)	= or ? ASCII codes 61 or 63 (1 character)	(n characters)	Carriage Return ASCII code 13 (1 character)

Target-to-Controller						
Start of Packet	**Target Address**	**Address De-limiter**	**Instruction Code**	**Code Qualifier**	**Optional Arguments**	**End of Packet**
> ASCII code 62 (1 character)	(4 characters)	/ ASCII code 47 (1 character)	(3 characters)	=, ?, !, or * ASCII codes 61,63,33 or 42 (1 character)	(From 0 to n characters)	Carriage Return, Line Feed ASCII codes 13,10 (2 characters)

C.5.1 Start of Packet

Controller-to-Target: This is the character '<' (ASCII code 60)

Target-to-Controller: This is the character '>' (ASCII code 62)

Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message.

C.5.2 Target Address

While up to 9,999 devices can be uniquely addressed, connection to the CRS-311 imposes some basic limitations.

In **RS-232** applications, the Switch address is fixed at 0000.

In **RS-485** applications, the Switch may be set to an address of 1000, 3000, 5000 or 7000. This allows up to four Switches to be connected on the same bus.

Remote commands and queries that can be sent to the modems via the Switch depend upon the modem protocol and the installed options. Please consult the appropriate modem manual for further information. An external M&C application can monitor the modems, transparently through the Switch, using *virtual* addressing:

- 0100 for the TM, and
- 1100 for the RM, which are **added to the address of the Switch**.

Note that regardless of the Switch remote communications being configured for either RS-232 or RS-485 mode, the *internal* link between the Switch and the modems is always fixed at RS-232, 9600 baud, 8-N-1, address 0.

The Controller sends a packet with the address of a Target - the destination of the packet. When the Target responds, the address used is the same address, to indicate to the Controller the source of the packet. The Controller does not have its own address.

C.6 Instruction Code

This is a three-character alphabetic sequence that identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance. For example,

BKH is for **B**ac**K**up **H**oldoff time,

SID is for **S**witch **ID**, etc.

This aids in the readability of the message if seen in its raw ASCII form. Only upper case alphabetic characters may be used (A-Z, ASCII codes 65 - 90).

C.6.1 Instruction Code Qualifier

This single character further qualifies the preceding instruction code. Code Qualifiers obey the following rules:

1. From **Controller-to-Target**, the only permitted values are:

= **(ASCII code 61**	The **=** code is used as the **assignment** operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) that follow it. For example, BKH=12 would mean 'set the **B**ac**K**up **H**oldoff time to 12 seconds.'
? **(ASCII code 63)**	The **?** code is used as the **query** operator, and is used to indicate that the target should return the current value of the parameter defined by the preceding byte. For example, BKH? means 'what is the current value of **B**ac**K**up **H**oldoff time?'

2. From **Target-to-Controller**, the only permitted values are:

= **(ASCII code 61)**	The = code is used in two ways: First, if the controller has sent a query code to a target (for example: **BKH?** meaning 'what is the **B**ac**K**up **H**oldoff time?'), the target would respond with **BKH=*xx***, where ***xx*** represents the time in question. Second, if the controller sends an instruction to set a parameter to a particular value, then, providing the value sent in the argument is valid, the target will acknowledge the message by replying with **BKH=** (with no message arguments).
? **(ASCII code 63)**	The **?** code is only used as follows: If the controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is not valid, the target will acknowledge the message by replying (for example) with **BKH?** (without message arguments). This indicates that there was an error in the argument of the message sent by the controller.
! **(ASCII code 33)**	The ! code is only used as follows: If the controller sends an instruction code that the target does not recognize, the target will acknowledge the message by echoing the invalid instruction, followed by the ! character with. **Example: XYZ!**
*** **(ASCII code 42)**	The ***** code is only used as follows: If the controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is valid, but the modem will not permit that particular parameter to be changed at that time, the target will acknowledge the message by replying (for example) with **BKH*** (with no message arguments).
# **(ASCII code 35)**	The # code is only used as follows: If the controller sends a correctly formatted command, BUT the modem is not in remote mode, it will not allow reconfiguration, and will respond with, for example, **BKH#** (with no message arguments)**.**
~ **(ASCII Code 126)**	The **~** code is only used as follows: If a message was sent via the Switch to an attached modem or ODU, the message was transmitted transparently through the Switch. In the event of the other device not responding, the Switch would generate a response e.g. >0100/MGC~ indicating that it had finished waiting for a response and was now ready for further COMs.

C.6.2 Optional Message Arguments

Arguments are not required for all messages. Arguments are ASCII codes for the characters 0 to 9 (ASCII codes 48 to 57), A to Z (ASCII codes 65 to 90), period (ASCII code 46), and comma (ASCII code 44).

C.6.3 End of Packet

Controller-to-Target: This is the 'Carriage Return' character (ASCII code 13)

Target-to-Controller: This is the two-character sequence 'Carriage Return', 'Line Feed'. (ASCII code 13, and code 10).

Both indicate the valid termination of a packet.

C.7 Remote Commands and Queries

Where Column 'C' = Command; Column 'Q' = Query: Columns marked (X) indicate Command only, Query only, or Command/Query for Instruction Code.

Instr Code	C	Q	Page
AAM	X	X	C-10
ACT		X	C-8
AMQ		X	C-9
BBU	X	X	C-9
BKH	X	X	C-9
CAE	X		C-12
CLD	X		C-11
CST	X	X	C-11
DAY	X	X	C-11
EID		X	C-7
FLT		X	C-13
IMS	X	X	C-8
LRS	X	X	C-7

Instr Code	C	Q	Page
MAM	X	X	C-10
MOD		X	C-7
NUE		X	C-11
OPM	X	X	C-9
RNE		X	C-12
RSH	X	X	C-9
SAM	X	X	C-10
SGC	X	X	C-10
SID	X	X	C-7
SNO		X	C-7
SWR		X	C-7
TIM	X	X	C-11
XMI		X	C-8

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
Local/ Remote Status	LRS=	1 byte, value of 0 or 1	Command or Query. **x** indicates the local/remote status of the Switch: 0 = local 1 = remote	LRS= (message OK) LRS? (received OK, but invalid arguments found)	LRS?	LRS=x (see description of arguments)
Serial Number	N/A	9 bytes, numerical	Query only. Unit returns its 9-digit serial number. **Example:** SNO=176512523	N/A	SNO?	SNO=xxxxxxxxx (see description of arguments)
Software Revision	N/A	5 bytes, numerical	Query only. Unit returns the value of internal software revision installed in the unit, in the form **x.x.x** **Example:** SWR=1.0.1 (indicating Version 1.0.1)	N/A	SWR?	SWR=x.x.x (see description of arguments)
Equipment ID	N/A	4 bytes, alpha-numeric	Query only. Unit returns information concerning the equipment identification. S311 indicates this CRS-311 1:1 Switch unit. (S300 indicates CRS-300 1:N Switch).	N/A	EID?	EID=xxxx (see description of arguments)
Switch ID	SID=	24 bytes, ASCII	Command or Query. A user-defined Switch ID, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + - , . / 0-9 and A-Z.	SID= (message OK) SID? (received OK, but invalid arguments found) SID* (message OK, but not permitted in current mode)	SID?	SID=xxxxxxxxxxxxxxxxxxxxxx (see description of arguments)
Modem type	N/A	4 bytes, numeric	Query only. Unit returns information concerning the model of the Redundant Modem attached, where **xxxx** may be 5650 indicating the SLM-5650 modem.	N/A	MOD?	MOD=xxxx (see description of arguments)

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
TMI/RMI types	N/A	11 Bytes	Query only. x indicates the TMI/RMI type detected in each slot position: Positions 1 through 10 are TMIs, where **x** may be: 0 = none present 1 = CRS-320 rev A 2 = CRS-330 3 = CRS-340 rev A 4 = CRS-340 rev B 5 = CRS-370 6 = CRS-320 rev C 7 = undefined 8 = CRS-341 9 = CRS-316 A = CRS-336 B = undefined C = CRS-315 D = CRS-325 E = CRS-335 F = CRS-345 G = CRS-365 H = CRS-365D Position11 is the RMI, where **y** may be: 0 = none present 7 = CRS-310 D = CRS-307 E = CRS-306 F = CRS-305 **Example:** XMI=20000000007	N/A	XMI?	XMI=xxxxxxxxxxy (see description of arguments)
Independent Mode	IMS=	1 byte, value of 0 or 1	Command or Query. **x** indicates the normal/Independent Mode operational status of the Switch: 0 = normal operation 1 = Independent Mode enabled	IMS= (message OK) IMS? (received OK, but invalid arguments found)	IMS?	IMS=x (see description of arguments)
Active Modems	N/A	11 bytes, numerical	Query only. The active state of the two modems – for the 311 Switch the TM is always active. (Retained for CRS-311 Switch compatibility) **x** indicates the Traffic Modem **y** indicates the Redundant Modem 0 = Modem is not active 1 = Modem active	N/A	ACT?	ACT=x000000000y (see description of arguments)

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
Active Modem Query	N/A	11 bytes, numerical	Query only. Indicates the state of the two Modems (Command format maintained to keep compatible with the CRS-300) **x** Indicates the Traffic Modem **y** Indicates the Redundant Modem Value: 0 = TMI/RMI not present. Modem cannot be activated. 1 = TMI/RMI present, but modem not activate. 2 = TMI/RMI present, modem active and responding. 3 = TMI/RMI present, modem active but not responding.	N/A	AMQ?	AMQ=x0000000000y (see description of arguments)
Bridge/Backup Mode	BBU=	3 bytes, value of 0 or 1	Command or Query. The bridge/backup state: **yy** = fixed at 01 for CRS-311 0 = bridging mode, ie TM is online 1 = backing-up mode, ie RM is online. This parameter can only be changed when in Manual mode.	BBU= (message OK) BBU? (received OK, but invalid arguments) BBU* (message OK, but not permitted in current mode)	BBU?	BBU=xyy (see description of arguments)
Operating Mode	OPM=	1 byte, numerical	Command or Query. **x** indicates the operating mode, where: 0 = manual mode 1 = auto mode	OPM= (message OK) OPM? (received OK, but invalid arguments) OPM* (message OK, but not permitted in current mode)	OPM?	OPM=x (see description of arguments)
Backup Holdoff Time	BKH=	2 bytes, numerical	Command or Query. The backup holdoff time is the delay when auto mode prepares to backup a faulted modem: 01-99 = # of seconds delay after Redundant Modem has acquired Traffic Modem's configuration before online swap actually takes place.	BKH= (message OK) BKH? (received OK, but invalid arguments) BKH* (message OK, but not permitted in current mode)	BKH?	BKH=xx (see description of arguments)
Restore Holdoff Time	RSH=	2 bytes, numerical	Command or Query. The restore holdoff time is the delay when auto mode prepares to return a modem (previously faulted, now good) back online due to a different Traffic Modem's failure: 01-99 = # of seconds after offline Traffic Modem lost its fault before it is put back online..	RSH= (message OK) RSH? (received OK, but invalid arguments found) RSH* (message OK, not permitted in current mode)	RSH?	RSH=xx (see description of arguments)

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
Modem Alarm Mask	MAM=	1 byte, numerical	Command or Query. **x** indicates the Modem alarm mask: 0 = no faults masked 1 = Tx faults masked 2 = Rx faults masked	MAM= (message OK) MAM? (received OK, but invalid arguments found) MAM* (message OK, but not permitted in current mode)	MAM?	MAM=x (see description of arguments)
Switch Alarm Mask	SAM=	1 byte, numerical	Command or Query. **x** indicates the Switch alarm mask: 0 = no faults masked 1 = PSU-A faults masked 2 = PSU-B faults masked	SAM= (message OK) SAM? (received OK, but invalid arguments found) SAM* (message OK, but not permitted in current mode)	SAM?	SAM=x (see description of arguments)
Audio Alarm Mask	AAM=	1 byte, numerical	Command or Query. **x** indicates the Audio alarm mask: 0 = no faults masked (audio enabled in response to any fault) 1 = Switch faults masked 2 = Modem faults masked 3 = All faults masked (audio never enabled)	AAM= (message OK) AAM? (received OK, but invalid arguments found) AAM* (message OK, but not permitted in current mode)	AAM?	AAM=x (see description of arguments)
Switch Global Configuration	SGC=	29 bytes, numerical	Command or Query. Global configuration of the Switch, in the form: OasssssssssBNNbbrrMSAsssssssss, where: **O** = Operating Mode – same as OPM (1 bytes) **a** = Active Modem – same as ACT for TM (1 byte) **s** = 9 spare bytes **B** = Bridge/Backup State – same as BBU (1 byte) **NN** = always 01 for the 311 **bb** = Backup Holdoff Time – same as BKH (2 byte) **rr** = Restore Holdoff Time – same as RSH (2 byte) **M** = Modem Alarm Mask – same as MAM (1 byte) **S** = Switch Alarm Mask – same as SAM (1 byte) **A** = Audio Alarm Mask – same as AAM (1 bytes) **s** = 8 spare bytes	SGC= (message OK) SGC? (received OK, but invalid arguments found) SGC* (message OK, but not permitted in current mode)	SGC?	SGC=OasssssssssBNNbbrrMSAsssssssss (see description of arguments)

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
Config Store	CST=	1 byte, numerical, 0 to 9	Command or Query. The command forces the Switch to store its current configuration in the Configuration Memory location defined by the argument **n** (0 to 9). **Example:** CST=4 (Store current configuration in location 4) **WARNING:** Use with caution! If the location already contains data, it will be automatically overwritten. If in doubt, query the location first. The query returns the contents of the location.	CST= (message OK) CST? (received OK, but invalid arguments found) CST* (message OK, but not permitted in current mode)	CST?n where n is 0 to 9	Returns the same format as the SGC, with the form: CST=xxx....xxx for a valid config, and CST* where no valid config is found
Config Load	CLD=	1 byte, numerical, 0 to 9	Command only. Forces the Switch to retrieve the Configuration Memory location defined by the argument **n** (0 to 9) and to re-program the Switch with that stored configuration.	CLD= (message OK) CLD? (received OK, but invalid arguments found) CLD* (message OK, but the memory location does not contain configuration info)	N/A	N/A
Date	DAY=	6 bytes, numerical	Command or Query. The date, in the form ddmmyy (international date convention), where: **dd** = day of the month, between 01 and 31, **mm** = month of the year, between 01 and 12, and **yy** = year, between 97 and 96 (1997 to 2000, then 2000 to 2096) **Example:** DAY=240457 would be April 24, 2057.	DAY= (message OK) DAY? (received OK, but invalid arguments) DAY* (message OK, but not permitted in current mode)	DAY?	DAY=ddmmyy (see description of arguments)
Time	TIM=	6 bytes, numerical	Command or Query. The time from midnight, in the form hhmmss, where **hh** = hours, between 00 and 23, **mm** = minutes, between 00 and 59, and **ss** = seconds, between 00 and 59 **Example:** TIM=231259 would be 23 hours, 12 minutes and 59 seconds from midnight.	TIM= (message OK) TIM? (received OK, but invalid arguments) TIM* (message OK, but not permitted in current mode)	TIM?	TIM=hhmmss (see description of arguments)
Number of Unread Stored Events	N/A	2 bytes, numerical	Query only. Switch returns the number of Stored Events, which remain unread, *over the remote control*. Viewing the stored events from the front panel of the modem does not affect this value. **Example:** NUE=98	N/A	NUE?	NUE=xx (see description of arguments)

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
Clear All Stored Events	CAE=	None	Command only. Instructs the unit to clear all Stored Events. This command takes no arguments.	CAE= (message OK) CAE* (message OK, but not permitted in current mode)	N/A	N/A
Retrieve Next 5 unread Stored Events	N/A	80 bytes	Query only. Switch returns the oldest 5 Stored Events, which have not yet been read over the remote control. Reply format: [cr]Sub-body[cr]Sub-body[cr]Sub-body[cr]Sub-body[cr]Sub-body, where Sub-body=KLMddmmyyhhmmss, **K** is the fault/clear indicator, where F = Fault, C = Clear, I = Info **L** is the faulting/clearing unit, values: 1 through 9, A =TM, B=RM, C=Switch, D=Info **M** is the fault code, where the value depends on faulting unit: Switch codes are 1 to F, indicating the **position** of the fault within the FLT string. Modem codes are: 1= Unit, 2= Rx traffic, 3= Tx traffic Info codes are: 0= Power off, 1= Power on, 2= Log cleared **ddmmyy** is the date of the event (international format). **hhmmss** is the time of the event. If there are no new events, the unit replies with RNE*. If fewer than 5 events remain, the last positions are filled with zeroes.	N/A	RNE?	RNE=[cr]KLMddmmyyhhmmss[cr]KLMddmmyyhhmmss[cr]KLMddmmyyhhmmss[cr]KLMddmmyyhhmmss[cr]KLMddmmyyhhmmss (see description of arguments)

Parameter Type	Command (Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes: i.e., ASCII codes between 48 and 57)	Response to Command (Target-to-Controller)	Query (Code and qualifier)	Response to query (Target-to-Controller)
Faults and Status	N/A	15 bytes, alpha-numeric	Query only. Unit returns the current fault and status codes for the Switch itself, where: **r** = Redundant Modem: 0 = OK, 1 = RMI not present 2 = RM I/O timeout 3 = RM comms problem 4 = RM is in a test mode 5= RM is rejecting an MGC configuration string Power supply information, values 0 or 1 only. **A/a** = + 5V PSU-A under/over **B/b** = +5V PSU-B under/over **C/c** = +12V PSU-A under/over **D/d** = +12V PSU-B under/over **E/e** = -12V PSU-A under/over **F/f** = -12V PSU-B under/over **m** is TMI: interface mismatch: 0 = no problem, 1 indicates the TM position of a TMI interface mismatch **i** is modem I/O communications: 0 = no problem, 1 indicates the traffic modem is activated but is not responding.	N/A	FLT?	FLT=rAaBbCcDdEeFfmi (see description of arguments)

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Appendix D. INDEPENDENT MODE OPERATION

D.1 Introduction

IMPORTANT

This feature is for use ONLY with the SLM-5650/5650A.

Per customer request, an optional Independent Mode of operation in the CRS-311 switch is available for use with the SLM-5650/5650A modems. In Independent Mode, the modems each operate independently and simultaneously (dual-carrier). In this mode, the CRS-311 is used only to enable control and monitoring of both modems via a single RS-232/RS-485 control line.

D.2 Feature Description

Figure D-1 shows the CRS-311 connected in the standard way; Figure D-2 shows the CRS-311 connected in Independent Mode.

Key functionality in* Independent Mode*:

a. The CRS-311 will not switch if a fault occurs. Switch configuration is "hard-wired" to primary modem:
    i. Data switch routes data signals to/from the primary modem.
    ii. The CRS-281x IF switch connects the Redundant Modem's Tx IF to the User's Tx IF.

b. No automatic control of the Redundant or primary modem configuration:
    i. Does NOT control the configuration of the Redundant Modem (i.e. no "mirroring" or other control of the Redundant Modem's configuration to match the primary modem).
    ii. Does NOT mute the RF output of primary modem under any circumstances.

c. Supports RS-232/RS-485 remote monitor and control connectivity to both modems.

d. The "Stored Event" LED on the CRS-311 Front Panel will flash at **twice the current rate** when Independent Mode is enabled.

e. Independent Mode is selectable via the Front Panel menu or remote control command:

- *To configure via the CRS-311 Front Panel menu*:
  - Select **`UTIL → INDEP-MODE`**, then press **[ENTER]**;
  - Using the ◄ ► buttons, select either **`NORMAL-OP`** or **`ENABLE-INDEP`**, then press **[ENTER]**.
- *To configure via remote control command:* **IMS=*x*,** where: ***x***=0 (off), or ***x***=1 (Independent Mode enabled).

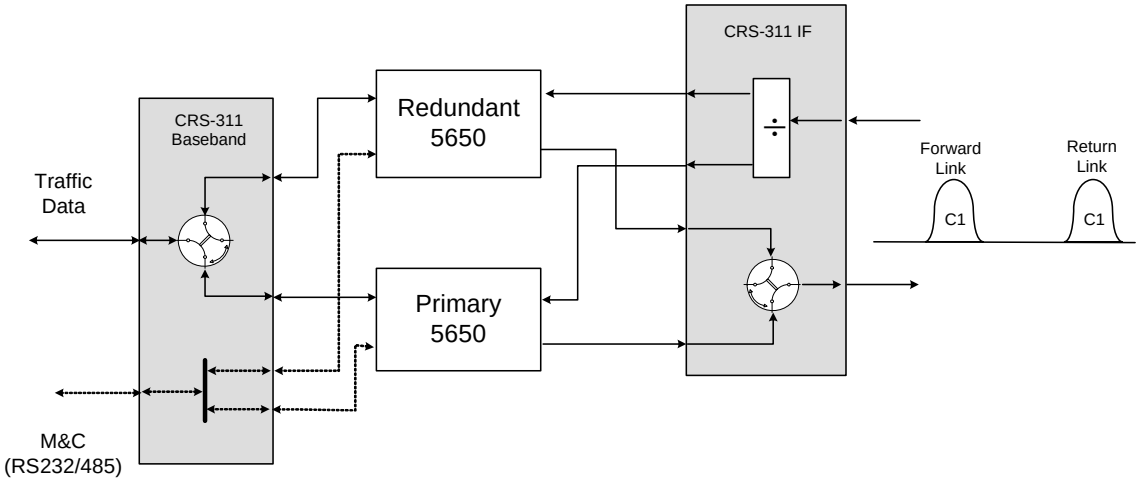


Figure D-1. Standard Connections to CRS-311

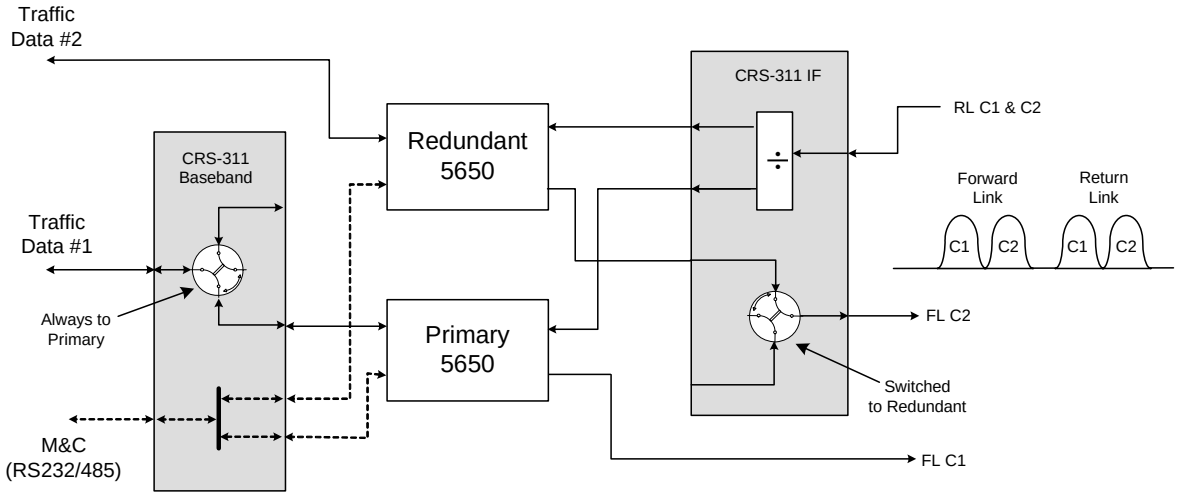


Figure D-2: CRS-311 in Independent Mode

Appendix E. CRS-311 RETROFIT FOR SLM-5650/5650A NP INTERFACE OPERATION

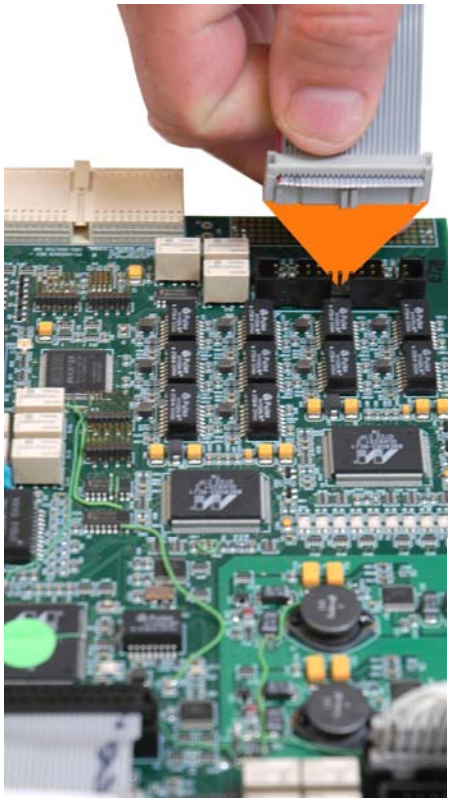
E.1 Introduction

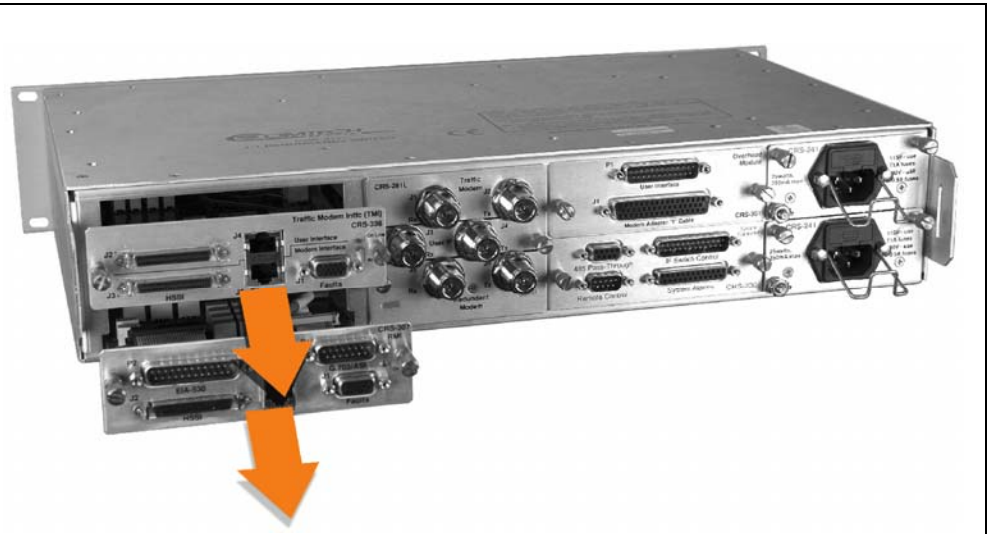
This appendix describes the procedure required to upgrade any CRS-311 1:1 Redundancy Switch from traditional serial terrestrial interface operation to operation in tandem with SLM-5650/5650A Redundant and Traffic Modems equipped with the optional Network Processor (NP) Interface Module (required to handle 4-Port Ethernet data traffic).

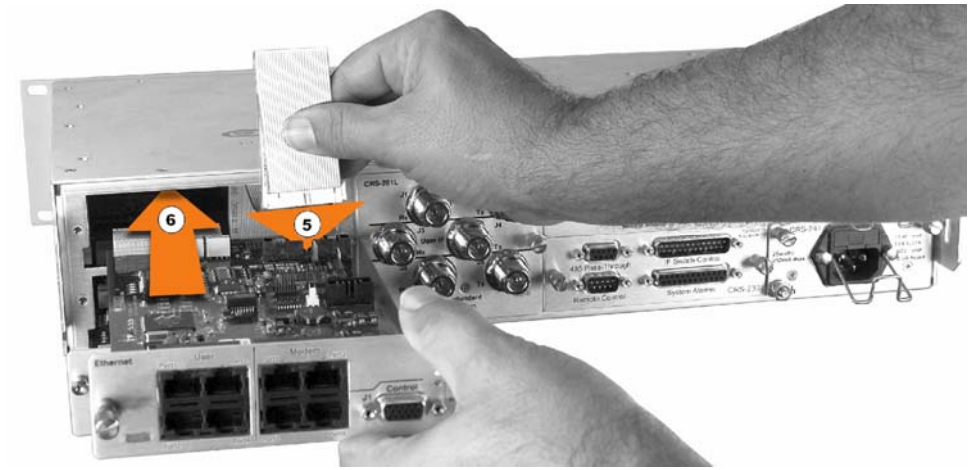
E.1.1 Field Upgrade Kit KT-0000078 (Required for Retrofit)

NP (Network Processor) Upgrade Redundancy Kit KT-0000078		
CEFD P/N	**QTY**	**Description**
PL-0000293	1	CRS-505 RMI: EIA-530, G.703, HSSI, 4-Port Ethernet
PL-0000294	1	CRS-515 TMI: 4-Port Ethernet
CA-0000089	1	Ribbon Cable: RMI-to-TMI

E.1.2 Retrofit Procedure

Step	Task		
1	Plug the CA-0000089 Ribbon Cable, shipped separately with the new CRS-505 RMI and CRS-515 TMI modules, into the P1 connector on the CRS-505 RMI. (**Note:** This connector is labeled and positioned identically on the CRS-515 TMI – see **Step 5**.)		

2	Prepare the CRS-311 Switch Chassis for retrofit by loosening the thumbscrews then removing the existing RMI and TMI modules. (**Note:** The configuration shown here is for illustrative purposes only. The actual redundant/traffic modem interfaces, power modules, and controller interfaces, as originally installed, may vary.)	
3	Thread the CA-0000089 Ribbon Cable's unconnected (loose) end through the bottom (RMI) slot opening into the CRS-311 chassis, looping the end out through the top (TMI) slot opening.	
4	Install the CRS-505 RMI into its chassis slot while pulling lightly on the unconnected (loose) end of the CA-0000089 Ribbon Cable. Engage the RMI until it is properly seated in the receptacle on the chassis backplane. Do not tighten the CRS-505 RMI's thumb screws at this time.	

5	Connect the loose (unconnected) end of the CA-0000089 Ribbon Cable to the P1 socket on the CRS-515 TMI.	
6	Install the CRS-515 TMI into its chassis slot. Engage the TMI until it is properly seated in the receptacle on the chassis' backplane.	
7	Securely hand-tighten the thumbscrews on both the TMI and RMI.	

The retrofit has been completed and the CRS-311 1:1 Redundancy Switch is ready to be connected to the SLM-5650/5650A modems per **Chapter 3. CABLES and CONNECTIONS, Sect. 3.3 SLM-5650/5650A Modem Connections**.

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^{5}	6.336×10^{4}	5.280×10^{3}	1.760×10^{3}	—	1.609×10^{3}	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
C = (F - 32) * 0.555
F = (C * 1.8) + 32

Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoirdupois	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	1.0×10^{3}	35.27	32.15	2.205	2.679	—

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