CRS-400

1:8 Redundancy Switch
Installation and Operation Manual

Part Number MN/CRS400.IOM Revision 0

Errata A

Comtech EF Data Documentation Update

Subject:	Changes to Related Documents	
Date:	October 13, 2003	
Original Document Part Number/Rev:	MN/CRS400.IOM	Rev 0
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This information will be incorporated into the next revision.

Change Specifics:

RELATED DOCUMENTS

Comtech EF Data SDM-2020 Satellite Modulator Installation and Operation Manual
Comtech EF Data SDM-2020 Satellite Demodulator Installation and Operation Manual
Comtech EF Data CRS-280L 1:N Redundancy Switch Installation and Operation Manual

CRS-400

1:8 Redundancy Switch
Installation and Operation Manual

Comtech EF Data is an ISO 9001
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Part Number MN/CRS400.IOM
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Comtech EF Data, 2114 West 7th Street, Tempe, Arizona 85281 USA, (480) 333-2200, FAX: (480) 333-2161.

CUSTOMER SUPPORT

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For more information regarding the warranty policies, see Warranty Policy, p. xii.

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ABOUT THIS MANUAL

This manual provides installation and operation information for the Comtech EF Data CRS-400 1:8 Redundancy Switch. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the CRS-400 1:8 Redundancy Switch.

RELATED DOCUMENTS

Comtech EF Data SDM-2020 Satellite Modulator Installation and Operation Manual
Comtech EF Data SDM-2020 Satellite Demodulator Installation and Operation Manual

CONVENTIONS AND REFERENCES

CAUTIONS AND WARNINGS

Indicates information critical for proper equipment function.

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.

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 English to Metric conversions.

RECOMMENDED STANDARD DESIGNATIONS

Recommended Standard (RS) Designations have been superseded by the new designation of the Electronic Industries Association (EIA). References to the old designations are shown only when depicting actual text displayed on the screen of the unit (RS-232, RS-485, etc.). All other references in the manual will be shown with the EIA designations (EIA-232, EIA-485, etc.) only.

TRADEMARKS

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

REPORTING COMMENTS OR SUGGESTIONS CONCERNING THIS MANUAL

Comments and suggestions regarding the content and design of this manual will be appreciated. To submit comments, please contact the Comtech EF Data Customer Support Department.

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 COMPLIANCE

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

EN50082-1 COMPLIANCE

This equipment meets the electromagnetic compatibility/generic immunity standard as defined in EN50082-1.

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.

Note: 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.

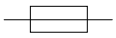
This equipment meets the Safety of Information Technology Equipment specification as defined in EN60950.

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.
	Chassis Ground.

Note: For additional symbols, refer to “Cautions” listed earlier in this preface.

WARRANTY POLICY

This Comtech EF Data product is 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 customer is responsible for freight to Comtech EF Data and all related custom, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges **only** for return of the equipment from the factory to the customer. 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.

LIMITATIONS OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper installation or maintenance, abuse, unauthorized modification, or operation outside of environmental specifications for the product, or, for damages that occur due to improper repackaging of equipment for return to Comtech EF Data.

No other warranty is expressed or implied. Comtech EF Data specifically disclaims the implied warranties of merchantability and fitness for particular purpose.

EXCLUSIVE REMEDIES

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.

DISCLAIMER

Comtech EF Data has reviewed this manual thoroughly in order that it will be an easy-to-use guide to your equipment. All statements, technical information, and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representations or warranties concerning the products described. Further, Comtech EF Data reserves the right to make changes in the specifications of the products described in this manual at any time without notice and without obligation to notify any person of such changes.

If you have any questions regarding the equipment or the information in this manual, please contact the Comtech EF Data Customer Support Department.

Chapter 1. Introduction

CRS-400
1:8 Redundancy
Switch

Optional CRS-280
IF Switch

1.1 DESCRIPTION

The Comtech EF Data CRS-400 1:8 Redundancy Switch is designed for use with the Comtech EF Data SDM-2020 modulator and demodulator to provide fully automatic protection of traffic circuits in case of equipment failure. It is intended for hub and other redundancy applications and currently supports the HSSI interface type.

Connection to the traffic modulators/demodulators and the redundant modulator/demodulator is simple – a Data cable, which carries all data signals and alarm information, a 485 cable for remote control interfaces, and, in some cases, a fault cable. This simplifies rack cabling, and reduces the number of potential failure points.

CAUTION

The Comtech EF Data CRS-400 switch is designed specifically as an accessory product for the Comtech EF Data SDM-2020 modulator and demodulator and is not designed to operate with any other manufacturer's equipment.

The CRS-400 is fully modular in construction. All replaceable modules insert into slots in the rear. This includes the Controller, Power Supply Units (PSU), Traffic Modem Interface (TMI) and the Redundant Modem Interface (RMI). Power consumption is below 25 W for a fully populated switch, so no fan cooling is required.

The CRS-400 incorporates the following key reliability features:

- Twin, independent, AC power supplies
- Maintains normal traffic paths, error free, when AC power is removed

Note: Redundant Modulator/Demodulator traffic returns to normal traffic path if power is lost

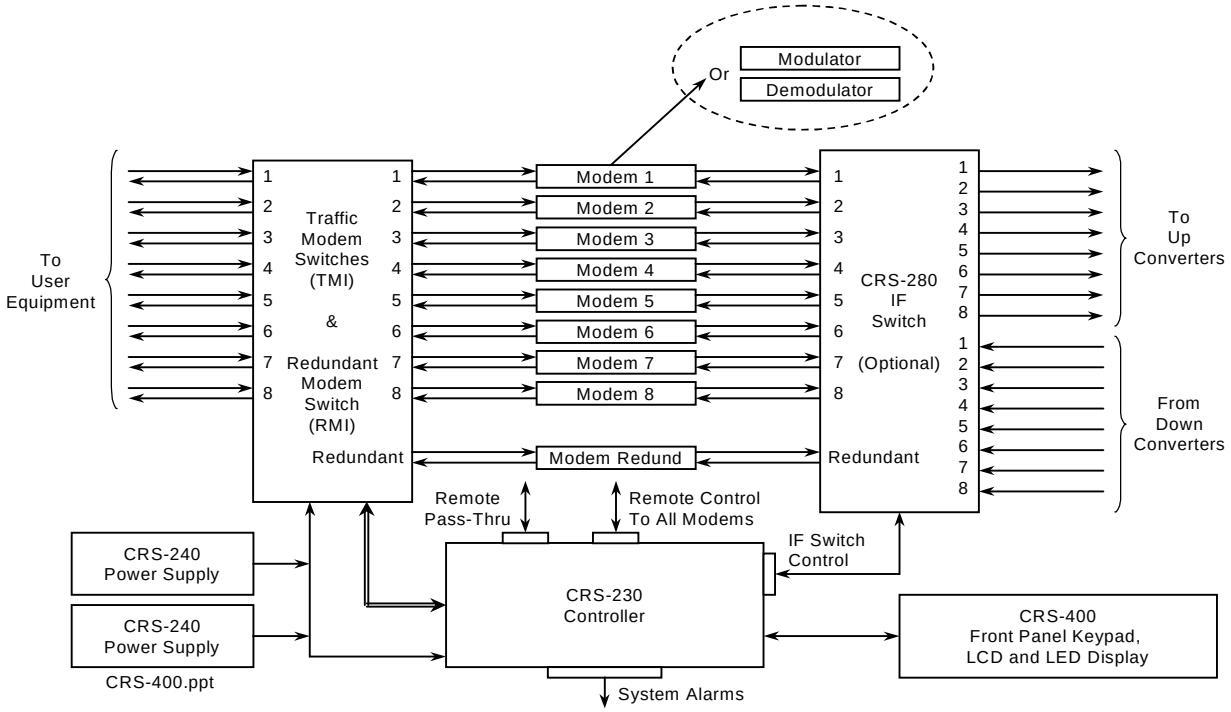


Figure 1-1 CRS-400 Block Diagram with Modems and CRS-280 IF Switch

The function of the CRS-400 Redundancy Switch is depicted in Figure 1-1. User data enters and exits the switch at the left hand side of the diagram, while IF leaves and enters from the right. The data and clock signals to and from a traffic modulator/demodulator are routed through a TMI, via a set of relays. There are up to 8 TMIs in the switch, labeled 1 through 8 in the figure. The relays in the TMI are arranged so that the unpowered state connects the data signals directly through to the traffic modulator/demodulator. If the power supplies to the system are lost, or if a TMI carrying traffic is removed, traffic is not interrupted. In normal circumstances, when the redundant modulator/demodulator is not in service, no data is carried through the CRS-400 backplane – all data is routed through the TMI.

There are several other key operational features of the CRS-400 architecture:

- "Bridging" a traffic modulator/demodulator clock and data: A copy of the data and clock signals feeding a particular modulator/demodulator is selectively routed to the redundant modulator/demodulator.
- "Bridging" a traffic modulator/demodulator IF: RMI Rx IF is tuned to receive any selected carrier.
- Live traffic may be checked on the redundant demodulator when the traffic demodulator is placed in "bridge" mode.

There are two ways to set up the CRS-400 for IF operation. The first method does not require an optional IF switch and is used when all modulators/demodulators within a group are connected to the same up/down converter.

The second method is used when operation with more than one up/down converter is required. In this case, adding the CRS-280 IF Switch permits connections to as many converters as traffic modulators/demodulators.

The data switch and IF switch are shown in Figure 1-2 and Figure 1-3, respectively. Data enters the TMI modules (CH1 - CH8) at the bottom of Figure 1-2. The Tx data entering each channel is routed through the TMI and sent out to the traffic modulators/de-modulators. The Tx data and clock are also buffered by an amplifier to make them available for bridging and routing through the RMI.

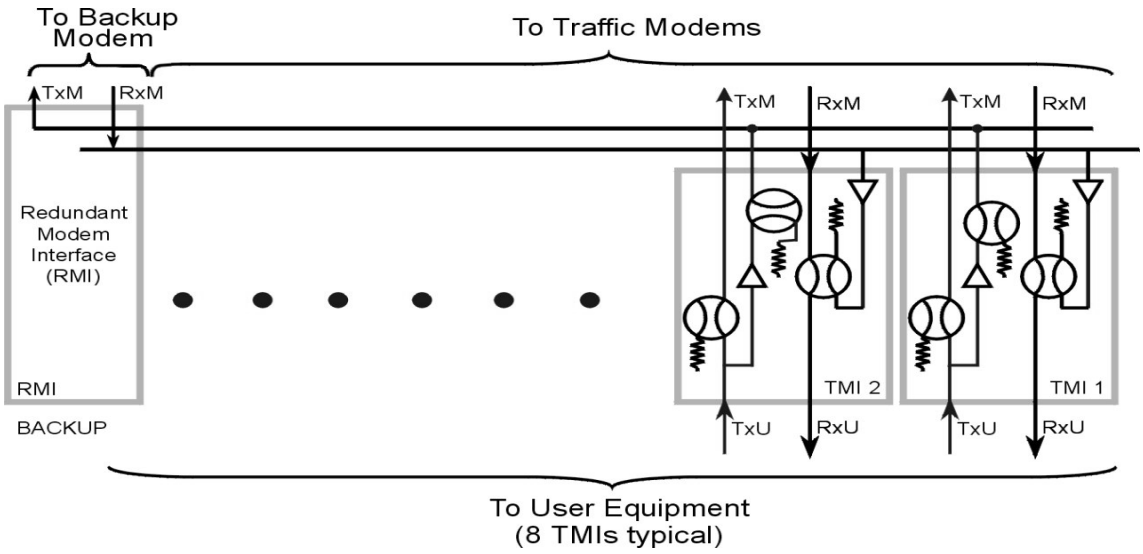


Figure 1-2 CRS-400 Data Switch Block Diagram (TMI #1 is Bridged)

Figure 1-3 depicts the separate Tx and Rx sections of the optional IF switch. Either in the non-energized state of the relays, or when the switch is not powered, the IF traffic is routed straight through on the primary units. Traffic enters the Tx section of the switch from the bottom of the switch and leaves from the top. In the Rx section of the switch, traffic flows in the opposite direction. There is a loss of 3 dB in the demodulator path because of the receive splitter.

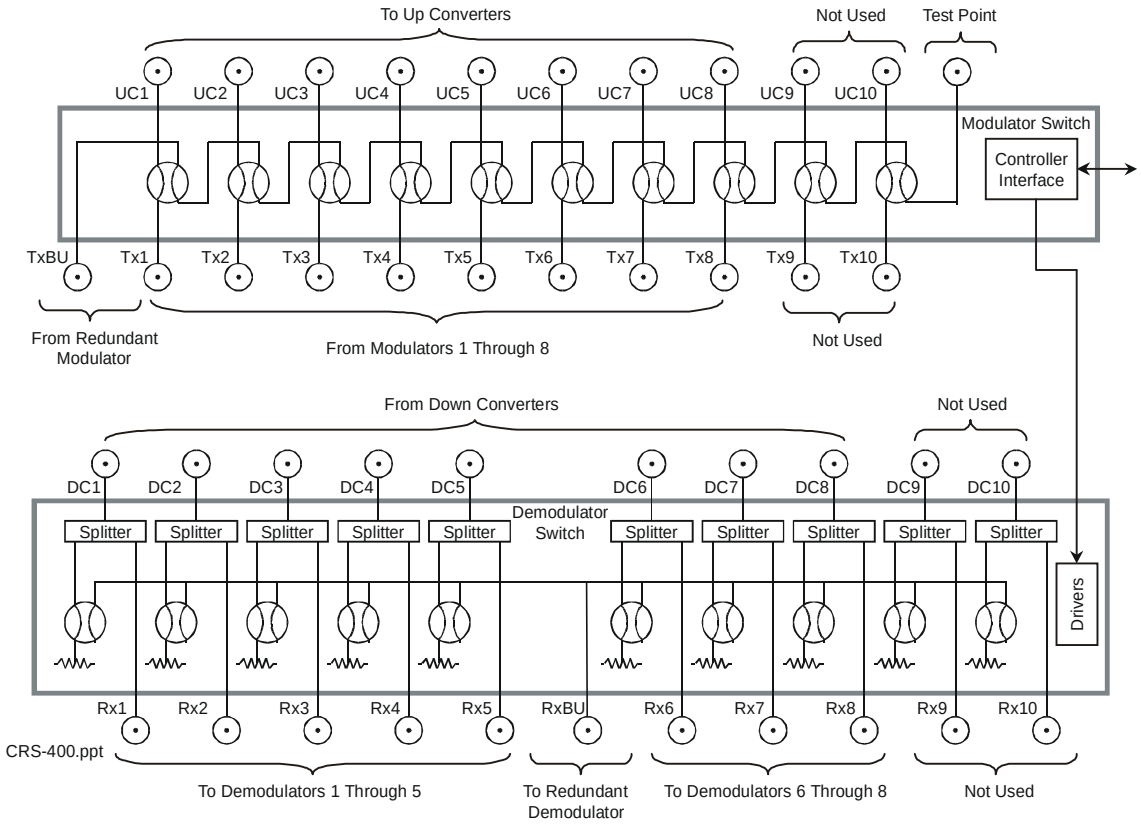


Figure 1-3 CRS-280 IF Switch Block Diagram (with TMI and RMI Modules)

All of the modulators/demodulators are connected to the CRS-400 via a single, 9-pin, EIA-485, multi-drop cable and the HSSI cable. The EIA-485 link permits the CRS-400 to determine and store a modulator/demodulator's configuration, and to send a chosen configuration to the redundant modulator/demodulator.

1.2 FRONT AND REAR PANELS

The front panel contains the Vacuum Fluorescent Display (VFD), keypad, and several LED indicators. Enter data via the keypad, and messages are displayed on the VFD. Behind the front panel, there is an audio alarm that can be controlled to respond to various faults.

External cables are attached to connectors on the rear panel of the CRS-400's plug-in modules.

The connectors are listed below for reference.

- Data connector to each Mod/Demod
- User Data Interface connector for each traffic Mod/Demod to the outside world
- System Alarms connector
- Remote Control connector
- Auxiliary EIA-485 connector, (Pass-Through)

Diagrams of the front and back panels are shown in Chapter 2.

1.3 MAJOR ASSEMBLIES AND OPTIONS

Part Number	Description	Model #	Comments	Install Option
	Main Unit Chassis, Motherboard and Display		Main Unit	Factory
AS/9163	Traffic Modem Interface, HSSI	CRS-410	Option	User
AS/9165	Redundant Modem Interface, HSSI	CRS-412	Option	User
AS/0377	System Controller	CRS-230		
AS/0376	Power Supply: 100–250 VAC	CRS-240	With Main Unit	User
FP/CV9167	Blank Panel		Option	User
PL/WR9212-1	485 Multi-drop cable		With Main Unit	User
AS/8976-2	I/F Switch: 50 Ohm (Not Available)	CRS-280-2	Option	User
AS/8976-1	I/F Switch: 75 Ohm	CRS-280-1	Option	User
PL/WR9195-6	HSSI – 6 foot cable		Option With Main Unit	User
PL/0946-1	IF BNC to BNC 50 Ohm, 4 foot cable		Spare	User
PL/0946-2	IF BNC to BNC 50 Ohm, 8 foot cable		Option With Main Unit	User
PL/0813-4	IF BNC to BNC 75 Ohm, 4 foot cable		Spare	User
PL/0813-8	IF BNC to BNC 75 Ohm, 8 foot cable		Option With Main Unit	User

1.4 SPECIFICATIONS (PRELIMINARY)

Characteristic	Requirement
AC Prime Power	Two independent inputs, 90 to 264 VAC; 50/60 Hz; at 25 Watts
Size/Weight	
Data Switch/Control Unit	4U 19 in. by 20.1 in. deep, Rack Mount (4U 48.26 cm W by 51.054 cm D) < 20 pounds (< 9.07 kg)
IF Switch Unit	4U 19 in. by ~4.5 in. deep, Rack Mount (4U 48.26 cm W by 11.43 cm D) < 10 pounds (<4.54 kg)
Environmental	
Temperature	0 to +40°C Operating -50 to +100°C Storage
Humidity	95% at +40°C, Non-condensing
EMC And Safety	EN 55022 Class B emissions EN 50082-1 immunity EN 60950 Safety FCC Part 15 Class B

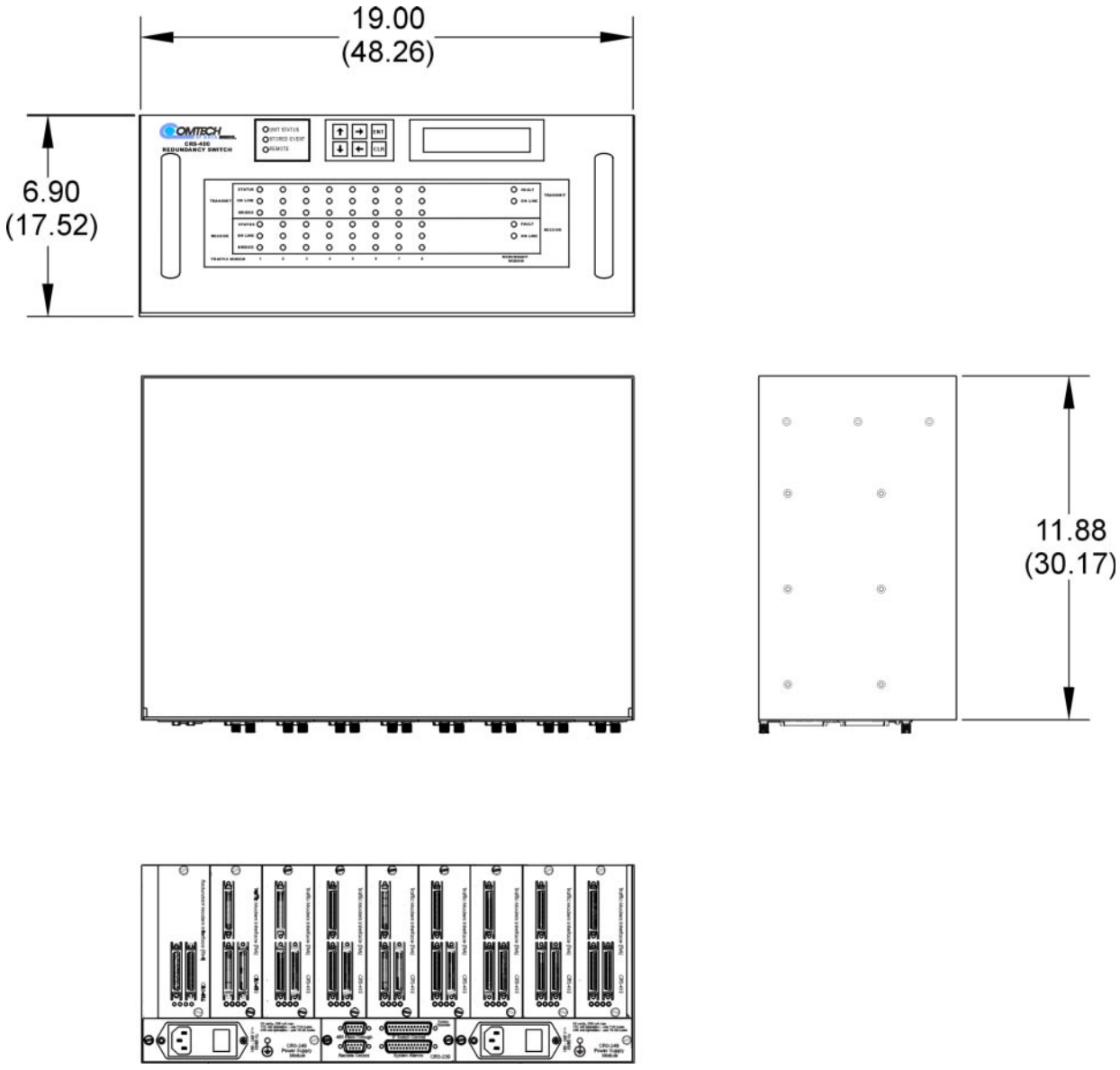
1.4.1 DATA REDUNDANCY AND CONTROLLER

Characteristic	Requirement
Number of Prime Mods/Demods	1 to 8
Number of Backup Mods/Demods	1
Operating Mode - Data Switch	Dependent or Independent
Operating Mode - IF Switch	Dependent or Independent
Mod/Demod Priority/Programmable	1 Bridge Mode
Switching Hold Off Time	2 to 99 Seconds
Switching	Manual or Auto
Default on Power Loss	Redundant Modulator/Demodulator traffic returns to the normal traffic path.
Operating Modes	Fully Automatic Manual, force backup to replace selected traffic channel Manual, force backup to parallel traffic channel, Bridge Remove selected traffic channel from control, Active or Not Active
User interface/Connector (8 Data/TMI Channels)	HSSI to 70 Mbit/s SCSI-2 female 75 Ohm, Supporting : BNC-Female
Configuration Control	Remote: EIA-485/232-C, programmable Both switch and mod/demod communications Manual: Menu driven from switch front panel Both switch and mods/demods
Tx Offline Activity	Bridged unit receives a copy of the clock and data from one of the traffic channels. User designates the traffic channel.

1.4.2 CRS-280 IF REDUNDANCY SWITCH SPECIFICATIONS

Characteristic	Requirement
Tx/Rx Operating Frequency	50 to 180 MHz
Return Loss	18 dB return loss into 75Ω (50Ω optional)
Tx to Tx Channel Isolation	> 50 dB
Rx to Rx Channel Isolation	> 50 dB
Tx to Rx Channel Isolation	> 60 dB
Number of Uplinks	1 to 8 traffic mods/demods
Transmit IF Loss	< 1.5 dB over operating frequency
Receive IF Loss	< 5 dB over operating frequency
Tx / Rx Connectors	BNC female
L-Band IF Switch	
Number of Downlinks	1 to 8 traffic units
Powering of IF Switch	From the CRS-400 chassis for 70 / 140 MHz or L-Band Switch

1.4.3 OUTLINE DRAWING



Dimensions are shown in both inches and (centimeters).

Chapter 2. Installation and Initial Setup

Note: The term “modulator/demodulator” will be abbreviated to “mod/demod” throughout the remainder of this chapter.

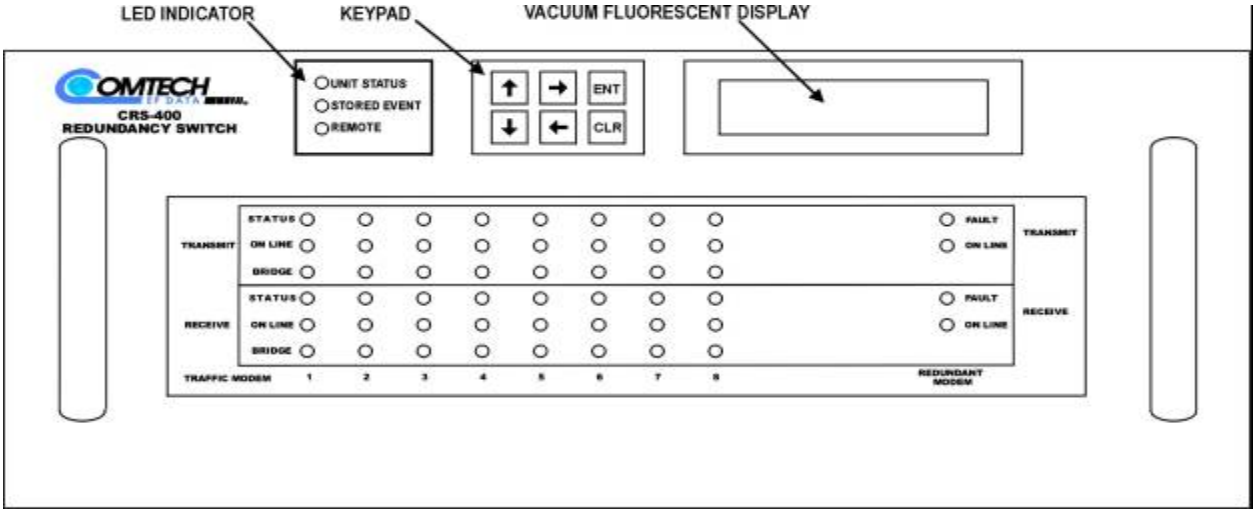


Figure 2-1 CRS-400 Front Panel

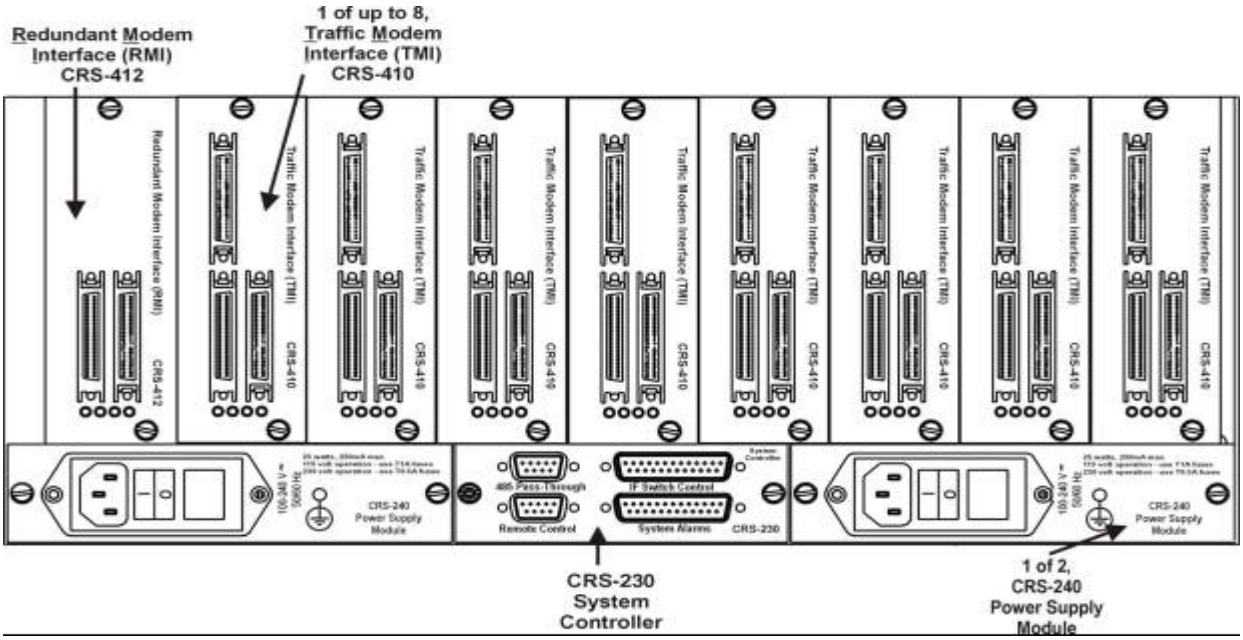


Figure 2-2 CRS-400 Rear Panel, with 8 HSSI TMI and 1 HSSI RMI

2.1 UNPACKING AND INSPECTION

1. Inspect shipping containers for damage.

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

   Be sure to keep all shipping materials for the carrier's inspection.
6. If the unit needs to be returned to Comtech EF Data, please use the original shipping container.

2.2 FRONT PANEL

Figure 2-1 is an illustration of the front panel. The CRS-400 is constructed as a 4U 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.

2.3 REAR PANEL

The connectors on the rear panel (see Figure 2-2) of the CRS-400 include:

- Data connectors
  - Data connector to each Mod/Demod
  - User Data Interface connector for each traffic Mod/Demod to the outside world
  - Redundant Modem Interface (RMI) connectors
- System Alarms connector
- Remote Control connector
- Auxiliary (Pass-Through) EIA-485 connector, 19200 baud with 7-E-2 (7 Data bits, Even parity, and 2 Stop bits protocol only)
- IF Switch Control connector
- Power Supply connectors

2.3.1 DATA CONNECTORS

The Data connectors on the TMI plug-ins lead to/from the mods/demods, and lead to/from the outside world (User Data).

The User Data female connector can be treated as an extension of the traffic mod/demod's Data connector. The RMI has no User Data connector, since it will only replace one of the traffic mods/demods. The pinout for both connectors is provided in the next chapter.

Open Collector TTL (OC-TTL) signals for mod/demod faults are used to initiate switching in the CRS-400 switch. The conductors are either in the data cable or in a separate cable, depending upon the type of data interface.

Note: It is the user's responsibility to provide the appropriate User Data cable to connect between the outside user equipment and the TMI.
Reliable Data cables are available from Comtech EF Data to connect between the TMI (or RMI) and the Mod (or Demod).

2.4 MOUNTING INSTRUCTIONS

The CRS-400 is constructed as a 4U high rack-mounting chassis. Rack-handles at the front of the unit facilitate removal from and placement into a rack.

Mount the switch in the rack using the mounting holes on the front panel.

DO NOT MIX MODELS OF MODS/DEMODS CONNECTED TO THE SWITCH

For the CRS-400 to operate correctly, identical types of Mod/Demod models must be used for all traffic Mods/Demods, and for the redundant Mod/Demod.

2.4.1 PROVIDE AIRFLOW

Typically, the CRS-400 is mounted in a rack along with all the Mods/Demods with which it is to operate, so it is important to ensure that there is adequate clearance for ventilation.

Since the switch itself is relatively passive, no additional clearance is needed between it and the nearest Mod/Demod.

In rack systems where there is high heat dissipation, provide forced-air cooling by installing top- or bottom-mounted fans or blowers.

Do not allow the internal rack temperature to exceed 50° C.

2.4.2 About Rack Support

Mount the switch using front panel screws only. Do not install rack slides to the side of the CRS-400 chassis. Contact the factory if there are questions about rack supports.

2.5 Installation Details

Cable connections for the switch are wired on a channel by channel basis as indicated in Figure 1-1 of Chapter 1, a block diagram of the CRS-400. Further detail for the data switch and IF switch is provided in Chapter 1, Figure 1-2 and Figure 1-3. The subsequent tables provide the detail cable connections between the CRS-400 and the mods/demods and other interfaces.

In Paragraph 2.13 a separate connection table is presented for connections made to the optional IF switch.

2.6 Cables and Connectors

Please use the following information to verify that you have the correct cables and connectors available prior to installing the unit.

Comtech EF Data can supply IF cables or IF splitters/combiners with the CRS 280 Redundancy Switch as an option.

2.6.1 HSSI Cable Physical Requirements

The HSSI cables required between each Mod/Demod and its plug-in card (TMI or RMI) should be of shielded, twisted-pair construction with the grounded shield bonded to the back shell. All 50 pins should be wired to the same pin number at either connector (pin-to-pin), with a male connector at both ends. The Data and Clock must be on twisted-pair cable.

Appropriate HSSI cables lengths are available from Comtech EF Data, so please consult the factory for ordering information. Please note that these cables are an extra-cost item.

2.6.2 TMI DATA CONNECTOR (HSSI)

Table 2-1 describes the pinout for the HSSI connector. User equipment connects to the CRS-400 at J5. Make the connections from the CRS-400 to the mod/demod using J6 and J7 for the modulator and demodulator, respectively. Two connectors, J6 and J7, are provided to eliminate the need for a Y-cable between the mod/demod and the switch when the modulator and demodulator are housed in separate chassis. Use only J6 when connecting a combined modulator and demodulator (modem) to the switch.

Table 2-1 HSSI Pinout (J5 / J6 / J7) 50-Pin Mini-D/SCSI-2 Male and Female

HSSI/EIA-613 Interface Connector Pinout -- J6 / J7 To modem						J5 To User
Signal Function	HSSI Signal	EIA-613 Circuit	Pin # (+, -)	Circuit Direction	Comment	Pin # (+, -)
Signal Ground	SG	102	1, 26		Mod/Demod	1, 26
Receive Timing	RT	115	2, 27	from DCE	Demodulator	2, 27
DCE Available	CA	107	3, 28	from DCE	Mod/Demod	3, 28
Receive Data	RD	104	4, 29	from DCE	Demodulator	4, 29
Loopback Circuit C	LC	undefined	5, 30	from DCE	Mod/Demod	unused
Send Timing	ST	114	6, 31	from DCE	Modulator	6, 31
Signal Ground	SG	102	7, 32		Mod/Demod	7, 32
DTE Available	TA	108/2	8, 33	to DCE	Mod/Demod	8, 33
Terminal Timing	TT	113	9, 34	to DCE	Modulator	9, 34
Loopback Circuit A	LA	143	10, 35	to DCE	Mod/Demod	unused
Send Data	SD	103	11, 36	to DCE	Modulator	11, 36
Loopback Circuit B	LB	144	12, 37	to DCE	Mod/Demod	unused
Signal Ground	SG	102	13, 38		Mod/Demod	13, 38
TX PSYNC (*Note 1)*	TPSYNC	undefined	14, 39	to DCE	Modulator	unused
TX DVALID (*Note 1)*	TDVALID	undefined	15, 40	to DCE	Modulator	unused
Reserved (to DCE)			16, 41		unused	unused
Reserved (to DCE)			17, 42		unused	unused
Reserved (to DCE)			18, 43		unused	unused
Signal Ground	SG	102	19, 44		Mod/Demod	19, 44
Carrier Detect (lock) (*Notes 1 and 2)*	CD	undefined	20	from DCE	Demodulator	20

HSSI/EIA-613 Interface Connector Pinout -- J6 / J7 To modem						J5 To User
Signal Function	HSSI Signal	EIA-613 Circuit	Pin # (+, -)	Circuit Direction	Comment	Pin # (+, -)
Demod Fault *(Notes 1 and 3)*	DF	undefined	45	from DCE	Demodulator	unused
Mod Fault *(Notes 1 and 3)*	MF	undefined	21	from DCE	Modulator	unused
Reserved (to DTE)			46		unused	unused
RX PSYNC *(Note 1)*	RPSYNC	undefined	22, 47	from DCE	Demodulator	unused
RX DVALID *(Note 1)*	RDVALID	undefined	23, 48	from DCE	Demodulator	unused
Test Mode	TM	142	24, 49	from DCE	Mod/Demod	unused
Signal Ground	SG	102	25, 50		Mod/Demod	25, 50

Notes:

1) Noted signal function names are non-HSSI defined signals. On Cisco routers there is no connection to those pins. Refer to the Comtech EF Data web site for an Application Note describing the use of the SDM-2020 with Cisco routers.

2) TTL - output.

3) TTL – open collector output.

The HSSI interface uses the type of SCSI-2 connector shown in Figure 2-3.

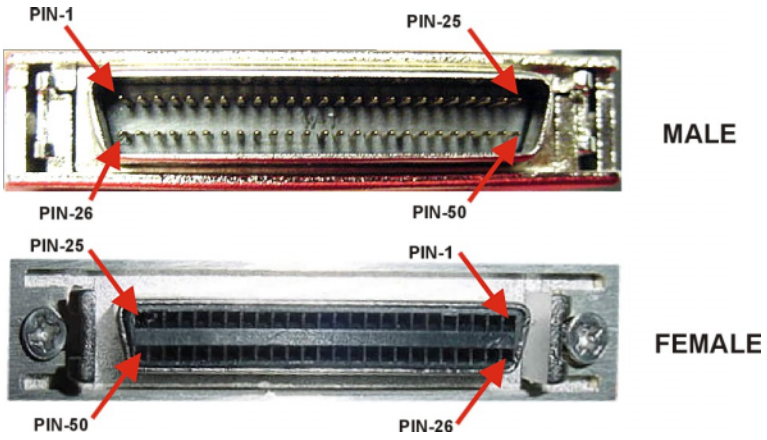


Figure 2-3 SCSI-2 (ECL/HSSI) Connector, Pin Locations

2.6.3 SYSTEM ALARMS CONNECTOR

Located on the System Controller card, the System Alarms connector provides access to Form-C relay contacts that indicate the fault status of the switch and the summary faults.

If any of the attached mods/demods has any fault active, the corresponding Tx or Rx summary relay will energize, forcing the normally open pin to connect to (and the normally closed pin to disconnect from) the common pin.

Another pin provides a ground connection when the audio alarm is sounded so that the user may add additional audible alarms.

There are also relay contacts to indicate which, if any, of the traffic mods/demods is currently being backed up. To determine which mod/demod is being backed up (see the connector pinout, Table 2-2), decode the BCD relay outputs.

Table 2-2 Systems Alarm Connector Pinout, 25-Pin D Type Female

Pin		Description
13		Unused Relay – NC Contact
	25	Unused Relay – NO Contact
12		Mod/demod Summary Rx Traffic Fault – NC Contact
	24	Mod/demod Summary Rx Traffic Fault – NO Contact
11		Mod/demod Summary Tx Traffic Fault – NC Contact
	23	Mod/demod Summary Tx Traffic Fault – NO Contact
10		Mod/demod Summary Unit Fault – NC Contact
	22	Mod/demod Summary Unit Fault – NO Contact
9		Switch Unit Fault – NC Contact
	21	Switch Unit Fault – NO Contact
8		Common contact for pins 9-12 and 21-24
	20	Audio Indicator (Gnd = Audio on Float = Audio off)
7		Ground
	19	Not Connected
6		BU Mod Replaces Traffic Mod “N”, Bit 1 of 3 – NO Contact
	18	BU Mod Replaces Traffic Mod “N”, Bit 2 of 3 – NO Contact
5		BU Mod Replaces Traffic Mod “N”, Bit 3 of 3 – NO Contact
	17	Unused Relay – NO Contact
4		BU Demod Replaces Traffic Demod “N”, Bit 1 of 3 – NO Contact

Pin		Description
	16	BU Demod Replaces Traffic Demod “N”, Bit 2 of 3 – NO Contact
3		BU Demod Replaces Traffic Demod “N”, Bit 3 of 3 – NO Contact
	15	Unused Relay – NO Contact
2		Unused Relay – NO Contact
	14	Unused Relay – NO Contact
1		Common contact for pins 3-6 and 15-18

*** Note**: Mod/demod Select 0-3 represent the binary address of the Mod/Demod.

2.6.4 IF SWITCH CONTROL CONNECTOR

The IF Switch Control connector should be cabled directly to the corresponding connector on the CRS-280 IF Switch, if used. This supplies power to the CRS-280, along with the logic interface to drive the currently selected traffic mod/demod, and to decide whether the system is in bridged or back-up mode. The CRS-280 must perform the same bridging and backing up functions to the transmit and receive IF signals to match what the CRS-400 does to the terrestrial data signals. Table 2-3 provides the pinout information.

Table 2-3 IF Switch Control Connector, 25-Pin D Type Male

Pin #	Condition
16	Enable
5	Clock
17	Serial Data
4	Mod_Backup
8	Demod_Backup
3	Rev_Bit0, (for PCA hardware revision control)
18	Rev_Bit1
6	Rev_Bit2
19	Rev_Bit3
7	Product_ID_Bit0, (for IF switch identification)
20	Product_ID_Bit1
21	IF Switch Present

Pin #	Condition
10, 22	+5V input
12, 24	+12V input
11, 13	Ground
1, 2, 9, 14, 15	No Connection

2.6.5 REMOTE CONTROL CONNECTOR

The Remote Control connector provides access to the remote control ports of the switch, both EIA-232 and EIA-485. Table 2-4 provides the pinout information.

Table 2-4 Remote Control Connector, 9-Pin D Type Male

Pin	Description
1	Ground
9	EIA-485 Transmit Data B
8	EIA-485 Transmit Data A
5	EIA-485 Receive Data B
4	EIA-485 Receive Data A
2	EIA-232 Transmit Data
3	EIA-232 Receive Data
6	Not connected
7	Not connected

2.6.6 AUXILIARY SERIAL CONNECTOR / PASS-THROUGH

This connector is used for switch remote control of each SDM-2020 modulator or demodulator. This remote communication is fixed at a rate 19200 Baud with 7-E-2 character format. Ensure that each mod/demod is set for EIA-485 4-wire communications and the matching protocol and baud rate.

The pinout for EIA-485 communication at the switch is the same as the remote control on the SDM-2020 modems. Table 2-5 provides the pinout information.

Table 2-5 Auxiliary Serial Connector/Pass-Through, Cable # PL/9195-1

CRS-400 9-Pin D Male	Description	VO
9	EIA-485 Receive Data B	I
8	EIA-485 Receive Data A	I
5	EIA-485 Transmit Data B	O
4	EIA-485 Transmit Data A	O
1	Ground	
2	Not connected	
3	Not connected	
6	Not connected	
7	Not connected	

2.7 TMI MODULES

The following paragraphs describe settings for any of the individual TMI modules that require jumper or other installation settings on the module.

2.7.1 HSSI MODULE

An outline drawing of the HSSI interface is shown in Figure 2-4. The jumper settings are explained in Table 2-6 and Table 2-7.

- Recommended Setting: CA looped to TA at J5.

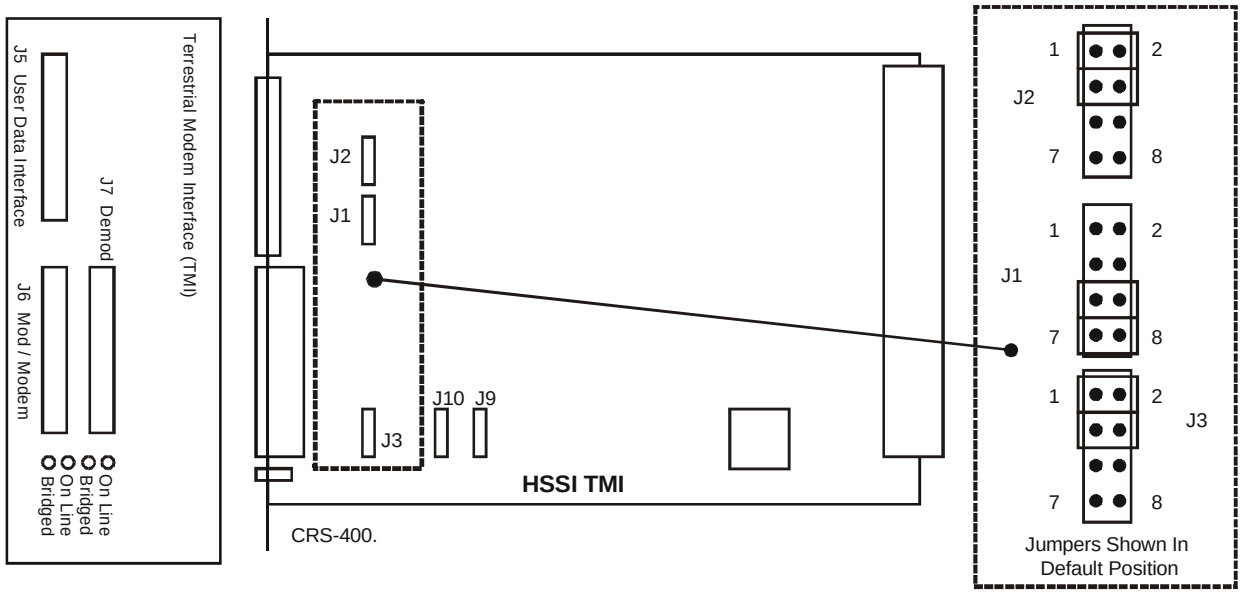


Figure 2-4 HSSI TMI Module

Table 2-6 HSSI TMI Jumper Selection (TA/CA)

TA/CA Selection	J1 Jumpers	J2 Jumpers	J3 Jumpers
Default: CA Looped to TA at J5	5 - 6 7 - 8	1 - 2 3 - 4	1-2 3-4
Modulator Only or Mod/Demod. J5-TA to Modulator, CA From Modulator to J5.	1 - 2 3 - 4	5 - 6 7 - 8	1 - 2 3 - 4
Demodulator Only. CA from Demod to J5 (TA ignored)	1 - 2 3 - 4	None	5 - 6 7 - 8

Table 2-7 HSSI TMI Jumper Selection (RT/RD)

RT/RD Selection	J9 Jumpers	J10 Jumpers
Default: RT/RD from Demod	5 - 6 7 - 8	5 - 6 7 - 8
RT/RD from Modem (Full Duplex at J6)	1 - 2 3 - 4	1 - 2 3 - 4

2.8 RMI MODULES

The following paragraphs describe settings for any of the individual RMI modules that require jumper or other installation settings on the module.

2.8.1 HSSI MODULE

Figure 2-5 shows the RMI module, Table 2-8 and Table 2-9 describe the jumper settings on the module.

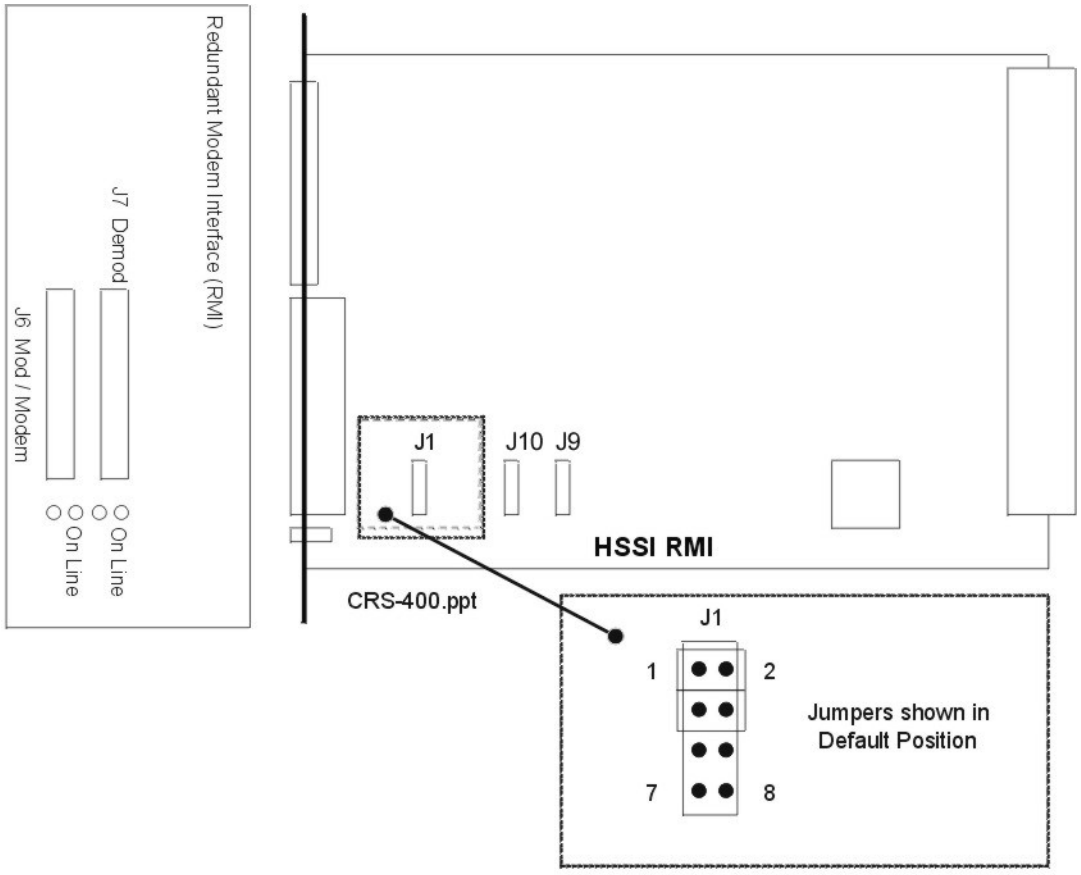


Figure 2-5 HSSI RMI Module

Table 2-8 HSSI RMI Jumper Selection

TA/CA Selection	J1 Jumpers
Default: Modulator Only or Mod/Demod. CA From Modulator to J6.	1 - 2 3 - 4
Demodulator Only. CA from Demod to J7 (TA ignored)	5 - 6 7 - 8

Table 2-9 HSSI TMI Jumper Selection (RT/RD)

RT/RD Selection	J9 Jumpers	J10 Jumpers
Default: RT/RD from Demod	5 - 6 7 - 8	5 - 6 7 - 8
RT/RD from Modem (Full Duplex at J6)	1 - 2 3 - 4	1 - 2 3 - 4

2.9 CONNECTING THE CABLES

Ensure that all power to the equipment is off.

All Mods/Demods must be the same model and contain the same software revision so that the Redundant Mod/Demod can properly mimic all traffic Mods/Demods.

2.9.1 HSSI CONNECTION

1. Connect HSSI data cables between each traffic Mod/Demod and TMI card.
2. Connect a HSSI data cable between the redundant Mod/Demod and the RMI card.
3. Replace any unused cards with blank panels.
4. Connect the multidrop cable (PL/WR9212-1) from the Pass-Through connector to each SDM-2020 remote port.
5. Do not connect the IF ports at this time.
6. Apply power to the Mods/Demods only.

Table 2-10 lists connections made between the CRS-400 and SDM-2020 units.

Table 2-10 CRS-400 to SDM-2020 Data Connection

From		To			
Switch Connectors		SDM-2020			Future
		Mod Only	Demod Only	Mod + Demod	
TMI	J5 (User)	-	-	-	
	J6	J3	-	J3, Mod	
	J7	-	J3	J3 Demod	
RMI	J6	J3	-	J3, Mod	
	J7	-	J3	J3, Demod	
Controller	Remote (User)	-	-	-	
	Remote Pass-Through	J1	J1	J1	
	IF Sw Control	-	-	-	
	System Alarms (User)	-	-	-	

2.10 CONFIGURING THE MODS/DEMODS – FIRMWARE VERSIONS

IMPORTANT

For correct operation of the CRS-400, the Mods/Demods must have the following Firmware versions installed:

Minimum Revision					
Feature	**CRS-400**	**SDM-2020 Mod**	**SDM-2020 Demod**	**Future**	**Future**
HSSI		M&C Firmware Ver 8.1.6	M&C Firmware Ver 22.2.1		
75 Ohm Data	Ver xxx Backplane xxx	M&C Firmware newer than April 2001	M&C Firmware newer than April 2001		

If the Mods/Demods do not meet this requirement, please contact the factory.

1 Configure these parameters for the SDM-2020 Mod/Demod remote control interfaces:

EIA-485: 4-wire

Rate: 19200 Baud

Format: 7 Data Bits, Even Parity, 2 Stop Bits (7-E-2)

Note: These values are the default settings for the SDM-2020 Utility/System menu, REMOTE BAUD RATE/PARITY settings.

Mod
Remote Address: Positions 1 through 8, set Addresses 1 through 8, with the Redundant Modulator at Address 9

Demod
Remote Address: Positions 1 through 8, set Addresses 11 through 18, with the Redundant Demodulator at Address 19

The switch is now ready for the next procedure, Applying Power to the Switch.

2.11 APPLYING POWER TO THE SWITCH

Note: Each CRS-400 is shipped with two power supplies, and it is recommended that both be used for maximum reliability.

With the terrestrial cabling complete and the Mods/Demods powered on, but the IF ports still unconnected, applying power to the CRS-400 is the next procedure. The auto-sensing AC power supplies do not require any adjustments.

1. Plug in the supplied line cords.
2. Turn on the switches on the rear panel.

The switch should show a green Unit Status.

The IEC line input connector for each Power Supply Module contains the ON/OFF switch for that module. It is also fitted with two fuses, one each for line and neutral connections (or L1, L2, where appropriate). These are contained within the body of the connector, behind a small plastic flap.

- For 115/230 volt AC operation, use T1A fuses, (slow-blow) 20mm fuses.

For continued operator safety, always replace the fuses with the correct type and rating.

2.11.1 SINGLE POWER SUPPLY OPERATION (TEST)

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

1. Go to the CONFIG, OPTIONS, MASKS, SW-ALARMS menu.
2. Select the unused power supply.

The switch is now ready for the next procedure, Configuring the Switch.

2.12 CONFIGURING THE SWITCH

The unit was shipped with the following default configuration:

- No units (mods/demods) are active.
- The switch was set to Manual operating mode. (This Manual setting causes the Stored Event LED to blink.)

The TMI modules have internal jumpers to be configured. Use the front panel keypad and display to configure the switch as described in the following paragraphs.

2.12.1 ACTIVATE DESIRED TRAFFIC MODS/DEMODS

Ensure that the redundant mod/demod installation is complete prior to activating any traffic mods/demods, because an active unit is going to be polled regularly by the switch.

1. Go to the CONFIG, ACTIVE menu.
2. Activate all desired traffic Mods/Demods.

   After ENTER is pressed, the Switch Status LED briefly turns red. The switch then polls each of the activated Mods/Demods, and programs the bridged Mod/Demod configuration into the redundant Mod/Demod.

   Once the programming is completed successfully, the red LED turns green.

   Note: The Demod takes several seconds to configure. If the LED remains red, check the communication status using the (MONITOR: COMM-STATE) menu.

2.12.2 VERIFY REMOTE COMMUNICATIONS TO EACH ACTIVE MOD/DEMOD

The LEDs are arranged in columns corresponding to each modulator and demodulator, and should accurately reflect the status of each.

1. Verify that the Status LED for each modulator and demodulator shows a green light, indicating no faults.
2. Verify that the Online LED is lit for all connected TMIs.
3. Verify that the Online LED is not lit for the redundant Mod/Demod (for systems not using the CRS-280 IF switch).
4. Verify that the Bridge LED is lit for only one traffic Mod/Demod.

Notes: Use the INFO and MONITOR menus to view the status of the mods/demods, in addition to viewing the LEDs.

Use MONITOR: COMM-STATE to verify the devices that are responding via remote control.

The switch is now ready for the next procedure, Configuring the IF Carriers.

2.13 CONFIGURING THE IF CARRIERS

Next, configure the IF carriers for all the Mods/Demods. There are two configuration methods: single transponder and multiple transponders.

For a single transponder, all the Mods/Demods are connected to the same up/down converter.

For multiple transponders, the Mods/Demods may be grouped and connected in various combinations to multiple up/down converters. The CRS-280 IF Switch is required for multiple transponder operation.

Proceed with the transponder configuration method applicable to your system.

2.13.1 CONFIGURING AND CABLING FOR A SINGLE TRANSPONDER

2.13.1.1 TRANSMIT SIDE

1. Configure each Modulator's transmit settings to the proper data rate, IF frequency and output power level.
2. Combine the carriers (with user-supplied BNC cables) into a single power combiner.
3. Feed the output of the combiner to the up converter.

Ensure that the impedance for the Mods/Demods' cables and combiner are the same to prevent problems resulting from a mismatch.

2.13.1.2 RECEIVE SIDE

1. Attach the output of the down converter (with user-supplied BNC cables) to a single splitter.
2. Feed the output of the splitter into the Receive IF ports of the Demodulators.

When a traffic Modulator is taken offline, its Transmit IF shuts down automatically and is replaced by the redundant Modulator IF.

2.13.2 CONFIGURING AND CABLING FOR MULTIPLE TRANSPONDERS, USING THE CRS-280 TRANSPONDER SWITCH

The CRS-280 provides complete isolation of the IF signals. The redundant Mod/Demod IF signals are routed to the traffic Mod/Demod IF path when the RMI is online.

Once connected, the CRS-400 automatically senses the presence of the CRS-280. The CRS-400, upon switching, leaves the offline modulator with its RF on, and the CRS-280 switch relays isolate any undesired signals.

1. Connect the CRS-280 to the CRS-400 with a 25-pin control cable.
2. Refer to Table 2-11 for a complete listing of the CRS-280 IF connections.
3. Connect the Transmit and Receive IF of each Mod/Demod to the CRS-280 with the correct IF cables.

The same IF connections are used between the CRS-280 and all modems as shown in Table 2-11.

Table 2-11 CRS-280 IF Switch Connections

From CRS-280	To Other	To Modulator		From CRS-280	To Demodulator
Tx BU	-	Tx IF, Ch Bu		Rx1	Rx IF, Ch1
Tx1	-	Tx IF, Ch1		Rx2	Rx IF, Ch1
Tx2	-	Tx IF, Ch2		Rx3	Rx IF, Ch2
Tx3	-	Tx IF, Ch3		Rx4	Rx IF, Ch3
Tx4	-	Tx IF, Ch4		Rx5	Rx IF, Ch4
Tx5	-	Tx IF, Ch5		RxBu	Rx IF, Ch Bu
Tx6	-	Tx IF, Ch6		Rx6	Rx IF, Ch5
Tx7	-	Tx IF, Ch7		Rx7	Rx IF, Ch6
Tx8	-	Tx IF, Ch8		Rx8	Rx IF, Ch7
Tx9 (Not Used)	-	-		Rx9 (Not Used)	-
Tx10 (Not Used)	-	-		Rx10 (Not Used)	-
Switch Control	CRS-230 IF Switch Control	-		-	-

Once the applicable transponder configuration and cabling has been completed, the switch is ready for the next procedure, Configuring Automatic Operation Mode.

2.14 CONFIGURING AUTOMATIC OPERATION MODE

After the IF cabling is finished, the system should be completely operational; however, it is still operating in Manual mode. While in Manual mode, the switch does not automatically react to any traffic Mod/Demod failures it detects.

Comtech EF Data recommends that an unattended system be set to operate in Auto mode.

2.14.1 SET AUTO MODE ON

When Auto mode is enabled, the first active Mod/Demod that fails is first bridged by the redundant Mod/Demod, then backed up. To enable Auto mode:

1. Go to the CONFIG, AUTO menu and turn on Auto mode.
2. Verify that the Stored Event LED stops blinking.

Additional configuration settings are useful for fine-tuning the switch's Auto mode. These settings, Backup Holdoff, Restore Holdoff, Alarm Mask, and Restore Time are described next.

2.14.2 BACKUP HOLDOFF OPERATION

When in Auto mode, additional delays may be introduced to the backup procedure by setting the number of seconds for a "backup holdoff". The default backup holdoff period is five seconds (a minimum of 2 seconds is allowed).

If a traffic modulator or demodulator fails, the switch waits for the backup holdoff time to determine two things: 1) does the traffic Mod/Demod remain faulted, and 2) is the redundant Mod/Demod not exhibiting the same fault? If the answer is yes to both questions for the entire backup holdoff time, then the switch places the traffic onto the redundant Mod/Demod.

The switch performs the actual backup as follows: First, the faulty unit is bridged. Second, the faulty unit is backed up. Holdoff times prevent unwarranted backups due to an intermittent fault, or due to a transmit fault detected by both demods, which cannot be resolved by switching.

2.14.2.1 SET THE BACKUP HOLDOFF PERIOD

1. Go to the CONFIG, OPTIONS, HOLDOFFS menu.
2. Change the BACKUP HOLDOFF to any number in the range of 2 to 99 seconds.

2.14.3 125

2.14.4 RESTORE HOLDOFF OPERATION

The “Restore Holdoff” setting, which is also programmable from 2 to 99 seconds, determines the switch’s ability to automatically put a backed up traffic Mod/Demod online again if its fault goes away. Normally, a failed Mod/Demod that was taken offline will remain offline indefinitely (unless the Auto-Restore feature is enabled). If the fault goes away, traffic will be returned to the unit (in Auto mode) if another traffic Mod/Demod fails. The switch places the originally failed Mod/Demod back online if its fault has been clear for the full programmed Restore Holdoff time. The redundant Mod/Demod can then be used to backup a newly failed Mod/Demod.

The switch has no prioritization scheme, so that multiple traffic Mod/Demod failures are treated on a “first come, first serve” basis only. If the redundant unit is set to bridge the highest priority circuit, switching time will be minimized in the event of a failure. If two faults occur simultaneously, and are both sustained for the holdoff time, the lower number circuit will be backed up.

2.14.4.1 SET THE RESTORE HOLDOFF PERIOD

1. Go to the CONFIG, OPTIONS, HOLDOFFS menu.
2. Change the RESTORE HOLDOFF to any number in the range of 2 to 99 seconds.

2.14.5 ALARM MASKING

Another way to adjust the switch’s reaction in Auto mode is to mask Mod/Demod faults. The user may disable modulator, demodulator, 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.

Note: These masks are global to all the Mods/Demods attached to the switch.

2.14.5.1 SET THE ALARM MASKS

1. Go to CONFIG, OPTIONS, MASKS, MODEM-ALARMS.
2. Set the mask parameters as desired.

Note: Please read the manual for the SDM-2020 also. Details of the modulator and demodulator equipment operation are not covered in the CRS-400 manual.

Once the switch has been installed and setup has been completed, regular operation may begin. Please refer to Chapter 3, Operation, for more information.

Chapter 3. Operation

3.1 Front Panel Display

Users can fully control and monitor the CRS-400 from the front panel using the display and keypad. The display has two lines each of 24 characters:

```
COMTECH  CRS-400  SWITCH
SN 123456789    VER 1.01
```

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

```
CONFIG: MANUAL AUTO[OFF]
ACTIVE  REMCONT  OPTIONS
```

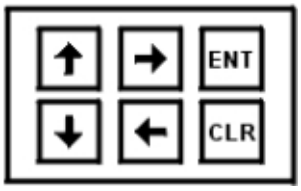
Where this solid block cursor would obscure the item being edited (for example, a numeric field) the cursor will automatically change to an underline cursor.

To prevent the display from becoming burnt by a constant image, the unit employs a screen saver feature. After one hour, the screen saver activates. The top line of the display shows the Switch ID (which can be entered by the user), and the bottom line shows the current status of the switch followed by the message “Press any key....”.

The message moves across the screen constantly. Press any key to restore the previous screen.

3.2 FRONT PANEL KEYS

The keypad contains six individual key switches mounted behind a sealed membrane overlay. The keys have a positive "click" action for tactile feedback. These six switches are identified as follows:



UP ARROW	↑	Edits the value at the current cursor position, if appropriate. Increments the value of a numeric field.
DOWN ARROW	↓	Edits the value at the current cursor position, if appropriate. Decrements the value of a numeric field.
RIGHT ARROW	→	Moves the cursor to the right, when it is displayed.
LEFT ARROW	←	Moves the cursor to the left, when it is displayed.
ENTER	**ENT**	Accepts an edited entry. Most menus prompt users to press this key by displaying the text (PRESS ENTER), (ENTER) or (ENT). Press ENT to accept the entry and display the previous menu.
CLEAR	**CLR**	Exits the current operation and displays the previous menu without accepting any configuration changes.

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.

3.3 LED INDICATORS

Table 3-1 describes the three LEDs at the top left of the front panel. These LEDs reflect the condition of the switch itself.

Table 3-1 Switch LED Indicators

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, Auto Switching On
	Orange	Stored Events exist for the switch. Solid Orange or Off indicates switch is in Auto mode.
	Orange Flashing	Switch is in Manual 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

The front panel contains 3 LEDs (Status, On Line, Bridge) for each traffic modulator and demodulator connected to the rear of the switch, and 2 LEDs (Fault, On Line) each for the redundant modulator and demodulator. All of these LEDs are described in Table 3-2.

Table 3-2 Transmit and Receive Traffic Mod/Demod LED Indicators

LED	Color	Condition
Status	Red	A Unit Fault exists
	Green	No Unit Fault
	Orange	TMI is installed but Unit not active
	Off	TMI is not installed
On line	Green	The Unit is On Line, and ready to carry traffic
	Off	The Unit is Off Line (standby) - forced by the Switch
Bridge	Orange (or Yellow)	Unit is currently being Bridged by Redundant Unit
	Off	Unit is not being Bridged

3.4 MENU TREES

Nested menus display all available options and prompt users to carry out required actions.

Figure 3-1 and Figure 3-2 show the menu structure for both dependent and independent switching modes of operation.

See Appendix A for detailed descriptions of the individual menu commands and related options.

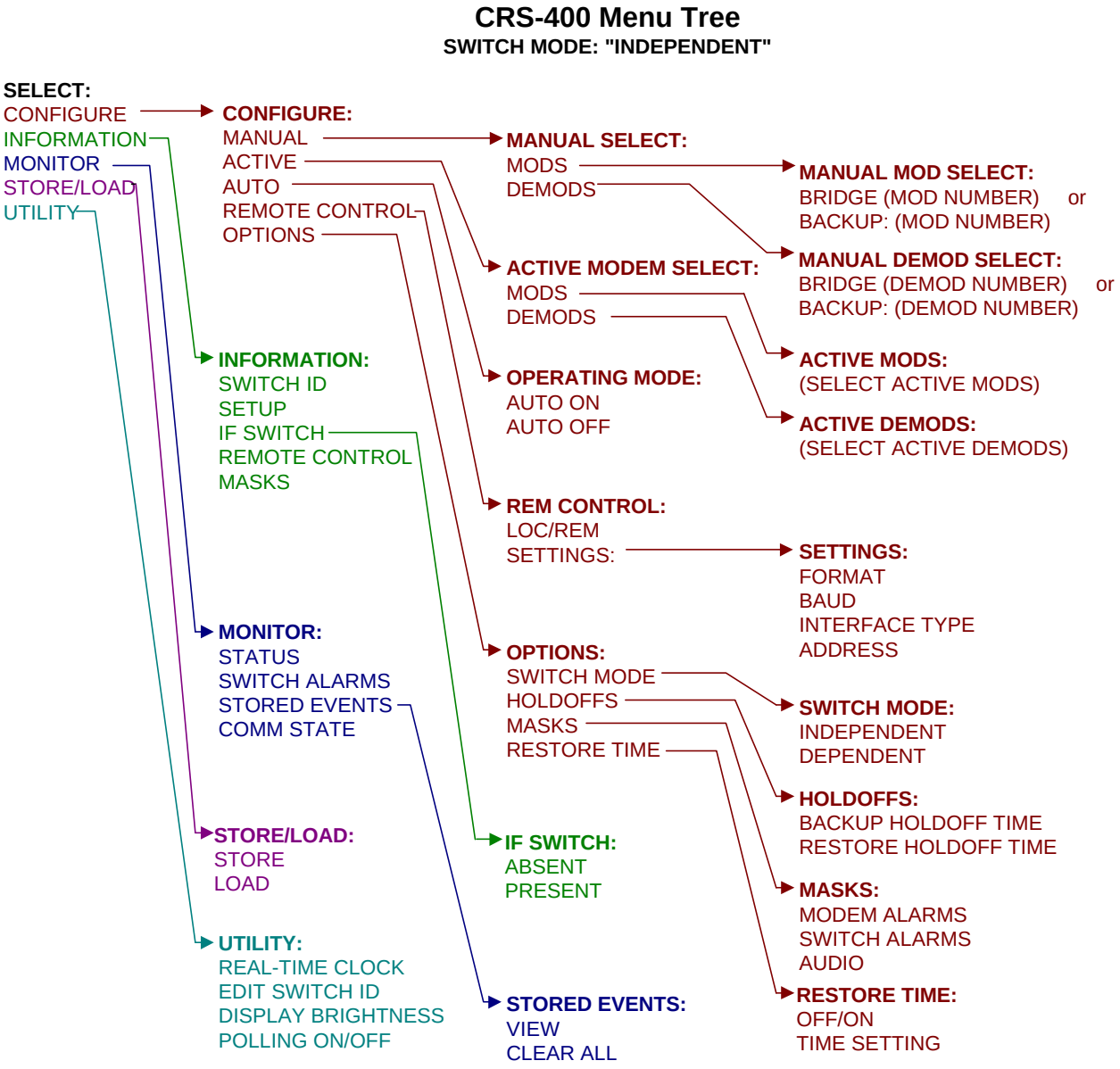


Figure 3-1 Principle Menus Tree for Independent Mode

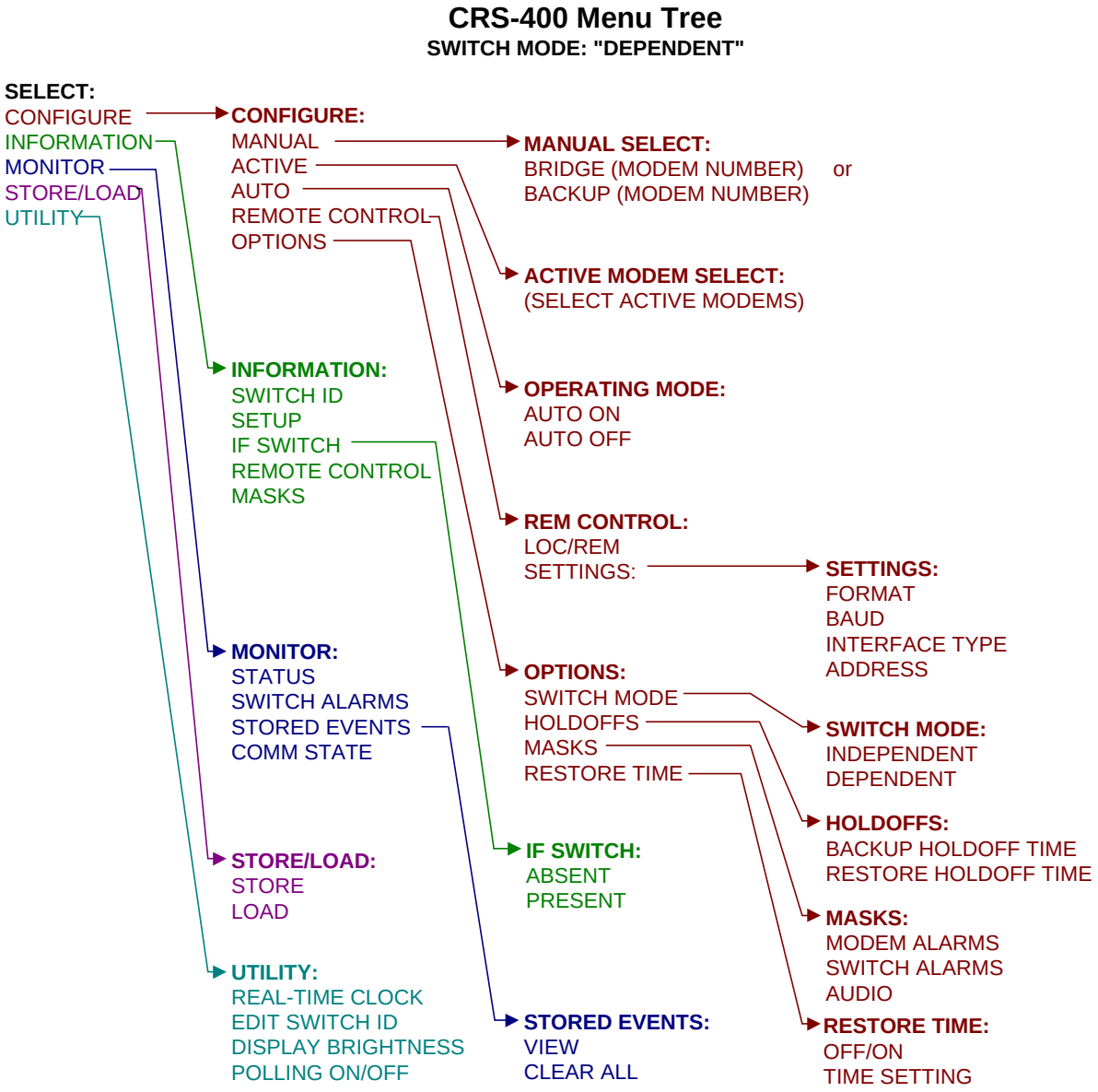


Figure 3-2 Principle Menus Tree for Dependent Mode

3.5 FLASH UPGRADING

The CRS-400 uses “flash memory” technology internally, so that new firmware can be uploaded to the unit from an external Personal Computer (PC). Flash upgrading makes software updates and new feature additions very simple, and allows updates to be delivered via the Internet, E-mail, or on diskette. It is not necessary to open the unit to perform the upgrade. Simply connect the switch to the serial port of a computer and execute a software utility.

The cable to connect the PC to the switch is the same as is used for normal EIA-232 remote control, and consists of 3 wires between 9-pin D type female connectors. See Chapter 2 for pinout details and an illustration of this cable.

Comtech EF Data distributes the free software utility named CCCFLASH.EXE. It is designed to run under Windows™ 3.1x, Windows 95/98 or Windows NT. This is the same program used to flash upgrade the CDM-550T modem. The latest switch firmware file (for example, 400V102.CCC) is distributed with the flash upgrade utility.

3.5.2 FLASH UPGRADE PROCEDURE

1. Copy both the utility (CCCFLASH.EXE) and the new firmware file to the same subdirectory (folder) on the computer’s hard disk. Do not use the root directory.
2. Connect the switch remote control port to an EIA-232 serial port on the PC.
3. Execute the CCCFLASH.EXE utility.
4. Follow the instructions presented on the screen, and the upload will take place automatically.

   After the successful upload process, the unit automatically re-starts, running the new version of firmware.

   Note: During this process, the non-volatile RAM that stores the configuration of the switch is erased.
5. Re-enter the desired configuration parameters.

3.5.3 FLASH UPGRADE HELP

Full on-line help is provided with CCCFLASH.EXE. Please contact Comtech EF Data Customer Support if you have questions, or for additional assistance.

Appendix A. FRONT PANEL OPERATION DETAILS

A.1 OPENING SCREEN

This screen is displayed whenever power is first applied to the unit:

```
COMTECH CRS-400 SWITCH
 SN 123456789 VER 1.01
```

Press any key to go to the top level selection screen:

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

A.2 SELECT

The following choices are presented:

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

A.3 CONFIG

```
CONFIG: MANUAL AUTO[OFF]
ACTIVE  REMCONT  OPTIONS
```

The sub-branches available are:

MANUAL	- allows manual control of the bridge/backup of each active mod/demod.
ACTIVE	- allows selection of the active mods/demods, or modems.
AUTO[ON]	- allows auto mode to be turned on or off (off = manual mode). The currently selected state is always shown on this menu
REMOTE	- defines the remote control settings.
OPTIONS	- sets several operating parameters of the switch that pertain to enabling or disabling the availability of traffic mods/demods, the reporting of faults and time delays for responding to faults.

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, and configuration parameters may only be changed via remote control.

A.3.1 (CONFIG) MANUAL

```
MANUAL SELECT:
BRIDGE:02    BACKUP:02
```

Use the LEFT/RIGHT keys to select whether to bridge or backup, then use the UP/DOWN keys to scroll through the mod/demod numbers until the desired number is displayed. Press ENTER.

Manual Mode: Both these selections are available when the switch is in Manual mode (Auto is OFF). Numbers for active traffic units are displayed during scrolling, inactive units are skipped.

Auto Mode: In Auto mode, the switch controls the backup function, based on its fault relay activity. Therefore, the BACKUP selection is unavailable. This screen is not available if the switch is currently in Auto Mode **AND** is backing up a traffic mod/demod.

While the redundant is backing up a traffic unit, and the user, in Manual mode, commands the redundant to change from backup to bridging, an option is shown for using the configuration of the redundant unit to program the offline traffic unit, if desired.

A.3.2 (CONFIG) AUTO[OFF OR ON]

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

Use this option to turn Auto mode OFF or ON. When Auto Mode is OFF, the switch is said to be in Manual mode, and the following conditions apply:

- The switch does not respond automatically to any mod/demod faults. It simply performs whatever manual setting was selected on the previous menu.
- The STORED EVENT indicator blinks to alert the user that automatic switching will not occur.
- If Dependent, the mods/demods are activated as a pair.
- If Independent, the mods and demods are each activated separately, as required.

A.3.3 (CONFIG) ACTIVE

```
ACTIVE MODEMS: (ENTER)
 1 2 3 - 5 6 - 8
```

A TMI must be present in order for a mod/demod to be activated. A "-" (hyphen) indicates an inactive unit. Move the cursor left/right to the desired unit and press the UP key. The unit number will show in that position. Press ENTER. Similarly, press DOWN to deactivate a unit.

A.3.4 (CONFIG) REMOTE CONTROL

```
SELECT REMOTE CONTROL:
LOC/REM   SETTINGS   (ENT)
```

Select LOC/REM or SETTINGS using the LEFT/RIGHT arrow keys, then press ENTER.

A.3.4.1 (CONFIG, REM CONTROL) LOC/REM

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

If LOCAL is selected, remote control is disabled, but remote monitoring is still possible, so the remote control settings are displayed.

If REMOTE is selected, then remote control is enabled, and the remote control settings are available.

A.3.4.2 (CONFIG, REM CONTROL) SETTINGS

```
REMOTE CONTROL: FORMAT
BAUD  TYPE  ADDRESS  (ENT)
```

Because remote monitoring is available at all times, the remote control settings may be set without the need to be in REMOTE mode.

Select FORMAT, BAUD, TYPE, or ADDRESS using the LEFT/RIGHT arrow keys, then press ENTER.

A.3.4.2.1 (CONFIG, REM, SETTINGS) FORMAT

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

Select the data format for the remote control using the RIGHT/LEFT arrow keys, and press ENTER. Possible format choices are listed below:

8-N-1	=	8 data bits	No parity	1 stop bit
7-E-2	=	7 data bits	Even parity	2 stop bits
7-O-2	=	7 data bits	Odd parity	2 stop bits

A.3.4.2.2 (CONFIG, REM, SETTINGS) BAUD

```
EDIT SWITCH BAUDRATE:
19200 BAUD (PRESS ENTER)
```

Edit the baud rate of the remote control bus connected locally to the M&C computer. Change the value using the UP/DOWN arrow keys, and press ENTER.

Possible Baud Values:

300	1200	2400	4800	9600	19200

A.3.4.2.3 (CONFIG, REM, SETTINGS) TYPE

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

Select RS232, RS485 (2-wire), or RS485 (4-wire). Use the LEFT/RIGHT arrow keys to select an interface type, then press ENTER.

Note: RS-485 2-wire is available, but not preferred.

In RS232 mode the bus address is fixed at 0, and the following screen is displayed:

A.3.4.2.3.1 (CONFIG, REM, SETTINGS, TYPE) RS232

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

However, if either RS485 mode is selected, you may edit the bus address:

A.3.4.2.3.2 (CONFIG, REM, SETTINGS, TYPE) RS485

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

To edit the RS485 bus address of this unit:

1. Change the value of the address using the UP/DOWN arrow keys.
2. Press ENTER.

The only permitted addresses are:

1000	2000	3000	4000	5000	6000	7000	8000	9000

A.3.5 (CONFIG) OPTIONS

```
OPTIONS: MASKS  MODE[IND]
HOLDOFFS    RESTORE-TIME
```

Use OPTIONS to select mode and masks, affecting how the switch will react to various faults.

A.3.5.1 (CONFIG, OPTS) MASKS

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

The switch logs and reacts to its own faults and mod/demod faults. Use this sub-menu to mask any of these fault types, and to enable or disable an audible indicator (buzzer).

A.3.5.1.1 (CONFIG, OPTS, MASKS) MODEM ALARMS

```
MODEM ALARM MASK: NONE
MOD   DMD   BOTH     (ENTER)
```

Use this option to mask traffic faults for MOD (Tx), DMD (Rx), or BOTH, so that the switch will not react to them. Select one of the four options: NONE, MOD, DMD, or BOTH.

Masking faults will prevent the switch from performing Auto mode functions when these mod/demod faults are sensed, and it keeps the faults from being logged by the switch. Unmasked mod/demod faults are logged in the switch events log for activated units.

A.3.5.1.2 (CONFIG, OPTS, MASKS) SWITCH ALARMS

```
SWITCH ALARM MASK: NONE
← PSU-A  PSU-B →    (ENTER)
```

To have the switch ignore an out-of-range voltage output condition for one of the power supplies, use this option. Only one of the units can be masked at a time.

Normally, this mask is useful for operating with only one power supply, or if a supply must be removed for service or replacement.

A.3.5.1.3 (CONFIG, OPTS, MASKS) AUDIO

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

This options controls which, if any, alarm types should cause an audible alarm (buzzer) to sound when the switch detects the alarm condition. This option can be set for unmasked, or switch and/or mod/demod alarms.

The buzzer is located behind the front panel. In addition, a relay closure to ground activates on pin 20 of the System Alarms connector, so that other indicators can be attached to the audible alarm.

A.3.5.2 (CONFIG, OPTS) SWITCH MODE

```
SELECT SWITCH MODE:
DEPENDENT   INDEPENDENT
```

With the DEPENDENT mode setting, the switch will back up a faulted modulator or demodulator with *both* the redundant modulator *and* demodulator.

With the INDEPENDENT mode setting enabled, the switch will back up a faulted modulator only with the redundant modulator, or backup a faulted demodulator only with the redundant demodulator.

A.3.5.3 (CONFIG, OPTS) HOLDOFFS

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

Use HOLDOFFS to set the holdoffs, or delay times, between the switch's modem alarm detection and its reactions to the alarm. Both holdoffs can be set from 2 to 99 seconds.

Note: Holdoffs are only applicable when the switch is in Auto mode.

Backup Holdoff When an active mod/demod exhibits an unmasked fault, the switch bridges it with the redundant unit and checks that the latter is not also faulted. If no fault is detected in the redundant unit, the Backup Holdoff determines how long the switch will wait before performing the actual backup, or switchover of traffic, to the redundant mod/demod.

Restore Holdoff The switch continues to back up a faulted traffic mod/demod even after the fault clears, unless another active mod/demod becomes faulted. In this case, the Restore Holdoff is the length of time that the originally faulted mod/demod must stay unfaulted before the switch will automatically put it back online so that the redundant mod/demod is available to bridge the newly faulted mod/demod.

A.3.5.4 (CONFIG, OPTS) RESTORE-TIME

```
RESTORE TIME:  [OFF]
 OFF/ON  SET-TIME (ENT)
```

```
RESTORE TIME:  [24hr clk]
 02:10  (PRESS ENTER)
```

Note: The RESTORE feature is only active in Auto mode.

If the switch is set for Auto mode and a sustained fault occurs, it will switch to back-up and stay there until any further fault occurs, or the user intervenes (taking the switches to Manual and then selecting to switch from backing up to bridging a unit).

Enabling the RESTORE TIME setting allows the switch to automatically restore operation from backup to the main traffic unit at a selected time, *if all the faults are cleared*.

Select OFF to disable or ON to enable the RESTORE TIME feature and press ENTER. If RESTORE TIME is ON, set the time (using the 24-hour clock) when the automatic restoral should occur, and press ENTER.

Note: Set the RESTORE TIME for a time when traffic is low; for example, 2:00 a.m.

If enabled, and in Auto mode, at the RESTORE TIME, the offline traffic unit is configured to match the configuration of the redundant unit. This is done in case the unit has come back from repair. It has been activated, but the user may not know the correct configuration. It is then checked to see that there are no faults. If there are no faults, the unit is brought online, freeing up the redundant unit.

A.4 INFO (INFORMATION)

```
INFO: SWITCH-ID  SETUP
IF-SWITCH  REMCONT  MASK
```

Select an INFO parameter to view, using the LEFT/RIGHT keys, then press ENTER.

INFO screens display information on the current configuration of the switch without risking inadvertent changes.

A.4.1 (INFO) SWITCH-ID

```
SWITCH ID:
THIS IS A TEST MESSAGE
```

This displays the user-defined Switch ID string, which is entered via the UTILITY, SWITCH-ID screen. To return to the previous menu, press ENTER or CLEAR.

A.4.2 (INFO) SETUP

```
 MOD:123---78  DE:12-------8
  AUTO:OFF  BH:05  RH:20  IND
```

The information on this screen reflects some of the settings configured in the CONFIG, OPTIONS menu. Active traffic mods/demods are listed on the top line, while Auto mode, times for Backup Holdoff and Restore Holdoff, and Independent or Dependent mode are listed on the bottom line.

A.4.3 (INFO) IF-SWITCH

```
     IF-SWITCH IS ABSENT
```

Or

```
    IF-SWITCH IS PRESENT
```

This screen shows whether an IF Transponder Switch is connected to the CRS-400 1:8 Redundancy Switch. When an IF switch is present, the CRS-400 does not exert transmit IF control for an offline mod, the IF switch manages that. There are two models of IF switch: CRS-280 (70/140) and CRS-282 (L-band).

A.4.4 (INFO) REMCONT (REMOTE CONTROL INFO)

```
REM CNTL: REMOTE  RS485-4W
ADDRESS: 5000 19200 8N1
```

This screen shows whether the unit is in LOCAL or REMOTE mode, and gives details of the interface type selected, the switch address, the baud rate and character format. Press ENTER or CLEAR to return to the previous menu.

A.4.5 (INFO) MASKS (ALARM MASK INFO)

```
ALARMS MASKED:
MOD  DMD  ← PSU-A  PSU-B →
```

This screen shows which alarms 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 masked at the same time, but are shown together here to indicate their relative positions.

A.5 MONITOR

```
MONITOR: STATUS SW-ALARM
STORED-EVENTS COMM-STATE
```

Select a parameter to monitor using the LEFT/RIGHT arrow keys, then press ENTER.

A.5.1 (MONITOR) STATUS

```
RM BRIDGING  MOD:1  BH:05s
RD BRIDGING  DMD:4  BH:05s
```

This screen shows the current status of the switch.

When the redundant mod/demod is not backing up any of the traffic mods/demods, the display shows which TM is currently being bridged by the RM. If Auto mode is on, it will also show the backup holdoff time should the bridged TM fail. If Auto mode is off, Backup Holdoff (BH) displays “OFF”.

When the switch has taken the bridged TM offline and replaced it with the RM (whether manually or automatically), the screen changes as shown below:

```
RM BACKG UP  MOD:1  RH:05s
RD BACKG UP  DMD:4  RH:05s
```

Note that the Restore Holdoff (RH) times are shown.

A.5.2 (MONITOR) SWITCH ALARMS

```
SWITCH ALARM:  MOD I/O
               PROBLEM
```

or

```
SWITCH ALARM:  DEMOD I/O
               PROBLEM
```

(or power supply fault)

To decode an I/O fault, go to MONITOR: COMM-STATE.

A.5.3 (MONITOR) STORED EVENTS

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

Select VIEW or CLEAR ALL, using the LEFT/RIGHT arrow keys, then press ENTER. CLEAR ALL does not prompt for confirmation–the command acts immediately.

A.5.3.1 (MONITOR, STORED-EVENTS) VIEW

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

Use the UP/DOWN arrow keys to scroll backwards or forwards through the entries in the event log. To return to the previous menu, press ENTER or CLEAR.

The event log can store up to 98 events. When a fault condition occurs, it is time-stamped and put into the log. Next to the FT (for fault) indicator is either the TM number, RM (redundant mod/demod fault) or SW (switch fault). Similarly, when the fault condition clears, this is also recorded, as shown below:

```
LOG23: 26/01/00 10:37:35
OK-06 DMD ALARM (UP/DN)
```

To clear the Event Log, select CLEAR-ALL. The previous menu returns.

However, if there are faults present on the unit at this time, they will be re-time-stamped, and new log entries will be generated.

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

A.5.4 (MONITOR) COMM-STATE (COMMUNICATIONS)

```
COMMS OK:  MOD:1234-!--R
           DMD:--345678R
```

This screen indicates which mods/demods have good EIA-485 I/O communications with the switch.

An exclamation mark (!), if present, indicates the position of an I/O communications problem. This is a position that has been activated, but a unit is not responding:

- Check the bus address and communications settings
- Check that the bus cable is properly attached.

A.6 STORE/LD (STORE OR LOAD CONFIGURATION)

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

Select STORE or LOAD using the LEFT/RIGHT arrow keys, then press ENTER.

The switch can store up to 10 different switch configurations in non-volatile memory. These are configurations for the switch itself, not the modems attached to it. Switch configurations contain the information for active units, bridge/backup units, backup holdoff, restore holdoff, etc. For more information, see the Switch Global Configuration remote command in Section B.6, Remote Control Commands.

A.6.1 (STORE/LD) STORE

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

Select the location to store the current configuration to, using the UP/DOWN arrow keys, then press ENTER.

Available Locations:

1	2	3	4	5	6	7	8	9	10

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

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

To return to the previous menu, press ENTER or CLEAR.

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 LEFT/RIGHT arrow keys, then press ENTER. Selecting YES will overwrite the existing configuration at the selected location.

A.6.2 (STORE/LD) LOAD

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

Select the location to load a configuration from, using the UP/DOWN arrow keys, then press ENTER.

Available Locations:

1	2	3	4	5	6	7	8	9	10

If the selected location contains valid data, the following screen will be displayed:

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

To return to the previous menu, press ENTER or CLEAR.

If, however, the selected location does not contain valid data, the following screen will be displayed:

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

To return to the previous menu, press ENTER or CLEAR.

A.7 UTIL (UTILITY)

```
UTILITY: CLOCK  SWITCH-ID
DISPLAY  POLLING  (ENTER)
```

Select a parameter using the LEFT/RIGHT arrow keys, then press ENTER.

Use this sub-menu to select from a number of different utility functions, which are described in the following paragraphs.

A.7.1 (UTILITY) CLOCK (SET REAL-TIME CLOCK)

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

To edit the time and date settings of the real-time clock:

1. Select the digit to be edited using the LEFT/RIGHT arrow keys.
2. Change the value of the digit using the UP/DOWN arrow keys.
3. Press ENTER.

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

A.7.2 (UTILITY) SWITCH-ID

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

To edit the Switch ID string:

1. Use the Left/Right arrow to select a character position on the bottom line.
2. Use the Up/Down arrows to edit the selected character.
3. Once the string edits are finished, press ENTER.

Note: Only the bottom line is available (24 characters).

Available Characters:

(	)	*	+	-	,	.	/	space				
0	1	2	3	4	5	6	7	8	9			
A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A.7.3 (UTILITY) DISPLAY (DISPLAY BRIGHTNESS)

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

To edit the display brightness, use the UP/DOWN arrow keys. Press ENTER when the brightness is suitable.

A.7.4 (UTILITY) POLLING

```
POLLING:  SUSPEND  RESUME
 WILL RESUME IN 91 SEC
```

The switch is continually polling units via the EIA-485 bus. To temporarily suspend polling (example: for viewing a redundant unit configuration via the front panel), use the RIGHT/LEFT arrow keys to select SUSPEND, and press ENTER. The second line of the display shows the number of seconds remaining (counting down from 99) before polling will automatically resume.

To resume polling immediately, use the RIGHT/LEFT arrow keys to select RESUME, and press ENTER.

Appendix B. REMOTE CONTROL

B.1 INTRODUCTION

This section describes the protocol and message command set for remote monitor and control of the CRS-400 Redundancy Switch.

The electrical interface is either an EIA-485 multi-drop bus (for the control of many devices) or an EIA-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.

B.2 EIA-485

For applications where multiple devices are to be monitored and controlled, a full-duplex (or 4-wire plus ground) EIA-485 is required. Half-duplex (2-wire plus ground) EIA-485 is possible, but is not preferred.

In full-duplex EIA-485 communication there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions. It is assumed that there is a ‘controller’ device (a PC or dumb terminal), that transmits data, in a broadcast mode, via one of the pairs. Many ‘target’ devices are connected to this pair, that all simultaneously receive data from the controller. The controller is the only device with a line-driver connected to this pair - the target devices only have line-receivers connected.

In the other direction, on the other pair, each target has a tri-stateable line driver connected, and 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, and each time the controller transmits, in a framed 'packet' of data, the address of the intended recipient target is included. 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.

EIA- 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.

B.3 EIA-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 EIA-232 electrical levels, on one conductor, and target-to-controller data is carried in the other direction on the other conductor.

B.4 BASIC PROTOCOL

Whether in EIA-232 or EIA-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. The asynchronous character format may be:

8-N-1 8 data bits, no parity, 1 stop bit

7-E-2 7 data bits, even parity, 2 stop bits

7-O-2 8 data bits, odd parity, 2 stop bits.

The selectable baud rates are 300, 1200, 2400, 4800, 9600 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 uses Address 0 (universal address) in EIA-485 mode. In this case, the target does not respond.

B.5 PACKET STRUCTURE

Controller-to-target:

	Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
Character	<		/		= or ?		Carriage Return
ASCII Code	60		47		61 or 63		13
Number of Characters	1	4	1	3	1	n	1

Example: <0000/RSH=30{CR}

Target-to-controller:

	Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
Character	<		/		=, ?, ! or *		Carriage Return Line Feed
ASCII Code	60		47		61, 63, 33 or 42		3, 10
Number of Characters	1	4	1	3	1	From 0 to n	2

Example: >0000/OPM=1{CR}{LF}

B.5.1 START OF PACKET

Controller to Target: This is the character '<' (ASCII code 61)

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.

B.5.2 ADDRESS

While up to 9,999 devices can be uniquely addressed via an EIA-485 bus, the 1:N Redundancy Switch imposes some addressing specifications. The Switch address is x000:

In EIA-232 applications the switch address is fixed at 0000.

In EIA-485 applications, the switch address may be set to 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, or 9000. Up to nine switches may be connected on the same bus.

The addresses of the modulators and/or demodulators that may be attached to the Switch must each have its addresses set correctly, according to the Switch address and the unit's position in the Switch set-up:

x001 for Traffic Mod #1	x011 for Traffic Demod #1
x002 for TM #2 and on up to	x012 for TD #2 and on up to
x008 for TM #8 and	x018 for TD#8 and
x009 for the Redundant Mod	x019 for the Redundant Demod

Remote monitor and control of units attached to the Switch is available, transparently via the Switch, to any devices with addresses x001 through x099, attached to the auxiliary EIA-485 link. The command protocol of the messages is dictated by the device being addressed.

Note that in either EIA-232 or EIA-485 mode, the **auxiliary** link from the switch to all the modems is **fixed** at EIA-485, 8-N-1, 19200 baud (multidrop).

The modem addresses (001-019) must be set on each mod/demod, via the front panel.

Example: To send a message to TM# 1 (front panel address set to 001) attached to the multidrop cable of switch (address 5000), the controller sends a message using address, 5001, and the responses from the modulator (via the switch) will indicate address 5001.

B.5.3 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, OPM is for OPerating Mode, BKH is for BacKup Holdoff, 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).

B.5.4 INSTRUCTION CODE QUALIFIER

This is a single character that 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)

? (ASCII code 63)

They have these meanings:

The ‘=’ code (controller to target) 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, in a message from controller to target, OPM=1 would mean ‘set the OPerating Mode to Auto’

The ‘?’ code (controller to target) 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, in a message from controller to target, OPM? would mean ‘what is the current Operating Mode?’

2) From Target to Controller, the only permitted values are:

= (ASCII code 61)

? (ASCII code 63)

! (ASCII code 33)

* (ASCII code 42)

(ASCII code 35)

They have these meanings:

The **=** code (target to controller) is used in two ways:

First, if the controller has sent a **query** code to a target (for example OPM?, meaning 'what is the Operating Mode?'), the target would respond with OPM=x, where x is 0 representing Manual mode or 1 representing Auto mode.

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 OPM= (with no message arguments).

The **?** code (target to controller) is only used as follows:

If the controller sends a correctly formatted instruction to set a parameter, but using an **invalid** argument, then the target will acknowledge the message by replying (for example) with OPM? (with no message arguments).

The ***** code (target to controller) is only used as follows:

If the controller sends a correctly formatted instruction, but the unit **cannot implement at this time**, the target will acknowledge the message by replying (for example) with OPM* (with no message arguments).

The **#** code (target to controller) is only used as follows:

If the controller sends a correctly formatted instruction, but the unit is **not in Remote** Mode, the target will acknowledge the message by replying (for example) with OPM# (with no message arguments).

The **!** code (target to controller) 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!

B.5.5 MESSAGE ARGUMENTS

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

B.5.6 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 codes 13 and 10).

Both indicate the valid termination of a packet.

B.6 REMOTE CONTROL COMMANDS

Parameter Type	Command (controller to target)	Argument count	Description of arguments Note: All arguments are ASCII numeric codes between 48 and 57.	Responses to Command (target to controller)	Query (controller to target)	Response to Query (target to controller)
Local/ Remote Status	LRS=	1 byte, numerical, 0 or 1	Command or Query Sets or queries the local/remote status of the Switch: 0 = Local 1 = Remote	LRS= LRS? LRS#	LRS?	LRS=x (see description of arguments)
Equipment ID	n.a.	4 bytes, ASCII	Query only. Switch returns information concerning the equipment identification, with only a base switch “S400” currently in use.	n.a.	EID?	EID=xxxx (see description of arguments)
Switch ID string	SID=	24 bytes, ASCII	Command or Query. Sets or queries the user-defined Switch ID string, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + - , . / 0-9 and A-Z.	SID= SID? SID#	SID?	SID=xxxxxxxxxxxxxxxxxxxxxxxx (see description of arguments)
Operating Mode	OPM=	1 byte, numerical, 0 or 1	Command or Query. Sets the operating mode: 0 = manual mode 1 = auto mode	OPM= OPM? OPM* OPM#	OPM?	OPM=x (see description of arguments)
Switching Mode	SWM=	1 byte, numerical, 0 or 1	Command or Query. Sets the Switching mode: 0 = Dependent switching – Mods & Demods switched together 1 = Independent switching – Mods & Demods switched separately **Note**: can only be changed if the OPM is manual AND there are no units in back-up. ACM settings may be affected.	SWM SWM? SWM* SWM#	SWM?	SWM=x (see description of arguments)
Active Mods	ACM=	8 bytes, numerical	Command or Query. Sets or queries the active state of all 8 Traffic Mods (or Mod & Demods, if Dependent): 0 = de-activate Traffic Mod 1 = activate Traffic Mod **Note**: only active units will be monitored by the switch.	ACM= ACM? ACM* ACM#	ACM?	ACM=xxxxxxxx (see description of arguments)

Parameter Type	Command (controller to target)	Argument count	Description of arguments Note: All arguments are ASCII numeric codes between 48 and 57.	Responses to Command (target to controller)	Query (controller to target)	Response to Query (target to controller)
Active Demods	ACD=	8 bytes, numerical	Command or Query. Sets or queries the active state of all 8 Traffic Demods: 0 = de-activate Traffic Demod 1 = activate Traffic Demod **Note**: only active units will be monitored by the switch. Use ACM if in Dependent mode.	ACD= ACD? ACD* ACD#	ACD?	ACD=xxxxxxxx (see description of arguments)
Bridge/Backup Modulator	BBM=	2 bytes, numerical	Command or Query. Sets or queries the bridged/backup state for Mods: x = 0/1 indicating bridged/backup of Modulator y = 1-8, the number of Mod that the Redundant Mod is tracking. **Note**: requires TMIs to be present, & mods to be active (see ACM).	BBM= BBM? BBM* BBM#	BBM?	BBM=xy (see description of arguments)
Bridge/Backup Demodulator	BBD=	2 bytes, numerical	Command or Query. Sets or queries the bridged/backup state for Demods: x = 0/1 indicating bridged/backup of Demodulator y = 1-8, the number of Demod that the Redundant Demod is tracking. **Note**: requires TMIs to be present, & demods to be active (see ACD). Use BBM if in Dependent mode.	BBD= BBD? BBD* BBD#	BBD?	BBD=xy (see description of arguments)
Active Mod Query	n.a.	8 bytes, numerical	Query only. Returns the state of all 8 Traffic Mods, which is usually as set by ACM, but possibly overruled by Switch conditions, where x is: 0 = TMI not present (cannot be activated) 1 = TMI present but Mod/Modem not activated 2 = TMI present, Mod activated and responding 3 = TMI present, Mod activated but NOT responding	n.a.	AMQ?	AMQ=xxxxxxxxy (see description of arguments) y indicates the Redundant unit/RMI state, similarly, but activation is assumed.
Active Demod Query	n.a.	8 bytes, numerical	Query only. Returns the state of all 8 Traffic Demods, which is usually as set by ACD, but possibly overruled by Switch conditions, where x is: 0 = TMI not present (cannot be activated) 1 = TMI present but Demod not activated 2 = TMI present, Demod activated and responding 3 = TMI present, Demod activated but NOT responding Use AMQ if in Dependent mode.	n.a..	ADQ?	ADQ=xxxxxxxxy (see description of arguments) y indicates the Redundant unit/RMI state, similarly, but activation is assumed.

Parameter Type	Command (controller to target)	Argument count	Description of arguments Note: All arguments are ASCII numeric codes between 48 and 57.	Responses to Command (target to controller)	Query (controller to target)	Response to Query (target to controller)
Backup Holdoff Time	BKH=	2 bytes numerical,	Command or Query. Sets or queries the backup holdoff delay time, used when Auto Mode prepares to backup a faulted Mod/Demod: xx = 02-99, seconds of delay before online swap begins.	BKH= BKH? BKH* BKH#	BKH?	BKH=xx (see description of arguments)
Restore Holdoff Time	RSH=	2 bytes, numerical	Command or Query. Sets or queries the restore holdoff delay time. Used in Auto Mode. xx = 02-99 seconds. This is the time for which an offline Traffic Unit must be fault-free before it may be put back online if the Redundant Unit needs to bridge a different newly-faulted Unit.	RSH= RSH? RSH* RSH#	RSH?	RSH=xx (see description of arguments)
Switch Global Configuration	SGC=	42 bytes, numerical	Command or Query. Global configuration of switch, in the form: OmmmmmmmmIMMDDbbrrMSAEttttsssssssssddddddddd where: O = Operating Mode – same as OPM= (1 bytes) m = Active Mod/ems – same as ACM= (8 bytes) I = in/dependent Switching Mode – same as SWM (1 byte) MM= Bridge/Backup State – same as BBM (2 bytes) DD= Bridge/Backup State – same as BBD (2 bytes) bb = Backup Holdoff Time – same as BKH (2 bytes) rr = Restore Holdoff Time – same as RSH (2 bytes) 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) E = Restore Time Enable – same as RTE (1 byte) tttt – Restore Time - same as RTT (4 bytes) s = spare byte (8 bytes) d = Active Demods – same as ACD= (8 bytes)	SGC= SGC? SGC* SGC#	SGC?	SGC=OmmmmmmmmIMMDDbbrrMSAEttttsssssssssddddddddd (see description of arguments)
Modem Alarm Mask	MAM=	1 byte, numerical	Command or Query. Sets or queries the mod/demod alarm mask: 0 = No faults masked 1 = Mod faults masked 2 = Demod faults masked 3 = Both Mod & Demod faults masked	MAM= MAM? MAM* MAM#	MAM?	MAM=x (see description of arguments)
Switch Alarm Mask	SAM=	1 byte, numerical	Command or Query. Sets or queries the modem alarm mask: 0 = No faults masked 1 = PSU A faults masked 2 = PSU B faults masked	SAM= SAM? SAM* SAM#	SAM?	SAM=x (see description of arguments)

Parameter Type	Command (controller to target)	Argument count	Description of arguments Note: All arguments are ASCII numeric codes between 48 and 57.	Responses to Command (target to controller)	Query (controller to target)	Response to Query (target to controller)
Audio Alarm Mask	AAM=	1 byte, numerical	Command or Query. Sets or queries 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= AAM? AAM* AAM#	AAM?	AAM=x (see description of arguments)
Retrieve next 5 unread Stored Events	n.a.	79 bytes	Query only. 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 = ABCddmmyyhhmmss A is the fault indicator: F = Fault, C = Clear, I = Info B is the faulting/clearing Unit: 1-8 = Mod (1-8) 9 = Redundant Mod A-H = Demod (1-8) I = Redundant Demod J = Switch K = Power on/off, or log cleared (Info events) C is the fault code number , as defined: Switch: 1 through D, the same as FLT? string. Modem: 0 Info: 0= Power off, 1= Power on, 2= Log cleared. ddmmyy hhmmss indicates the date & 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 padded with zeros.	n.a.	RNE?	RNE=[cr] ABCddmmyyhhmmss[cr] ABCddmmyyhhmmss[cr] ABCddmmyyhhmmss[cr]ABCddmmyyhhmmss[cr]ABCddmmyyhhmmss (see description of arguments)

Parameter Type	Command (controller to target)	Argument count	Description of arguments Note: All arguments are ASCII numeric codes between 48 and 57.	Responses to Command (target to controller)	Query (controller to target)	Response to Query (target to controller)
Retrieve Number of unread Stored Events	n.a.	2 bytes, numerical	Query only. Switch returns the number of Stored Events which remain unread, in the form xx. **Note**: This means 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)
Clear All Stored Events	CAE=	None	Command only (takes no arguments). Instructs the unit to clear the Stored Events Log.	CAE= CAE? CAE#	n.a	n.a.
Serial Number	SNO=	9 bytes numerical	Query only. (FACTORY USE command) Unit returns its 9 digit serial number. Example: SNO=000001765	SNO= SNO? SNO* SNO#	SNO?	SNO=xxxxxxxxx (see description of arguments)
Software Revision	n.a.	4 bytes, numerical	Query only. Unit returns the value of internal software revision installed in the unit, in the form x.xx Example: SWR=1.03 (Ver 1.03)	n.a.	SWR?	SWR=x.xx (see description of arguments)
Restore Time Enable	RTE=	1 byte, numerical, 0 or 1	Command or Query. Effective only in Auto Mode (see OPM) If there is a unit is back-up mode and Auto-Restore is enabled: at the Restore Time, the offline unit will be correctly configured (if necessary) and if it stays unfaulted, it will be switched on-line.	RTE= RTE? RTE* RTE#	RTE?	RTE=x (see description of arguments)
Restore Time	RTT=	4 bytes, numerical	Command or Query. Format is hhmm, using a 24 hour clock. hh = hours, between 00 and 23, and mm = minutes, between 00 and 59. See RTE above for details.	RTT= RTT? RTT* RTT#	RTT?	RTT=hhmm (see description of arguments)
Date	DAY=	6 bytes, numerical	Command or Query. Format is ddmmyy, 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 represents April 24, 2057	DAY= DAY? DAY* DAY#	DAY?	DAY=ddmmyy (see description of arguments)

Parameter Type	Command (controller to target)	Argument count	Description of arguments Note: All arguments are ASCII numeric codes between 48 and 57.	Responses to Command (target to controller)	Query (controller to target)	Response to Query (target to controller)
Time	TIM=	6 bytes, numerical	Command or Query. Format is hhmmss, using a 24 hour clock, where hh = hours, between 00 and 23, mm = minutes, between 00 and 59, and ss = seconds, between 00 and 59 Example: TIM=231259 represents the time 23:12:59.	TIM= TIM? TIM* TIM#	TIM?	TIM=hhmmss (see description of arguments)
Config Store	CST=	1 byte, numerical, 0-9	Command or Query. Forces the unit to store the current modem configuration in Configuration Memory location defined by the one byte argument (0 - 9). Example CST=4 (Store current config into location 4) **WARNING: Use with care! If the location already contains data, it will be automatically overwritten. If in doubt, query the location using CST?x.**	CST= CST? CST#	CST?x where x is 0-9	CST=xxxxx… where xxxx… is the same format as SGC, or CST* if no config is stored
Config Load	CLD=	1 byte, numerical, 0-9	Command only. Forces the switch to retrieve the Configuration Memory location defined by the one byte argument (0 to 9). and to re-program the switch with that stored configuration. **WARNING: Use with care! Current configuration settings will be overwritten. If in doubt, query the contents of the location using CST?x.**	CLD= CLD? CLD* CLD#	n.a.	n.a..
Repeat Last Message	n.a.	n.a.	Query only. Responds with a repeat of the last response message. Note: this is the one instruction where the response code does not match the RLM that was sent.	n.a.	RLM?	See the section corresponding to the response instruction code
Faults and Status	n.a.	14 bytes, numerical	Query only. Unit returns the current fault and status codes for the switch itself, where each location in the string is either 0 for no fault or 1 for faulted, and the positions are: Leftmost 1 = Mod remote comm problem (use AMQ for detail) 2 = Demod remote comm problem (use ADQ for detail) 3/4 = +5V PSU-A under/over 5/6 = +5V PSU-B under/over 7/8 = +12V PSU-A under/over 9/10 = +12V PSU-B under/over 11/12 = -12V PSU-A under/over Rightmost 13/14 = -12V PSU-B under/over	n.a.	FLT?	FLT=xxxxxxxxxxxxxx (see description of arguments

Appendix C. CABLE DRAWINGS

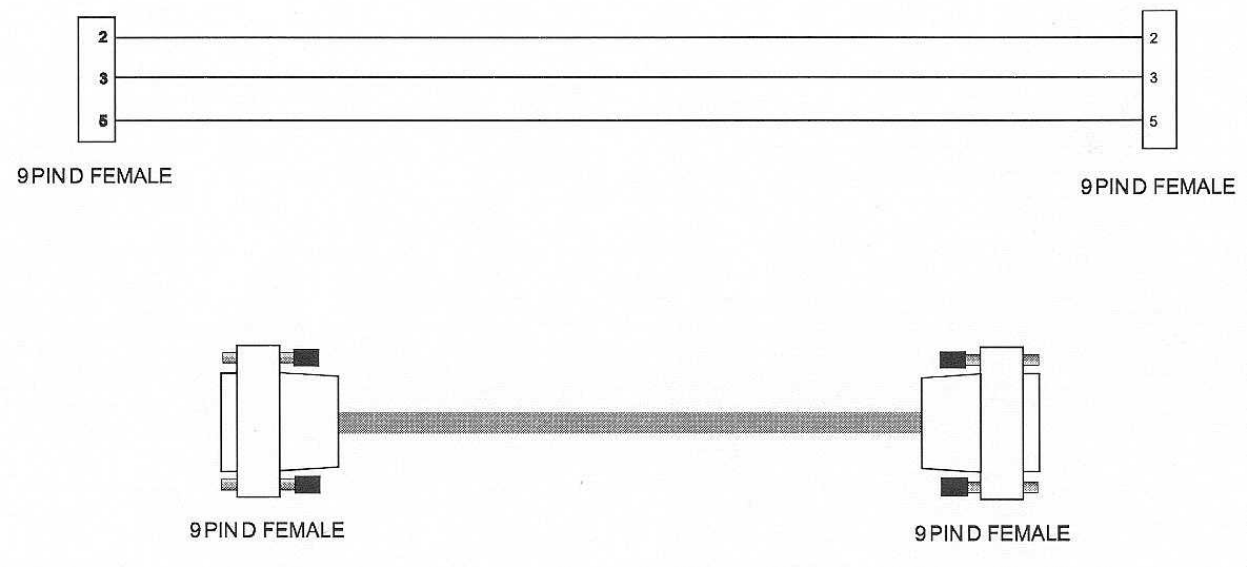


Figure C-1 PC 9-Pin Serial Port to CRS-400 EIA-232 Remote Control Port

Figure C-1 shows the cable required for a simple EIA-232 connection between a PC serial port and the CRS-400 remote control port. This cable is needed for flash upgrading.

Figure C-2 shows the HSSI data cable drawing for connections between the modem and the switch, and between the user data and the switch.

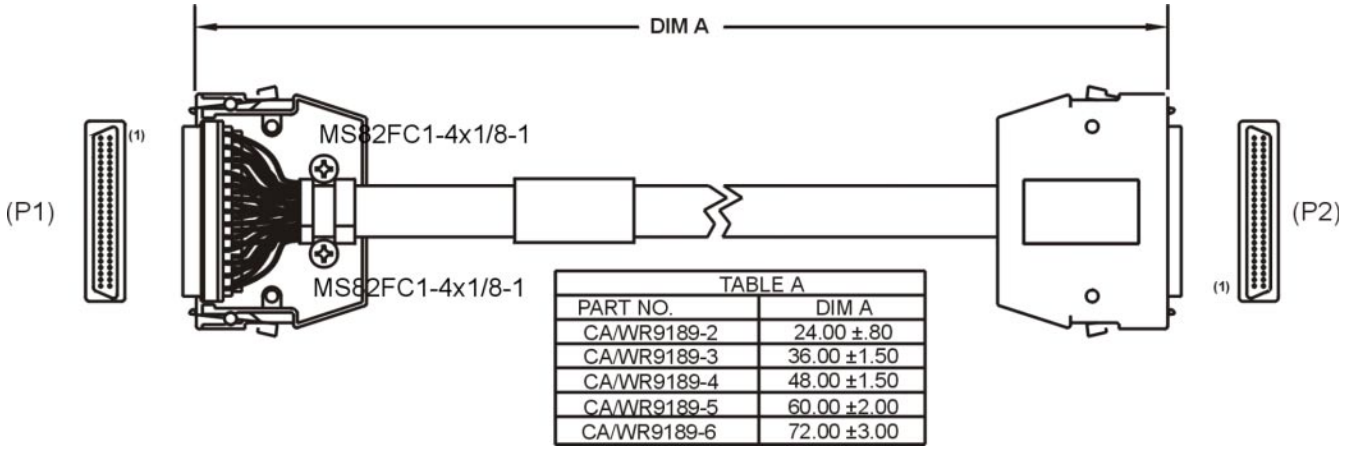


TABLE A

PART NO.	DIM A
CA/WR9189-2	24.00 ±.80
CA/WR9189-3	36.00 ±1.50
CA/WR9189-4	48.00 ±1.50
CA/WR9189-5	60.00 ±2.00
CA/WR9189-6	72.00 ±3.00

Figure C-2 HSSI Data Cable

Table C-1 CA/WR9189 Cable Assembly (Pinout, Male/Male, HSSI, Shielded)

From	To	Signal	Color	Pair
		GND	Drain	
P1-01	P2-01	SIG GND	BLK	X
P1-26	P2-26		RED	
P1-02	P2-02	RT	BLK	X
P1-27	P2-27		WHT	
P1-03	P2-03	CA	BLK	X
P1-28	P2-28		GRN	
P1-04	P2-04	RD	BLK	X
P1-29	P2-29		BLU	
P1-05	P2-05	OPEN	BLK	X
P1-30	P2-30		YEL	
P1-06	P2-06	ST	BLK	X
P1-31	P2-31		BRN	
P1-07	P2-07	SG	BLK	X
P1-32	P2-32		ORG	
P1-08	P2-08	TA	RED	X
P1-33	P2-33		WHT	
P1-09	P2-09	TT	RED	X
P1-34	P2-34		GRN	
P1-10	P2-10	LA	RED	X
P1-35	P2-35		BLU	
P1-11	P2-11	SD	RED	X
P1-36	P2-36		YEL	
P1-12	P2-12	LB	RED	X
P1-37	P2-37		BRN	
P1-13	P2-13	SG	RED	X
P1-38	P2-38		ORG	

From	To	Signal	Color	Pair
		GND	Drain	
P1-14	P2-14	OPEN	GRN	X
P1-39	P2-39		WHT	
P1-15	P2-15	OPEN	GRN	X
P1-40	P2-40		BLU	
P1-16	P2-16	OPEN	GRN	X
P1-41	P2-41		YEL	
P1-17	P2-17	OPEN	GRN	X
P1-42	P2-42		BRN	
P1-18	P2-18	OPEN	GRN	X
P1-43	P2-43		ORG	
P1-19	P2-19	SIG GND	WHT	X
P1-44	P2-44		BLU	
P1-20	P2-20	OPEN	WHT	X
P1-45	P2-45		YEL	
P1-21	P2-21	OPEN	WHT	X
P1-46	P2-46		BRN	
P1-22	P2-22	OPEN	WHT	X
P1-47	P2-47		ORG	
P1-23	P2-23	OPEN	BLU	X
P1-48	P2-48		YEL	
P1-24	P2-24	OPEN	BLU	X
P1-49	P2-49		BRN	
P1-25	P2-25	SIG GND	BLU	X
P1-50	P2-50		ORG	

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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 Avoir.	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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