CRS-150

1:1 Redundancy Switch

Accessory Product for use only with
Comtech EF Data CDM-600 Modems
(Requires Modem Firmware Version 1.1.0 or Higher)

Part Number MN/CRS150.IOM   Revision 0

Errata A

Comtech EFData Documentation Update

Subject: Changes to table of paragraph 2.4 and Figure 1

Date: February 3, 2003
Document: CRS-150 1:1 Redundancy Switch Installation and Operation Manual, Rev. 0, dated April 24, 2002
Part Number: MN/CRS150.EA0
Collating Instructions: Attach this page to page 2-2

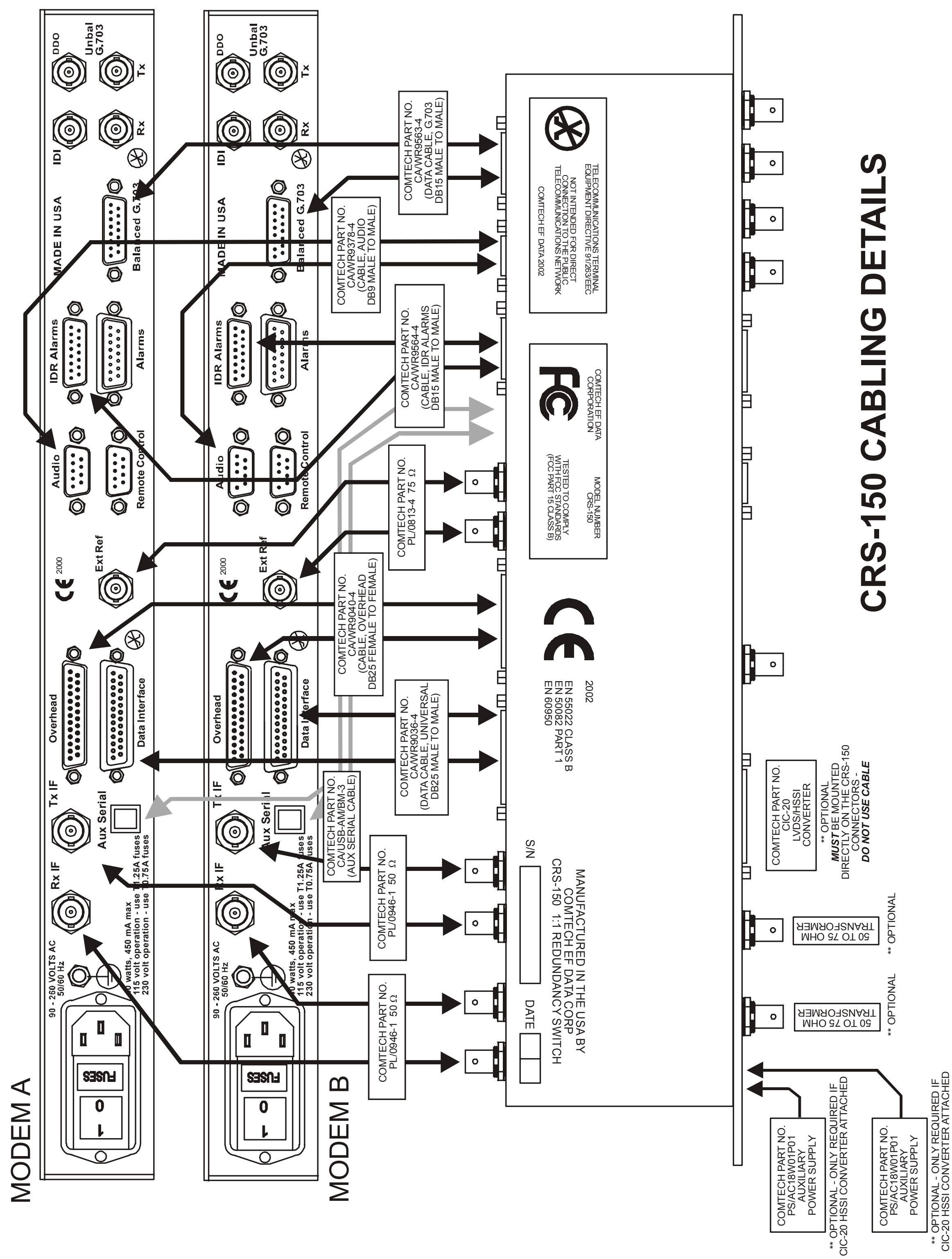
Comments:

The following changes provide updated information for the table of paragraph 2.4 and Figure 1. This information will be incorporated into the next revision.

Change Specifics:

Quantity	Part #	Description
2	CA/WR9036-4	Data Cable, Universal, DB25 Male to Male, length = 4 feet
2	CA/WR9040-4	Cable, Overhead, DB25 Female to Female, length = 4 feet
2	CA/WR9564-4	Cable, IDR Alarms, DB15 Male to Male, length = 4 feet
2	CA/WR9378-4	Cable, Audio, DB9, Male to Male, length = 4 feet
2	**CA/WR9563-4**	**Data Cable, G.703, DB15 Male to Male, length = 4 feet**
2	CA/USB-AM/BM-3	Auxiliary Serial Cable, USB, length = 3 feet
2	PL/0813-4	External Reference, 75 Ω, length = 4 feet
4	PL/0946-1	IF Coax Cable, 50 Ω, length = 4 feet **
** The CRS-150 has been optimized to work with 50 Ω systems, and it is very important that 50 Ω cables are used between the CRS-150 and the traffic modems. For users with a 75 Ω system, 50 to 75 Ω transformers are supplied with the CRS-150 that should be connected to the external IF ports.		

COMTECH EF DATA



Errata B

Comtech EFData Documentation Update

Subject: Changes to table of paragraph 2.4 and Figure 1

Date: December 17, 2003
Document: CRS-150 1:1 Redundancy Switch Installation and Operation Manual, Rev. 0, dated April 24, 2002
Part Number: MN/CRS150.EA0
Collating Instructions: Attach this page to page 2-2

Comments:

The following changes provide updated information for the table of paragraph 2.4 and Figure 1. This information will be incorporated into the next revision.

Errata B supersedes Errata A.

Change Specifics:

Quantity	Part #	Description
2	**PL/6233**	**Data Cable, Universal, DB25 Male to Male, length = 4 feet**
2	CA/WR9040-4	Cable, Overhead, DB25 Female to Female, length = 4 feet
2	CA/WR9564-4	Cable, IDR Alarms, DB15 Male to Male, length = 4 feet
2	CA/WR9378-4	Cable, Audio, DB9, Male to Male, length = 4 feet
2	**CA/WR9563-4**	**Data Cable, G.703, DB15 Male to Male, length = 4 feet**
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CRS-150

1:1 Redundancy Switch
Accessory Product for use only with
Comtech EF Data CDM-600 Modems
(Requires Modem Firmware Version 1.1.0 or Higher)

Comtech EF Data is an ISO 9001
Registered Company.

Part Number MN/CRS150.IOM
Revision 0
April 24, 2002

CUSTOMER SUPPORT

Contact the Comtech EF Data Customer Support Department for:

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

Contact Customer Support using any of the following methods:

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

Email: service@comtechefdata.com

Internet: www.comtechefdata.com

Phone: (480) 333-2200 (Main Comtech EF Data Number)
(480) 333-4357 (Customer Support Desk)
Fax: (480) 333-2161

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

1. Request a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support Department.

2. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.

3. To ensure that the product is not damaged during shipping, pack the product in its original shipping carton/packaging.

4. Ship the product back to Comtech EF Data. (Shipping charges should be prepaid.)

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

Table of Contents

Figures

Tables

ABOUT THIS MANUAL

This manual provides installation and operation information for the Comtech EF Data CRS-150 1:1 Redundancy Switch. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the CRS-150 1:1 Redundancy Switch.

RELATED DOCUMENTS

Comtech EF Data CDM-600 Satellite Modem Installation and Operation Manual

CONVENTIONS AND REFERENCES

CAUTIONS AND WARNINGS

IMPORTANT — Indicates information critical for proper equipment function.

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

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

METRIC CONVERSION

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

In order that the CRS-150 continues to comply with these standards, observe the following instructions:

- Connections to the transmit and receive IF ports (BNC female connectors) should be made using a good quality coaxial cable - for example RG58/U (50 ohm) or RG59/U (75 ohm).
- All 'D' type connectors attached to the unit must have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the back-shell.
- The equipment must be operated with its cover on at all times. If it becomes necessary to remove the cover, the User should ensure that the cover is correctly re-fitted before normal operation commences.

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.

The equipment is rated for operation at +12 volts DC and -12 volts DC. It has a maximum power consumption of 4.5 watts, and draws a maximum of 250 mA at +12 volts DC and 120 mA at -12 volts DC. The power supply current is, in all circumstances, supplied by either a single Comtech CDM-600 Modem, or a pair of these Modems.

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

EQUIPMENT CONNECTION

The CRS-150 is designed for operation ONLY with Comtech CDM-600 Modems. These Modems supply DC operating current (electronically fused and protected) and control signals for the correct functioning of this unit. Connection to other manufacturer’s equipment could result in damage to the unit. It is not compatible with other Comtech EF Data Modems.

ENVIRONMENTAL

The CRS-150 must not be operated in an environment where the unit is exposed to extremes of temperature outside the ambient range 0 to 50^{0}C, precipitation, condensation, or humid atmospheres above 95% RH, altitudes (un-pressurized) greater than 2000 meters, excessive dust or vibration, flammable gases, corrosive or explosive atmospheres.

Operation in vehicles or other transportable installations that are equipped to provide a stable environment is permitted. If such vehicles do not provide a stable environment, safety of the equipment to EN60950 may not be guaranteed

TELECOMMUNICATIONS TERMINAL EQUIPMENT DIRECTIVE

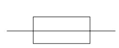
In accordance with the Telecommunications Terminal Equipment Directive 91/263/EEC, this equipment should not be directly connected to the Public Telecommunications Network.

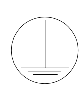
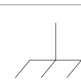
LOW VOLTAGE DIRECTIVE (LVD)

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.

NOTES:

Chapter 1. INTRODUCTION

CRS-150 Redudancy Switch

The CRS-150 1:1 Redundancy Switch is a companion product for use with the Comtech EF Data CDM-600 Satellite Modem. Designed to continuously monitor a pair of modems in a redundant configuration, the CRS-150 will automatically switch data and IF signals from a failed online modem to the standby modem, in the event of an equipment failure or undesired traffic condition. Traffic paths are fully protected, and the system operator can have increased confidence that equipment failures will not adversely affect system availability.

Accordingly, a 1:1 system comprises an online modem, a standby modem, and the CRS-150 Redundancy Switch.

WARNING

The CRS-150 is an accessory product designed specifically for the Comtech EF Data CDM-600 modem, and must *not* be used with any other equipment.

IMPORTANT

For correct operation of the CRS-150, the CDM-600 modems ***must*** have installed:

Firmware Version 1.1.0 (or higher)

If the modems do not meet this requirement, please contact the factory to arrange for a free Flash upgrade to be sent to you.

Figure 1. Rear Panel View

The CRS-150 includes, as standard, a universal data interface, which eliminates the need to exchange interface cards for different applications. Supported interfaces include:

- EIA-422 (EIA530) DCE
- V.35 DCE (at rates up to 10 Mbps)
- Synchronous EIA-232 DCE (at rates up to 300 kbps)
- LVDS (at rates up to 20 Mbps)
- Balanced and unbalanced G.703 at rates up to E2 (8.448 Mbps)

For Drop and Insert applications, the second G.703 port (T1 or E1) found on the rear panel of the CDM-600 is also provided. The operator does not have to configure the interface type - control signals from the modems automatically perform the selection.

Clock and data signals in the transmit direction are buffered and fed to both modems in the pair simultaneously. The Receive IF signal is split and fed to both modems. This means that both modems see identical Tx and Rx traffic signals all the time, which permits the CRS-150 to continually compare the fault status of both modems. If the CRS-150 sees an identical fault on both modems at the same time, it will infer that the fault condition exists in the external system, and eliminate an unnecessary switchover.

Only one modem in the pair (the online unit) is permitted to transmit its IF carrier signal at any one instant. For total security, the offline modem mutes its Tx carrier, and the CRS-150 provides further isolation by using an RF relay within the unit. Unlike some other 1:1 redundancy systems, which use a passive power combiner for this function (losing approximately 3.5 dB in output power level), the CRS-150 does not introduce any significant attenuation of output signal level.

As a companion product for the CDM-600, the CRS-150 provides full protection for ***all*** Open Network overhead signals (IDR Backward Alarms, Overhead Data Channels, Audio, etc.), as well as external reference signals.

An advantage of the CRS-150 redundancy system is the Auxiliary Serial connection between the two modems in the pair. With the appropriate cables connecting the two modems to the CRS-150, the online unit interrogates the standby unit at regular intervals, to determine its configuration. If a difference in configuration is detected, the online unit automatically reconfigures the standby unit, so that the configurations are always synchronized. If the standby unit is replaced, it does not have to be reprogrammed to match the online unit - the process is entirely automatic.

Operators can manually force a switchover from the front panel of the online modem, or via the remote control bus. Alternatively, operators may choose the conditions that will cause an automatic switchover. Automatic switchover conditions are controlled by two switches at the front of the unit. Choices include:

- Unit faults only
- Unit or Receive Traffic faults
- Unit or Transmit Traffic faults
- All three faults

This provides a great deal of flexibility in switch operation.

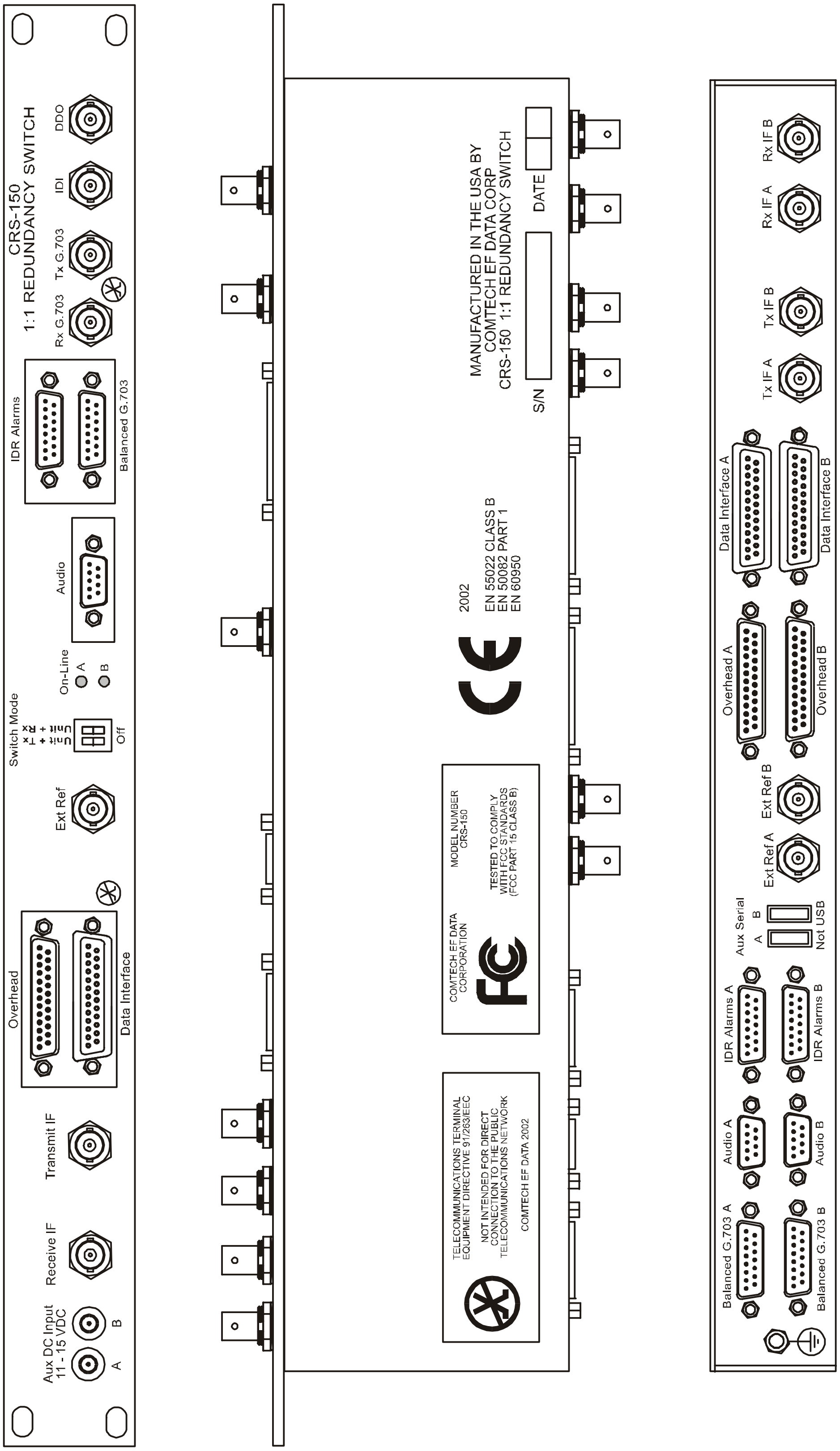
For operation at the maximum data rate of 20 Mbps, the CDM-600 uses a serial LVDS interface. However, many applications, including high-speed routers, use the popular HSSI interface (using negative ECL levels). For these applications Comtech EF Data offers an interface converter module that converts HSSI to LVDS.

The module is called the CIC-20, and is usually connected directly to the rear of the CDM-600. Like the CRS-150, it takes its operating power directly from the modem. However the CDM-600 modem can only safely supply enough current for one attached unit, not two. Therefore, when connecting a CIC-20 to the CRS-150, also connect an external supply (or supplies) to the CRS-150. This is a low-current DC supply providing a DC voltage between 11 and 15 volts. A single supply may be used, but for maximum reliability, a second diode-shared input is provided.

If used, plug the CIC-20 directly into the CRS-150 – do NOT use a cable.

Note that the CRS-150 is intended for mounting at the *rear* of a pair of modems in a 19” rack system.

Please read this operations manual in conjunction with the manual for the CDM-600, because details of CDM-600 operations are not covered in this document.



CRS-150 1:1 REDUNDANCY SWITCH

Chapter 2. INSTALLATION

IMPORTANT

For correct operation of the CRS-150, the CDM-600 modems ***must*** have installed:

Firmware Version 1.1.0 (or higher)

If the modems do not meet this requirement, please contact the factory to arrange for a free Flash upgrade to be sent to you.

2.1 UNPACKING

Inspect shipping containers for damage. If shipping containers are damaged, they should be kept until the contents of the shipment have been carefully inspected and checked for normal operation.

Remove the packing list from the outside of the shipping carton. Open the carton and remove the contents, checking the contents against the packing list. Verify completeness of the shipment and that the unit functions correctly. 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.

If the unit needs to be returned to Comtech EF Data, please use the original shipping container.

2.2 MOUNTING

The CRS-150 is designed to be rack-mounted ***at the rear*** of the two CDM-600 modems that it is connected to.

2.3 CONFIGURATION

There are only two configuration switches to set, which are located on the front panel of the unit. These two switches control the conditions that initiate an automatic switchover. Please consult the following sections on how to set these switches.

2.4 CONNECT EXTERNAL CABLES

Figure 2 shows how to connect a pair of CDM-600 Modems together with the CRS-150.

At a minimum, two Universal Data Cables and IF cables must be attached. This provides DC power, control and fault signals from the modems to the CRS-150, and permits operation with the basic V.35, RS422 and LVDS data interface types.

The following table lists cable assemblies that may be supplied with the CRS-150.

Quantity	Part #	Description
2	CA/WR9036-4	Data Cable, Universal, DB25 Male to Male, length = 4 feet
2	CA/WR9040-4	Cable, Overhead, DB25 Female to Female, length = 4 feet
2	CA/WR9564-4	Cable, IDR Alarms, DB15 Male to Male, length = 4 feet
2	CA/WR9378-4	Cable, Audio, DB9, Male to Male, length = 4 feet
2	CA/WR9536-4	Data Cable, G.703, DB15 Male to Male, length = 4 feet
2	CA/USB-AM/BM-3	Auxiliary Serial Cable, USB, length = 3 feet
2	PL/0813-4	External Reference, 75 Ω, length = 4 feet
4	PL/0946-1	IF Coax Cable, 50 Ω, length = 4 feet **
** The CRS-150 has been optimized designed to work with 50 Ω systems, and it is very important that 50 Ω cables are used between the CRS-150 and the traffic modems. For users with a 75 Ω system, 50 to 75 Ω transformers are supplied with the CRS-150 that should be connected to the external IF ports.		

Additional accessory equipment that may be ordered includes:

- PL/9459-1 (CIC-20 LVDS to HSSI Interface Converter)
- PS/AC18W01P01 (Auxiliary Power Supply for use with CIC-20)

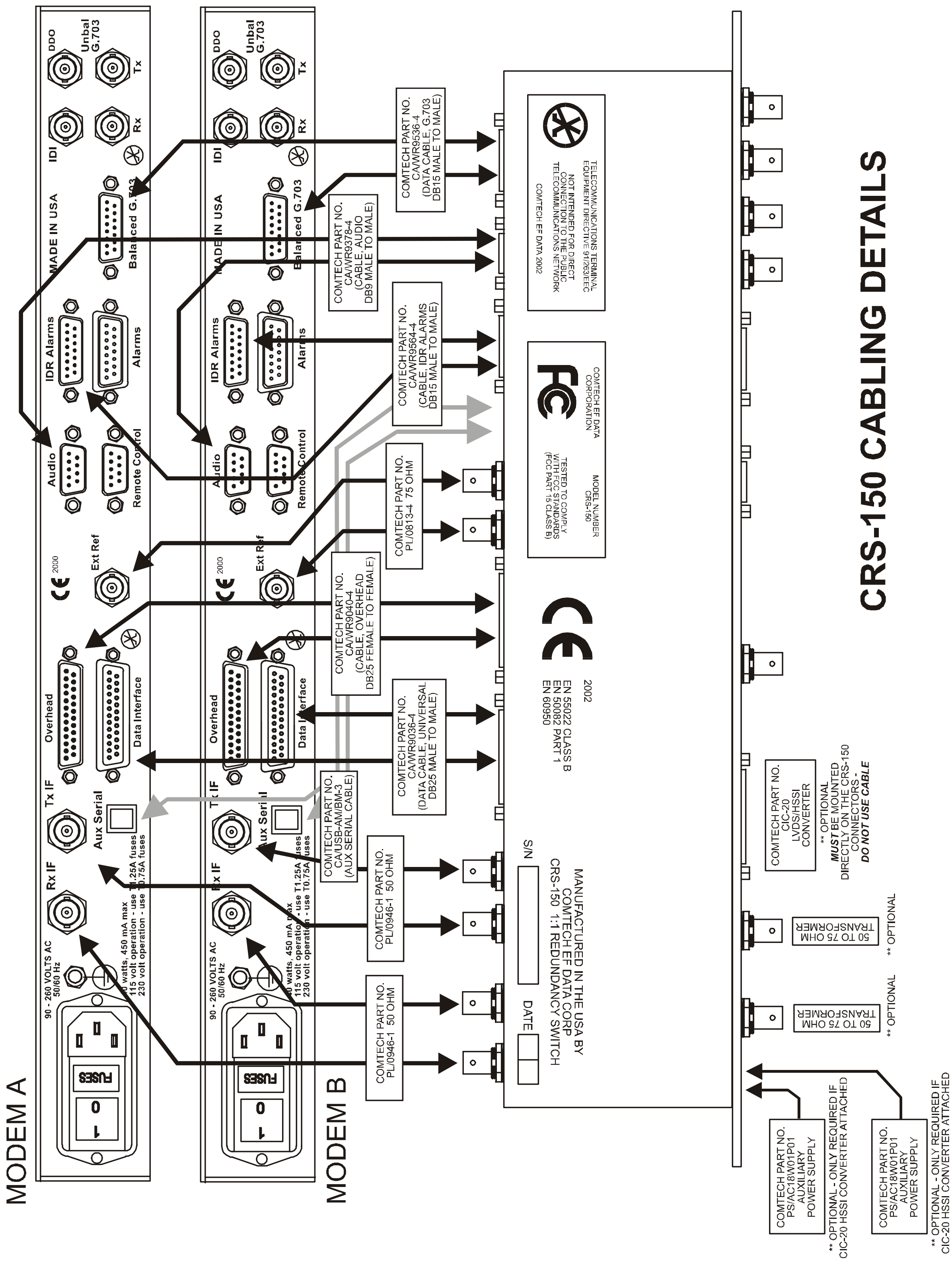


Figure 2. Cabling Details

It is essential to ensure that the data and IF connections, both Rx and Tx, are made correctly. For example, the Transmit IF from Unit 'A' connects to the Tx IF port 'A' on the CRS-150, and Unit 'B' to 'B', and the same for the Rx IF connections. Failure to observe this requirement will result in the system malfunctioning.

IMPORTANT

When connecting the Universal Data Interface cable between the CRS-150 and the modems, ensure that screw locks on the 'D' type connectors are securely fastened. This will prevent the accidental un-mating of the cable, particularly when a standby unit is being removed or replaced.

Chapter 3. FUNCTIONAL DESCRIPTION

The CRS-150 connects to two modems, an online unit, and a standby unit, monitors the fault status of these two units, and controls the routing of data and IF signals to and from the two units. In the case of an equipment failure, switching automatically takes place to protect the traffic circuit. At the heart of the CRS-150 is a Controller State Machine, which is responsible for fault monitoring and control of switching functions. It is implemented in a CPLD.

The redundancy switch derives its operating power from the two modems - online and standby. A diode sharing arrangement, with a current sharing circuit ensures that in normal operation power is taken equally from the two modems. However, in the event that one of the two units is removed, the remaining modem can supply all of the current requirement. The modems supply +12 volts DC (at a combined total of 250 mA max) and -12 volts DC (at a combined total of 120 mA max). Maximum power consumption occurs in a serial LVDS mode at maximum data rate (20 Mbps). Power consumption in EIA-232 modes is approximately 40% of the maximum values. The modem employs electronic fuses, which prevent excessive current from being drawn by the CRS-150, should an anomalous condition occur.

Transmit Clock and Data signals entering the unit via the Data Interface are buffered and fed to both units simultaneously. This ensures that the standby unit sees the same traffic conditions as the online unit. Receive Data and Clock signals coming from the online modem are routed, using signal relays, to the Data Interface. In the event that a switchover occurs, these relays switch so the standby unit then supplies the Data and Clock signals.

As only one modem in the pair (the online unit) is permitted to transmit its IF carrier signal at any one instant, the standby unit is forced to disable its TX carrier, by asserting the TX Carrier Off signal at the Data Interface. In addition, the CRS-150 provides further isolation (and security) by using an RF relay within the unit. Unlike some other 1:1 redundancy systems, which use a passive power combiner on the two Tx IF ports (and hence lose approximately 3.5 dB in output power level) the CRS-150 does not introduce any significant attenuation of output signal level.

The Receive IF signal is fed to both units simultaneously, using an internal power divider. This does introduce a loss of approximately 3.5 dB, but given the wide dynamic range of the demodulator in the CDM-600, this is not considered to be a problem. The advantage of this scheme is that the demodulators in both online and standby units are locked, and therefore, if a switchover does occur, there will be no delay while waiting for the demodulator to acquire lock, which greatly speeds the time for the switchover to occur.

Fault status information is fed from each of the two modems, via the Data Interface connector. The Controller State Machine decides, based on the fault status, which of the two units, ‘A’ or ‘B’ is to be the online unit. It will assert a control signal to the standby unit, which mutes its Tx IF carrier, and simultaneously indicates to the microcontroller within the standby unit that the unit is no longer ‘online’. This results in the ‘online’ LED on the front panel of the unit being extinguished. This status is also reported over the remote control bus, so an external M&C system can determine the state of the redundancy system. At the same time, a green LED will illuminate on the front of the CRS-150 to indicate whether the ‘A’ or ‘B’ unit is online.

The operator determines the conditions which cause an automatic switchover. This is controlled by two switches at the front of the unit, and the operator can select between Unit faults only, Unit faults or Receive Traffic faults, Unit faults or Transmit Traffic faults, or all three. This is covered in detail in a later section. With the ‘bridging’ architecture of the CRS-150 (whereby identical traffic signals are routed to both online and standby units) the Controller State Machine can avoid un-necessary switchovers. By examining the fault status of both units, it can infer if the fault is external to the system. For example, suppose that the CRS-150 has been configured to switch following Unit faults or Transmit Traffic faults, and that the modems are configured for external clock operation. Now suppose that the external equipment (network, mux, router, etc) fails. Both the standby and the online units will now show a Transmit Traffic fault (No Clock Detected from Terrestrial Interface). The CRS-150 Controller State Machine will see that both these faults have occurred at the same time (in fact, within a 0.3 second window) and infers that the fault is external. Therefore, no unnecessary switchover is initiated.

Chapter 4. CONNECTOR PINOUTS

4.1 FRONT PANEL CONNECTORS

The front panel connectors provide all necessary external connections between the CRS-150 Redundancy Swich and other equipment.

Figure 3. Front Panel

Table 1. External Connections – Front Panel

Name	Connector Type	Function
RX IF	BNC	RF Input
TX IF	BNC	RF Output
Overhead	25-pin D (male)	Overhead Data Input/Output
Data Interface	25-pin D (female)	Data Input/Output
External Reference	BNC	Input
Audio	9-pin D (female)	Audio Signal Input/Output
IDR Alarms	15-pin D (female)	Backward Alarm Outputs
Balanced G.703	15-pin D (female)	Balanced G.703 Data
RX Unbalanced G.703	BNC	Receive G.703
TX Unbalanced G.703	BNC	Transmit G.703
IDI G.703	BNC	Insert Data In
DDO G.703	BNC	Drop Data Output
Aux DC Power	2.1 mm Socket	Power for External devices

IMPORTANT

To maintain compliance with the European EMC Directive (EN55022, EN50082-1) properly shielded cables are required for data I/O.

4.1.1 Overhead Interface Connector

The overhead interface connector is a 25-pin male D interface located on the front panel of the Redundancy Switch. Refer to Table 2 for pin assignments.

Table 2. Overhead Interface Connector Pin Assignments

Pin #	Signal Function	Signal Name	Direction
14	IDR 64 kbps ESC Tx Data +	TX-422DAT-B	In
2	IDR 64 kbps ESC Tx Data -	TX-422DAT-A	In
12	IDR 64 kHz ESC Tx Clock +	TX-422CLK-B	Out
15	IDR 64 kHz ESC Tx Clock -	TX-422CLK-A	Out
11	IDR 1 kHz Tx Octet Clock +	TX-OCT-B	Out
24	IDR 1 kHz Tx Octet Clock -	TX-OCT-A	Out
16	IDR 64 kbps ESC Rx Data +	RX-422DAT-B	Out
3	IDR 64 kbps ESC Rx Data -	RX-422DAT-A	Out
9	IDR 64 kHz ESC Rx Clock +	RX-422CLK-B	Out
17	IDR 64 kHz ESC Rx Clock -	RX-422CLK-A	Out
19	IDR 1 kHz Rx Octet Clock +	RX-OCT-B	Out
4	IDR 1 kHz Rx Octet Clock -	RX-OCT-A	Out
20	Balanced Ext. Ref. Clock +	EXT-CLK-B	In
23	Balanced Ext. Ref. Clock -	EXT-CLK-A	In
13	IBS ESC RS232 Tx Data	TX-232-DATA	In
22	IBS ESC RS232 Tx Clock	TX-232-CLK	Out
8	IBS ESC RS232 Rx Data	RX-232-DATA	Out
10	IBS ESC RS232 Rx Clock	RX-232-CLK	Out
5	IBS Tx High-Rate ESC Data	TX-ASYNC	In
6	IBS Rx High-Rate ESC Data	RX-ASYNC	Out
1	IDR Back Alarm 1 H/W input	BW-IN1	In
18	IDR Back Alarm 2 H/W input	BW-IN2	In
21	IDR Back Alarm 3 H/W input	BW-IN3	In
25	IDR Back Alarm 4 H/W input	BW-IN4	In
7	Signal Ground	Ground	-

4.1.2 DATA INTERFACE CONNECTOR

The Data Interface connector, a 25-pin D type female, conducts data input and output signals to and from the Redundancy Switch, and connects to customer's terrestrial equipment. Refer to Table 3 for pin assignments.

Table 3. Data Interface Connector Pin Assignments

Pin #	Generic Signal Description	Direction	EIA-422 EIA 530 LVDS	V.35	EIA-232	Circuit #
2	Transmit Data A	DTE to Modem	SD A	SD A	BA	103
14	Transmit Data B	DTE to Modem	SD B	SD B	-	103
24	Transmit Clock A	DTE to Modem	TT A	SCTE A	DA	113
11	Transmit Clock B	DTE to Modem	TT B	SCTE B	-	113
15	Internal Transmit Clock A	Modem to DTE	ST A	SCT A	DB	114
12	Internal Transmit Clock B	Modem to DTE	ST B	SCT B	-	114
3	Receive Data A	Modem to DTE	RD A	RD A	BB	104
16	Receive Data B	Modem to DTE	RD B	RD B	-	104
17	Receive Clock A	Modem to DTE	RT A	SCR A	DD	115
9	Receive Clock B	Modem to DTE	RT B	SCR B	-	115
8	Receiver Ready A	Modem to DTE	RR A	RLSD *	CF	109
10	Receiver Ready B	Modem to DTE	RR B	-	-	109
23	External Carrier Off (EIA-232 '1' or TTL 'low')	DTE to Modem	-	-	-	-
7	Signal Ground	-	SG	SG	AB	102
1	Shield	-	Shield	FG	AN	101

NOTES:

1. Receiver Ready is an EIA-232-level control signal on a V.35 interface
2. DO NOT connect signals to pins which are not shown - these pins are reserved for use by the redundancy system
3. 'B' signal lines are not used for EIA-232 applications
4. For X.21 operation, use the EIA-422 pins, but ignore Receive Clock if the Modem is DTE, and ignore Transmit clocks if the Modem is DCE

4.1.3 AUDIO INTERFACE CONNECTOR

The Audio interface connection is a 9-pin female D connector located on the front panel of the Redundancy Switch. Refer to Table 4 for pin assignments.

Table 4. Audio Interface Connector Pin Assignments

Pin #	Signal Function	Direction
1	Tx Audio 1 +	In
6	Tx Audio 1 -	In
2	Rx Audio 1 +	Out
7	Rx Audio 1 -	Out
8	Tx Audio 2 +	In
4	Tx Audio 2 -	In
9	Rx Audio 2 +	Out
5	Rx Audio 2 -	Out
3	Common	

4.1.4 IDR ALARMS CONNECTOR

The IDR Alarm interface connection is a 15-pin female connector located on the rear panel of the modem. Refer to Table 5 for pin assignmernts.

Table 5. IDR Alarm Interface Connector Pin Assignments

Pin #	Signal Function	Name
2	Backward Alarm 1 is active	BA-1-NO
9		BA-1-COM
1	Backward Alarm 1 is not active	BA-1-NC
10	TBD	MON-A
4	Backward Alarm 2 is active	BA-2-NO
11		BA-2-COM
3	Backward Alarm 2 is not active	BA-2-NC
6	Backward Alarm 3 is active	BA-3-NO
13		BA-3-COM
5	Backward Alarm 3 is not active	BA-3-NC
14	TBD	MON-B
8	Backward Alarm 4 is active	BA-4-NO
15		BA-4-COM
7	Backward Alarm 4 is not active	BA-4-NC
12	Ground	GND

4.1.5 BALANCED G.703 INTERFACE CONNECTOR

The Balanced G.703 connector is a 15-pin female D type, located on the front panel of the Redundancy Switch. Refer to Table 6 for pin assignments.

Table 6. Balanced G.703 Interface Connector Pin Assignments

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

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

4.1.6 BNC CONNECTORS

There are several BNC connectors located on the front panel of the Redundancy Switch. Refer to Table 7 for details.

Table 7. BNC Connectors

BNC Connector	Reference	Description	Direction
RX-IF	J1	RX-IF signals	In
TX-IF	J2	TX-IF signals	Out
EXT REF	J9	External Reference Input	In
IDI	J10A	Insert Data Input	In
DDO	J11A	Drop Data Output	Out
RX (IDO)	J10B	RX G.703 (Unbalanced)	Out
TX (IDI)	J11B	TX G.703 (Unbalanced)	In

4.1.7 AUXILIARY DC POWER INPUTS

For operation at the maximum data rate of 20 Mbps, the CDM-600 uses a serial LVDS interface. However, many applications, including high-speed routers, use the popular HSSI interface (using negative ECL levels). For these applications Comtech EF Data offers an interface converter module that converts HSSI to LVDS. The module is called the CIC-20, and is usually connected directly to the rear of the CDM-600. Like the CRS-150, it takes its operating power directly from the modem. However the CDM-600 modem can only safely supply enough current for one attached unit, not two. Therefore, if a User desires to connect a CIC-20 to the CRS-150 unit, an external supply (or supplies) needs to be connected to the CRS-150. This is a low-current DC supply providing a DC voltage between 11 and 15 volts. Either a single supply may be used, but for maximum reliability, a second diode-shared input is provided.

The front panel of the CRS-150 incorporates two independent DC inputs (using 2.1 mm sockets, with the outer conductor grounded). Comtech EF Data can supply the appropriate AC/DC supply, complete with IEC power input connector (Part number PS/AC18W01P01).

4.2 REAR PANEL CONNECTORS

The rear panel connectors of the CRS-150 Redundancy Switch provide all the connections between the Redundancy Switch and the two modems in the 1:1 pair.

IMPORTANT

Note that with the exception of the main connections between the 25 pin data ports (which is mandatory), the other connections are purely optional.

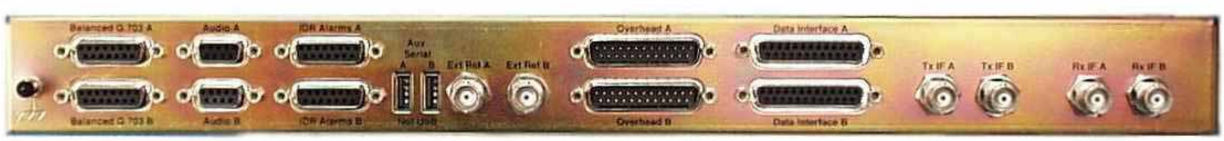


Figure 4. Rear Panel Connectors

Table 8. External Connections – Rear Panel

Name	Connector Type	Function
RX IF (A and B)	BNC	RF Outputs
TX IF (A and B)	BNC	RF Inputs
Overhead (A and B)	25-pin D (male)	Overhead Data Inputs/Outputs
Data Interface (A and B)	25-pin D (female)	Data Input/Outputs
External Reference (A and B)	BNC	Outputs
Audio (A and B)	9-pin D (female)	Audio Signal Inputs/Outputs
IDR Alarms (A and B)	15-pin D (female)	Backward Alarm Outputs
Balanced G.703 (A and B)	15-pin D (female)	Balanced G.703 Data
Auxiliary Serial	USB	Serial Inputs/Outputs

4.2.1 OVERHEAD INTERFACE CONNECTORS (A AND B) FOR CONNECTION FROM REDUNDANCY SWITCH TO MODEMS

The overhead interface connectors (A and B) are 25-pin male D type, located on the rear panel of the Redundancy Switch. Refer to Table 9 for pin assignments.

Table 9. Overhead Interface Connector Pin Assignments

Pin #	Signal Function	Signal Name	Direction
14	IDR 64 kbps ESC Tx Data +	TX-422DAT-B	Out
2	IDR 64 kbps ESC Tx Data -	TX-422DAT-A	Out
12	IDR 64 kHz ESC Tx Clock +	TX-422CLK-B	In
15	IDR 64 kHz ESC Tx Clock -	TX-422CLK-A	In
11	IDR 1 kHz Tx Octet Clock +	TX-OCT-B	In
24	IDR 1 kHz Tx Octet Clock -	TX-OCT-A	In
16	IDR 64 kbps ESC Rx Data +	RX-422DAT-B	In
3	IDR 64 kbps ESC Rx Data -	RX-422DAT-A	In
9	IDR 64 kHz ESC Rx Clock +	RX-422CLK-B	In
17	IDR 64 kHz ESC Rx Clock -	RX-422CLK-A	In
19	IDR 1 kHz Rx Octet Clock +	RX-OCT-B	In
4	IDR 1 kHz Rx Octet Clock -	RX-OCT-A	In
20	Balanced Ext. Ref. Clock +	EXT-CLK-B	Out
23	Balanced Ext. Ref. Clock -	EXT-CLK-A	Out
13	IBS ESC RS232 Tx Data	TX-232-DATA	Out
22	IBS ESC RS232 Tx Clock	TX-232-CLK	In
8	IBS ESC RS232 Rx Data	RX-232-DATA	In
10	IBS ESC RS232 Rx Clock	RX-232-CLK	In
5	IBS Tx High-Rate ESC Data	TX-ASYNC	Out
6	IBS Rx High-Rate ESC Data	RX-ASYNC	In
1	IDR Back Alarm 1 H/W input	BW-IN1	Out
18	IDR Back Alarm 2 H/W input	BW-IN2	Out
21	IDR Back Alarm 3 H/W input	BW-IN3	Out
25	IDR Back Alarm 4 H/W input	BW-IN4	Out
7	Signal Ground	Ground	-

4.2.2 DATA INTERFACE CONNECTORS (A AND B) FOR CONNECTION FROM REDUNDANCY SWITCH TO MODEMS

The Data Interface connectors (A and B), 25-pin female D types, conduct data input and output signals btween the Redundancy Switch and the modems. Refer to Table 10 for pin assignments.

Table 10. Data Interface Connector Pin Assignments

Pin #	Signal Description	Direction	EIA-422 EIA 530 LVDS	V.35	EIA-232	Circuit #
2	Transmit Data A	Switch to Modem	SD A	SD A	BA	103
14	Transmit Data B	Switch to Modem	SD B	SD B	-	103
24	Transmit Clock A	Switch to Modem	TT A	SCTE A	DA	113
11	Transmit Clock B	Switch to Modem	TT B	SCTE B	-	113
15	Internal Transmit Clock A	Modem to Switch	ST A	SCT A	DB	114
12	Internal Transmit Clock B	Modem to Switch	ST B	SCT B	-	114
3	Receive Data A	Modem to Switch	RD A	RD A	BB	104
16	Receive Data B	Modem to Switch	RD B	RD B	-	104
17	Receive Clock A	Modem to Switch	RT A	SCR A	DD	115
9	Receive Clock B	Modem to Switch	RT B	SCR B	-	115
8	Receiver Ready A	Modem to Switch	RR A	RLSD *	CF	109
10	Receiver Ready B	Modem to Switch	RR B	-	-	109
23	External Carrier Off (EIA-232 ‘1’ or TTL ‘low’)	Switch to Modem	-	-	-	-
18	Fused +12 volts	Modem to Switch	-	-	-	-
25	Fused -12 volts	Modem to Switch	-	-	-	-
21	Bal/Unbal interface	Modem to Switch	-	-	-	-
20	1:1 Switch present	Switch to Modem	-	-	-	-
6	Unit fault	Modem to Switch	-	-	-	-
13	Tx Traffic fault	Modem to Switch	-	-	-	-
5	Rx Traffic fault	Modem to Switch	-	-	-	-
7	Signal Ground	-	SG	SG	AB	102
1	Shield	-	Shield	FG	AN	101

4.2.3 AUDIO INTERFACE CONNECTORS (A AND B) FOR CONNECTION FROM REDUNDANCY SWITCH TO MODEMS

The Audio interface connectors (A and B) are 9-pin female D types, located on the rear panel of the Redundancy Switch. Refer to Table 11 for pin assignments.

Table 11. Audio Interface Connector Pin Assignments

Pin #	Signal Function	Direction
1	Tx Audio 1 +	Out
6	Tx Audio 1 -	Out
2	Rx Audio 1 +	In
7	Rx Audio 1 -	In
8	Tx Audio 2 +	Out
4	Tx Audio 2 -	Out
9	Rx Audio 2 +	In
5	Rx Audio 2 -	In
3	Common	

4.2.4 IDR ALARMS CONNECTORS (A AND B) FOR CONNECTION FROM REDUNDANCY SWITCH TO MODEMS

The IDR Alarm interface connectors are 15-pin female D types, located on the rear panel of the Redundancy Switch. Refer to Table 12 for pin assignmernts.

Table 12. IDR Alarm Interface Connector Pin Assignments

Pin #	Signal Function	Name
2	Backward Alarm 1 is active	BA-1-NO
9		BA-1-COM
1	Backward Alarm 1 is not active	BA-1-NC
4	Backward Alarm 2 is active	BA-2-NO
11		BA-2-COM
3	Backward Alarm 2 is not active	BA-2-NC
6	Backward Alarm 3 is active	BA-3-NO
13		BA-3-COM
5	Backward Alarm 3 is not active	BA-3-NC
8	Backward Alarm 4 is active	BA-4-NO
15		BA-4-COM
7	Backward Alarm 4 is not active	BA-4-NC
12	Ground	GND

4.2.5 Balanced G.703 Interface Connectors (A and B) for Connection from Redundancy Switch to Modems

The Balanced G.703 connectors (A and B) are 15-pin female D types, located on the rear panel of the Redundancy Switch. Refer to Table 13 for pin assignments.

Table 13. Balanced G.703 Interface Connector Pin Assignments

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

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

IMPORTANT

In order to simplify the cabling between the CDM-600 modems and the CRS-150 Redundancy Switch, all G.703 signals are carried between modems and switch on the BALANCED connections, regardless of the choice of balanced/unbalanced connectors on the CRS-150 front panel.

The user should not be concerned about this – the modem signals the appropriate port type (balanced or unbalanced) to the CRS-150, so *correct operation of the ports is assured.*

4.2.6 BNC Connectors (A and B) for Connection from Redundancy Switch to Modems

There are several BNC connectors located on the rear panel of the Redundancy Switch. Refer to Table 14 for details.

Table 14. BNC Connectors

BNC Connector	Description	Direction
RX-IF (A and B)	RX-IF signals	Out
TX-IF (A and B)	TX-IF signals	In
EXT REF (A and B)	External Reference Input	Out

4.2.7 Auxiliary Serial Connectors (A and B) for Connection from Redundancy Switch to Modems

There are two auxiliary ports on the rear panel of the Redundancy switch, using USB connectors. Please note that although the connector style used is a USB type, these ports should not be connected to the USB of a PC. The pinouts of these connectors is shown in Table 15.

Table 15. Auxiliary Serial Port connectors

Pin Name	USB Connector Pin #	Description	Direction
Ground	1		-
TX Async	2	RS232 Tx data	Out
RX Async	3	RS232 Rx data	In
Ground	4		-

4.2.8 Ground Connector

A #10-32 stud on the rear panel of the Redundancy Switch is used for connecting a common chassis ground among equipment.

Chapter 5. OPERATION

IMPORTANT

For correct operation of the CRS-150, the CDM-600 modems ***must*** have installed:

Firmware Version 1.1.0 (or higher)

If the modems do not meet this requirement, please contact the factory to arrange for a free Flash upgrade to be sent to you.

If the modems do not meet this requirement, please contact the factory to arrange delivery of a free Flash upgrade.

5.1 AUTOMATIC OPERATION

Once the cables are connected in accordance with the instructions and diagram in Section 2, the system is ready to be put into operation. Before proceeding, check that the Auxiliary Serial link between the two units is functioning correctly. From the front panel of the online unit, access the main menu, then select INFO:

INFO (Information)

```
INFO: ALL ID FORMAT TX RX CLOCKS  EDMAC
 DROP  INSERT  REMOTE  ALARM-MASK  MISC
```

Highlight MISC using the [←][→] arrow keys, then press ENTER. On the bottom line, the screen should show that the 1:1 link is active.

```
TEST MODE = NORMAL
1:1 REDUNDANCY = CONNECTED       ONLINE
```

If it does not, then check that the cable is correctly installed before proceeding.

Next, decide which conditions should initiate a switchover. Configure the two switches on the left side of the CRS-150 accordingly. Choose from among four conditions:

1. Unit faults only (both switches in the Down, or ‘OFF’ position).
2. Unit faults or Tx Traffic faults (the left switch in the Up, or ‘ON’ position)
3. Unit faults or Rx Traffic faults (the right switch in the Up, or ‘ON’ position)
4. Unit faults or Rx or Tx faults (both switches in the Up or ‘ON’ position)

Some possible fault conditions are listed below:

Unit faults:	Power supply fault, +5 volts Power supply fault, +12 volts Power supply fault, -5 volts Power supply fault, +18 volts Power supply fault, -12 volts Tx synthesizer lock Rx synthesizer lock Power cal Checksum error
Tx Traffic faults:	No Clock from terrestrial interface (masked when on Internal Clock) Tx FIFO slip AIS detected on incoming data *
Rx Traffic status:	Demodulator unlocked AGC Alarm - signal level too high * Frame sync lost (Reed-Solomon or EDMAC) Buffer Underflow * Buffer Overflow * AIS detected on incoming data * Eb/No threshold exceeded *

Users can choose to mask those alarms marked with an asterisk (*). To do so, select CONFIG from the main menu of the online unit. The following menu will be displayed:

```
CONFIGURE ALARM MASK:   AIS   BUFFER
     RXIF   SAT-ALM   TERR-ALM
```

Use the [←] [→] arrow keys to select the parameter to edit, then press ENTER.

One of the following sub-menus will be displayed:

CONFIG: MASK: AIS

```
AIS:  TX-TERR-AIS= MASKED  (ACTIVE,MASK)
      RX-SAT-AIS = ACTIVE  (ACTIVE,MASK)
```

Use the [←] [→] arrow keys to select the parameter to edit. Select either ACTIVE or MASKED, using the [↑] [↓] arrow keys, then press ENTER.

If TX-TERR-AIS is set to ACTIVE, a fault will be generated whenever the modulator senses that the 'all ones' condition is present in the terrestrial data.

If RX-SAT-AIS is set to ACTIVE, a fault will be generated whenever the demodulator senses that the 'all ones' condition is present in the receive data.

If an alarm is MASKED, no alarm will be generated.

CONFIG: MASK: BUFFER SLIP

```
BUFFER SLIP= ACTIVE  (ACTIVE,MASK)
```

Select either ACTIVE or MASKED, using the [↑] [↓] arrow keys, then press ENTER.

If ACTIVE is selected, then a Buffer Slip fault will be generated whenever the receive circuitry senses that the buffer has either underflowed, or overflowed.

If MASKED is selected, no alarm will be generated.

CONFIG: MASK: RX-IF

```
RXIF:   AGC = ACTIVE  (ACTIVE,MASK)
       EbNo = MASKED  (ACTIVE,MASK)
```

Use the [←] [→] arrow keys to select the parameter to edit: AGC or EbNo. Select either ACTIVE or MASKED, using the [↑] [↓] arrow keys, then press ENTER.

If ACTIVE is selected, then an AGC alarm is generated whenever the receive signal level exceeds –20 dBm (for the desired carrier). An Eb/No alarm is generated whenever the demodulator sees the receive Eb/No fall below the pre-determined value.

If MASKED is selected, no alarm will be generated.

CONFIG: MASK: SATELLITE ALARMS

```
     SATELLITE ALARMS
   TRANSMIT      RECEIVE
```

Select either TX or RX, using the [←][→] arrow keys, then press ENTER.

CONFIG: MASK: SATELLITE ALARMS: TX

```
PROCESS ALARMS FROM  (H/W, S/W, OFF)
BWA1=OFF   BWA2=OFF   BWA3=S/W
```

Select the Backward Alarm (BWA) to be edited using the [←][→] arrow keys. Edit the settings using the [↑] [↓] arrow keys, then press ENTER.

Select how the TX IDR backward alarm inputs are to be used. An activated alarm may respond to a hardware input at P5A (H/W) or be software controlled by a receive fault on the modem (S/W).

CONFIG: MASK: SATELLITE ALARMS: RX

```
PROCESS ALARMS RECEIVED FROM SATELLITE
BWA1=N, BWA2=N, BWA3=N, BWA4=N
```

Select which Receive IDR backward alarms are to be monitored.

CONFIG: MASK: TERR-ALM

```
TERR-ALM: TX = ACTIVE  (ACTIVE,MASK)
          RX = OFF    (OFF,ENABLED)
```

These **alarms are only valid for D&I operation.**

Use the [←] [→] arrow keys to select the parameter to edit. Edit the alarms using the [↑] [↓] arrow keys, then press ENTER.

IMPORTANT

RECOMMENDATION:

Comtech EF Data recommends that for most applications, the CRS-150 should be configured to switch ***on Unit faults only.***

The system, now configured, is ready to be put into service.

5.2 MANUAL OPERATION

There are two ways to force a manual switchover in a 1:1 system:

1. Switchover from the Front Panel (Utilities Menu)
2. Switchover from the Remote Bus (ASCII String)

First, from the front panel of the online unit, select the Utilities menu:

UTILITIES

```
UTILITIES:  SET-RTC  DISPLAY-BRIGHTNESS
LAMP  1:1-MANUAL-SWITCH  EDIT-CIRCUIT-ID
```

Select the Utilities parameter using the [←][→] arrow keys, then press ENTER.

Select 1:1 MANUAL SWITCH, then press ENTER.

(UTILITIES) 1:1 Manual Switch

```
PRESS ENTER TO FORCE THIS
UNIT TO STANDBY (1:1 ONLY)
```

If the unit is part of a 1:1 redundant pair of modems, and this unit is currently online, pressing ENTER will cause the unit to switch to standby.

Note that this only works from the front panel of the online unit. If this is carried out from the front panel of the Standby unit, it will not cause a switchover.

The second method is via the remote control bus. Sending the ASCII string <XXXX/FSW=<CR> to the online unit (where XXXX is the address of the online unit) will force a switchover.

This can be accomplished with the user's own software, or with Comtech EF Data's Monitor and Control Software package (SatMac).

If it becomes necessary to remove a Standby unit from the redundancy system, turn the power off before attempting to disconnect any of the cables.

Similarly, when replacing a Standby unit, fully connect all of the cables before applying power.

<u>REMEMBER</u>:

The top unit is 'A'

The bottom unit is 'B'

Chapter 6. SUMMARY OF SPECIFICATIONS

Equipment Type	1:1 Redundancy Switch
Modems Supported	Comtech EF Data CDM-600 Digital Satellite Modem
Operating Modes	Fully Automatic Manual (via the front panel of the Online Modem, or via the Modem's remote control interface)
Architecture	Full bridging architecture, with configuration synchronization Tx Clock and Data signals fed to both Online and Standby units Rx IF signal fed to both Online and Standby units Continuous fault comparison of Online and Standby units (The configuration of Online and Standby units is synchronized via the Auxiliary Serial link between the two Modems)
Switch Conditions	Switchover initiated following: Unit faults only, or: Unit faults or Receive Traffic Faults, or: Unit faults or Transmit Traffic Faults, or: Unit faults or Receive or Transmit Traffic Faults
Fault detection time	1 second maximum
Switchover time	Within 0.5 seconds of fault detection
Main Data Interfaces	RS422/EIA530 DCE (25 pin D-type female, pinout per EIA530) to 10 Mbps V.35 DCE to 10 Mbps Synchronous RS232 to 300 kbps Serial LVDS to 20 Mbps (A standard HSSI interface is provided with the addition of the Comtech CIC-20 LVDS/HSSI Interface Converter module, for operation up to 20 Mbps)
G.703 Interfaces	G.703, T1, E1, T2 and E2, balanced and unbalanced (BNC connectors for 75 Ω unbalanced, and 15 pin D-type for 120 Ω balanced) Note that for T1 and E1 Drop and Insert applications the unit supports Rx, Tx connections, as well as Drop Data Out (DDO) and Insert Data In (IDI) 'G.703-like' signals at 512 kbps and 1024 kbps (through DDO and IDI ports)
Overhead Interface	Intelsat IESS-308/309/310 Open Network overhead signals, including: IDR Overhead Data Channels (64 kHz, 8kHz, and Octet clocks) IBS ESC and High-Rate ESC Balanced External Reference Input IDR Backward Alarm Inputs (25 pin D-type male)

Audio	2 x 4-wire 600 Ω audio interface, per Intelsat IESS-308 (9 pin D-type female)
IDR Backward Alarms	Backward Alarm Outputs BA-1 through BA-4 (Form C relays) per Intelsat IESS-308 (15 pin D-type female)
External Reference	75 Ω BNC, unbalanced input 120 Ω balanced input
IF Switching/ Splitting	Transmit IF: Switched by RF relay (0.3 dB max loss) Receive IF: Passive power splitting (3.5 dB max loss)
IF Impedance	Optimized for 50 Ω (> 20 dB return loss on external IF ports) 75 Ω supported with the use of external RF transformers (supplied)
IF Connectors	BNC female
IF Frequency range	52 - 176 MHz
Weight	4.6 lbs (2.1 kg)
Dimensions	1.75 inches (44.5 mm) high, 19 inches (482.5 mm) wide 4.2 inches (107 mm) deep (excluding connectors)
Power requirements	4.5 Watts maximum + 12 volts DC @ 250 mA (max) -12 volts DC @ 120 mA (max) (Power is supplied by the Online and Standby Modems, and the unit current shares when both an >A= and >B= unit are present. These power supplies are electronically fused and protected.) (A pair of auxiliary DC inputs are provided for powering external equipment connected to the main data interface, such as a CIC-20 Interface Converter)
Approvals	'CE' as follows: EN 55022 Class B (Emissions) EN 50082-1 (Immunity) EN 60950 (Safety) FCC Part 15 Class B

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	—

COMTECH EF DATA

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