UT-4500 Series

Up Converter
Installation and Operation Manual

Part Number MN/UT4500.IOM
Revision 2

Errata A
Comtech EF Data Documentation Update

Subject:	Revised 5.6.4.7 Packed Configuration Status

Date: December 16, 2005
Document: UT-4500 Series, Up Converters, Installation and Operation
Manual, Revision 1, dated June 20, 2005
Part Number: MN/UT4500.EA1
Collating Instructions: Attach this page to page 73

Comments:

Revise paragraph 5.6.4.7 to read:

Change Specifics:

5.6.4.7   Packed Configuration Status

Configuration Status: <DEV/PACRCS_'cr'
Confirmation: >DEV/PACRCS_aaaabbbcdeffgghijkl'cr''lf']
where:

- aaaa = # of 125kHz steps above base frequency[1]
- bbb = # of 0.25 dB steps above 0.00 dB[2]
- c = 1 if Transmitter ON, 0 if OFF, 2 if Cold
- d = 1 if unit ONLINE, 0 if OFFLINE
- e = 1 if Redundancy ON, else 0
- ff = converter # (01-12,BU or 00 if e = 0)
- gg = 00 if 'ff' is 00 (redundancy OFF)
- gg = chain length (01-12) if 'ff' is BU
- gg = XX if 'ff' = 01 - 12
- h = A if Auto Mode, M if Manual[3]
- I = 1 if Cold Start Enabled, else 0
- j = 1 if Auto recovery enabled, else 0
- K = 1 if an Ext. Ref is present, else 0
- l = 1 if Remote Mode, 0 if Local Mode

Notes:

1. If the converter is 1 kHz step size, this will be the number of 1 kHz steps above the base frequency. **Also, this will be 5 bytes(aaaaa) long for model 4513X converters with 125 KHz frequency step size. This will be 7 bytes(aaaaaaa) long for all 1KHz step size converters.**

2. If the converter is 0.1 -dB step size, this will be the number of 0.1 -dB steps above the base frequency

3. If it is a backup Converter, it is always 'A'.

4. **If it is the primary converter, gg = P1 or P2 (single or dual polarity system.**

Errata B
Comtech EF Data Documentation Update

Subject: Added Dual IF Rack Mount Converters

Date: August 28, 2006
Document: UT-4500 Series, Up Converters, Installation and Operation
                                 Manual, Revision 2, dated June 20, 2005
Part Number: MN/UT4500.EB2
Collating Instructions: Attach this page to page 25

Comments:

Add the attached procedure to System Operation

Change Specifics:

Dual IF Rack Mount Converters

Comtech EF Data offers converters with the ability to switch the output IF frequency (Downconverters) and/or the input IF frequency (Upconverters) from 70 MHz to 140 MHz or vice versa. The actual IF bandwidth is maintained as the standard ± 18 MHz (± 20 MHz) of the 70 MHz configurations.

The software modification required for the implementation of the IF frequency switching are:

1. A front panel command to allow the output IF to switch from 70MHz to 140.
   a. The new selection is located in the "Configuration" menu tree. The "normal" FREQ/ATT/MUT menu is split into two. First menu screen now has "RF FRE= XXXXX MHz on top line, with "IF FRE= XXX MHz" and "Rx= XXX" on second line. A second menu screen contains the attenuator setting.
   b. Mute behavior after changing the IF frequency is the same as the normal mute behavior after changing the RF frequency.

2. A new remote command is implemented to accomplish the identical operation as in (1).
   a. Command structure similar to the RF frequency selection.

The default is 70 MHz

Command	Details
Set IF Frequency:	<DEV/IFF_xxx'cr' (where xxx is either 140 or 70 without requiring leading zero.
Confirmation:	>DEV/IFF_ xxx'cr''lf'] (where xxx is either 140 or 70 without requiring leading zero.
Retrieve Frequency:	<DEV/IFF_'cr'
Confirmation:	>DEV/IFF_ xxx'cr''lf'] (where xxx is either 140 or 70 without requiring leading zero.

Mute behavior after changing the IF frequency would be the same as the mute behavior after changing the RF frequency.

Redundant operation

The customer can not "mix" dual IF converters with standard converters in a redundant system

UT-4500 Series

Up Converter
Installation and Operation Manual
Part Number MN/UT4500.IOM
Revision 2
November 11, 2005

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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

A Customer Support representative may be reached at:

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

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

or, E-Mail can be sent to the Customer Support Department at:

service@comtechefdata.com

Contact us via the web at www.comtechefdata.com.

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. xii.

Table of Contents

Figures

Tables

ABOUT THIS MANUAL

This manual provides installation and operation information for the Comtech EF Data UT4500 Series Up Converter. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the UT4500 Series Up Converter.

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 are equivalent to 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 (EIA-232, EIA-485, etc.).

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.
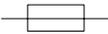
Symbol	Definition
⏚	Protective Earth.
⏚	Chassis Ground.

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 to provide 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

**UT-4500
Series Up
Converter**

1.1 OVERVIEW

This manual provides instructions on the installation, operation and maintenance for the UT-4500 Series Up Converters manufactured by Comtech EF Data Corp.

UT-4505	UT-4514
UT-4505E	UT-4514C
UT-4505F	UT-4514D
UT-4505G	UT-4514E
UT-4505H	UT-4514F
UT-4505J	
UT-4505I	UT-4518
UT-4505X	UT-4518E

Individual specifications for each model are included in this section.

1.2 FUNCTIONAL DESCRIPTION

The UT-4500 Series Up Converters are designed for use in communication systems, or in satellite up-link data systems, for the transmission of SCPC, DAMA and TDMA communication signals. The Up Converters can also be used in communications system applications with full transponder HDTV and analog TV.

The converter is designed to be hard mounted in a standard 19-inch rack or cabinet, or to be rack mounted using slide mechanisms provided with the converter to allow it to be serviced without its removal from the rack. An internally mounted exhaust fan for cooling is mounted on the rear of the chassis. An AC power connector, with an on/off switch, is also located on the rear on the chassis. A six-foot AC power cord is supplied with the converter.

All operator controls, indicators and displays for local and remote operation are located on the front panel of the converter. Connectors for the external interface connections are located on the rear of the converter chassis.

Figure 1. Front Panel (Model UT-4505 shown)
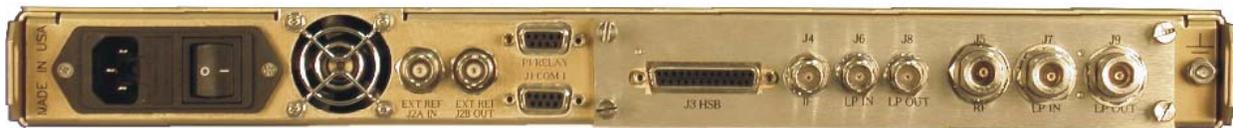
Figure 2. Rear Panel (shown with TSM Module)

IF INPUT
(70 or 140 MHz)

RF OUTPUT
(14000-14500 MHz)

I/O MODULE

MONITOR

&

CONTROL

CONVERTER
SIGNAL PATH
MODULE

OSC

SYNTHESIZER

OSC

5/10 MHz
REF. OSC.

POWER SUPPLY
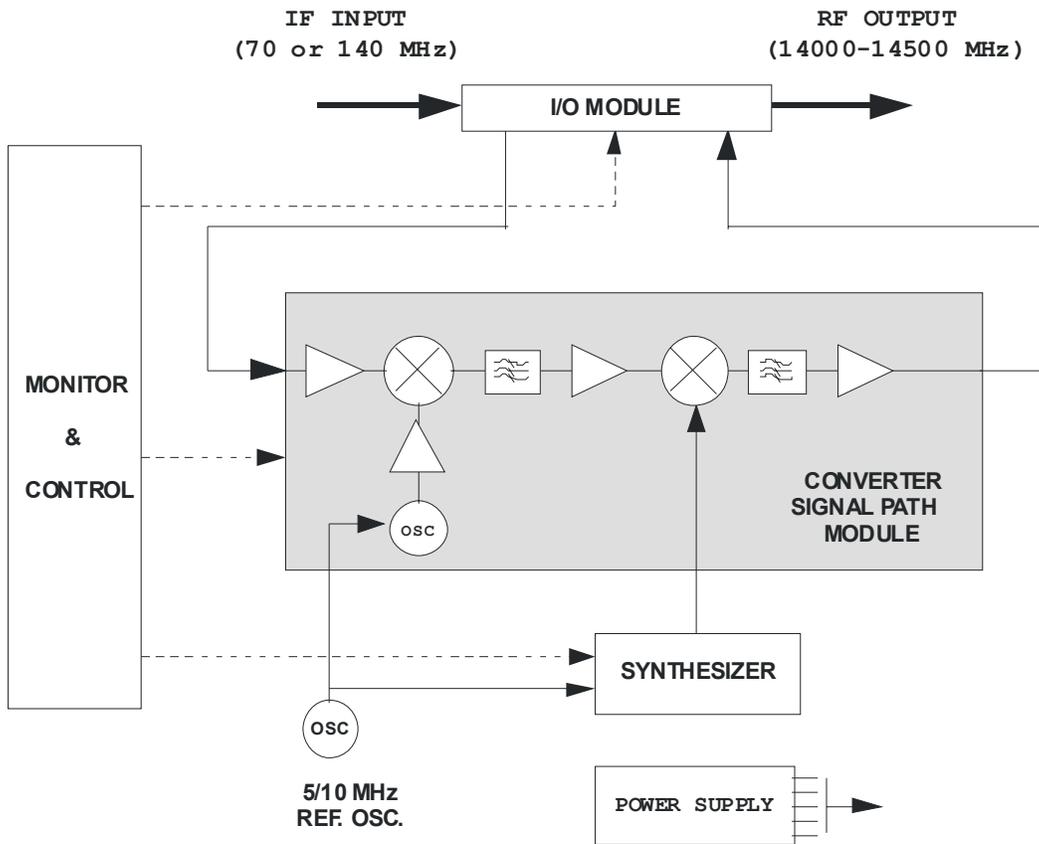
Figure 3. Typical Functional Block Diagram (Model UT-4514 shown)

1.3 SPECIFICATIONS

Note: Contact CEFD for specific requirements.

Table 1. UT-4505 C-Band Up Converter Specifications

Characteristic	Specification
Frequency Range	
UT-4505	5845 to 6425 MHz
Conversion	Dual, No Inversion
Step Size	125 kHz standard, 1kHz optional
Preset Channels	32 Frequencies and Gains
Stability Over Time	$\pm\ 1 \times 10^{-9}$ /Day
Stability Over Temp	$\pm\ 1 \times 10^{-8}$ 0 to 50°C
IF Input	
Noise Figure	12 dB Maximum at 0 dB Attenuation
Level	-35 dBm Typical
Range	+20 dBm at 1 dB Compression
	52 to 88 or 104 to 176 MHz, (optional 50 to 80 MHz or 100 to 180 MHz, see Note)
Impedance	50 or 75 Ω
Return Loss	23 dB Min. with IO Module or Switch Module
RF Output	
Output Level	+17 dBm at 1 dB Compression
Intermodulation	-50 dBc @ 0 dBm Output SCL
Carrier Mute	-70 dBc
Non–carrier Spurious	-80 dBm
Carrier Spurious	-65 dBc @ 0 dBm Output
AM to PM	0.1°/dB at -5 dBm Out
Return Loss	20 dB Minimum with IO Module
	18 dB Minimum with Switch Module
Impedance	50 Ω
Transfer	
Gain	35 dB ± 2 dB
Gain Adjust	0 to 25 in 0.25 dB Steps
	0.1 dB Steps Optional
Gain Stability	± 0.25 dB/Day
Ripple: 70 MHz IFCF	± 0.25 dB (± 18 MHz), optional ± 20 MHz, see Note)
140 MHz IFCF	0.75 dB (± 36 MHz), optional ± 40 MHz, see Note)
Slope	0.05 dB/MHz
IF Bandwidth	36 or 72 MHz, (optional 40 or 80 MHz, see Note)
External Ref.	Input 5 or 10 MHz @ +3dBm
	Optional 10 MHz Rear Panel Reference Output

Characteristic	Specification	
Group Delay		
Linear Group Delay	0.03 ns/MHz	
Parabolic Delay	0.01 ns/MHz^2	
Group Delay Ripple	1 ns Peak-to-Peak	
Phase Noise	**Limit (dBc/Hz)**	**Typical (dBc/Hz)**
100 Hz	-80	-83
1 KHz	-89	-92
10 KHz	-95	-97
100 KHz	-105	-109
1 MHz	-120	-124
Remote Control (Rear Panel)	Comm Port EIA-485 or EIA-232	
Indicators (Front Panel)		
Power On	Green LED	
Mute	Yellow LED	
Remote	Yellow LED	
Reference	Yellow LED	
Stored Fault	Red LED	
Fault	Red LED	
Test Points (Front Panel)		
RF Sample	SMA, -20 dBc Nominal	
IF Sample	BNC, -20 dBc Nominal	
Optional L.O. Sample		
Power		
Voltage	90 to 250 Vac Autoranging, optional –48 Vdc	
Frequency	47 to 63 Hz	
Dissipation	60 Watts	
Environmental		
Temperature	0 to 50° C (32 to 122° F)	
Altitude	10,000 Feet MSL	
Humidity	0 to 95 % Relative	
Physical		
Width	19 Inches (48.30 cm)	
Height	1.75 Inches (4.45 cm)	
Depth	22 Inches (55.90 cm)	
Weight	15 Pounds (7.00 kg)	
MTBF	49,740 hrs. (calculated)	
	>100,000 hrs. (field experience)	
Summary Alarm		
Relay Closure	Form C	

Table 2. UT-4505/E/F/G/H/J/X Up Converter Specifications

Characteristic	Specification
Frequency Range	
UT-4505	5845 to 6425 MHz
UT-4505/E	6725 to 7025 MHz
UT-4505/F	6425 to 6725 MHz
UT-4505/G	5925 to 6725 MHz
UT-4505/H	5850 to 6650 MHz
UT-4505/J	7025 to 7075 MHz
Conversion	Dual, No Inversion
Step Size	125 kHz standard, 1kHz optional
Preset Channels	32 Frequencies and Gains
Stability Over Time	$\pm 1 \times 10^{-9}$ /Day
Stability Over Temp	$\pm 1 \times 10^{-8}$ 0 to 50°C
IF Input	
Noise Figure	12 dB Maximum at 0 dB Attenuation
Level	-35 dBm Typical
Range	52 to 88 or 104 to 176 MHz, (optional 50 to 80 MHz or 100 to 180 MHz, see Note)
Impedance	50 or 75 Ω
Return Loss	23 dB Min. with IO Module or Switch Module
RF Output	
Output Level	+17 dBm at 1 dB Compression
Intermodulation	-50 dBc @ 0 dBm Output SCL
Carrier Mute	-70 dBc
Non–carrier Spurious	-80 dBm
Carrier Spurious	-65 dBc @ 0 dBm Output
AM to PM	0.1°/dB at -5 dBm Out
Return Loss	20 dB Minimum with IO Module
	18 dB Minimum with Switch Module
Impedance	50 Ω
Transfer	
Gain	35 dB ± 2 dB
Gain Adjust	0 to 25 in 0.25 dB Steps
	0.1 dB Steps Optional
Gain Stability	± 0.25 dB/Day
Ripple: 70 MHz IFCF	± 0.25 dB (± 18 MHz), optional ±20 MHz, see Note)
140 MHz IFCF	0.75 dB (± 36 MHz), optional ± 40 MHz, see Note)
Slope	0.05 dB/MHz
IF Bandwidth	36 or 72 MHz, (optional 40 or 80 MHz, see Note)
Slope	0.05 dB/MHz

Characteristic	Specification	
External Ref.	Input, either 5 or 10 MHz Option @ +3dBm Optional 10 MHz Rear Panel Reference Output	

Group Delay
    Linear Group Delay
    Parabolic Delay
    Group Delay Ripple
	0.03 ns/MHz
	0.01 ns/MHz^2
	1 ns Peak-to-Peak	

Phase Noise	**Limit (dBc/Hz)**	**Typical (dBc/Hz)**
100 Hz	-69	-72
1 KHz	-79	-82
10 KHz	-89	-92
100 KHz	-99	-102
1 MHz	-109	-112
Remote Control (Rear Panel)	COMM Port EIA-485 or EIA-232	

Indicators (Front Panel)
    Power On
    Mute
    Remote
    Reference
    Stored Fault
    Fault
	
	Green LED
	Yellow LED
	Yellow LED
	Yellow LED
	Red LED
	Red LED	

Test Points (Front Panel)
    RF Sample
    IF Sample
    Optional L.O. Sample
	
	SMA, -20 dBc Nominal
	BNC, -20 dBc Nominal	

Power
    Voltage
    Frequency
    Dissipation
	
	90 to 250 Vac Autoranging, optional –48 Vdc
	47 to 63 Hz
	60 Watts	

Environmental
    Temperature
    Altitude
    Humidity
	
	0 to 50°C (32 to 122°F)
	10,000 Feet MSL
	0 to 95 % Relative	

Physical
    Width
    Height
    Depth
    Weight
    MTBF
	
	19 Inches (48.30 cm)
	1.75 Inches (4.45 cm)
	22 Inches (55.90 cm)
	15 Pounds (7.00 kg)
	49,740 hrs. (calculated)
	>100,000 hrs. (field experience)	

Summary Alarm Relay Closure	 Form C	

Table 3. UT-4505I/M Up Converter Specifications

Characteristic	Specification
Frequency Range	
UT-4505I	5845 to 6725 MHz
UT-4505M	5725 to 6725
Conversion	Dual, No Inversion
Step Size	125 kHz standard, 1kHz optional
Preset Channels	32 Frequencies and Gains
Stability Over Time	$\pm 1 \times 10^{-9}$ /Day
Stability Over Temp	$\pm 1 \times 10^{-8}$ 0 to 50°C (32 to 122°F)
IF Input	
Noise Figure	12 dB Maximum at 0 dB Attenuation
Level	-35 dBm Typical
Range	52 to 88 or 104 to 176 MHz
Impedance	50 or 75 Ω
Return Loss	23 dB Min. with IO Module or Switch Module
RF Output	
Output Level	+17 dBm at 1 dB Compression
Intermodulation	-50 dBc @ 0 dBm Output SCL
Carrier Mute	-70 dBc
Non–carrier Spurious	-80 dBm
Carrier Spurious	-65 dBc @ 0 dBm Output
AM to PM	0.1°/dB at -5 dBm Out
Return Loss	20 dB Minimum with IO Module
Impedance	50 Ω
Transfer	
Gain	35 dB ± 2 dB
Attenuation Adjust	0 to 25 in 0.25 dB Steps
	0.1 dB Steps Optional
Gain Stability	± 0.25 dB/Day
Ripple:	± 0.25 dB (± 18 MHz),
	0.75 dB (± 36 MHz)
Slope	0.05 dB/MHz
External Ref.	Input, either 5 or 10 MHz
	Option @ +3 dBm
	Optional 10 MHz Rear Panel Reference Output
Group Delay	
Linear Group Delay	0.03 ns/MHz
Parabolic Delay	0.01 ns/MHz^2
Group Delay Ripple	1.0 ns Peak-to-Peak

Characteristic	Specification	
Phase Noise	**Limit (dBc/Hz)**	**Typical (dBc/Hz)**
100 Hz	-69	-72
1 KHz	-79	-82
10 KHz	-89	-92
100 KHz	-99	-102
1 MHz	-109	-112
Remote Control (Rear Panel)	Comm Port EIA-485 or EIA-232	
Indicators (Front Panel)		
Power On	Green LED	
Mute	Yellow LED	
Remote	Yellow LED	
Reference	Yellow LED	
Stored Fault	Red LED	
Fault	Red LED	
Test Points (Front Panel)		
RF Sample	SMA, -20 dBc Nominal	
IF Sample	BNC, -20 dBc Nominal	
Optional L.O. Sample		
Power		
Voltage	90 to 250 Vac Autoranging, optional –48 Vdc	
Frequency	47 to 63 Hz	
Dissipation	60 Watts	
Environmental		
Temperature	0 to 50° C (32 to 122° F)	
Altitude	10,000 Feet MSL	
Humidity	0 to 95 % Relative	
Physical		
Width	19 Inches (48.30 cm)	
Height	1.75 Inches (4.45 cm)	
Depth	22 Inches (55.90 cm)	
Weight	15 Pounds (7.00 kg)	
MTBF	49,740 hrs. (calculated)	
	>100,000 hrs. (field experience)	
Summary Alarm		
Relay Closure	Form C	

Table 4. UT-4514 and UT-4514/C/D/E/F Up Converter Specifications

Characteristic	Specification
Frequency Range	
UT-4514	14.00-14.50 GHz
UT-4514/C	12.75-13.25 GHz
UT-4514/D	13.75-14.50 GHz
UT-4514/E	14.70-15.00 GHz
UT-4514/F	12.75-14.50 GHz
Conversion	Dual, No Inversion
Step Size	125 KHz
Preset Channels	32 Frequencies and Gains
Stability Over Time	$\pm\ 1 \times 10^{-9}$ /Day
Stability Over Temp	$\pm\ 1 \times 10^{-8}$ 0-50° C
RF Output	
Output Level	+10 dBm at 1 dB Compression
Intermodulation	-38 dBc at 0 dBm Output
Carrier Mute	-70 dBc
Non–carrier Spurious	-80 dBm
Carrier Spurious	-65 dBc at 0 dBm Output
AM to PM	0.1°/dB at -5 dBm Out
Return Loss	20 dB Minimum with RF/IF Connector Module
	18 dB Minimum with Switch Module
Impedance	50 Ω
IF Input	
Noise Figure	13 dB Maximum at 0 dB Attenuation
Level	-35 dB Typical
Range	52 to 88 or 104 to 176 MHz, (optional 50 to 80
Impedance	MHz or 100 to 180 MHz, see Note)
Return Loss	50 or 75 Ω
	23 dB Minimum with RF/IF Connector Module or Switch Module
Transfer	
Gain	35 dB ± 2 dB
Gain Adjust	0-25 in 0.25 dB Steps
Gain Stability	± 0.25 dB/Day
Ripple	± 0.25 dB
Slope	0.05 dB/MHz
Linear Group Delay	0.03 ns/MHz
Parabolic Delay	0.01 ns/MHz 2
Group Delay Ripple	1 ns Peak-to-Peak
External Reference	5 or 10 MHz, +3 dBm Nominal

Characteristic	Specification	
Phase Noise	**Limit (dBc/Hz)**	**Typical (dBc/Hz)**
100 Hz	-72	-79
1 KHz	-79	-82
10 KHz	-89	-92
100 KHz	-98	-101
1 MHz	-110	-114
Indicators		
Power On	Green LED	
Mute	Yellow LED	
Remote	Yellow LED	
Reference	Yellow LED	
Stored Fault	Red LED	
Fault	Red LED	
Test Points		
RF Sample	SMA, -20 dBc Nominal	
IF Sample	BNC, -20 dBc Nominal	
Power		
Voltage	90-250 Vac Auto-ranging	
Frequency	47-63 Hz	
Dissipation	60 Watts	
Environment		
Temperature	0 - 50°C (32 to 122°F)	
Altitude	10,000 Feet MSL	
Humidity	0-95 % Relative	
Physical		
Width	19 Inches (48.30 cm)	
Height	1.75 Inches (4.45 cm)	
Depth	22 Inches (55.90 cm)	
Weight	15 Pounds (7.00 kg)	
Options		
- 1	RF/IF Connector Module	
- 2	Transmit Switch Module	
Summary Alarm		
Relay Closure	Form C	

Table 5. UT-4518 and UT-4518/E Up Converter Specifications

Characteristic	Specification
Frequency Range	
UT-4518	17.30-18.10 GHz
UT-4518/E	17.30-18.40 GHz
Conversion	Dual, No Inversion
Step Size	125 KHz
Preset Channels	32 Frequencies and Gains
Stability Over Time	$\pm 1 \times 10^{-9}$/Day
Stability Over Temp	$\pm 1 \times 10^{-8}$ 0-50°C
RF Output	
Output Level	+10 dBm at 1 dB Compression
Intermodulation	-38 dBc at 0 dBm Output
Carrier Mute	-70 dBc
Non–carrier Spurious	-80 dBm
Carrier Spurious	-65 dBc at 0 dBm Output
AM to PM	0.1°/dB at -5 dBm Out
Return Loss	20 dB Minimum with IO Module
	18 dB Minimum with Switch Module
Impedance	50 Ω
IF Input	
Noise Figure	13 dB Maximum at 0 dB Attenuation
Level	35 dB Typical
Range	52-88 or 104-176 MHz
Impedance	50 or 75 Ω
Return Loss	23 dB Minimum with IO Module or Switch Module
Transfer	
Gain	35 dB $\pm$ 2 dB
Gain Adjust	0 - 25 in 0.25 dB Steps
Gain Stability	$\pm$ 0.25 dB/Day
Ripple	$\pm$ 0.25 dB
Slope	0.05 dB/MHz
Linear Group Delay	0.03 ns/MHz
Parabolic Delay	0.01 ns/MHz 2
Group Delay Ripple	1 ns Peak-to-Peak
External Reference	5 or 10 MHz, +3 dBm Nominal

Characteristic	Specification	
Phase Noise	__LIMIT__	__TYPICAL__
100 Hz	-66 dBc/Hz	-69 dBc/Hz
1 KHz	-76 dBc/Hz	-79 dBc/Hz
10 KHz	-86 dBc/Hz	-89 dBc/Hz
100 KHz	-96 dBc/Hz	-99 dBc/Hz
1 MHz	-106 dBc/Hz	-109 dBc/Hz
Indicators		
Power On	Green LED	
Mute	Yellow LED	
Remote	Yellow LED	
Reference	Yellow LED	
Stored Fault	Red LED	
Fault	Red LED	
Test Points		
RF Sample	SMA, -20 dBc Nominal	
IF Sample	BNC, -20 dBc Nominal	
Power		
Voltage	90-250 Vac Autoranging	
Frequency	47-63 Hz	
Dissipation	60 Watts	
Environment		
Temperature	0 - 50° C (32 to 122° F)	
Altitude	10,000 Feet MSL	
Humidity	0-95 % Relative	
Physical		
Width	19 Inches (48.30 cm)	
Height	1.75 Inches (4.45 cm)	
Depth	22 Inches (55.90 cm)	
Weight	15 Pounds (7.00 kg)	
Options		
- 1	IO Module	
- 2	RF/IF Switch	
Summary Alarm		
Relay Closure	Form C	

1.3.1 DIMENSIONAL ENVELOPE (UT-4500)

Dimensions are shown in both inches and centimeters.
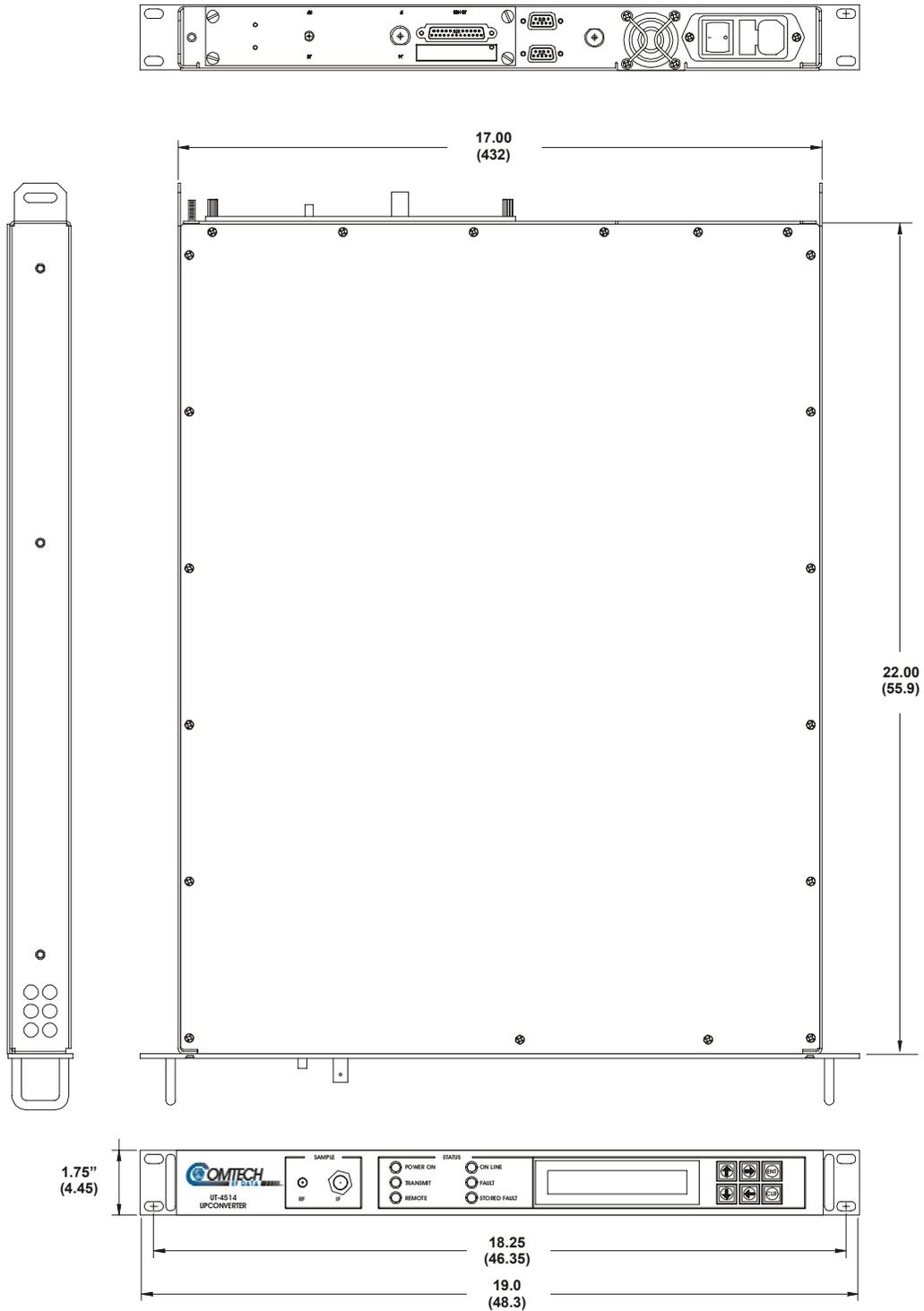
Figure 4. UT-4514 Dimensional Envelope

1.4 PHYSICAL CONFIGURATION

Figure 5 is a top view layout of a UT-4500 Series Up Converter chassis with the cover removed. Major chassis components are shown in **Figure 5**. The major module assemblies shown in the layout are:

‣ Signal Path Module.

‣ Step Loop Module.

‣ Monitor & Control (M&C) Assembly.

‣ Transmit I/O Switch Module - not shown - located in the right front space when facing the rear of the chassis.

‣ Reference Oscillator Assembly.

‣ Sum Loop Module

‣ Power Supply Assembly
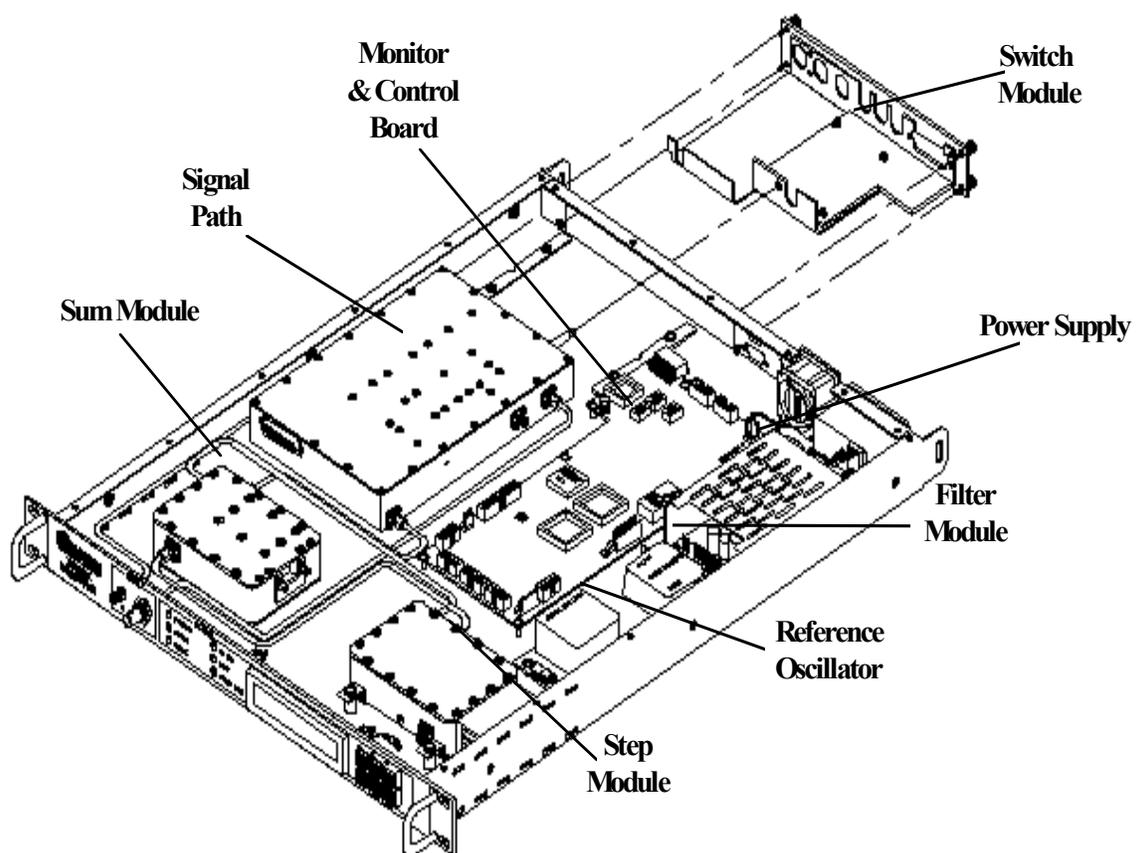
Figure 5. Physical Configuration - Up Converter

15

1.5 FRONT PANEL DISPLAY

The front panel display is a two line, 24-character, LCD display. Each configuration function, or operating mode, is shown on the display when the operator enters a command into the keypad on the front panel.

1.6 FRONT PANEL TEST POINT SAMPLES

Two test point connections are located on the front panel for monitoring the RF output and the IF input. An SMA connector is provided for the RF output, and a BNC connector is provided for the IF input. There also is an optional RF LO monitor available.

1.7 PRIME POWER SWITCH

The on/off prime power switch is located on the rear of the chassis adjacent to the prime power input connector. The power switch contains a filter and dual fuse. The dual fuse is rated for 2 Amps.

1.8 NEW IN THIS MANUAL

Changes made to Initial Issue:

Incorporated Errata, A through D for Rev. 0

Added paragraph 1.8 for description of change.

NOTES:

Chapter 2. Installation

2.1 UNPACKING AND INSPECTION

Inspect the shipping container for damage. If the shipping containers are damaged, keep them 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.

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

2.2 RACK MOUNT INSTALLATION

The UT-4500 Series Up Converters are designed for installation in a standard 19-inch rack cabinet or enclosure. The converter chassis requires 1-3/4 inches of panel height space. Adequate air ventilation should be provided on both sides of the rack mounted equipment.

If the converter is to be mounted on slides, the slides must be the Comtech EF Data rack slides provided with the converter. Mount the slides on the sides of the converter chassis with the mounting hardware provided. Then, install the slide rails in the rack cabinet enclosure.

Slide the converter into the front of the rack cabinet until the rear of the front panel contacts the mounting surface of the cabinet. Secure the converter to the rack cabinet with four screws inserted through the converter's front panel slotted holes.

2.3 PRIME POWER CONNECTION

The detachable power cord mates with the AC Prime power receptacle on the rear of the converter chassis. A power cord for connection to 90 to 125 VAC, or 205 to 240 VAC, power sources is provided with the converter.

2.4 CABLE CONNECTIONS

Connect the signal cables to the connectors on the rear panel as shown in **Figure 6**. The cable signal functions are listed in **Table 6**.

2.4.1 REAR PANEL CONNECTIONS

Table 6. Rear Panel Connectors

Connector	Description
Prime Power	AC Prime Power Input (AC POWER), Optional –48 VDC
J1:	Serial Communications Interface for EIA-485 or EIA-232 COMM links (COM 1).
J2:	External Reference Oscillator Input
J3:	High Speed Bus (HSB)
J4:	Converter IF Input (IF).
J5:	Converter RF Output (RF).
J6:	IF TSM Switching Loop Input (LP IN).
J7:	RF TSM Switching Loop Input (LP IN).
J8:	IF TSM Switching Loop Output (LP OUT).
J9:	RF TSM Switching Loop Output (LP OUT).
P1:	Summary Fault Output (RELAY).

2.4.2 EIA-485/EIA-232 INTERFACE (COM 1), CONNECTOR J1

The EIA-485/EIA-232 Interface connector, J1, is 9 pin "D" type DB9F connector socket. The pin-out specifications for EIA-485 are contained in **Table 7** and **Table 8**. The specification for EIA-232 is contained in **Table 9**. The mating connector is a DB9M.

<table>
<tr><td colspan="2">Table 7. J1, 2 Wire EIA-485 Interface Pin-Out</td></tr>
<tr><th>Pin #</th><th>Description</th></tr>
<tr><td>1</td><td>GND; Ground</td></tr>
<tr><td>2</td><td></td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td>+RX/TX; Signal</td></tr>
<tr><td>5</td><td>-RX/TX; Signal Complement</td></tr>
<tr><td>6</td><td></td></tr>
<tr><td>7</td><td></td></tr>
<tr><td>8</td><td>+RX/TX; Signal</td></tr>
<tr><td>9</td><td>-RX/TX; Signal Complement</td></tr>
</table>

Note: Pins 8 & 9 are the loop to the next converter.

<table>
<tr><td colspan="2">Table 8. J1, 4 Wire EIA-485 Interface Pin-Out</td></tr>
<tr><th>Pin #</th><th>Description</th></tr>
<tr><td>1</td><td>GND; Ground</td></tr>
<tr><td>2</td><td></td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td>+TX; Signal</td></tr>
<tr><td>5</td><td>-TX; Signal Complement</td></tr>
<tr><td>6</td><td></td></tr>
<tr><td>7</td><td></td></tr>
<tr><td>8</td><td>+RX; Signal</td></tr>
<tr><td>9</td><td>-RX; Signal Complement</td></tr>
</table>

<div align="center">Table 9. J1, EIA-232 Interface Pin-Out</div>

Pin #	Description
1	
2	TD; Transmit Data
3	RD; Receive Data
4	
5	GND; Ground
6	DSR; Unit Ready - always high.
7	RTS; Request to Send. Looped to CTS.
8	CTS; Clear to Send
9	

2.4.3 HIGH SPEED BUS (HSB), CONNECTOR J3

The High-Speed Bus connector, J3, is 25 pin "D" type DB25F connector socket. The pin-out specifications is contained in **Table 10**. The mating connector is a DB25M.

Note: **T**his is not a "straight through" cable assembly. Contact Comtech EF Data for detailed wire drawings when cabling between converters.

Table 10. J3, High Speed Bus Connector Pin-Out

Pin #	Description	Pin #	Description	Pin #	Description
1	Cntl_12	10	Aux_3	18	Cntl_3
2	Cntl_10	11	Aux_1	19	Cntl_1
3	Cntl_8	12	-Rx/Tx	20	+14V Out
4	Cntl_6	13	GND	21	+14V In
5	Cntl_4	14	Cntl_11	22	GND
6	Cntl_2	15	Cntl_9	23	Aux_2
7	Cntl_In	16	Cntl_7	24	GND
8	+14V Out	17	Cntl_5	25	+Rx/Tx
9	+14V In				

2.4.4 SUMMARY FAULT OUTPUT (RELAY), CONNECTOR P1

The summary fault output connector, P1, is 9 pin "D" type DB9F connector. The pin-out specifications are contained in **Table 11**. The mating connector is a DB9M.

Table 11. P1, Summary Fault Connector Pin-Out

Pin #	Description
1	Summary Fault NC
2	Summary Fault NO
3	
4	
5	Ground
6	Summary Fault Com
7	External Fault Input
8	
9	

Notes: 1   Pin 1 to Pin 6: Fault.

2   Pin 2 to Pin 6: No Fault.

3   Pin 7 to Pin 5: Forced Fault. Typically used with external group delay equalizers
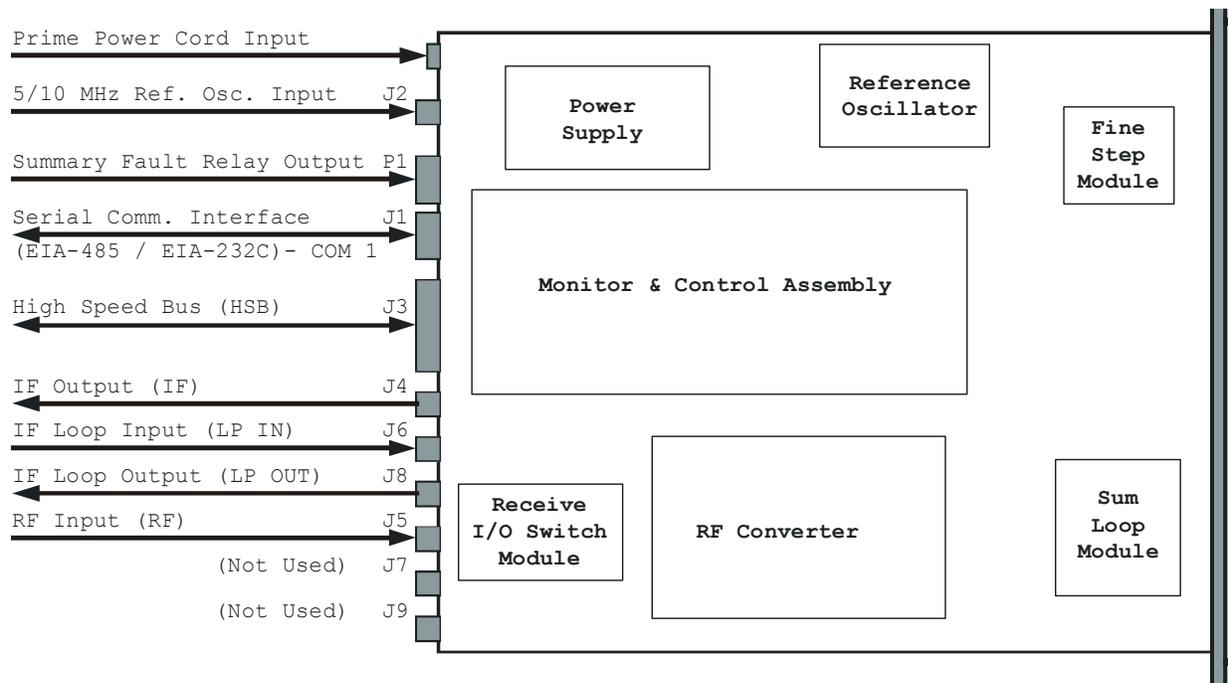
Figure 6. Cable Interconnect Diagram

2.4.5 CABLE CONNECTIONS FOR NON-REDUNDANT SYSTEM OPERATION

In non-redundant converter configuration the converter has an Input/Output Module (IOM-XX) for the RF input and the IF Output. A converter with a Transmit Switch Module may be operated in a non-redundant configuration if an IOM is unavailable. Figure 7 is an illustration of the converter cable connections with an IOM installed. **Figure 8** is an illustration of the converter cable connections with a TSM installed.

2.4.6 CABLE CONNECTIONS FOR REDUNDANT SYSTEM OPERATION

In subsystems where a redundant converter configuration is used, the backup converter has an Input/Output Module (IOM-XX) and the online converters have Transmit Switch Modules (TSM-XX) which switch to the backup converter when a fault is detected. Redundant system operation is discussed in Chapter 4, Redundant System Operation.

IOM-XX

J4　　　　　J5

J3 HSB　　　**IF**　　　**RF**

**IF
OUTPUT**

**RF
INPUT**

**NO
CONNECTION**
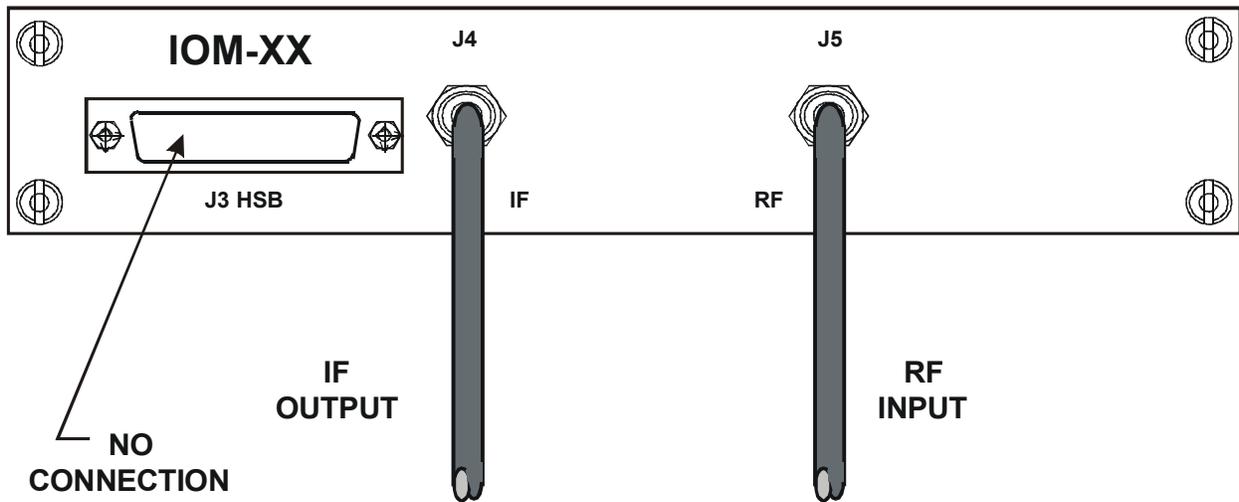
Figure 7. Non-Redundant Converter Configuration

TSM-XX

J4　　J6　　J8　　J5　　J7　　J9

J3 HSB　　**IF**　　**LP IN**　　**LP OUT**　**RF**　　**LP IN**　　**LP OUT**

IF OUTPUT

RF INPUT

**NO
CONNECTION**

UP CONVERTER - TSM

IF INPUT

RF OUTPUT
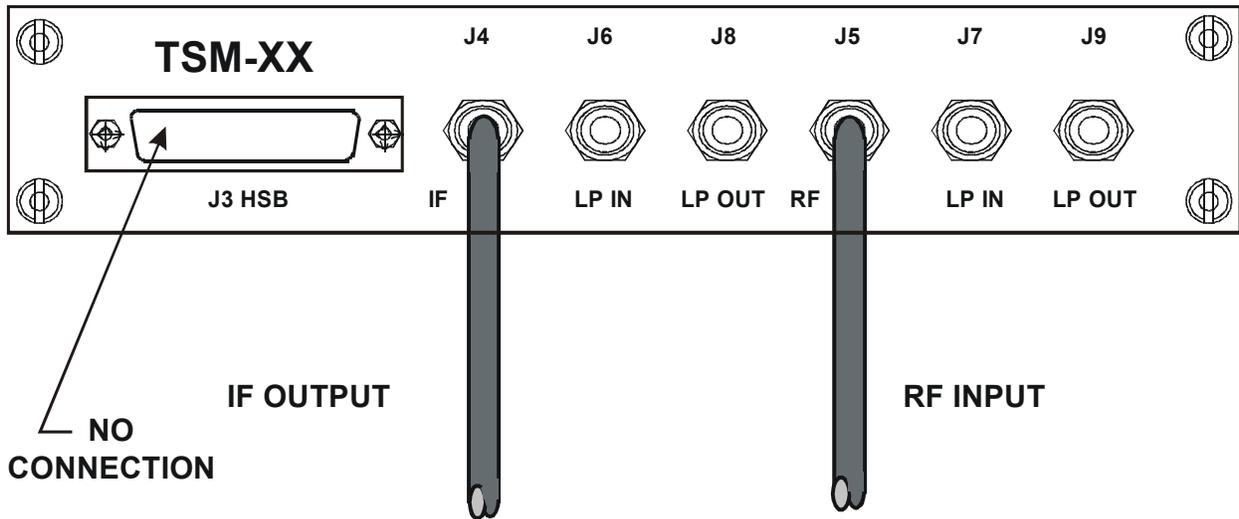
**Figure 8. Non-Redundant Converter Configuration With Transmit Switch Module (TSM-XX)
Installed**

Chapter 3. System Operation

3.1 OVERVIEW

This chapter contains instructions for operating the converter. Illustrations of the front and rear panels are provided showing the keypad for operator input commands, LCD Display, LED status indicators, and the connectors. Tables are provided to show the control and operating functions of the converter.

The front and rear panels are shown below. **Table 12** lists of the operating functions for the keypad, LCD display, LED indicators and test sample connections on the front panel.

Figure 9. Front Panel (Model UT-4505 shown)

Figure 10. Rear Panel (with TSM Module and optional REF Output)

Table 12. Operating Functions – Front Panel

Item	Reference Designation	Functional Description
ENT	Enter key	Enters commands into the converter.
CLR	Clear key	Clears commands and data selected and not entered.
→	Right Arrow key	Selects functions and the menu operating data.
←	Left Arrow key	Selects functions and the menu operating data.
↑	Up Arrow key	Selects the operating menu and data values.
↓	Down Arrow key	Selects the operating menu and data values.
UT_4514-1 SW VER 4.06 SN45143513	LCD Display	Displays commands and data entered into the keypad.
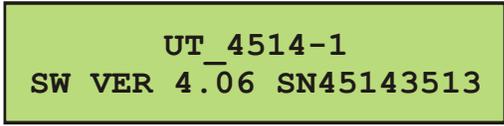
Indicator	Color	Function
POWER ON	Green	Prime power is applied when the light is on.
TRANSMIT	Yellow	Transmit function operating when the light is on.
REMOTE	Yellow	In Remote Control Mode when the light is on.
ON LINE	Yellow	Operating on-line to transmit data when the light is on.
FAULT	Red	Fault condition exists when the light is on.
STORED FAULT	Red	Faults stored and logged when the light is on.

Item	Reference Designation	Function
RF SAMPLE	RF	An SMA connector test point to sample RF.
IF SAMPLE	IF	A BNC connector test point to sample IF.

3.2 SWITCHING POWER ON

Before turning the Prime Power Switch to the ON position, check to ensure that the installation is complete, and verify that the converter is connected to the proper prime power source, RF Output and IF Input.

Switch the ON/OFF Prime Power Switch on the rear panel to ON. Verify that the cooling fan is operating, and that the POWER ON LED STATUS indicator light is on.

After the AC power is switched on and before pressing the buttons on the keypad, the LCD display message should be similar to:

```
   UT-4514-X

 SW VER 2.08    SN4514XXXX
```
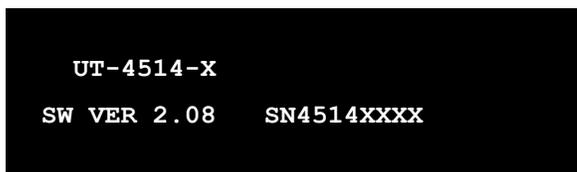
3.3 OPERATION

Local operation of the RF Up Converter is controlled by operator input commands initiated through the six button keypad on the front panel shown in **Figure 11**. The keypad is the local operator's interface to control, configure and monitor the status of the converter. Operator inputs and commands entered into the keypad are displayed by the front panel twenty-four character, two line, LCD display. See Chapter 5 for Remote Control.

There are six operating command functions: Configuration, Pre-Select, Monitor Status, Currents Faults, Stored Faults and Utility Functions. A flow chart for selecting the commands, operating menus, and data inputs is shown in **Figure 12** through **Figure 20**.
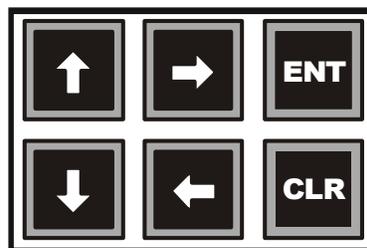
Figure 11. Keypad
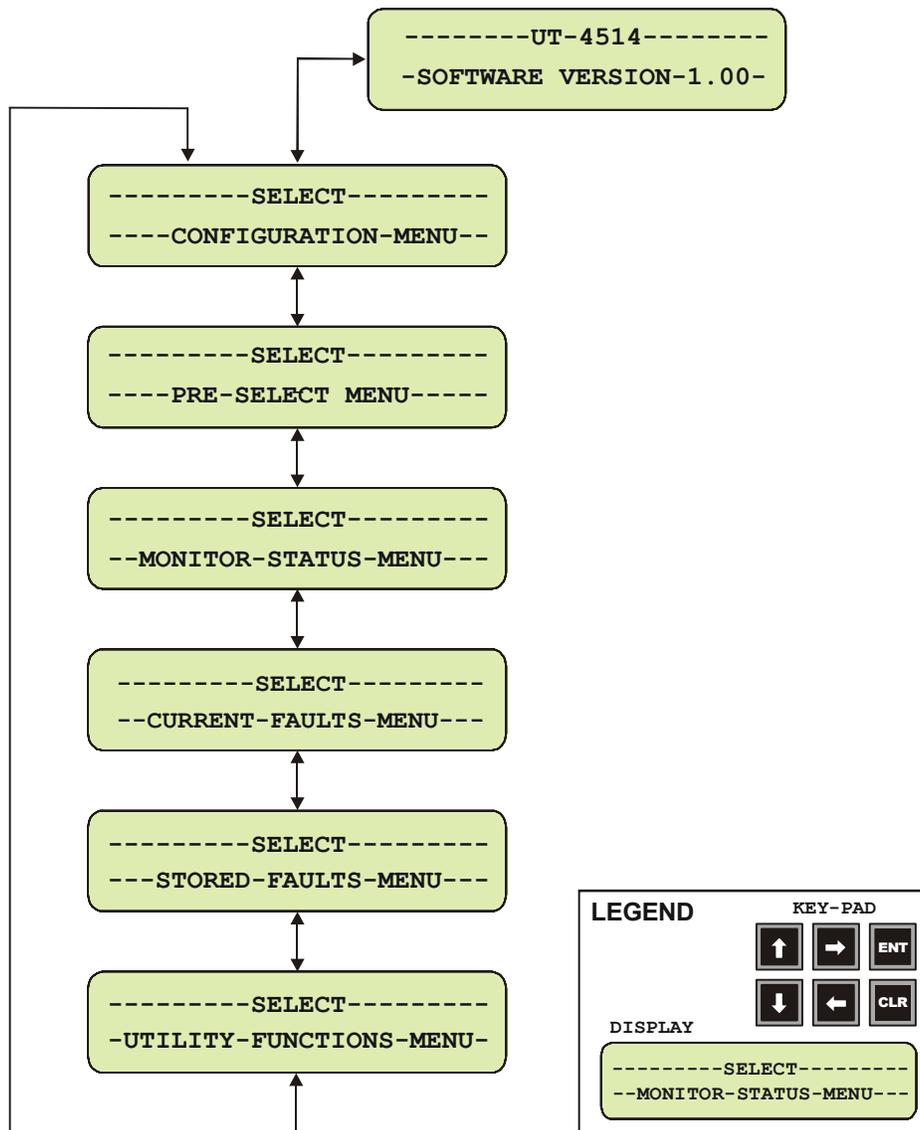
Figure 12. Converter Operating Command Functions

Figure 13. Configuration Menu Commands - Redundancy OFF.

* Displayed only when there is a 5/10 MHz reference input.

```
      ---------SELECT---------
      ----CONFIGURATION-MENU--
```

ENTER

```
FREQ= 14XXX.XXX-MHz-----
ATTN=-10.00-DB---Tx=OFF-
```

** Manual when "Redundancy
   Config ON" and not in "BU"

```
----EXTERNAL-5-MHz------
--REFERENCE-PRESENT-----
```

* Displayed only when there is
  a 5/10 MHz reference input.

```
--ENTRY-MODE-=-REMOTE---
-COLD-START-=-DISABLED--
```

```
FAULT RECOVERY:-MANUAL--
-----------------------
```

```
REDUNDANCY-CONFIG?-OFF--
-----------------------
```

ENT + DOWN + ENT

```
REDUNDANCY-CONFIG?-ON---
-CONVERTER-#-XX---------
```

CLR

LEGEND   KEY-PAD

↑ → ENT

↓ ← CLR

DISPLAY

```
---------SELECT---------
--MONITOR-STATUS-MENU---
```

Figure 14. Configuration Menu Commands - Redundancy ON, Backup Unit Not Selected

```
  ---------SELECT----------
  ----CONFIGURATION-MENU--
```

                    ENTER

```
  FREQ= 14XXX.XXX-MHz-----
  ATTN=-10.00-DB---Tx=OFF-
```

```
  ----EXTERNAL-5-MHz------
  --REFERENCE-PRESENT-----
```
* Displayed only when there is a 5/10 MHz reference input.

```
  --ENTRY-MODE-=-REMOTE---
  -COLD-START-=-DISABLED--
```

```
  FAULT RECOVERY:-MANUAL--
  -----------------------
```

```
  REDUNDANCY-CONFIG?-OFF--
  -----------------------
```

ENT + DOWN + ENT

ENT + UP + ENT

```
  REDUNDANCY-CONFIG?-ON---
  -CONVERTER-#-XX---------
```
ENT + RIGHT+UP + ENT

```
  REDUNDANCY-CONFIG?-ON---
  -CONVERTER-#-01---------
```

ENT + RIGHT+UP . . . +UP + ENT

```
  REDUNDANCY-CONFIG?-ON---
  -CONVERTER-#-BU---1:NN--
```

```
  -CONVERTER-123456789ABC-
  -AUTO/MAN-AAM-----------
```

```
  CONV-01-OFFSET=+00.00-DB
  --ACTIVATE-BACKUP:-NO---
```

```
  -CONV-#01-FRQ=XXXXX.XXX-
  -ATEN=10.00---MANUAL-OK-
```

LEGEND   **KEY-PAD**

[↑] [→] [ENT]
[↓] [←] [CLR]

DISPLAY

```
  ---------SELECT---------
  --MONITOR-STATUS-MENU---
```

**Figure 15. Configuration Menu Commands -
Redundancy ON and Backup Unit Selected**

```
---------SELECT---------
-----PRE-SELECT-MENU----
```

ENTER

```
-DISPLAY-PRE-SELECT-XX--
XXXXX.XXX-MHz--XX.XX--DB
```

```
-CONFIGURE-CONVERTER-TO-
-----PRE-SELECT?-XX-----
```

```
-PROGRAM-PRE-SELECT-XX--
XXXX.XXX-MHZ---XX.XX-DB-
```

```
----CLEAR-DATA-FROM-----
-----PRE-SELECT?-XX-----
```

LEGEND   KEY-PAD

↑ → ENT
↓ ← CLR

DISPLAY

```
---------SELECT---------
--MONITOR-STATUS-MENU---
```
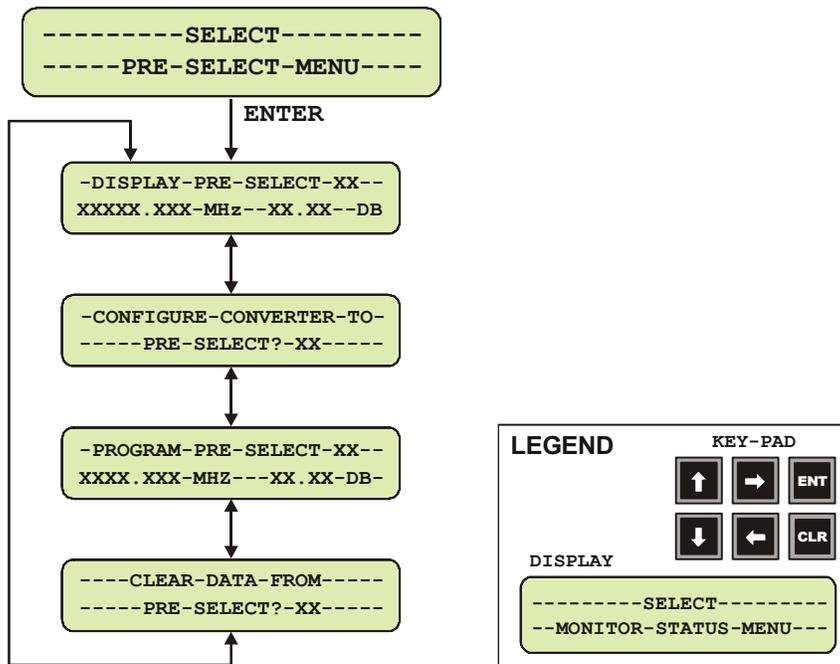
Figure 16. Pre-Select Menu Commands

```
---------SELECT---------
---MONITOR-STATUS-MENU--
```

ENTER

```
15VDC=-15.6--14VDC=-14.0
-VCC-=5.0---5VCis-=-4.0-
```

```
--CONVERTER-TEMP-=-+50C-
--IFLO-TUNING-=-X.X-V---
```

```
SYNTH.-TUNING-=-X.X-V---
--COARSE=X.XX-FINE=X.XX-
```

LEGEND   KEY-PAD

↑ → ENT
↓ ← CLR

DISPLAY

```
---------SELECT---------
--MONITOR-STATUS-MENU---
```
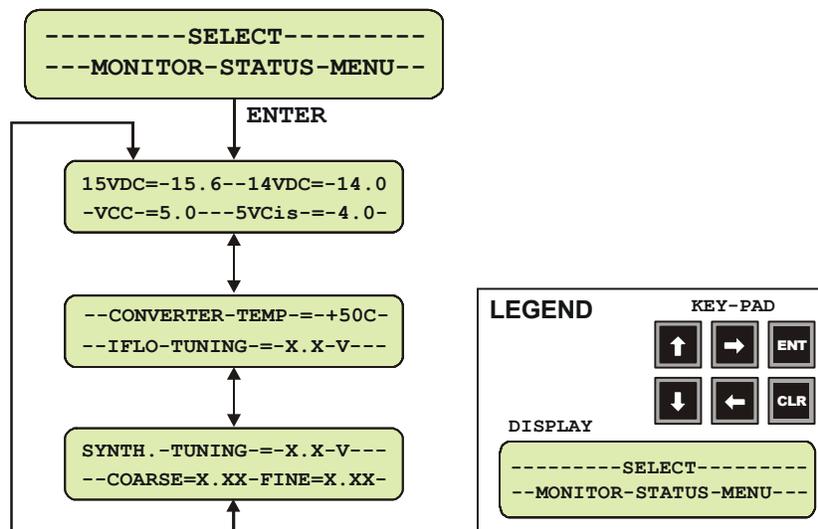
Figure 17. Monitor Status Menu Commands

```
---------SELECT---------
---CURRENT-FAULTS-MENU--
```
           │ ENTER
           ▼
```
------POWER-FAULTS------
15VDC=OK-14VDC-OK-VCC=OK
```
           ↕
```
-INFO-LOCK-DETECT-=-OK--
REFERENCE-LOCK-DET-=-OK-
```
           ↕
```
SYNTH-FAULTS:-SUM-LD=OK-
FINE-LD=OK--COARSE-LD=OK
```
           ↕
```
-CONV-TEMPERATURE-=-OK--
--HIGH-SPEED-BUS-=-OK---
```

LEGEND KEY-PAD

↑ → ENT
↓ ← CLR

DISPLAY
```
---------SELECT---------
--MONITOR-STATUS-MENU---
```
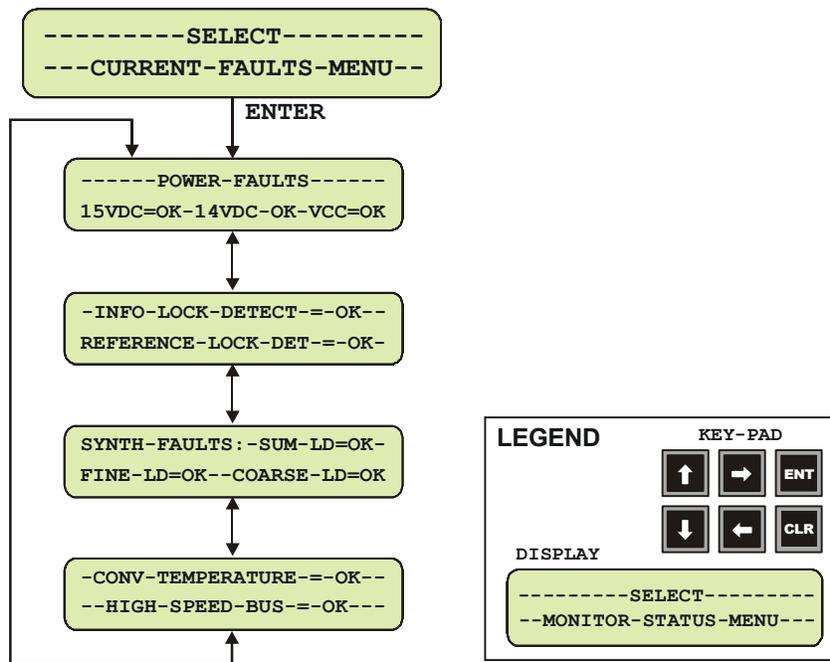
Figure 18. Current Faults Menu Commands

```
---------SELECT---------
---STORED-FAULTS-MENU---
```
           │ ENTER
           ▼
```
TOTAL-FAULTS-STORED:--XX
LAST-19:20:05---05/19/02
```
           ↕
```
----CLEAR-ALL-STORED----
-------FAULTS?-NO-------
```
           ↕
```
ST-FAULT-XX-----19:20:05
OK-FINE-LOCK----05/19/02
```

ENT + UP
to scroll thru
◄ Stored Faults

◄ CLR to return

LEGEND KEY-PAD

↑ → ENT
↓ ← CLR

DISPLAY
```
---------SELECT---------
--MONITOR-STATUS-MENU---
```

**Figure 19. Stored Faults Menu Commands**

Figure 20. Utility Function Menu Commands

3.3.1 CONVERTER COMMANDS

The converter commands are in a tree structured menu format designed for access and execution of all control functions, and to prevent the execution of an invalid entry by the operator. When the prime power is turned on, the LCD display will contain a message indicating the converter model number and the version number of the firmware installed in the converter.

To select a Command Function press the "ENT" button on the keypad. The LCD display will indicate:

```
SELECT

CONFIGURATION MENU
```

This will provide the local operator access to the Command Function Menus, which is the top level structure to start the selection of Command Function Menus to input into the converter. To sequence to the next Command Function Menu press a "DOWN" or "UP" arrow button on the keypad. The converter will step to the next Command Function Menu each time a "DOWN" or "UP" arrow button is pressed. The current Command Function Menu will be displayed on the LCD display. The Command Function Menus are shown in **Figure 12**.

To select a specific Command Function Menu press the "ENT" keypad button. If a function is selected in error, press the clear ("CLR") button which will return the converter to the main command menus to allow the selection of another function. Any one of the six Command Function Menus can be selected using this procedure.

Once a Command Function has been selected, use the "RIGHT" or "LEFT" arrow keypad buttons to sequence through the Operating Mode Commands. Each of the modes will be displayed on the LCD display. A specific operating mode is selected by pressing the "ENT" button. If an mode is selected in error, press the clear ("CLR") button which will return the converter to the operating menus to allow the selection of another mode.

When an operating mode is selected, a parameter or a digit within the parameter will be flashing on the LCD display. Use the "RIGHT" and "LEFT" arrows buttons to sequence through the parameters or digits to select the next parameter or digit. A specific parameter or value is selected by pressing the "ENT" button. If a parameter or value is selected in error, press the clear ("CLR") button which will return the converter to the original parameter or value to allow another selection.

After selecting a parameter or digit, use the "UP" or "DOWN" arrow buttons to select the next parameter, or to increment or decrement the value of a digit. A specific new parameter or new value is selected by pressing the "ENT" button. If a parameter or value is selected in error, press the clear ("CLR") button which will return the converter to the original parameter or value to allow another selection.

Each time the clear ("CLR") button is pressed, the converter will return to the menu level prior to the last "ENT" command.

3.3.2 CONFIGURATION FUNCTIONS MENU

The Configuration Functions are as follows:

3.3.2.1 FREQUENCY OPERATING MODE

Frequency (FREQ):

Displays the current converter frequency in MHz, and allows the selection of a new frequency channel between RF_{Low} to RF_{High} MHz (e.g.; 14000.000 to 14500.000 MHz for Model UT-4514) in 125 KHz steps through keypad inputs.

Attenuation (ATTN):

Input and displays the converter attenuation setting which is selected between 0.00 to 25.00 in 0.25 dB steps. The default setting is 10.00 dB.

Tx: The converter is ON or OFF. The default mode is OFF.

3.3.2.2 EXTERNAL REFERENCE

External Reference:

The External Reference is displayed only when the 5 or 10 MHz external reference input to the converter is present.

3.3.2.3 ENTRY MODE/COLD START

The entry mode is Local or Remote. The default is Remote.

COLD Start:

The COLD Start Mode, if enabled, mutes the converter output signal for a pre-determined time, 15 minutes, after power is applied to the converter to ensure that the reference oscillator is stable. The default mode is Disabled. This function is disabled in redundant systems.

3.3.2.4 FAULT RECOVERY

Fault Recovery:

Fault Recovery is Manual or Auto. The default is Auto.

3.3.2.5 REDUNDANCY MODE

Refer to Chapter 4, Redundant System Operation.

3.3.3 PRE-SELECT FUNCTION MENU

3.3.3.1 DISPLAY PRE-SELECT

Displays the frequency and attenuation pre-selects for the converter. 1 to 32 frequencies can be pre-selected. If no frequencies have been pre-selected, the LCD display will indicate "NONE".

3.3.3.2 CONFIGURE CONVERTER TO PRE-SELECT

This command allows the local operator to pre-select from 1 to 32 frequencies to pre-set a programmed frequency channel and attenuation setting.

3.3.3.3 CLEAR DATA FROM PRE-SELECT

This command allows the local operator to clear a pre-set frequency and attenuation setting from a pre-selected converter.

3.3.3.4 PROGRAM PRE-SELECT

This command allows the local operator to input a pre-set frequency channel and attenuation settings into a converter.

3.3.4 MONITOR STATUS FUNCTION MENU

Monitors and displays the status of:

▸ 15 and 14 Vdc power supplies.
▸ Converter internal temperature.
▸ IFLO tuning voltage level.
▸ Synthesizer Sum., Coarse and Fine Loop tuning.

3.3.5 CURRENT FAULTS FUNCTION MENU

Displays the status of the current fault conditions. The LCD display will indicate "FT" when a fault condition exists. The display will indicate "OK" when a fault has not occurred.

3.3.5.1 POWER FAULTS

Displays the DC voltage power supply faults.

▸ 15 Vdc Power Supply.
▸ 14 Vdc Power Supply.
▸ VCC voltage.

3.3.5.2 CONVERTER OSCILLATOR FAULTS

Displays the converter oscillator faults:

▸ IFLO Lock Detect.
▸ Reference Oscillator Lock Detect (only present if external reference is detected.).

3.3.5.3 SYNTHESIZER FAULTS

Displays the synthesizer faults:

  ‣ Sum Loop Detect.
  ‣ Coarse Loop Detect.
  ‣ Fine Loop Detect.

3.3.5.4 CONVERTER OVER TEMPERATURE FAULT

Displays a converter temperature fault condition.

3.3.6 STORED FAULTS

The converter displays a total of one hundred (100) faults which are date and time
stamped and stored in memory as they occur. The stored faults remain in memory until a
clear command is entered. When the number of faults reaches 100, the 100th fault will
display ER.

3.3.6.1 TOTAL STORED FAULTS

Displays the total number of faults stored. The most recent fault stored is displayed on
the LCD display.

3.3.6.2 CLEAR ALL STORED FAULTS

Input command to clear all faults. The command is "YES" or "NO' which is displayed on
the LCD display.

3.3.6.3 DISPLAY STORED FAULT

The local operator can sequence through the stored faults starting with the most recent
fault. The fault number, time, description and date is displayed on the LCD display.

3.3.7 UTILITY FUNCTION MENU

The local operator can input commands to the following Utility Functions which are displayed on the LCD display:

▹ TIME. Military time is used in hours, minutes and seconds.

▹ DATE. The date is displayed in month, day and year.

▹ Serial MODE (communications link).

▹ EIA-485 or EIA-232.

▹ Physical Address. The default address starts from one (001).

▹ BAUD (Rate). The default baud rate is 9600.

▹ PARITY. Even, Odd or None.

▹ Display Controls.

▹ DISPLAY CONTRAST. The default is 15, with values from 0 - 30.

▹ DISPLAY BRIGHTNESS. The default is 15, with values from 0 - 30.

▹ REF Adjust.

REFERENCE FREQUENCY ADJUSTMENT. The default tuning adjustment is 87, with values from 0 – 255

NOTES:

Chapter 4.
Redundant System Operation

4.1 OVERVIEW

The Comtech EF Data UT-4500 Series Up Converters are configured for redundant system operation using distributed protection switching in an active "Daisy Chain" configuration. Comtech EF Data's Proprietary "Daisy Chain" configuration distributes the converter protection switching functions in the converters.

This provides a system capability to backup from 1 to 12 online converters. A High Speed Bus (HSB) provides the communications interface between the backup and online converters to detect faults and reconfigure the subsystem to replace the failed converter.

When a faulted converter is removed from active operation, it is detached from the active converter chain by separating the converter from its switch module, leaving the active online converter chain intact through the switch module. The chain can be extended without affecting the online converter operation.

The active "chained" converters in a redundancy subsystem can also be indirectly controlled through the backup converter using the remote serial communication link - this capability is discussed in Chapter 5, Remote Control.

4.2 BACKUP CONVERTER

The "Daisy Chain" terminates in the backup converter. The backup converter has a microprocessor which performs fault detection, self reconfiguration and the logical switching functions. If the backup converter does not have a fault, it will assume the frequency and attenuation of the faulted converter and compensate for the chain losses. This capability is accomplished through the operation of the High Speed Bus (HSB) and the online converter detachable switch modules.

4.2.1 HIGH SPEED BUS (HSB)

In the "Daisy Chain" configuration, the backup converter communicates with the online units through the high-speed interface bus (HSB). The backup converter is able to detect faults and reconfigure itself to replace the faulted converter. The HSB interface is also used in the backup converter to monitor configuration changes made to an online converter. Changes in frequency, gain, or polarity are immediately entered into the backup table as well as information from new online units. The high-speed bus does not interfere with the remote serial communication link access to any of the converters in the chain.

4.2.2 DETACHABLE MODULES

Comtech EF Data's converters are designed with a detachable Input/Output Module (IOM) which contain the signal path connectors. The IOM is utilized for single thread operation, or for testing of the unit.

For redundant "Daisy Chain" operations, the on-line up converters are provided with a detachable Transmit Switch Module (TSM) replacing the IOM.

4.2.2.1 UP CONVERTER SWITCHING

Up converter switching is implemented with a detachable Transmit Switch Module (TSM). The TSM contains IF and RF transfer switches for input/output looping of the signal. Options for the TSM include SMA connectors for the RF output signal, and 50 or 75Ω BNC connectors for the IF.

4.3 REDUNDANT CONFIGURATIONS

Comtech EF Data UT-4500 Series Up Converters can be configured in several different redundant subsystem "Daisy Chain" configurations to meet the reliability requirements of a communication system. These configurations include:

Table 13. 4500 Series Up Converter Configurations

| 1:1 Redundant Subsystems		
	Single Source IF Input Configuration	
		The online converter uses an IF and RF transfer switch to switch the IF input and RF output signals. A single switched IF input and RF output is provided to and from the online converter. The transfer switches are contained in the Transmit Switch Module (TSM) installed in the online converter. When a fault occurs in the online converter, the TSM is de-activated to switch out the online converter, and switch the IF input and RF output to the backup converter. **Figure 21** is an illustration of the cable connections between the converters. **Figure 22** is a block diagram of this 1:1 redundant converter configuration.
	Dual Source IF Input Configuration	
		Two IF inputs, IF input #1 (priority) and IF input #2, are switched in the Transmit Switch Module (TSM) to provide redundant operation of the converters. The converters provide two switched RF outputs, RF output #1 (priority) and RF output #2. If converter #1 faults, converter #2 backs up the priority channel and IF signal #2 and RF signal #2 are not operational. **Figure 25** is an illustration of the cable connections between the converters. **Figure 26** is a block diagram of the 1:1 redundant, dual source IF input, converter configuration.
1:N Redundant Subsystems		
		IF and RF transfer switches in the TSM are used to switch the IF input and RF output of a faulted online converter to the backup converter. The IF input and RF output to the redundant converter subsystem is connected to online converter #N. **Figure 27** is an illustration of the cable connections between the converters. **Figure 28**is a block diagram of this 1:N redundant "Daisy Chain" converter configuration.
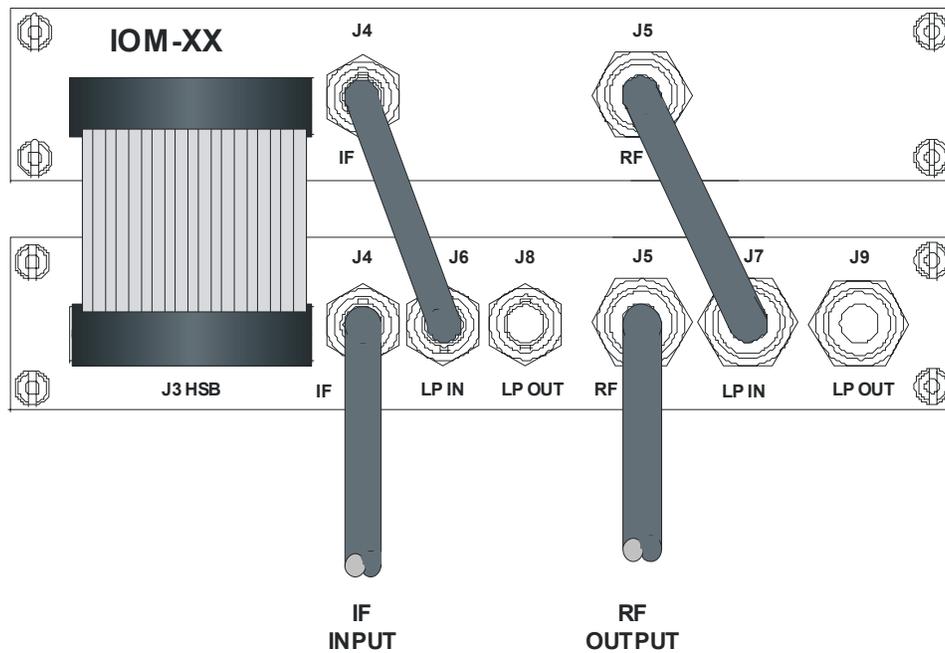
Figure 21. 1:1 Redundant Configuration - Single Source IF Input w/IOM and TSM-XX Installed
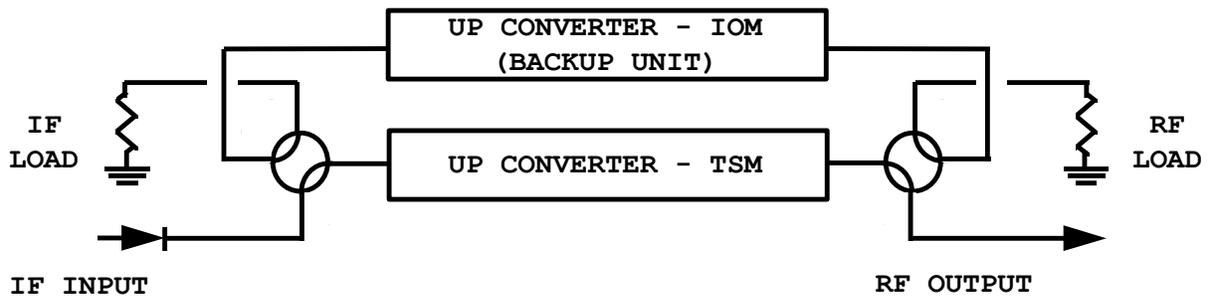

Figure 22. 1:1 Redundant Configuration Diagram - Single Source RF Input w/IOM-XX and TSM-XX Installed
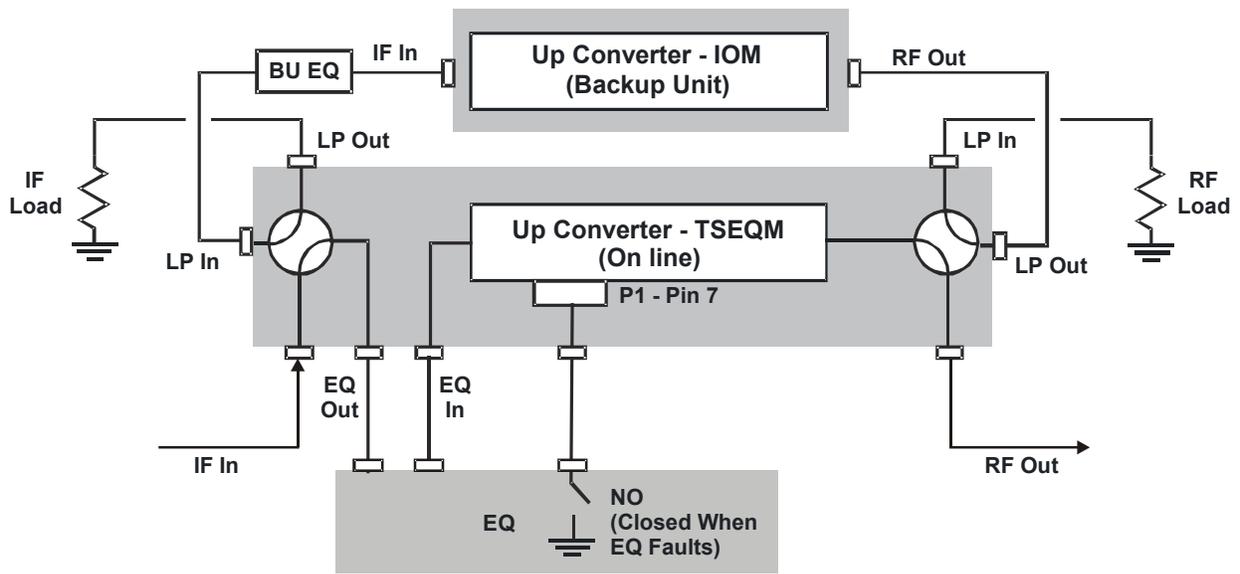
**Figure 23. 1:1 Redundant Configuration Diagram -
Single Source RF Input with IOM-XX and TSEQM-XX Installed**
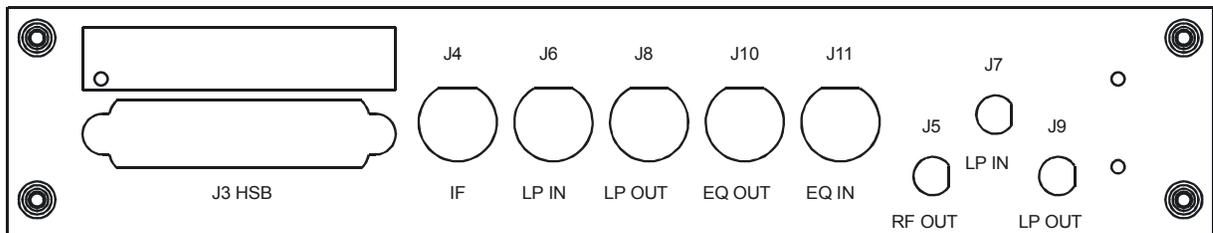

Figure 24. TSEQM Connection Locations
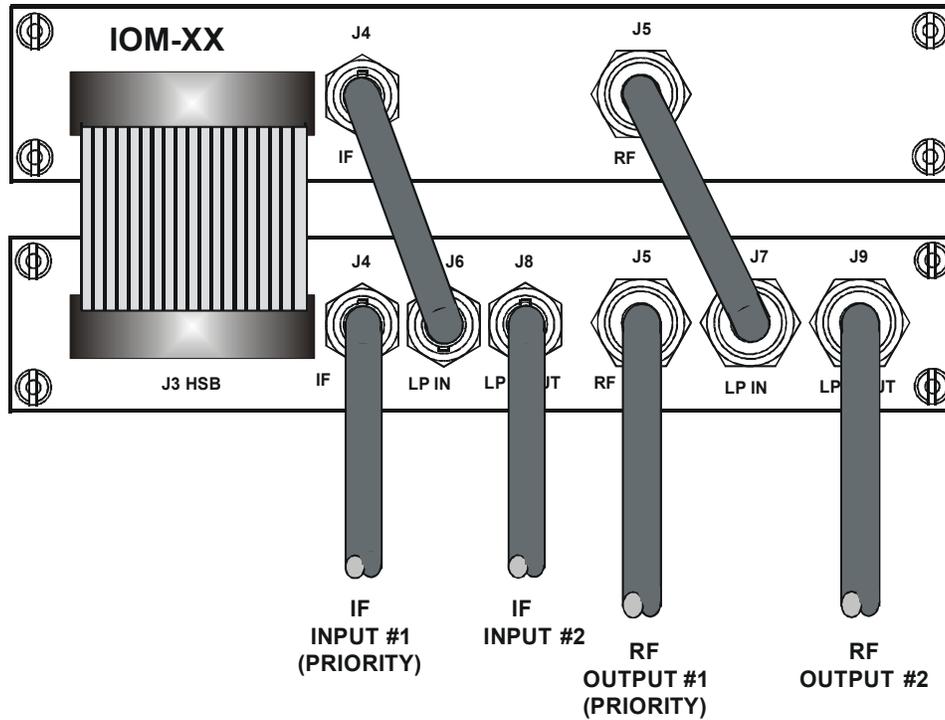
Figure 25. 1:1 Redundant Configuration - Dual Source IF Input
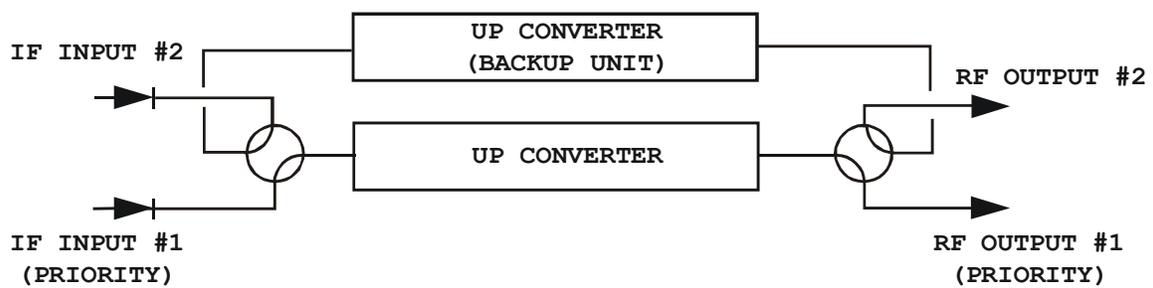
**Figure 26 1:1 Redundant Configuration Diagram
Dual Source IF Input with IOM-XX and TSM-XX Installed.**
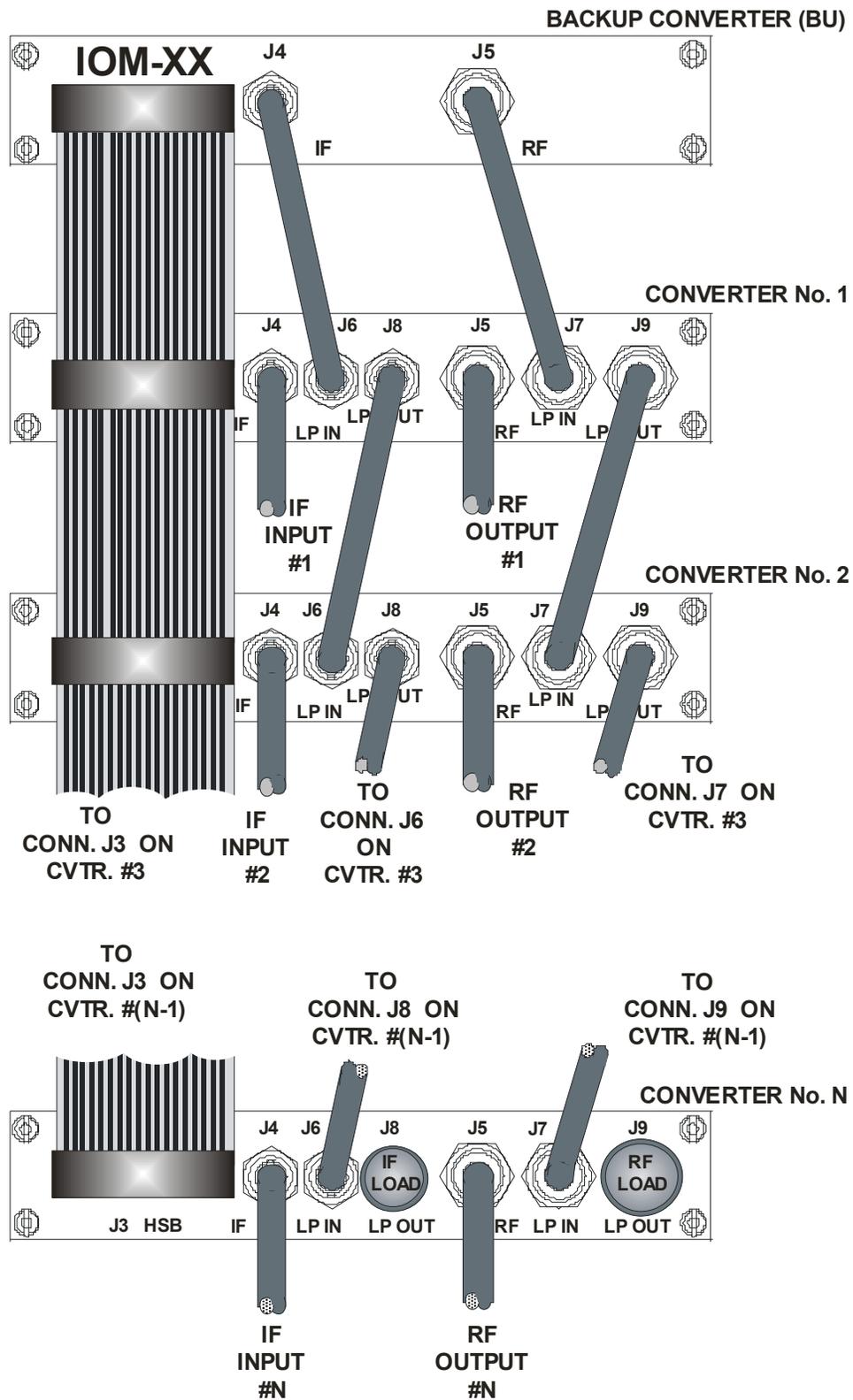
**Figure 27. 1:N Redundant Configuration with IOM-XX and TSM-XX Installed**
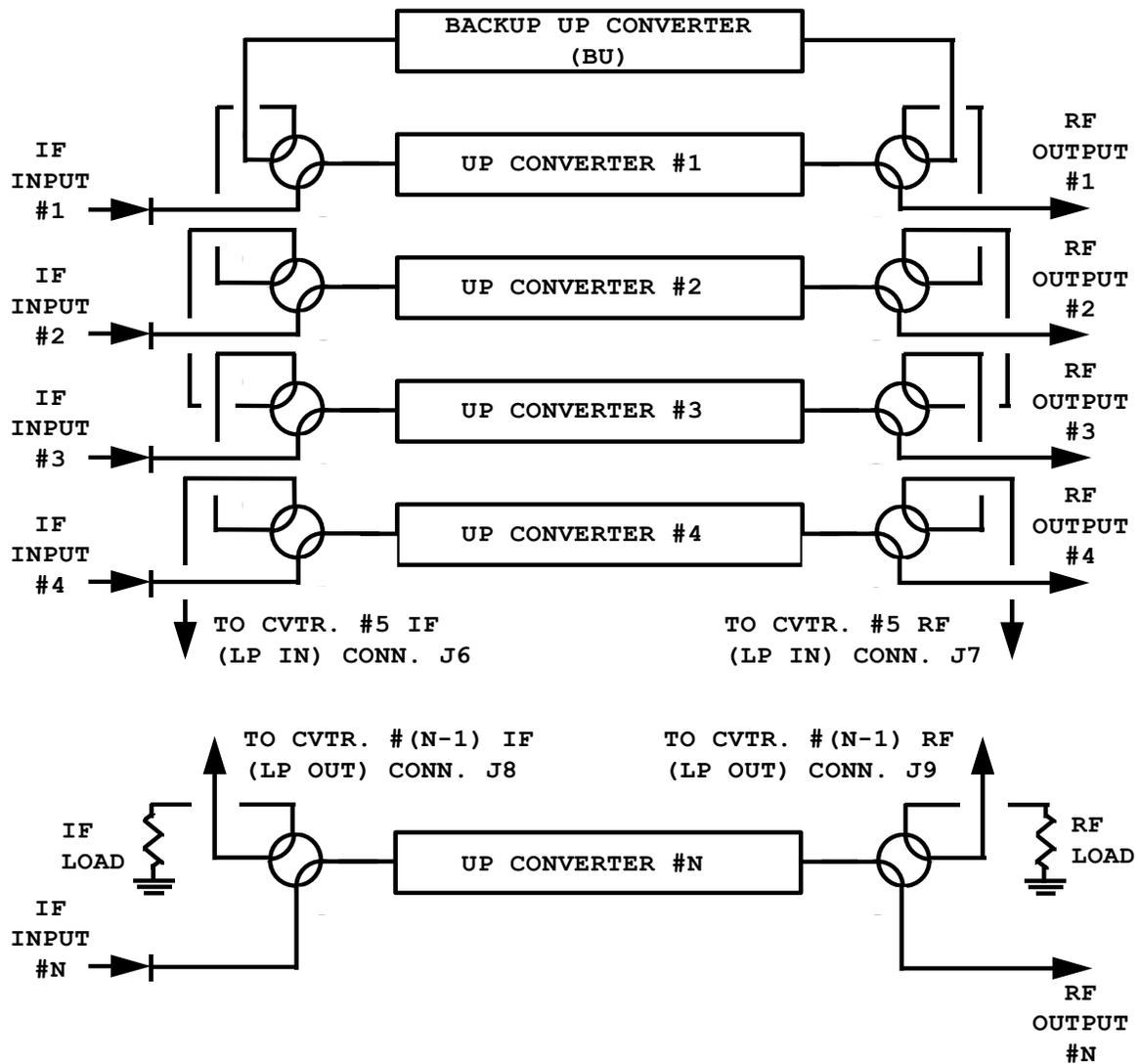
**Figure 28. 1:N Redundant Configuration Diagram
with IOM-XX and TSM-XX Installed**

4.4 REDUNDANT SYSTEM CONFIGURATION

4.4.1 INITIAL CONFIGURATION

Redundant system configuration is controlled from the converter's front panel configuration menu. Each online unit is assigned a redundancy configuration address. This address is dependent on the location of the online converter with reference to the backup. The unit closest to the backup must be converter # 1. The next unit down must be converter # 2. **Figure 29** shows the appropriate entries for a 1:3 system
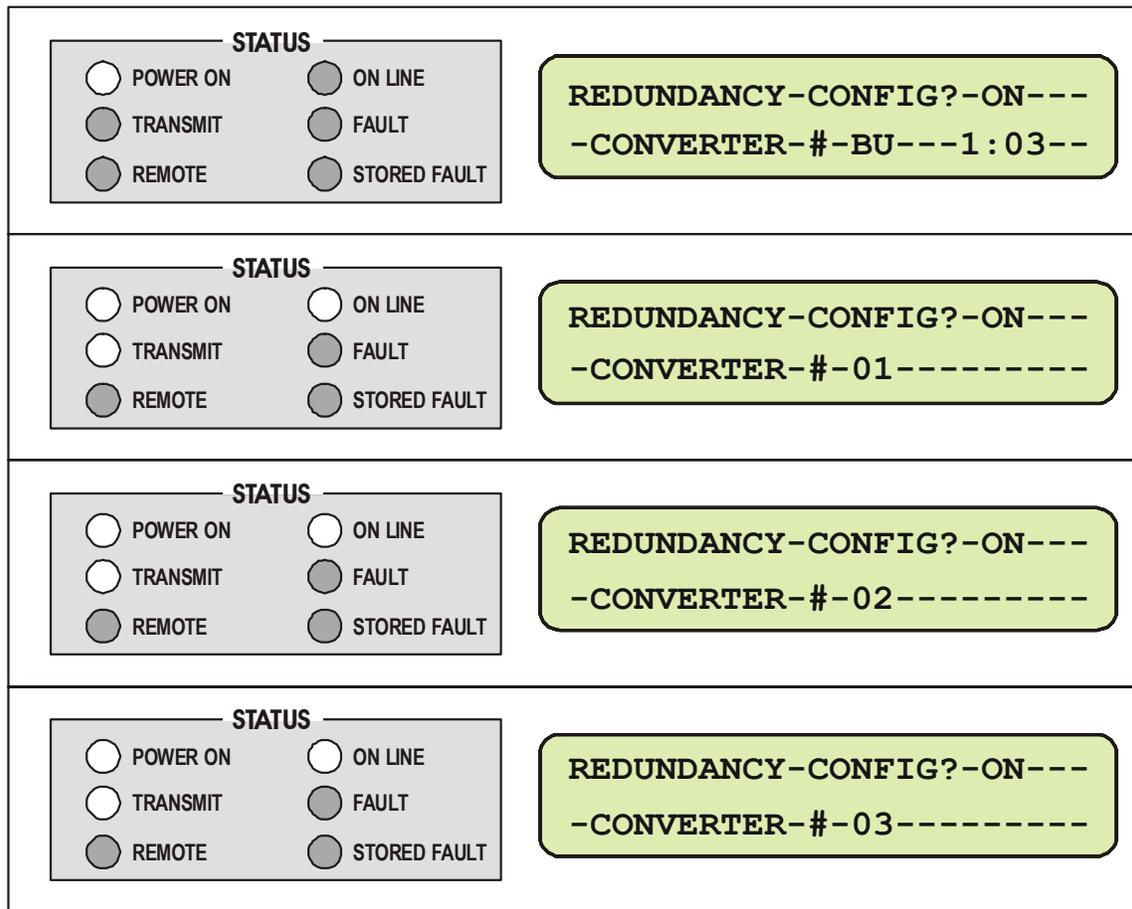
Figure 29. 1:3 Front Panel Displays

Configure the online units first, and then configure the backup unit. Redundant polling starts when the backup is configured. If this polling starts before the online units are configured, a high-speed bus fault will result. This fault should clear when configuration is completed. At this point, control of the redundant system is performed from the backup converter.

4.4.2 AUTOMATIC CONFIGURATION VERIFICATION

The backup converter has a menu that allows the operator to choose, on a converter-by-converter basis, manual (M) or automatic (A) operating mode.

Figure 30 shows the system configured for automatic (A) operation. In this mode, failure of an online converter will automatically cause a switchover to the redundant unit to occur. In the field, the simplest way to test this mode is to turn off an online unit. The AUTO/MANUAL selection is made in the converter. The online units will report their status as show in **Figure 30**.
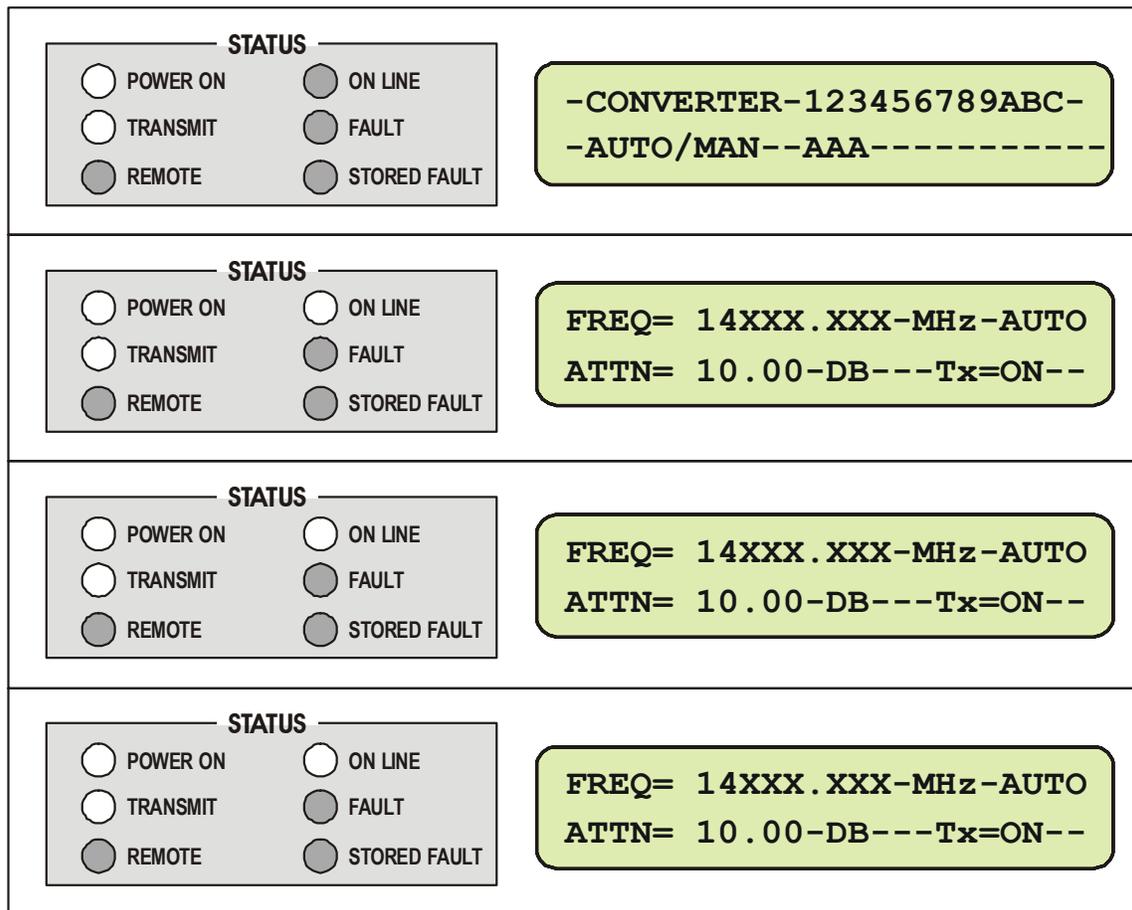
Figure 30. 1:3 System in AUTO Redundant Mode

Figure 31 depicts the front panel displays after power has been turned off on converter #1. Note the on line LED is illuminated on the backup converter. This indicates that the backup is now providing the frequency translation in place of the online unit. As soon as power is restored, converter #1 will come back online.
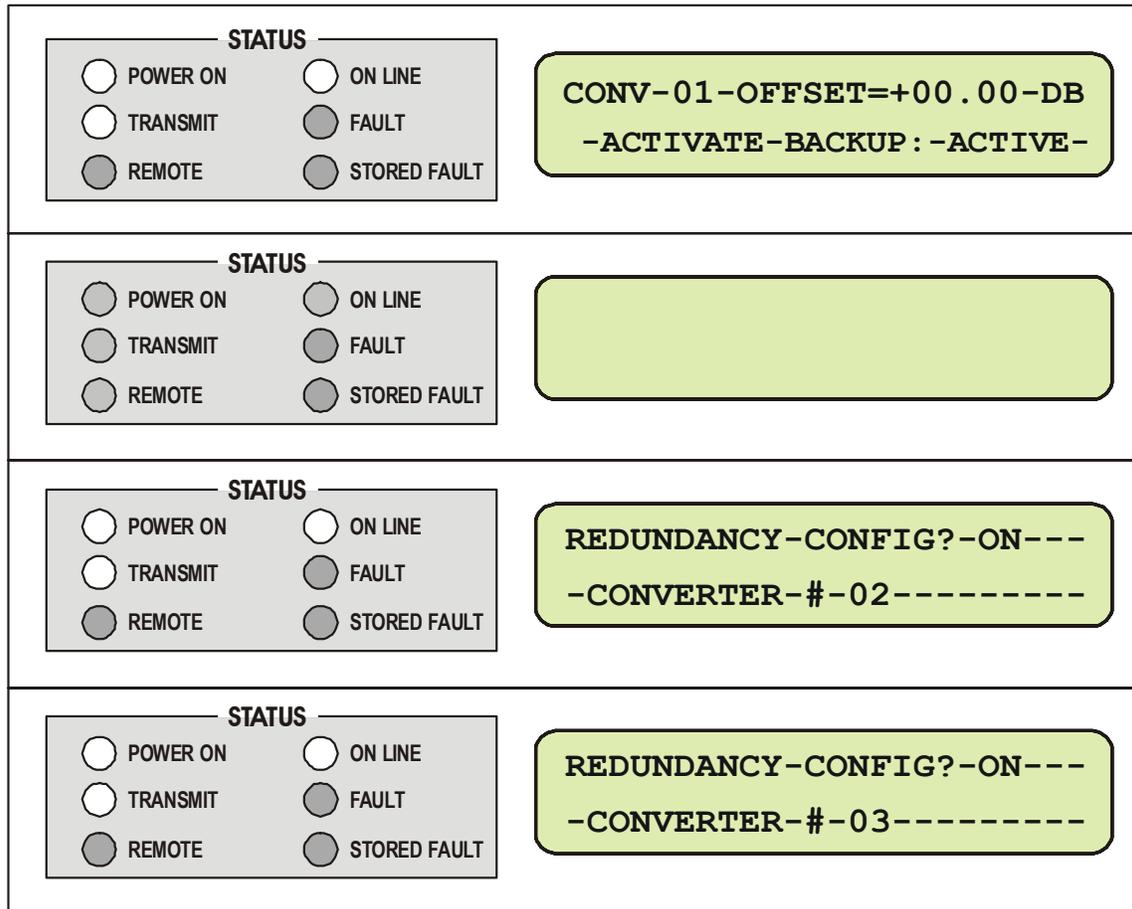
Figure 31. Converter #1 Being Backed Up

4.4.3 MANUAL CONFIGURATION/VERIFICATION

Figure 32 shows the system with converter #1 configured for manual (M) operation. In this mode, the backup converter can force switchover of an online unit. This mode also overrides fault status detection of the online units performed by the backup converter. If an online unit is configured to manual mode and this unit faults, no switchover will occur.
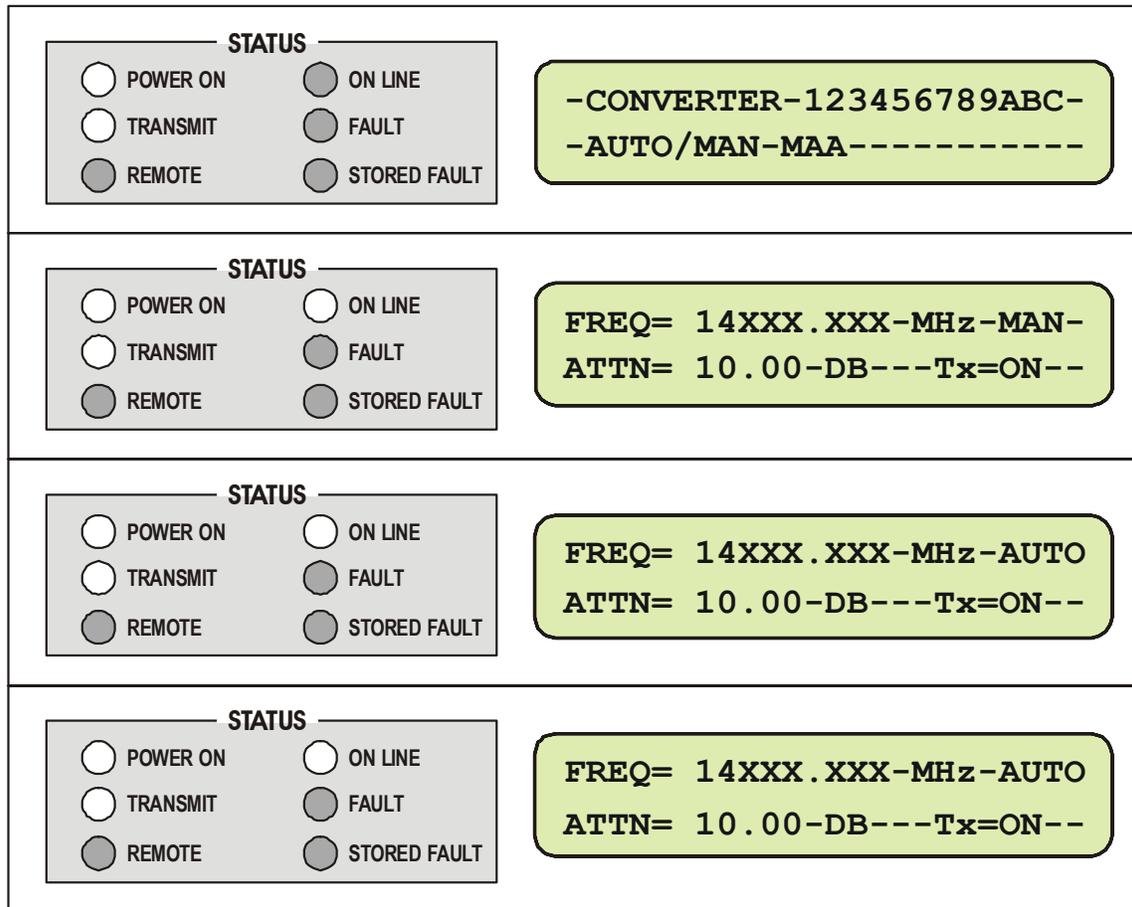
Figure 32. Converter #1 in MANUAL, Others in AUTO

Figure 33 shows the front panel displays after the backup has forced converter 1 offline. Note the online LED allows the user to tell whether the backup is currently active and which converter is being by passed.

STATUS
- ○ POWER ON   ○ ON LINE
- ○ TRANSMIT   ● FAULT
- ● REMOTE   ● STORED FAULT

```
CONV-01-OFFSET=+00.00-DB
-ACTIVATE-BACKUP:-FORCED-
```

STATUS
- ○ POWER ON   ○ ON LINE
- ● TRANSMIT   ● FAULT
- ● REMOTE   ● STORED FAULT

```
REDUNDANCY-CONFIG?-ON---
-CONVERTER-#-01---------
```

STATUS
- ○ POWER ON   ○ ON LINE
- ○ TRANSMIT   ● FAULT
- ● REMOTE   ● STORED FAULT

```
REDUNDANCY-CONFIG?-ON---
-CONVERTER-#-02---------
```

STATUS
- ○ POWER ON   ○ ON LINE
- ○ TRANSMIT   ● FAULT
- ● REMOTE   ● STORED FAULT

```
REDUNDANCY-CONFIG?-ON---
-CONVERTER-#-03---------
```

Figure 33. Forced BU of Converter #1

4.4.4 OFFSET ADJUSTMENT

The offset is used to compensate for cable and switch losses. When the system is initially set up and tested, each converter needs to be forced to backup and the offset adjusted to minimize gain mismatch between the normal and bypassed mode. This offset will be different for each converter and is stored in a table in the backup unit.

Set the offset as follows:

1   Connect a signal source to the input and a power meter or spectrum analyzer to the output of the first online converter. Record the output power.

2   Force a backup of the first online unit and adjust the offset until the output power matches what was recorded in step one.

3   Restore the online unit and repeat for the other online units.

4.4.5 REDUNDANCY SYSTEMS - CONVERTER REMOVAL

In a redundancy system, to remove an "inline" converter for repair the following procedure must be used:

1   Force backup of faulted unit.

2   Turn the power switch on the inline converter rear panel to OFF, and remove the power cord from the converter. DO NOT disconnect the RF and IF cables from the TSM Module.

3   Unscrew the mounting screws on the TSM Module first, and then unscrew the rack mounting screws on the front panel of the converter.

4   From the rear of the inline converter, hold the TSM Module and push the converter to the front of the rack until TSM Module is free of the converter chassis.

5   Remove the inline converter from the front of the rack.

To install the replacement unit, the following procedure must be used:

1   Power up the new unit on the bench.

2   Configure the new unit for the correct redundancy settings (Redundant = ON, Address = match old unit).

3   Power off the new unit.

4   Remove existing personality module from the new unit.

5   Carefully install the new unit into the rack. The existing module in the rack will be plugged into the new unit.

6   Power up the new unit and un-force the backup.

To remove a "Backup" converter for repair the following procedure must be used:

1   Turn the power switch on the backup converter rear panel to OFF, and remove the power cord from the converter. Disconnect the RF and IF cables from the IOM Module.

2   Unscrew the rack mounting screws on the front panel of the backup converter.

3   Remove the backup converter from the front of the rack.

NOTES:

Chapter 5.
Remote Control

5.1 GENERAL

Each Comtech EF Data series Up Converter can be remotely controlled through a serial port. Primary (chained) converters in a redundancy subsystem can also be indirectly controlled through the backup converter using virtual addressing. Comtech EF Data's simplified Command/Response protocol is easily invoked by either a monitor and control computer, a non-intelligent ASCII terminal or a laptop computer operating in terminal emulation mode. All converter configuration parameters as well as all monitor and status information is available via the remote port.

The Comtech EF Data converter family has been designed specifically to reduce the cost and complexity associated with operating in redundancy subsystem configurations. The backup converter in the redundancy subsystem automatically monitors the configuration and status for each of the primary (chained) converters. This information is communicated via the High Speed Bus interface is updated at a polling rate of 1.95 milliseconds per primary converter. If a primary converter fails, the backup detects this event and automatically reconfigures itself to the proper frequency and attenuation setting providing minimal loss of traffic on the failed channel.

The result of this design is to greatly reduce the throughput requirements (i.e. polling rate) of earth station monitor and control systems. The backup converter handles all of the 'time critical' tasks allowing the earth station monitor and control system to focus on less intelligent subsystems. This document specifies the remote control capabilities of the converter including hardware configuration and software command structure.

5.2 PROTOCOL

5.2.1 TRANSMISSION MODE

The transmission mode is half duplex implemented in Command/Response convention. This method requires the external system monitor and control unit to initiate all communications by command and all converters to respond with either confirmation or an error message. The confirmation may contain status information.

5.2.2 BAUD RATE

The default serial port Baud Rate is 9600. Baud rates of 1200, 2400, 4800, 19200, and 38400 are also supported.

5.2.3 FORMAT

The following parameters are the default character format.

- 1 Start Bit
- 8 Data Bits
- No Parity Bit
- 1 Stop Bit

5.2.4 CHARACTER SET

The character set implemented is ASCII.

5.2.5 RESPONSE TIMEOUT

A minimum of 500 milliseconds should be provided before declaring a 'no response' instance, at which time the command should be re-transmitted.

5.2.6 BUS INACTIVITY REQUIREMENT

Comtech EF Data recommends that a minimum of 50 milliseconds bus inactivity be provided by the user between the receipt of a response from an addressed converter and issuing the next command on the serial bus.

5.3 ACCESS METHODS

Converters may be accessed directly by using a physical address or indirectly through a backup converter by using a virtual address.

5.3.1 DIRECT ACCESS

Converters may be directly accessed by the EIA-232 interface or by the EIA-485 interface in a bus configuration.

5.3.1.1 EIA-485

In this control network, all converters including the backup converter are paralleled on a common EIA-485 cable. Both up and down converters can be mixed on the cable as long as each converter has a unique physical address. Only one EIA-485 port is required on the system's monitor and control computer. If a change is initiated directly to a converter in a redundancy subsystem, the backup converter will detect the change via the High Speed Bus and update its backup tables.

5.3.1.2 EIA-232

For EIA-232 control, a direct EIA-232 cable connection is made to each converter to be accessed. If an external Monitor and Control Computer is used, one EIA-232 port per converter is required. This mode is commonly used with an ASCII terminal for bench testing.

5.3.2 INDIRECT ACCESS

Converters in Redundancy Mode may be addressed indirectly by adding a virtual address to the backup converter's physical address. The virtual address corresponds to converter's position in the redundant subsystem. The backup converter recognizes the virtual address and executes the command via the high speed bus.

5.3.2.1 EIA-485

To control by using the EIA-485 interface, one or more backup converters are connected to a system's monitor and control computer or ASCII terminal with a common EIA-485 bus cable. Both up and down backup converters may be mixed on the cable as long as each has a unique device address. In order to indirectly address an online converter in the subsystem, a virtual address must be provided. The virtual address corresponds to the converter's position in the chain beginning with number 1. Virtual addressing is only recognized by a backup converter. Only one EIA-485 port is required on the monitor and control computer.

5.3.2.2 EIA-232

To control by using the EIA-232 interface, one EIA-232 port on the monitor and control computer is required for each backup converter. Virtual addressing must be established by command. All converters including the backup converter must be in the Redundancy Mode.

5.4 ADDRESSES

All converters are addressed in a command by the Device Address. The Device Address consists of a physical address or a physical address plus a virtual address.

5.4.1 PHYSICAL ADDRESS

Each converter in the system must have a unique physical address regardless of the access method used. The physical address consists of a string of 1, 2 or 3 numbers from 1 to 255. The physical address is entered into a converter via the front panel. For Direct Access, the physical address is the only address required to command a converter. A backup converter or a stand-a-lone converter can only be accessed with a physical address.

Example: 10   Addresses converter whose physical address is 10.

5.4.2 VIRTUAL ADDRESS

In order to access a converter controlled by a backup converter indirectly, a virtual address is required. A virtual address is appended to the physical address of the backup converter with a "V". The virtual address is a number from 1 to 12 and corresponds to the position of the active converter from the backup converter and is assigned by a configuration command.

Example: 10V3   Addresses the third converter controlled by the backup converter whose physical address is 10.

5.5 MESSAGE STRUCTURE

The structure of either a Command , Response or Error Message is as follows:

‣ Start Character.
‣ Device Address.
‣ Command or Response.
‣ End of Message String.

5.5.1 START CHARACTER

The Start Character begins each message:

Example: < Start of a user Command.

                > Start of a converter response.

5.5.2 DEVICE ADDRESS

The Device Address consists of a Physical Address or a Physical Address and an appended Virtual Address. For this document DEV is used for the generic case examples.

Example: <3V12

5.5.3 COMMAND

A Command is a variable length character string beginning with a / and containing either an instruction or an instruction and data for a converter to act upon. If data is passed by command it is appended to the instruction by an underscore(_). If data is retrieved by command underscore follows the instruction flagging the converter to supply data in a response. In this document /COM is used for the generic case examples.

Example: <DEV/COM_xxx'cr'   Sends data to a converter.

Example: <DEV/COM_'cr'   Requests information from a converter.

5.5.4 CONFIRMATION RESPONSE

A confirmation will change the start character, and echo the Device Address and Command. Any requested data will be appended to the Command.

Example: >DEV/COM_xxx'cr''lf']

5.5.5 ERROR RESPONSE

If a converter cannot execute a Command or detects a protocol violation, an error response is generated. An error is flagged by changing the "/" command designator in the response to a "?". Following the "?" error symbol are two characters which are unique error symbols useful for computer analysis. The two error symbols are followed by a text string explaining the error for the convenience of a human operator. For this document ER is used for the generic case examples response.

Example: >DEV?COM ER Error Message 'cr''lf']

5.5.6 END OF MESSAGE

End of message strings were devised in such a way that an orderly screen presentation would result when converters are controlled by simple ASCII terminals.

5.5.6.1 COMMAND ENDING

The end of message for a command is a carriage return. For this document 'cr' is used for the carriage return.

Example: <DEV/COM_'cr'

5.5.6.2 RESPONSE ENDING

End of message for a response is a carriage return, line feed and a bracket: 'cr''lf'].

Example: >DEV/COM_'cr''lf']

5.6 COMMAND / RESPONSE PAIRS

5.6.1 UTILITY COMMANDS

5.6.1.1 TIME

Command	Details
Set Time:	<DEV/TIM_hh:mm:ss'cr' hh = Hour*
Confirmation:	>DEV/TIM_hh:mm:ss'cr''lf'] mm = Minutes ss = Seconds
Retrieve Time:	<DEV/TIM_'cr'
Confirmation:	>DEV/TIM_hh:mm:ss'cr''lf']

* 24 hour military time is used.

5.6.1.2 DATE

Command	Details
Set Date:	<DEV/DAT_mm/dd/yy'cr' mm = Month
Confirmation:	>DEV/DAT_mm/dd/yy'cr'lf'] dd = Day yy = Year
Retrieve Date:	<DEV/DAT_'cr'
Confirmation:	>DEV/DAT_mm/dd/yy'cr''lf']

5.6.1.3 PHYSICAL ADDRESS

The default Physical Address from is 1.

Command	Details
Set Physical Address:	<DEV/SPA_xxx'cr' xxx = 1 to 255
Confirmation:	>DEV/SPA_xxx'cr''lf']
Retrieve Phys. Addr:	<DEV/SPA_'cr'
Confirmation:	>DEV/SPA_xxx'cr''lf']

5.6.1.4 BAUD RATE

The default baud rate is 9600.

Command	Details
Set Baud Rate:	<DEV/SBR_xxxx'cr' xxxx = 1200, 2400, 4800, 9600, 19K2, or 38K4
Confirmation:	>DEV/SBR_xxxx'cr''lf']
Retrieve Baud Rate:	<DEV/SBR_xxxx'cr'
Confirmation:	>DEV/SBR_xxxx'cr''lf']

5.6.1.5 LCD CONTRAST

The default is 15.

Command	Details
Set Contrast:	<DEV/CON_xx'cr' xx = 0 to 30
Confirmation:	>DEV/CON_xx'cr''lf']
Retrieve Contrast:	<DEV/CON_'cr'
Confirmation:	>DEV/CON_xx'cr''lf']

5.6.1.6 LCD BRIGHTNESS

The default is 15.

Command	Details
Set Brightness	<DEV/LCD_xx'cr' xx = 0 to 30
Confirmation:	>DEV/LCD_xx'cr''lf']
Retrieve Brightness:	<DEV/LCD_'cr'
Confirmation:	>DEV/LCD_xx'cr''lf']

5.6.1.7 REFERENCE OSCILLATOR TUNING

The default is 87.

Command	Details
Set Oscillator:	<DEV/SRO_xxx'cr' xxx = 0 to 255
Confirmation:	>DEV/SRO_xxx'cr''lf']
Retrieve Tuning:	<DEV/SRO_'cr'
Confirmation:	>DEV/SRO_xxx'cr''lf']

5.6.1.8 CONVERTER SLOPE ADJUSTMENT

The default is 0.3.

Command	Details
Set Slope Adjust:	<DEV/SSA_xxx'cr' xxx = 0.0 to 1.0
Confirmation:	>DEV/SSA_xxx'cr''lf']
Retrieve Slope Adjust:	<DEV/SSA_'cr'
Confirmation:	>DEV/SSA_xxx'cr''lf']

5.6.1.9 EQUIPMENT TYPE

Equipment Type is a command that retrieves the model number and software version of the equipment. The information cannot be changed by command.

Command	Details
Retrieve Equipment Type:	<DEV/RET_'cr'
Confirmation:	>DEV/RET_xxxxxxxxxx yyyyyyy'cr''lf'] xxxxxxxxxx = Model Number yyyyyyy = Software Version.

5.6.1.10 FIRMWARE INFORMATION

Retrieves the firmware information of the unit.

Command	Details
Retrieve Firmware Information:	<DEV/FRW_'cr'
Confirmation:	>DEV/FRW_'cr' BULK= FWnnnn-nr Ver=x.xx'cr' M&C = FWnnnn-nr Ver=x.xx'cr' FPGA= FWnnnn-nr Ver=x.xx'cr''if'] Where: nnnn-n firmware number r firmware revision x.xx firmware version **Note:** BULK, M&C, and FPGA have different firmware numbers, revisions, and versions among each other.

5.6.1.11 APPLICATION IDENTIFICATION

The Application Identification (AID) command allows a free form message to be created. It is intended to identify either the satellite, transponder, beam, destination or other aspects of the application that may be significant to operations.

The message length corresponds to capability of the LCD and is 48 characters in total. The second line begins at character 25, therefore, blanks must be used after line 1 information in order to space to line 2. A carriage return ends the command. Trailing blanks will be generated to fill the LCD field. The AID display will alternate with the Equipment type display by use of the clear function key on the front panel. The default is "AID MESSAGE".

Command	Details
Application ID:	<DEV/AID_xxxxxxx ... xxxxx'cr'
Confirmation:	>DEV/AID_'cr' xxxxxxxxxxxxxxxxxxxxxxxx'cr' xxxxxxxxxxxxxxxxxxxxxxxx'cr''lf']
Retrieve ID:	<DEV/AID_'cr'
Confirmation:	>DEV/AID_'cr' xxxxxxxxxxxxxxxxxxxxxxxx'cr' xxxxxxxxxxxxxxxxxxxxxxxx'cr''lf']

Note: xxxxxxx ... xxxxx = Your message, maximum 48 characters.

5.6.2 CONFIGURATION COMMANDS

5.6.2.1 FREQUENCY

The default is RF_{Low} MHZ (e.g.; 14000.000 MHZ for Model UT-4514).

Command	Details
Set Frequency:	<DEV/FRE_xxxxx.xxx'cr'
Confirmation:	>DEV/FRE_xxxxx.xxx'cr''lf']
Retrieve Frequency:	<DEV/FRE_'cr'
Confirmation:	>DEV/FRE_xxxxx.xxx'cr''lf']

Note: For example, xxxx.xxx = 14000.000 to 14500.000 MHZ in 125 KHz steps for Model UT-4514.

5.6.2.2 ATTENUATOR

The default is 10 dB.

Command	Details
Set Attenuator:	<DEV/ATT_ yy.yy'cr'
Confirmation:	>DEV/ATT_yy.yy'cr'lf']
Retrieve Attenuator:	<DEV/ATT_'cr'
Confirmation:	>DEV/ATT_ yy.yy'cr"lf']

Note: yy.yy = 0.0 to 25.00 dB in 0.25 steps.

5.6.2.3 COLD START

The cold start function, if enabled, mutes the output signal for a predetermined time following Power-Up to ensure a stable reference oscillator (15 minutes). The default is OFF. This command is disabled in redundant systems (i.e. COMMAND NOT AVAILABLE).

Command	Details
Set Cold Start:	<DEV/CLD_xxx'cr' xxx = ON or OFF
Confirmation:	>DEV/CLD_xxx'cr"lf']
Retrieve Status:	<DEV/CLD_'cr'
Confirmation:	>DEV/CLD_xxx'cr"lf']

5.6.2.4 MUTE

The default is ON.

Command	Details
Mute Output:	<DEV/MUT_xxx'cr' xxx = ON or OFF
Confirmation:	>DEV/MUT_xxx'cr"lf']
Retrieve Mute Status:	<DEV/MUT_'cr'
Confirmation:	>DEV/MUT_yyy'cr"lf'] yyy = ON/OFF/COLD

5.6.2.5 AUTO FAULT RECOVERY

The converter output is automatically muted in the event of a detected fault. Auto Fault Recovery, if enabled, will cause the output signal to go active (unmuted) if all faults clear. If disabled, the output will remain muted even after all faults clear until a MUT_OFF command is received (see 4.8.2.4). If Auto Fault Recovery is enabled and the converter detects the same fault more than five times in a five minute interval (ex: multiple IFLO lock detect faults) the function reverts to DISABLED and the converter remains muted. The default is ON.

Command	Details
Set Fault Recovery:	<DEV/AFR_xxx'cr' xxx = ON or 0FF
Confirmation:	>DEV/AFR_xxx'cr"lf']
Retrieve Status:	<DEV/AFR_'cr'
Confirmation:	>DEV/AFR_xxx'cr"lf']

5.6.2.6 PROGRAM PRESET

This command is used to stores up to 32 preset frequency and attenuation settings.

Command	Details
Program Preset:	<DEV/PGM_nn_xxxxx.xxx_yy.yy'cr'
Confirmation:	>DEV/PGM_nn_xxxxx.xxx_yy.yy'cr"lf']

Note: nn = Preset Number = 01 to 32.

xxxx.xxx = Frequency = RF_{Low} to RF_{High} (for example, 14000.000 to 14500.000 MHZ for Model UT-4514).

yy.yy = Attenuator = 00.00 to 25.00.

5.6.2.7 DISPLAY ALL PRESETS

This command is used to display all programmed preset numbers.

Command	Details
Display Presets:	<DEV/DPS_'cr'
Confirmation:	>DEV/DPS_'cr'
	P01 xxxxx.xxx yy.yy'cr' to P32 xxxxx.xxx yy.yy'cr"lf'] Where: xxxxx.xxx = Frequency yy.yy= Attenuator

Note: Only programmed preset numbers are returned. If no preset(s) is programmed, "No Pre-Selects Programmed" is returned.

5.6.2.8 CLEAR PRESET

This command is used to clear a preset number.

Command	Details
Clear a Preset:	<DEV/CLR_nn'cr'
Confirmation:	>DEV/CLR_nn_Cleared'cr"lf']

Note: nn = Preset Number = 01 to 32.

5.6.2.9 SELECT A PRESET

This command is used to configure the converter to the frequency and attenuation data assigned to a given preset number.

Command	Details
Select Preset:	<DEV/SEL_nn'cr'
Confirmation:	>DEV/SEL_nn_Selected'cr"lf']

Note: nn = Preset Number = 01 to 32.
         Only programmed preset numbers are available.

5.6.3 MODES

There are two modes of operation that may intersect: Redundant Mode and Automatic Mode.

5.6.3.1 REDUNDANCY MODE

Since the default mode is OFF, each converter including the backup converter must be commanded into the Redundancy Mode.

Polling on the high speed bus will not begin until the position assignments are made.

Command	Details
Redundancy Mode:	<DEV/RED_xxx'cr' xxx = ON or OFF
Confirmation:	>DEV/RED_xxx'cr"lf']
Redundancy Status:	<DEV/RED_'cr'
Confirmation:	>DEV/RED_xxx'cr"lf']

Each converter's chain position must be initialized including the backup converter. The following redundancy initialization command is only allowed if Redundancy Mode has been selected.

Command	Details
Initialize Command:	<DEV/ICT_xx_yy'cr'
Confirmation:	>DEV/ICT_xx_yy'cr''lf']
Initialize Status:	<DEV/ICT_'cr'
Confirmation:	>DEV/ICT_xx_yy'cr''lf'] xx = chain position = 01 to 12, or BU. Where BUselects the converter as the backup. yy = chain length for xx = BU (i.e. Backup converter) 01 to 12. yy = unused if xx = 01 to 12 (i.e. chain converter)

Example 1: The following command assigns the converter chain position "1".

<DEV/ICT_01'cr'

>DEV/ICT_01'cr''lf']

Example 2: The following command assigns the receiving converter as the backup converter in a 1:8 system.

<DEV/ICT_BU_08'cr'

>DEV/ICT_BU_08'cr''lf']

It should be reiterated that only the converter physically located at the top of a redundant rack should be assigned as the Backup unit. Likewise, assignment of chain positions in a redundant rack should be made according to the physical allocation of each converter in the rack (i.e. The top converter should be the Backup, the second converter should be assigned chain position 1, the third converter position 2, etc.).

5.6.3.2 AUTOMATIC/MANUAL MODE

This command provides for automatic switching by the backup converter if both units are in the Redundancy Mode. This command is only accepted by the backup converter. If a chain converter is set in Manual Mode, the backup converter will log the occurrence and not act upon further information from the converter until put into Automatic Mode. The default is off.

Command	Details
Automatic Mode:	<DEV/SAM_xx_y'cr'
Confirmation:	>DEV/SAM_xx_y'cr''lf']
Automatic Status:	<DEV/SAM_xx_'cr'
Confirmation:	>DEV/SAM_xx_y'cr''lf'] Where: xx = 01 to 12, converter number y = A for Auto; M for Manual

5.6.3.3 BACKUP MODE

This command allows the user to force a backup condition for maintenance and test purposes. This command must be sent to the converter designated as the backup converter (i.e., "BU"). When activated this command forces the backup converter to assume the state of the specified chain converter and forces the chain converter offline.

Command	Details
Initiate a Backup:	<DEV/FBU_xx_y'cr'

Confirmation:	>DEV/FBU_xx_y'cr"lf']
	
	       Where: xx = 01 to 12, converter number
	       y = 'F' to force a backup 'N' to remove a backup

Retrieve Backup Status:	<DEV/FBU_'cr'

Confirmation:	>DEV/FBU_xx_zzzzz'cr"lf']
	
	Where: xx = 01 to 12, converter number. If zzzzz = NONE, converter
	       number is not displayed.
	
	       zzzzz = 'NONE' if no backup active
	       = 'ACTIVE' if an automatic backup has occurred
	       = 'FORCED' if a forced backup is active

5.6.4 STATUS COMMANDS

Status commands retrieve configuration, maintenance and alarm status in summary form.

5.6.4.1 CONFIGURATION STATUS

Command	Details
Configuration Status:	<DEV/RCS_'cr'
Confirmation:	>DEV/RCS_'cr'

	FRE_xxxxx.xxx'cr' Frequency
	     ATT_yy.yy'cr' Attenuator
	     TX_nnn'cr' Transmitter - ON/OFF/COLD
	     ONL_nnn'cr' Online - ON/OFF
	     RED_xx_yy_z'cr' See Note
	     CLD_nnn'cr' Cold Start - ON/OFF
	     AFR_nnn'cr' Auto Flt Recovery-ON/OFF
	     EXT_xxx'cr"lf'] Ext. Ref. - YES/NO

Note: If Redundancy OFF xx_yy_z = OFF, else if Redundancy ON and converter selected as backup controller xx_yy_z = BU_yy where yy is the number of converters in the chain (i.e. 01 to 12), else if Redundancy ON and converter selected as a chain unit xx is the converter number (01 to 12), and z = A if Auto Mode or M if Manual Mode.

5.6.4.2 MAINTENANCE STATUS

Command	Details
Maintenance Status:	<DEV/RMS_'cr'
Confirmation:	>DEV/RMS_'cr'
	P15_xx.x'cr' 15 Vdc Supply P14_xx.x'cr' 14 Vdc Supply VCC_x.x'cr' VCC Supply 5VD_x.x'cr' Display 5 Vdc TEM_xx'cr' Temperature IFL_xx.x'cr' IFLO Tuning SUM_xx.x'cr' Sum Loop Tuning COR_xx.x'cr' Coarse Loop Tune FIN_xx.x'cr'"lf'] Fine Loop Tuning.

5.6.4.3 UTILITY STATUS

Command	Details
Utility Status:	<DEV/RUS_'cr'
Confirmation:	>DEV/RUS_'cr'

	COMM_aaaaaa'cr' RS-232 or RS-485
	ADD_xxx'cr' Address (001 to 255)
	BR_nnnn'cr' Baud Rate (1200, 2400, 4800, 9600,
	                     19K2, or 38K4)
	FMT_x-y-z'cr' Data Format x=data, y=parity, z=stop
	                     bit (8-N-1, 7-E-2, 7-O-2)
	REF_xxx'cr' Osc. Adjust (000 to 255)
	SLP_x.x'cr' Slope Adjust (0.0 to 1.0)
	CON_xx'cr' LCD Contrast (0 to 30)
	LCD_xx'cr'"lf'] LCD Brightness (0 to 30).

5.6.4.4 ALARM STATUS

Command	Details
Alarm Status:	<DEV/RAS_'cr'
Confirmation:	>DEV/RAS_'cr'
	P15_xx'cr' 15 Vdc Fault P14_xx'cr' 14 Vdc Fault VCC_xx'cr' VCC Fault 5VD_xx'cr' 5VD Fault TEM_xx'cr' Temperature Fault IFL_xx'cr' IFLO Lock Fault SUM_xx'cr' Sum Lock Fault COR_xx'cr' Coarse Lock Fault FIN_xx'cr' Fine lock Fault HSB_xx'cr' High Speed Bus Fault *REF_xx'cr'"lf'] Ref. Lock Fault xx = OK or FT

Note: REF_xx is only returned if an external reference is present.

5.6.4.5 SUMMARY ALARM STATUS

Summary alarm is set to Fault (FT) if any of the items in Paragraph 5.6.4.4 are faulted.

Command	Details
Summary Alarm:	<DEV/SAS_'cr' xx = OK or FT
Confirmation:	>DEV/SAS_xx'cr''lf']

5.6.4.6 TERMINAL STATUS CHANGE

The TSC_ command can be used to determine if the status of the terminal has changed since it was last polled. If any of the parameters listed in the RCS or RUS commands have changed as a result of user front panel operations or remote operations or if any new fault condition occur the TSC_ command will return YES. The TSC_ command will then continue to return YES until any of the following commands are received: RCS_, RUS_, RAS_, PACRCS_, PACRUS_, or PACRAS.

Configuration Status: <DEV/TSC_'cr'

Confirmation: >DEV/TSC_nnn'cr''lf']   nnn = YES/NO

5.6.4.7 PACKED CONFIGURATION STATUS

Configuration Status: <DEV/PACRCS_'cr'
Confirmation: >DEV/PACRCS_aaaabbbcdeffgghijkl'cr''lf']
            where:
                  aaaa   = # of 125kHz steps above base frequency[1]
                   bbb   = # of 0.25 dB steps above 0.00 dB[2]
                     c   = 1 if Transmitter ON, 0 if OFF, 2 if Cold
                     d   = 1 if unit ONLINE, 0 if OFFLINE
                     e   = 1 if Redundancy ON, else 0
                    ff   = converter # (01-12,BU or 00 if e = 0)
                    gg   = 00 if 'ff' is 00 (redundancy OFF)
                    gg   = chain length (01-12) if 'ff' is BU
                    gg   = XX if 'ff' = 01 - 12
                     h   = A if Auto Mode, M if Manual[3]
                     I   = 1 if Cold Start Enabled, else 0
                     j   = 1 if Auto recovery enabled, else 0
                     K   = 1 if an Ext. Ref is present, else 0
                     l   = 1 if Remote Mode, 0 if Local Mode

Notes: **1**   If the converter is 1 kHz step size, this will be the number of 1 kHz steps above the base frequency

             2   If the converter is 0.1 -dB step size, this will be the number of 0.1 -dB steps above the base frequency

             3   If it is a backup converter, it is always 'A'.

5.6.4.8 PACKED MAINTENANCE STATUS

Packed Maintenance Status: <DEV/PACRMS_'cr'

Confirmation: >DEV/PACRMS_aabbccddeeeffgghhii'cr''lf']

     where:

          aa = V15 scaled 123mV per count (0x00 - 0xFF)
          bb = V14 scaled 123mV per count (0x00 - 0xFF)
          bc = VCC scaled 39mV per count (0x00 - 0xFF)
          dd = V5D scaled 39mV per count (0x00 - 0xFF)
        eee = signed Temperature in degrees C (-10 to +60)
          ff = IFLO tune scaled 67mV per count (0x00 - 0xFF)
          gg = SUM tune scaled 54mV per count (0x00 - 0xFF)
          hh = COARSE tune scaled 78mV per count(0x00 - 0xFF)
          ii = FINE tune scaled 89mV per count (0x00 - 0xFF)

5.6.4.9 PACKED UTILITY STATUS

Packed Utility Status: <DEV/PACRUS_'cr'

Confirmation: >DEV/PACRUS_abbcdeeffghhii'cr''lf']

     where:

          a = 0=EIA-232, 1=EIA-485
          bb = Address in hex (01 to FF)
          c = 0 if Baud Rate 38400
             = 1 if Baud rate 19200
             = 2 if Baud rate 9600
             = 3 if Baud rate 4800
             = 4 if Baud rate 2400
             = 5 if Baud rate 1200
          d = 0 if Data Format 8-N-1
             = 1 if Data Format 7-E-2
             = 2 if Data Format 7-O-2
         ee = Osc. Adjust in hex (00 to FF)
          ff = Slope Adjust times by 10 (00 to 10)
          g = Always 0, unused
         hh = LCD Contrast (0 to 30)
          ii = LCD Brightness (0 to 30)

5.6.4.10 PACKED ALARM STATUS

Packed Alarm Status: <DEV/PACRAS_'cr'

Confirmation: >DEV/PACRAS_abcdefghijk'cr''lf']

    where:

        a = 1 if V15 Fault, else 0
        b = 1 if V14 Fault, else 0
        c = 1 if VCC Fault, else 0
        d = 1 if V5D Fault, else 0
        e = 1 if TEMP Fault, else 0
        f = 1 if IFLO Fault, else 0
        g = 1 if SUM Fault, else 0
        h = 1 if COARSE Fault, else 0
        I = 1 if FINE Fault, else 0
        j = 1 if HSB Fault, else 0
        k = 1 if EXT REF Fault, else 0

5.6.5 STORED ALARM

The 100 alarms are date/time stamped and stored in memory as they occur. The alarm entry is also updated with its date/time of clearance. The entry remains in memory until it is removed by command.

5.6.5.1 TOTAL STORED ALARMS

This command retrieves the total number of stored alarms and the time and date of the most recent alarm.

Retrieve Total Alarms: <DEV/TSA_'cr'

Confirmation: >DEV/TSA_TOTAL:nn'cr'

                            LAST:hh:mm:ss   mm/dd/yy'cr''lf']

    where:

        nn = 0 to 99; the 100th alarm will be ER
   hh.mm.ss = time in hour:minute:second
  mm/dd/yy = date in month/day/year

5.6.5.2 CLEAR ALL STORED ALARMS

Clear Alarms: <DEV/CAA_YES'cr'

Confirmation: >DEV/CAA_CLEARED'cr''lf']

5.6.5.3 LIST ALL ALARMS

This command retrieves a list of the stored alarms. This command is currently unavailable when using virtual addressing mode.

List All Alarms: <DEV/LAA_'cr'

Confirmation: >DEV/LAA_'cr'

         xx yyyyyyyyyyy hh:mm:ss   mm/dd/yy'cr'

         "   "   "   "
         "   "   "   "

         xxx yyyyyyyyyyy hh:mm:ss   mm/dd/yy'cr'"lf']

Where:

                xx = stored fault number
    yyyyyyyyyyy = fault description
       hh:mm:ss = fault time
      mm/dd/yy = fault date

5.7 ERROR PROCESSING

5.7.1 GENERAL ERRORS

The following Error Responses may be generated by any command instead of a confirmation:

>DEV?COM CU CMD UNRECOGNIZED'cr''lf']

>DEV?COM IP INVALID PARAM'cr''lf']

>DEV?COM PE PARITY ERROR'cr''lf']

5.7.2 CONFIGURATION ERRORS

The following Error Responses may be generated by configuration commands:

>DEV?COM LO DEVICE IN LOCAL MODE'cr''lf']

5.7.3 MODE ERRORS

The following Error Responses may be generated by Mode selection:

>DEV?COM AE ONLY VALID WHEN BACKUP'cr''lf']

>DEV?COM OE OFFLINE NOT AVAILABLE'cr''lf']

>DEV?COM CN COMMAND NOT AVAILABLE'cr''lf']

5.7.4 TIME-OUTS

A time-out should be assumed if there is no response in 500 milliseconds. The station monitor and control computer should try at least three times.

5.8 CONVERTER REMOTE COMMAND SUMMARY

Table 14. Remote Command Summary

Utility	Commands	Paragraph
Set Time	<DEV/TIM_hh:mm:ss'cr'	5.6.1.1
Set Date	<DEV/DAT_mm/dd/yy'cr'	5.6.1.2
Set Physical Address	<DEV/SPA_xxx'cr'	5.6.1.3
Set Baud Rate	<DEV/SBR_xxxx'cr'	5.6.1.4
Set LCD Contrast	<DEV/CON_xx'cr'	5.6.1.5
Set LCD Brightness	<DEV/LCD_xx'cr'	5.6.1.6
Set Reference Oscillator	<DEV/SRO_xxx'cr'	5.6.1.7
Set Converter Slope Adj.	<DEV/SSA_xxx'cr'	5.6.1.8
Retrieve Equipment Type	<DEV/RET_'cr'	5.6.1.9
Retrieve Firmware Information	<DEV/FRW_'cr'	5.6.1.10
Set Application ID Message	<DEV/AID_xxxxx...xxxxx'cr'	5.6.1.11
Configuration	**Commands**	**Paragraph**
Set Frequency	<DEV/FRE_xxxxx.xxx'cr'	5.6.2.1
Set Attenuation	<DEV/ATT_xx.xx'cr'	5.6.2.2
Select Cold Start Mode	<DEV/CLD_xxx'cr'	5.6.2.3
Mute/Unmute Converter	<DEV/MUT_xxx'cr'	5.6.2.4
Select Auto Fault Recovery Mode	<DEV/AFR_xxx'cr'	5.6.2.5
Program a Preset	<DEV/PGM_nn_xxxxx.xxx_yy.yy'cr'	5.6.2.6
Display All Presets	<DEV/DPS_'cr'	5.6.2.7
Clear a Preset	<DEV/CLR_nn'cr'	5.6.2.8
Select a Preset	<DEV/SEL_nn'cr'	5.6.2.9
Redundancy Mode	**Commands**	**Paragraph**
Select Redundancy ON/OFF	<DEV/RED_xxx'cr'	5.6.3.1
Configure Redundant Converter	<DEV/ICT_xx_yy'cr'	5.6.3.1
Select Auto/Manual Mode	<DEV/SAM_xx_y'cr'	5.6.3.2
Forced Backup Mode	<DEV/FBU_xx_y'cr'	5.6.3.3

Status	Commands	Paragraph
Retrieve Configuration Status	<DEV/RCS_'cr'	5.6.4.1
Retrieve Maintenance Status	<DEV/RMS_'cr'	5.6.4.2
Retrieve Utility Status	<DEV/RUS_'cr'	5.6.4.3
Retrieve Alarm Status	<DEV/RAS_'cr'	5.6.4.4
Summary Alarm Status	<DEV/SAS_'cr'	5.6.4.5
Terminal Status Change	<DEV/TSC_'cr'	5.6.4.6
Packed Configuration Status	<DEV/PACRCS_'cr'	5.6.4.7
Packed Maintenance Status	<DEV/PACRMS_'cr'	5.6.4.8
Packed Utility Status	<DEV/PACRUS_'cr'	5.6.4.9
Packed Alarm Status	<DEV/PACRAS_'cr'	5.6.4.10
Stored Alarm	**Commands**	**Paragraph**
Retrieve Total Stored Alarms	<DEV/TSA_'cr'	5.6.5.1
Clear All Stored Alarms	<DEV/CAA_YES'cr'	5.6.5.2
List All Stored Alarms	<DEV/LAA_'cr'	5.6.5.3

NOTES:

Chapter 6.
Theory of Operation

6.1 APPLICATIONS

This appendix contains a general description of the theory of operation for the Model UT-4500 Series Up Converters. The UT-4500 Series Up Converters are used for SCPC, DAMA AND TDMA, as well as for full transponder HDTV and analog TV, applications.

The converter operates over the RF frequency range with a typical gain of 35 dB. The RF output level is +10 dBm at 1 dB compression allowing the capability for longer cable runs to compensate for splitting networks without adding options such as external line amplifiers.

The phase noise performance exceeds the Intelsat phase noise mask for IBS and IDR services by more than 9 dB. This allows high capacity earth stations to add more demodulators and still meet transmission standards. The close-in phase noise is also very low make the converter ideal for low bit rate digital circuits such as used in DAMA hub earth stations.

A selectable EIA-232 or EIA-485 remote control serial communications connector interface is provided on the rear of the converter. All configuration control, status retrieval and adjustments are available as ASCII commands through the serial interface, or as local operator input command to the converter.

A detachable Input/Output Module (IOM) can be mounted in the rear of the converter chassis for switching the RF output for single thread operations, or for testing the output of the unit. The connectors for the IOM are located on the rear panel.

In applications where converters are "Daisy Chained" together to provide distributed on-line protection switching to a backup converter, the IOM is replaced with a detachable Transmit Switch Module (TSM). The TSM contains RF and IF transfer switches. Type N connectors are provided for the RF loop, and 50 or 75Ω BNC connectors are provided for the IF loop.

The "Daisy Chain" configuration is designed to chain the IF input and RF output of up to twelve (12) on-line converters together through TSM's terminating in a backup converter. When a fault occurs in an on-line converter, the TSM in the converter with the fault is commanded to switch to the backup converter. The backup converter performs the fault detection, self reconfiguration and the logical switching functions. If the backup converter has a fault, it will not attempt to perform the protection switching task. If the backup converter does not have a fault, it will assume the frequency and attenuation of the faulted on-line converter, and compensate for the chain losses.

The backup converter in the "Daisy Chain" communicates with the on-line converters through a high speed (data interface) bus (HSB). When faults are detected the backup converter re-configures itself to replace the on-line converter with the fault. The backup converter also uses the HSB to monitor configuration changes made to the on-line converters by either remote control or front panel command inputs. Changes in frequency, attenuation or polarity are entered into the backup table as they are made, as well as information from new on-line units. The HSB does not interfere with the remote control communications link for access to any of the converters in the "Daisy Chain".

The UT-4500 Series Up Converters are a standard 19-inch rack mounted units, 1.75 inches in height. The converter is 22 inches deep, and weighs 25 pounds. Prime power the converter can be either 100 to 125 Vac, or 205 to 240 Vac, at 47 to 63 Hz (or provided with an optional -48 Vdc prime power input). The power dissipation is 100 watts. The converter can operated in a temperature environment of 0 to 50°C (32 to 122°F) at 10,000 feet altitude in 0 to 95% relative humidity.

6.2 RF SIGNAL CONVERSION

As a typical example of the RF signal processing, in the Model UT-4514 Up Converter, the 70 MHz IF input is mixed in the first mixer with a 1150 MHz IFLO signal. The IFLO is locked to a 5/10 MHz reference oscillator. The first mixer is located in the Signal Path Assembly.

The intermediate IF is 1220 MHz which is mixed in the second stage mixer with 12780 to 13280 MHz synthesizer signal to provide an RF output frequency of 14000 to 1451X MHz in 125 KHz fine tuning steps. The synthesizer is also locked to the 5/10 MHz reference oscillator. The second mixer is located in the converter Signal Path Module, and the synthesizer consists of the Coarse/Fine Step Module and Sum Loop Module.

**Figure 34** is a typical functional block diagram of the converter.
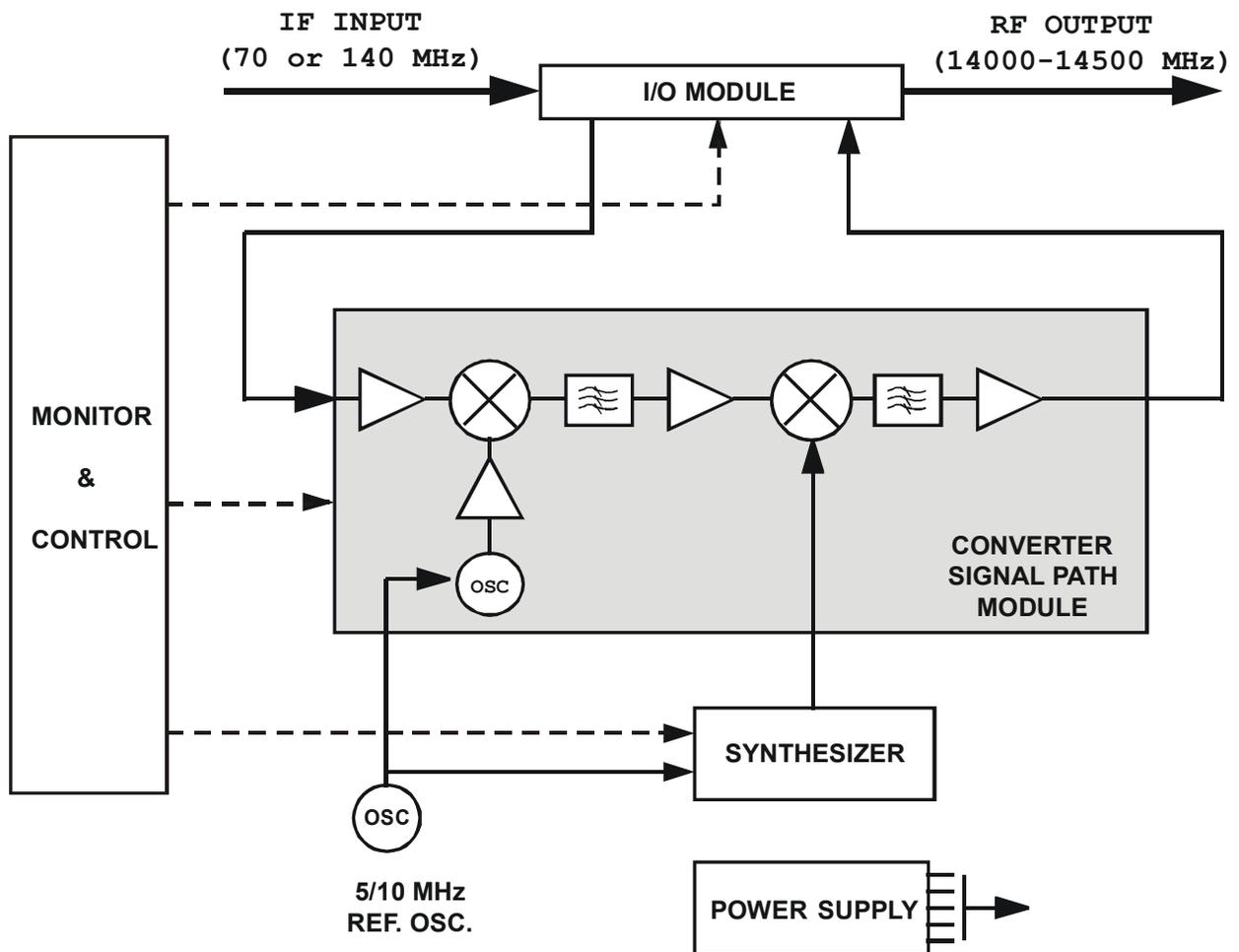
Figure 34. Typical Converter Functional Block Diagram (Model UT-4514 shown)

6.3 MONITOR & CONTROL

The Monitor & Control Assembly is designed to monitor the functions of the converter, and provide the control for remote and local command inputs to the converter. Remote control inputs are provided through the EIA-232 or EIA-485 communications port on the rear of the panel, or by local operator inputs through the keypad on the front panel. Local operator input commands and the status of the converter are displayed on the LCD display on the front panel.

A converter fault is indicated by the LED indicator on the front panel. Specific fault conditions are displayed on the LCD display through local keypad input commands.

Chapter 7.
Maintenance and Troubleshooting

7.1 OVERVIEW

This appendix is intended to provide procedures to assist operator and maintenance personnel in the checkout, maintenance and troubleshooting of the converter.

Comtech EF Data recommends that spare replacement converters be used to replace converters removed from the system for maintenance. Troubleshooting procedures are provided for fault isolation to the module level.

The input and output signals, the interconnecting cables and the location of the modules are as shown in **Figure 35**.

```
Prime Power Cord Input ────────────►┤▉│
                                           │  ┌──────────┐      ┌──────────┐              ┌────────┐
5/10 MHz Ref. Osc. Input    J2 ─────►┤▉│   │  │  Power   │      │Reference │              │ Fine   │
                                           │  │  Supply  │      │Oscillator│              │ Step   │
Summary Fault Relay Output  P1 ─────►┤▉│   │  └──────────┘      └──────────┘              │ Module │
                                           │                                              └────────┘
Serial Comm. Interface      J1 ◄────►┤▉│   │  ┌──────────────────────────────────┐
(RS-485 / RS-232C)- COM 1                  │  │                                  │
                                           │  │   Monitor & Control Assembly     │
High Speed Bus (HSB)        J3 ◄────►┤▉│   │  │                                  │
                                           │  └──────────────────────────────────┘
IF Input (IF)               J4 ─────►┤▉│   │
IF Loop Input (LP IN)       J6       │  ┌──────────┐  ┌──────────────────┐     ┌────────┐
                                           │  │ Transmit │  │                  │     │  Sum   │
IF Loop Output (LP OUT)     J8 ◄─────┤▉│   │  │I/O Switch│  │                  │     │  Loop  │
                                           │  │  Module  │  │   RF Converter   │     │ Module │
RF Output (RF)              J5 ◄─────┤▉│   │  │  (TSM)   │  │                  │     └────────┘
RF Loop Input (LP IN)       J7 ─────►┤▉│   │  └──────────┘  └──────────────────┘
RF Loop Output (LP OUT)     J9 ◄─────┤▉│
```

Figure 35. Converter Signal and Interconnecting Cable Diagram
(with TSM Switching Module).

7.2 MAINTENANCE TESTING

Use the instructions in Chapter 2, Installation, for installing the converter for checkout, and the procedures in Chapter 3, System Operation, for operating the converter.

The converter is a Up Converter which translates the input IF frequency from 52 to 88 MHz (or optional 104 to 176 MHz) to an output RF frequency - for example, the RF output frequency of the Model UT-4514 is 14000 to 14500 MHz. The IF input level is -35 dBm (typical), and the RF output level is +10 dBm at 1 dB compression.

7.2.1 TEST POINT SAMPLES

The IF input and RF output can be monitored at the RF Sample Test Points on the front panel. A BNC connector is provided for the IF sample, and an SMA connector is provided for the RF output. The RF sample output level is -20 dBc nominal, and the IF sample input level is -20 dBc nominal.

7.2.2 TROUBLESHOOTING

Converter operating problems can be identified by first observing the status indicators on the front panel. When a fault condition is indicated, the specific fault, or faults, can be identified in the **Figure 18**, which is accessed through the local operation keypad and displayed on the LCD display located on the front panel. The status of converter functions is displayed in the **Figure 17**. Refer to Paragraph 3.3, Operation, for a description of the converter command functions.

7.2.3 CONVERTER FAULTS

Check the Monitor Status Functions Menu for possible faults, or an indication of a marginal performance tolerance condition.

7.2.3.1 PRIME POWER

Check the dual fuses on the rear panel. The required prime power is 100 to 125 Vac, or 205 to 240 Vac, at 1 amp. The optional DC prime power is -48 Vdc.

7.2.3.2 DC POWER SUPPLY MODULE

15 Vdc:

A fault ("FT") indicates a voltage level exceeding ± 10% of the power supply voltage. Check the output of the DC Power Supply Module. The typical current output level is 3.0 amps. Check all connections to make sure they are secure. If the voltage exceeds ± 10%, or the power supply module current is not approximately 3.0 amps, or the fault still exists, remove the power supply and return it to Comtech EF Data for repair.

14 Vdc:

A fault ("FT") indicates a voltage level exceeding ± 10% of the power supply voltage. The 14 Vdc is developed in the modules. Check the output of the 15 Vdc Power Supply Module, check for other module faults, and check all connections. If the fault still exists, remove the converter and return it to Comtech EF Data for repair.

VCC (+5 Vdc):

A fault ("FT") indicates a voltage level exceeding ± 10% of the power supply voltage. The 5 Vdc is developed in the modules. Check the output of the 15 Vdc Power Supply Module, check for other module faults, and check all connections. If the fault still exists, remove the converter and return it to Comtech EF Data for repair.

7.2.3.3 RF CONVERTER MODULE

IFLO LOCK DETECT:

A fault ("FT") indicates that the IFLO is not locked. Check all connections to the converter module to make sure they are secure. If the fault still exists, remove the Converter Module and return it to Comtech EF Data for repair.

7.2.3.4 SYNTHESIZER SUM LOOP MODULE

SUM LOOP DETECT:

A fault ("FT") indicates that the sum loop is not locked. Check all connections to the converter module to make sure they are secure. If the fault still exists, remove the Sum Loop Module and return it to Comtech EF Data for repair.

7.2.3.5 SYNTHESIZER FINE STEP MODULE

COARSE LOOP DETECT:

A fault ("FT") indicates that the coarse loop is not locked. Check all connections to the converter module to make sure they are secure. If the fault still exists, remove the Fine Step Module and return it to Comtech EF Data for repair.

FINE LOOP DETECT:

A fault ("FT") indicates that the fine loop is not locked. Check all connections to the converter module to make sure they are secure. If the fault still exists, remove the Fine Step Module and return it to Comtech EF Data for repair.

7.2.3.6 REFERENCE OSCILLATOR MODULE

REFERENCE LOCK DETECT:

A fault ("FT") indicates that the reference oscillator detected an external reference, but could not lock to it. Disconnect the external reference. If the fault still exists, remove the Reference Module and return it to Comtech EF Data for repair.

7.2.3.7 TEMPERATURE FAULT

CONVERTER OVER TEMPERATURE FAULT:

A fault ("FT") indicates that the converter is over temperature. Turn the prime power switch off and return the converter to Comtech EF Data for repair.

7.2.4 CONVERTER I/O MODULES

The Converter I/O Modules (IOM, or TSM) are installed on the rear panel of the converter. The screws holding the I/O Module to the converter chassis are installed "hand tight".

IMPORTANT When installing an I/O Module "**DO NOT**" use a screwdriver to tighten the module mounting screws - install screws "hand tight" only.

7.3 SPARE

Comtech EF Data recommends field maintenance replacement at the RF converter level, and that the converter be returned to Comtech EF Data for repairs. However, for field replacement of the converter modules, the following is a list of recommended spare.

Contact Comtech EF Data for the correct spares for and particular converter.

NOTES:

Index

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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