HPCST-5000

75W, 100W, 125W, 150W SSPA System
High-Power C-Band Satellite Terminal
Installation and Operation Manual

Part Number MN/HPCST5000.IOM
Revision 0

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October 19, 1998

Comtech EFData, 2114 West 7th Street, Tempe, Arizona 85281 USA, (480) 333-2200, FAX: (480) 333-2161.

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Preface

About this Manual

This manual provides installation and operation information for the EFData HPCST-5000 high-power C-Band satellite terminal. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the HPCST-5000.

Conventions and References Used in this Manual

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Related Documents

The following documents are referenced in this manual:

- *EFData CST-5000 C-Band Satellite Terminal Installation and Operation Manual*
- *EFData RSU-503L Redundancy Switch Unit Installation and Operation Manual*
- *EFData KP-10 External Keypad Installation and Operation Manual*
- *EFData Monitor and Control Software for EFData Satellite Terminals User's Guide*
- *EFData Specification SP/6750, HPCST-5000 High Power C-Band Satellite System*
- EFData *Specification SP/5351, HPA-6075 C-Band and 75W Power Amplifier*
- *EFData Specification SP/5110, HPA-500/-700 C-Band High Power (TWT) Amplifier*
- *EFData Specification SP/5389, HPCST-5000 High Power C-Band Satellite Terminal System*

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CHAPTER 1. INTRODUCTION

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Chapter 1. INTRODUCTION

This chapter describes the HPCST-5000 C-Band satellite terminal, referred to in this manual as “the HPCST-5000” (refer to Figure 1-1).

Note: The basic manual will reflect the 70 MHz configuration. Refer to Appendix A for other options.

1.1 Description

Figure 1-1. HPCST-5000

The HPCST-5000 is a complete, high-power C-Band satellite terminal system consisting of the following components (Table 1-1):

Table 1-1. HPCST-5000 Major Assemblies

Nomenclature	Description
Single-Thread Configuration	
Low Noise Amplifier (LNA)	65° KLNA with TRF (Optional: Noise Temperatures available)
Radio Frequency Transceiver (RFT)	Consists of an: • Up converter with 70 (140) MHz IF input • Down converter with a 70 (140) MHz IF output • M&C microprocessor • Power supply
Solid-State Power Amplifier (SSPA)	Consists of a solid-state power amplifier.
Redundancy Configuration	
1:1 Redundant LNA Plate	Consists of transmit reject filter, redundant LNAs (65°K), and a C-Band waveguide switch.
Radio Frequency Terminal (RFT)	Consists of two radio frequency terminal (RFT) assemblies.
C-Band SSPA Assembly	Consists of two solid-state power amplifiers.
Redundancy Switch Unit (RSU-503L)	Along with a redundancy cable/hardware kit, the RSU-503L provides the system with a single M&C interface, redundancy switchover control, and cabling.

The HPCST-5000 outdoor terminal consists of weatherproof components for uplink and downlink requirements. The redundant assemblies have been designed for antenna or pole mounting. The system has a single user interface connector for remote M&C.

In the TX (uplink) direction, the terminal accepts a 70 (140) MHZ IF signal and TX it in the 5.850 to 6.425 GHz frequency band. This output is coupled through an N-type connector to the external high power amplifier (SSPA) assembly.

In the redundant system, a high power output to the antenna through a waveguide transfer switch is provided. A high-power termination is included on the offline channel port of the waveguide switch for testing.

In the RX (downlink) direction, the terminal accepts an RF signal in the 3.6 to 4.2 GHz band, and converts the signal to a 70 (140) MHz IF output. The LNA assembly has a type-N coax output routed to RFT RX RF inputs. The RFT TX output power level at 1 dB compression used to drive the external SSPA is +8 dBm maximum. The up and down converters are dual conversion, configured with a single or dual synthesizer for TX and RX transponder selection.

The onboard microcomputer monitors and controls (M&C) the operational parameters of the HPCST-5000 components. The M&C system enables the user to locally or remotely control functions such as:

- Output power level
- Output On/Off
- TX/RX channel frequency

The system also reports terminal configuration status, as well as fault status of all HPCST-5000 components.

The RFT terminal can be initially configured by a keyboard/LCD controller within the enclosure, or by connection of a common ASCII/EIA-232 terminal connected to the serial port at the redundancy system interface connector (RSU [J16]). A command set to allow configuration control and retrieval of status information. If the customer M&C control unit is a sophisticated M&C station computer; the serial port can be set to EIA-485 for bus operation.

1.2 Applications

When used in conjunction with EFData modems, the HPCST-5000 is ideal for:

- Single digit carriers up to 2.048 Mbit/s.
- Multiple carrier operation over a 36/72 MHz bandwidth.

Note: Refer to Appendix A for the 140 MHz configuration.

Because the HPCST-5000 has a 70 MHz IF input, it can also be used for other analog and digital applications.

Small-to-medium size earth stations are easily constructed and commissioned with the HPCST-5000.

When used with a high-gain antenna, the HPCST-5000 can also be used as the Radio Frequency (RF) electronics of a central hub in point-to-multipoint applications, as well as serve as the terminal for the end points of a network.

1.3 Options

Refer to Table 1-2 for HPCST-5000 options.

Table 1-2. HPCST-5000 Options

Wattage, W	Cable/Hardware Kit	(Output) Crossguide Coupler
75	Standard Duplex	None
100	Standard TX Only	40 dB
125		
150		

Refer to Figure 1-2 for configuration options.

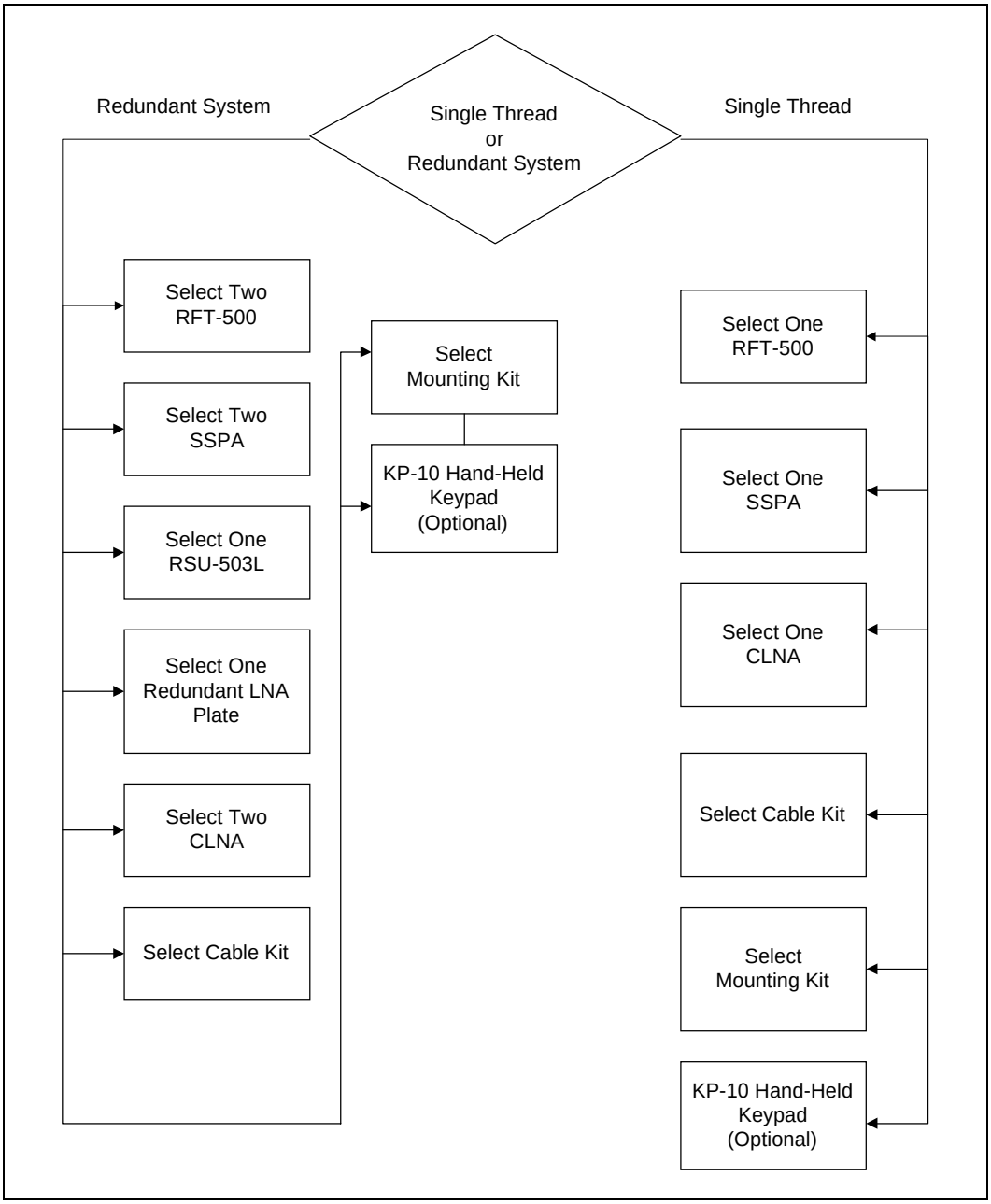


Figure 1-2. Configuration Options

1.4 Configurations

The HPCST-5000 can be ordered with various configurations, including:

- Single Thread Configuration
- 1:1 Redundant Configuration

1.4.1 Single Thread Configuration

Note: Refer to Section 3 for a detailed description of the single thread configuration.

The HPCST-5000 outdoor terminal consists of weatherproof components for uplink and downlink requirements. The single thread configuration (Figure 1-3) has been designed for antenna or pole mounting. The HPCST-5000 has a single customer-interface connector for remote monitor and control.

The on-board microcomputer monitors and controls the operational parameters. This Monitor and Control (M&C) system enables the customer to locally or remotely control functions such as:

- Input/Output attenuator level
- TX Output On/Off
- TX/RX channel frequency

The HPCST-5000 reports terminal configuration status, as well as fault status of all components. The RFT-500 can be initially configured by an optional on-board keypad, or an optional KP-10 Hand-Held Keypad, or by a connection of a common ASCII/EIA-232 or EIA-485 terminal connected to the serial port at the system interface connector (P1). A simple command set allows configuration control and retrieval of status information.

Refer to the *KP-10 Hand-Held Keypad, Installation and Operation Manual.*

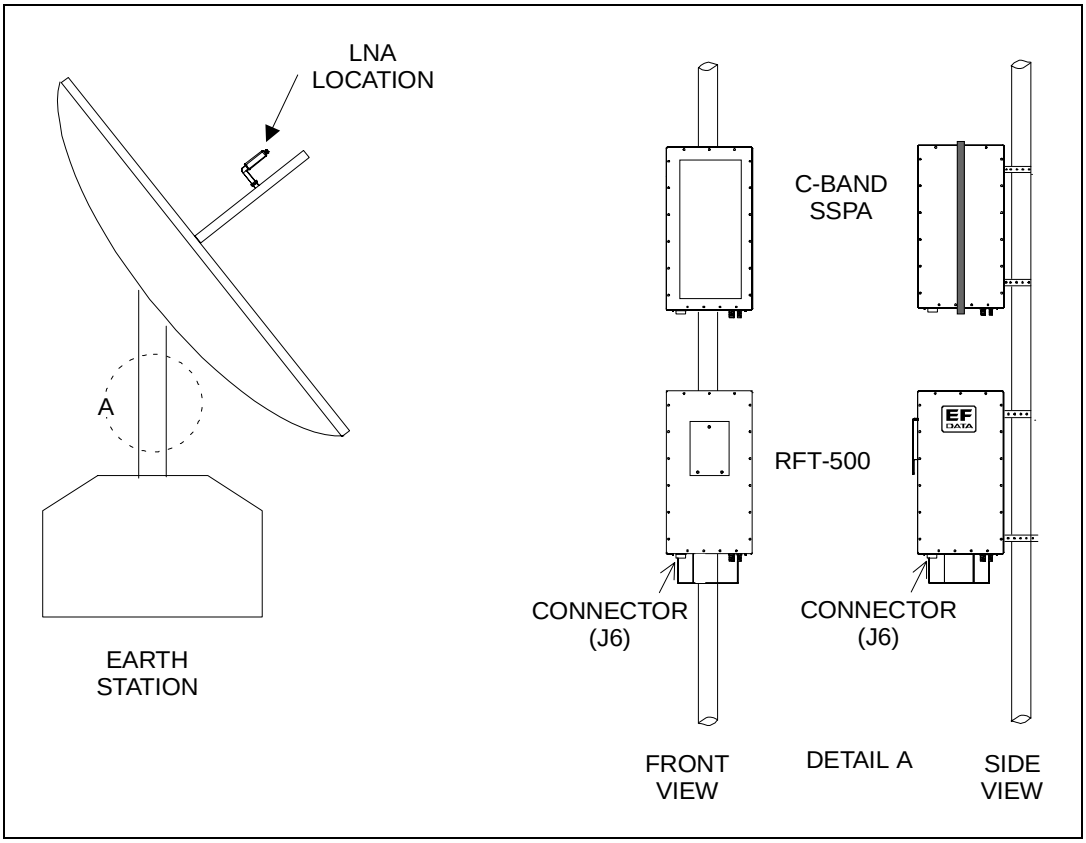


Figure 1-3. Typical View of Single Thread Installations

1.4.2 Redundant System

Note: Refer to Section 4 for a detailed description of the redundancy configuration.

Refer to Table 1-3 for typical HPCST-5000 redundant system components.

Table 1-3. HPCST-5000 Redundant System

Nomenclature	Description
1:1 Redundant LNA Plate	Consists of transmit reject filter, redundant LNAs (65°K), and a C-Band waveguide switch.
Radio Frequency Terminal (RFT)	Consists of two radio frequency terminal (RFT) assemblies. Each RFT includes an up converter, a down converter, an M&C microprocessor, and a power supply.
C-Band SSPA Assembly	Consists of two high-power SSPAs and a waveguide switch, high-power termination and connecting waveguide.
Redundancy Switch Unit (RSU-503L)	Along with a redundancy cable/hardware kit, the RSU-503L provides the system with a single M&C interface, redundancy switchover control, and cabling.

Note: For more information, refer to *RSU-503 Redundancy Switch Unit Installation and Operation Manual.*

The HPCST-5000 system outdoor terminal components are weatherproof units for the uplink and downlink requirements. The redundant assemblies have been designed for antenna or pole mounting. The HPCST-5000 system has a single customer-interface connector for remote monitor and control.

The on-board microcomputer monitors and controls the operational parameters. This M&C system enables the user to locally or remotely control functions such as:

- Input/Output attenuator level
- Output On/Off
- Transmit/Receive channel frequency

The HPCST-5000 reports terminal configuration status, as well as fault status of all components. The RFT can be initially configured by an optional on-board keypad or an optional KP-10 Hand-held Keypad, or by connection of a common ASCII/EIA-232 or EIA-485 terminal connected to the serial port at the system interface connector. A simple command set allows configuration control and retrieval of status information.

1.5 Component Descriptions

1.5.1 Radio Frequency Transceiver (RFT)

The RFT-500 assembly is a weatherproof enclosure housing the following:

- Up and down converters
- Frequency synthesizer
- M&C system
- Power supply and cables, which interface with an antenna subsystem

In the TX (uplink) direction, the terminal accepts a 70 (140) MHZ IF signal and transmits it in the 5.845 to 6.425 GHz frequency band. This output is coupled through an N-type connector to the external high power amplifier (SSPA) assembly. The redundant system provides the high power output to the antenna through a waveguide transfer switch. A high-power termination is included on the offline channel port of the waveguide switch for testing.

In the RX (downlink) direction, the terminal accepts an RF signal in the 3.6 to 4.2 GHz band, and converts the signal to a 70 (140) MHz IF output. The LNA assembly has a type-N coax output routed to RFT RX RF inputs.

The RFT TX output power level at 1 dB compression used to drive the external SSPA is +8 dBm maximum. The up and down converters are dual conversion, configured with a single or dual synthesizer for TX and RX transponder selection.

The microprocessor provides:

- On-line loop monitoring
- Dynamic control functions
- Configuration control
- Fault/status monitoring
- Serial computer/terminal interface

1.5.2 Low Noise Amplifier (LNA)

The low noise amplifier (LNA) assembly consists of a TX reject filter, waveguide switch, and two 65°K low-noise 50 dB gain amplifiers.

1.5.3 Solid-State Power Amplifier (SSPA)

Note: Refer to the SSPA Installation and Operational Manual for additional data.

The SSPA is available in:

- 75W
- 100W
- 125W
- 150W

The SSPA consists of the following subassemblies:

- Power amplifier
- Output waveguide assembly
- RF input isolation circuit

The SSPA is forced air cooled by a fan controlled by a thermal switch. The cooling fan is configured for 48 VDC operation. Depending upon the environmental conditions, the heat sink fins may become obstructed by debris, reducing the efficiency of the cooling system. The heat sink fins may require periodic maintenance in the form of removing debris.

1.5.4 Monitor and Control (M&C)

An on-board microcomputer monitors and controls all operational parameters and system status of the HPCST-5000. This powerful M&C system enables the user to locally or remotely control functions such as:

- TX/RX attenuator settings.
- TX/RX channel frequencies.

1.5.5 1:1 Redundant LNA Plate

The 1:1 redundant LNA plate provides noise temperature equivalent of 65°K and consists of two LNAs, waveguide switch (see Figure 1-4), and transmit reject filter.

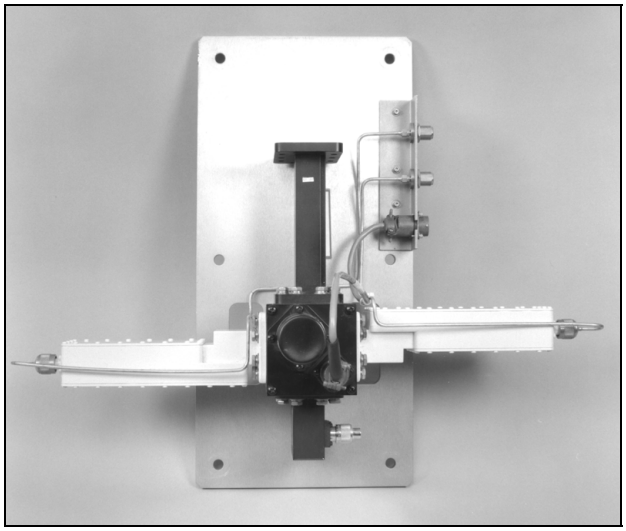


Figure 1-4. 1:1 Redundant LNA Plate

Note: Other LNAs are available. Contact EFData Customer Support for more information.

1.5.6 Redundant Switch Unit (RSU)

The RSU-503L (Figure 1-5) is an all-weather unit that provides for primary and backup operation as a communications terminal. The RSU is designed for mounting on either the antenna or support pole. The RSU controls the switching from primary to backup service in a 1:1 redundant configuration.

For information on the RSU-503L, refer to the *RSU-503 Redundancy Switch Unit Installation and Operation Manual*.

Figure 1-5. RSU-503L

1.5.7 KP-10 Hand-Held Keypad (Optional)

The optional KP-10 (Figure 1-6) is a handheld keypad that provides portable, external access for controlling Radio Frequency Terminals (RFTs) which are components of a CST, HPCST, or KST satellite terminal.

The KP-10 is typically used for initial set up or occasional changes to the configurations of RFTs, in both single and redundant systems. When the KP-10 is used with a redundant system, it is connected to an EFData redundancy switch unit.

Refer to the *KP-10 Hand-Held Keypad, Installation and Operation Manual.*

Figure 1-6. KP-10 Hand-Held Keypad (Optional)

1.6 High-Power C-Band Satellite Terminal Models

The HPCST is specifically designed for outdoor installation for earth station satellite communication. Because of the design, the units can be mounted on the antenna or the pole reducing transmission losses to the antenna feed. Refer to Table 1-4 for the HPCST model configurations.

Table 1-4. HPCST Models

Band	Model #	Frequency	Rated TX/RF Power, W
C-Band	HPCST-5000	TX: 5.845 to 6.425 GHz	75 100 125 150
C-Band	HPCST-5000	RX: 3.620 to 4.200 GHz	N/A

1.7 HPCST-5000 Specifications

1.7.1 Prime Power Specification

Refer to Table 1-5 for prime power specifications.

Table 1-5. Prime Power Specifications

Assembly	Ref Des	Option	Prime Power/Power Consumption
RFT-500	J5	AC	90 to 265 VAC, 47 to 63 Hz, 90W
SSPA-500:			Prime Power/Power Consumption
75W	J5	AC	90 to 265 VAC, 47 to 63 Hz, 500W
100W	J5	AC	90 to 265 VAC, 47 to 63 Hz, 700W
125W	J5	AC	90 to 265 VAC, 47 to 63 Hz, 800W
150W	J5	AC	90 to 265 VAC, 47 to 63 Hz, 1000W
LNA		DC	10.8 ± 0.2 VDC (as provided from RSU)
RSU-503L	J4, J8	DC	10.8 VDC (from either RFT-500)

1.7.2 System Interfaces

Refer to Table 1-6 for system interfaces on units.

Table 1-6. System Interfaces on Units

Description	Type
RFT-500:	
TX IF Input (J1)	TNC female, 50Ω, VSWR 1.5:1 maximum
RX IF Output (J3)	TNC female, 50Ω, VSWR 1.5:1 maximum
RX RF Input (J4, C-Band)	N, female, VSWR 1.5:1 maximum
TX RF Output (J2, C-Band)	N, female, VSWR 1.5:1 maximum
M&C Control (J6)	Circular, PT06E-16-26S
SSPA-500:	
RF TX Output (W/G)	CPR-137G, VSWR: 1.25:1 maximum
RF TX Input (J1, C-Band)	N, female, VSWR 1.25:1 maximum
RF TX Monitor (J4, C-Band)	N, female, VSWR 1.3:1, typical 40 dB coupler
M&C Control (J3)	Circular, PT06E-16-26S
LNA:	
RF RX Input (W/G)	CPR-229G, VSWR: 1.25:1 maximum
RF RX Output (2X)	N, VSWR 1.5:1 maximum., female
1:1 Switch Control	Circular, PT06E-14-19P

Table 1-6. System Interfaces on Units (Continued)

Description	Type
RS-503L:	
M&C for RFT #A (J4)	Circular, PT06E-16-26S
IF RX Input (J2)	TNC, female
IF TX Output (J1)	TNC, female
M&C for RFT #B (J8)	Circular, PT06E-16-26S
IF RX Input (J6)	TNC, female
IF TX Output (J5)	TNC, female
Remote M&C (J16)	Circular, PT06E-16-26S
IF RX Output (J15)	TNC, female
IF TX Input (J14)	TNC, female
Waveguide Switch (J10)	Circular, PT06E-14-19S
M&C Single Thread System with SSPA	Circular, KPT06E-16-26P on RFT-500
M&C 1:1 System with SSPA	Use J16 on RSU-503L
Waveguide TX Switch with SSPA	Circular, MS3112E-14-6S

1.7.3 System Environment Specification

Refer to Table 1-7 for environmental conditions.

Table 1-7. Environmental Specifications

Environment	Conditions
Temperature:	
Operating	-40° to +50°C (-40° to 122°F)
Survival	-50° to +70°C (-58° to 158°F) , non-operating
Vibration	1.5g, 5 to 200 Hz and normal transportation levels
Shock	6g maximum
Humidity	0% to 100% relative at -40° to +50°C (-40° to 122°F) 95% at 55°C (131°F) for 72 hours
Precipitation	MIL-STD-810/Method 506.2
Salt Fog	MIL-STD-810/Method 509.2
Sand and Dust	MIL-STD-810/Method 510.1
Altitude:	
Operation	0 to 10,000 ft, derate 2°C/1000 ft ASL
Survival	0 to 40,000 ft
Solar Radiation	360 BTU/hr/ft^2 at 50°C (122°F)
Safety	EN60950 (IEC-950, UL 1950)
Emissions	EN55022, Class A (FCC Part 15J, Class A)
Immunity	EN50082-1

1.7.4 HPCST-5000 Monitor and Control

The HPCST-5000 terminal system has a single interface connector (J16) located on the RSU-503L for redundant configurations. For single thread configuration, the M&C is connected to connector (P1) on the RFT-500. The interface provides the customer with control of the terminal system redundant configuration including the C-Band SSPA through the integrated system cable harness. The options for customer control of the terminal system are provided in Table 1-8.

Table 1-8. System Monitor and Control

System Type	Interface	M&C Options
HPCST-5000 Terminal System	EIA-232/EIA-485 Serial Bus	On-board Keypad, KP-10 Handheld Keypad, or ASCII terminal through J16 of the RSU-503L.

1.7.5 System Receive Characteristics

The RX performance is defined for the C-Band LNA input to the 70 (140) MHz output of the RFT-500. Intervening cable losses due to installation variables must be accounted for when comparing to the performance data provided in Table 1-9.

Table 1-9. System Receive Characteristics

Receiver Characteristics		
Input Frequency Range	3.625 to 4.200 GHz in 2.5 MHz steps (Optional: 125 kHz)	
Frequency Sense	No inversion	
Input Level	-127 to -80 dBm	
RX Gain Adjust (0.05 dB typical steps, 1 dB maximum)	95 dB minimum 0 to 20 dB minimum (remotely controlled)	
RX Frequency Stability	$\pm$ 1 x 10^{-8} at 23°C (73°F)	
Life RX Frequency Stability	$\pm$ 1 x 10^{-7} at 23°C (73°F)	
Gain Flatness	$\pm$ 1.0 dB/36 MHz $\pm$ 0.25 dB/4 MHz	
RX IF Output Bandwidth	70 $\pm$ 18 MHz at 1 dB (Optional: 140 $\pm$ 36 MHz at 2 dB)	
Noise Figure	65° K (other options available)	
TX Frequency Reject	60 dBm	
RX image Rejection	-45 dBm	
Linearity (Third order intercept)	Intermods < -35 dBc for two tones at –89 dBm at 95 dB gain.	
Group Delay (any 36 MHz): Linear Parabolic Ripple	IESS-309 (Fig. 3) < 10ns 0.28 ns/MHz 0.025 ns/MHz^2 1 ns P–P	
Synthesizer Lock Time	< 1 second	
Phase Noise (SSB) at: 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz	(Maximum) -30 dBc/Hz -60 dBc/Hz -70 dBc/Hz -75 dBc/Hz -80 dBc/Hz	Or < 2.8° rms (DSB) integrated 10 Hz to 1 MHz
Spurious (signal related) at 0 dBm RX IF output	-40 dBc	
Inband Overdrive	No damage to 0 dBm	
Third Order Intercept	+25 dBm minimum	
RX IF Output at 1 dB Compression	+15 dBm minimum	

1.7.6 System Transmit Characteristics

TX characteristics for the system are provided in Table 1-10.

Note: 1 dB compression characteristic is measured at the output flange of the C-Band SSPA.

Table 1-10. System Transmit Characteristics

Transmit Characteristics				
Frequency Range	5.845 to 6.425 GHz, in 2.5 MHz steps (125 kHz optional)			
Small Signal Gain (10 dB backoff), Nominal	75W 79 dB	100W 80 dB	125W 81 dB	150W 82 dB
TX IF Input Level Range	-35 to -25 dBm typical			
Power Output at $P_{1dB:}$ (minimum)	75W 48 dBm	100W 49 dBm	125W 50 dBm	150W 51 dBm
TX IF Input Bandwidth at –1 dB	70 ± 18 MHz (Optional: 140 ± 36 MHz)			
Gain: Stability (Overtemp) Flatness Variation	± 1.5 dB ± 1.5 dB/36 MHz ± 2.0 dB			
Group Delay (any 36 MHz): Linear Parabolic Ripple	< 30 ns 0.28 ns/MHz 0.15 ns/MHz^2 < 1 ns P-P			
TX Frequency Stability	± 1 x 10^{-8}			
TX Synthesizer Lock-up Time	< 1 second			
Spurious (not inter-mods) : At 6 dB backoff from P1 dB With Carrier Off Intermod Spurious with two equal carriers Harmonics (out-of-band)	IESS-309, Para. 3.2.1 -40 dBc min. (≤ 2.048 MHz inform. rate) -50 dBc min. (> 2.048 MHz inform. rate) - 24 dBm/4 kHz (anywhere in satellite band) - 32 dBm at 6 dB backoff - 60 dBm at 6 dB backoff			
Phase Noise (SSB) at: 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz	(Maximum) -30 dBc/Hz -60 dBc/Hz -70 dBc/Hz -75 dBc/Hz -80 dBc/Hz	Or < 2.8° rms (DSB) integrated 10 Hz to 1 MHz		

1.7.7 Leading Particulars

The physical size and weight of the terminal system components are provided in Table 1-11.

Note: A redundant system is twice the size and weight of the single system.

Table 1-11. Leading Particulars

Component	Maximum Size and Weight
RFT-500:	
Single Thread System:	
Dimensions	23”L x 9.3” W x 10.3” H (58.42 x 23.62 x 26.16 cm)
Weight	40 lbs. (18.1 kg)
SSPA-500:	
Single Thread System:	
Dimensions	18.5”L x 9.75”W x 9.25”H (46.99 x 24.76 x 23.49 cm)
Weight	35 lbs. (18.1 kg)
1:1 SSPA-500:	
Redundant Configuration:	
Dimensions	29.75”L x 21.25”W x 9.25”H (75.56 x 53.97 x 23.49 cm)
Weight	95 lbs. (43.09 kg)
RSU-503L:	
Dimensions	8.0”L x 11.0”W x 8.0”H (20.32 x 27.94 x 20.32 cm)
Weight	7.5 lbs (3.40 kg)
LNA (Dual):	
Dimensions	26.0”L x 21.0”W x 14”H (66.04 x 53.34 x 35.56 cm)
Weight	20 lbs (9.07 kg)

1.8 RFT Specification

Refer to Table 1-12 for RFT-500 specifications.

Table 1-12. RFT-500 Specifications

Transmit Characteristics		
Output Frequency (No Inversion)	5.845 to 6.425 GHz	
Input Frequency	70 ± 18 MHz 140 ± 36 MHz (optional)	
Output Power at 1 dB compression	+8 dBm	
Third Order Intercept	+18 dBm (for +8 dBm)	
Nominal Small Signal Gain	26 dB (for +8 dBm)	
Gain Adjust Range	0 to 25 dB, in 0.5 dB steps	
Gain Variation: Over 36 MHz Over 36 MHz, Temperature and Aging	 ± 1 dB maximum ± 2 dB maximum	
Noise Figure: Maximum Attenuation Minimum Attenuation	 23 dB maximum 15 dB maximum	
Group Delay (any 36 MHz): Linear Parabolic Ripple	< 30 ns 0.28 ns/MHz 0.15 ns/MHz^2 < 1 ns P-P	
Synthesizer Step Size	2.5 MHz (optional 125 kHz)	
Phase Noise (SSB) at: 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz	 -30 dBc/Hz -60 dBc/Hz -70 dBc/Hz -75 dBc/Hz -80 dBc/Hz	Or < 2.8° rms (DSB) integrated 10 Hz to 1 MHz
Frequency Stability: Annual at 23°C Over Temperature After 30 Minutes Warm-up Electrical Adjustment	 ± 1 x 10^{-7} ± 1 x 10^{-8} (-40° to +55°C) (-40° to +131°F) ± 1 x 10^{-8} 0.5 x 10^{-7}	
Isolation on Fault Shutdown	-60 dBc minimum	
Spurious: < 250 kHz Carrier Offset > 250 kHz Carrier Offset	 -35 dBc maximum -50 dBc maximum	
RF Output VSWR	1.5:1 at 50Ω	
RF Output Connector	N-Type female	
IF Input VSWR	1.5:1 at 50Ω	
IF Input Connector	TNC female	

Table 1-12. RFT-500 Specifications (Continued)

Receive Characteristics				
Input Frequency (No Inversion)	3.620 to 4.200 GHz			
Output Frequency	70 ± 18 MHz 140 ± 36 MHz (optional)			
Output Power at 1 dB Compression	+15 dBm			
Third Order Intercept	+25 dBm			
Gain Adjust Range (Typical, with LNA)	77 to 98 dB			
Gain Variation (with LNA): Over 36 MHz Over 36 MHz, Temperature and Aging	 ± 1.5 dB maximum ± 4 dB maximum			
Noise Temperature (with LNA)	LNA specification			
Group Delay (any 36 MHz): Linear Parabolic Ripple	< 30 ns 0.28 ns/MHz 0.15 ns/MHz^2 < 1 ns P-P			
Synthesizer Step Size	2.5 MHz (optional 125 kHz)			
Phase Noise (SSB) at: 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz	 -30 dBc/Hz -60 dBc/Hz -70 dBc/Hz -75 dBc/Hz -80 dBc/Hz	Or < 2.8° rms (DSB) integrated 10 Hz to 1 MHz		
Frequency Stability: Annual at 23°C Over Temperature After 30 Minutes Warm-up Electrical Adjustment	 ± 1 x 10^{-7} ± 1 x 10^{-8} (-40 to +55°C) (-40° to +131°F) ± 1 x 10^{-8} 0.5 x 10^{-7}			
Spurious Non-Signal Related	-60 dBm maximum			
Image Rejection (All Conversions)	> 35 dB			
Linearity	Intermods < -35 dBc for two tones at -89 dBm at 95 dB gain			
RF Input VSWR	1.5:1 at 50Ω			
RF Input Connector	Type N female			
IF Output VSWR	1.5:1 at 50Ω			
IF Output Connector	TNC female			
Monitor and Control				
Control Interface	EIA-232, EIA-485, or optional keyboard			
Control Functions	SELECT RF OUTPUT U/C FREQ D/C FREQ	U/C ATTN D/C ATTN PROGRAM BAUD	ADDRESS PARITY LNA PWR LNA FLT_	CAL. REF ADJ XFLT EN RSW MODE LOCK MODE
Monitor Functions	U/C TEMP D/C TEMP HPA TEMP		TUV TDV TIV	
Fault Detect Functions	RESTART UPLINK DOWNLINK 5V PWR	12V PWR HPA LNA U/C LOCK		U/C TUN D/C LOCK D/C TUN IF LOCK IF TUN

1.9 C-Band SSPA Specification

Refer to Table 1-13 for C-Band SSPA specifications.

Table 1-13. C-Band SSPA Specifications

Parameter	Specification			
Power: Power Requirements Power Consumption Power Factor Correction	 90 to 230 VAC, 47 to 63 Hz, single phase 6A typical at 110 VAC 95%, minimum			
Frequency Range	5.845 to 6.450 GHz			
Power Output (P_{1dB})	75 W 48	100 W 49	125 W 50	150 W 51
Small Signal Gain	75 W 79	100 W 80	125 W 81	150 W 82
Gain Flatness (at room temperature), maximum	2 dB P–P over 600 MHz 0.6 dB P–P over 40 MHz			
Gain Slope	0.015 dB/MHz, maximum			
Gain Variation	± 1.5 dB over frequency and temp range			
Local Gain Adjustment	± 3 dB, minimum			
Input Return Loss	19 dB, minimum			
Output Return Loss	19 dB, minimum			
Noise Figure at Maximum Gain	10 dB			
Spurious Rated Power, maximum	-65 dBc, maximum			
Harmonic at rated power	-60 dBc, maximum			
AM/PM Conversion at Rated Power	2.5°/dB			
Third Order Intermodulation (Two equal tones 5 MHz apart)	-34 dBc at 6 dB backoff from rated P_{1dB} -26 dBc at 3 dB backoff from rated P_{1dB}			
Group Delay: Linear Parabolic Ripple	 0.02 ns/MHz 0.003 ns/MHz^2 1 ns P–P			
Residual AM (F* = Frequency in kHz)	-45 dBc -20 (1+ log F*) dBc -80 dBc	0 to 10 kHz 10 kHz to 500 kHz 500 kHz to 1 MHz		
Phase Noise	Meets IESS-308/-309			

1.10 LNA Specification

Refer to Table 1-14 for LNA specification.

Table 1-14. LNA Specifications

Parameter	Specification
Frequency	3.620 to 4.200 GHz
Noise Temperature (with TRF)	65°K maximum (lower temperatures optional)
Gain	50 dB minimum, 54 dB nominal (optional 60 dB)
Gain Flatness	± 1 dB/575 MHz
Gain vs. Temperature	± 3 dB maximum
1 dB Compression Point	+10 dBm minimum
Third Order Intercept	+20 dBm minimum
Group Delay: Linear Parabolic Ripple	 ± 0.01 ns/MHz maximum 0.001 ns/MHz^2 maximum 0.1 ns P-P
Input VSWR	1.25:1
Output VSWR	1.5:1
Input Connector	CPR229G (hold pressure to 0.5 PSIG)
Output Connector	Type N
Spurious	Below thermal noise/100 kHz
TRF Rejection	55 dB

1.11 Dimensional Drawings

Refer to Figure 1-7 for RFT dimensional requirements.

Note: All dimensions are in inches, centimeters are in parenthesis.

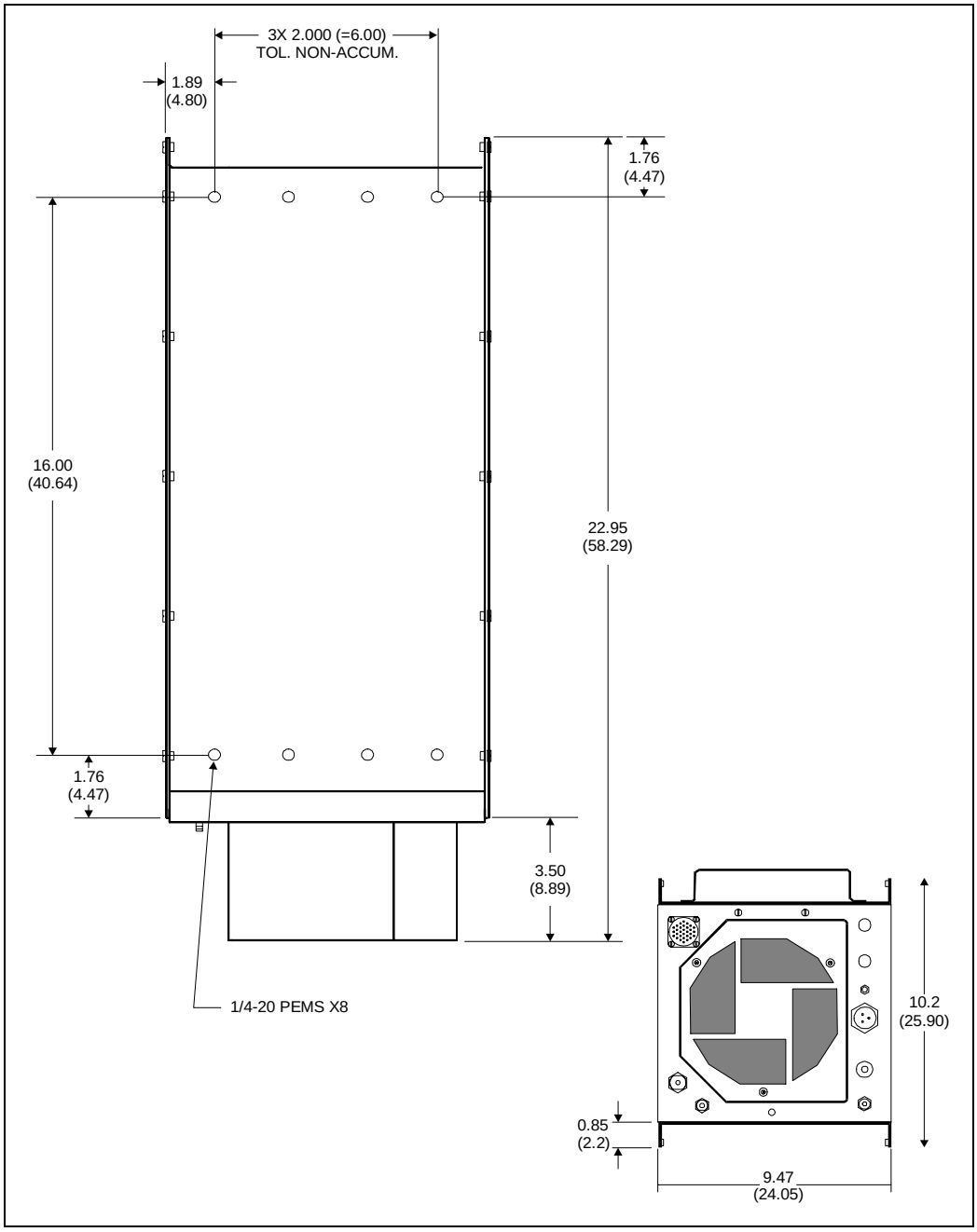
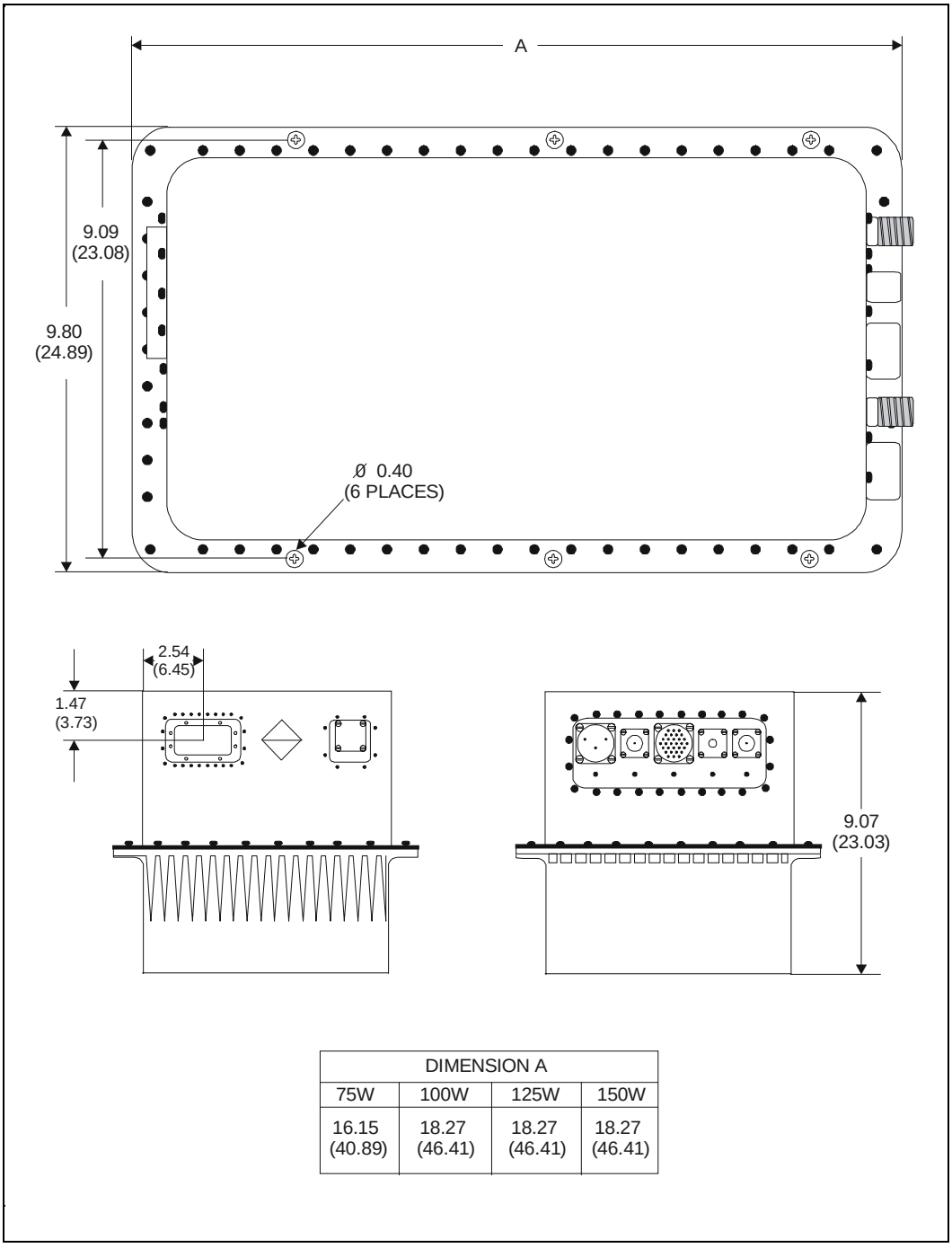


Figure 1-7. RFT Dimensional Requirements

Refer to Figure 1-8 for C-Band SSPA dimensional requirements.

Note: All dimensions are in inches, centimeters are in parenthesis.



DIMENSION A			
75W	100W	125W	150W
16.15 (40.89)	18.27 (46.41)	18.27 (46.41)	18.27 (46.41)

Figure 1-8. C-Band SSPA Dimensional Requirements

Refer to Figure 1-9 and Figure 1-10 for standard LNA dimensional requirements.

Note: All dimensions are in inches, centimeters are in parenthesis.

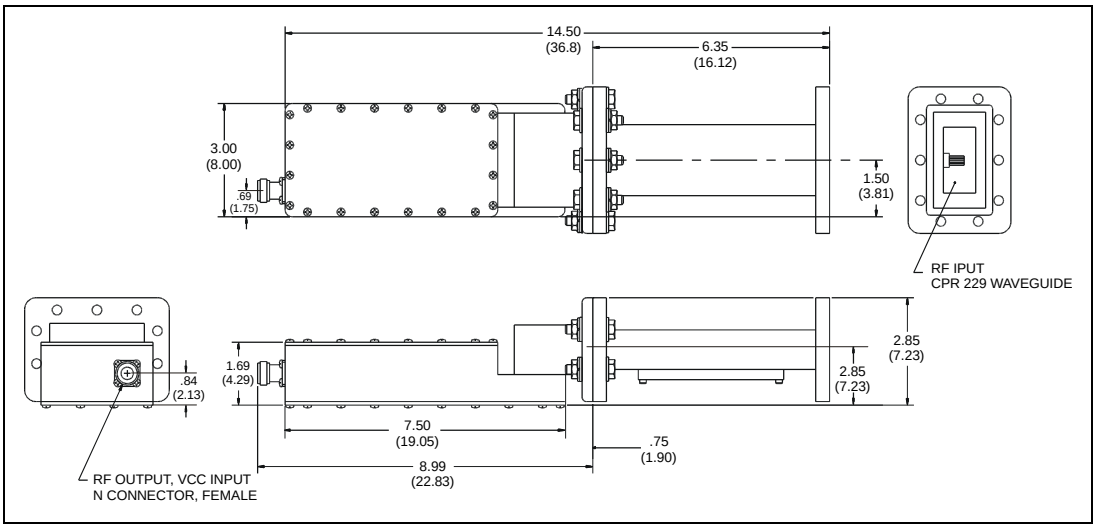


Figure 1-9. Single Thread Configuration Dimensional Requirements

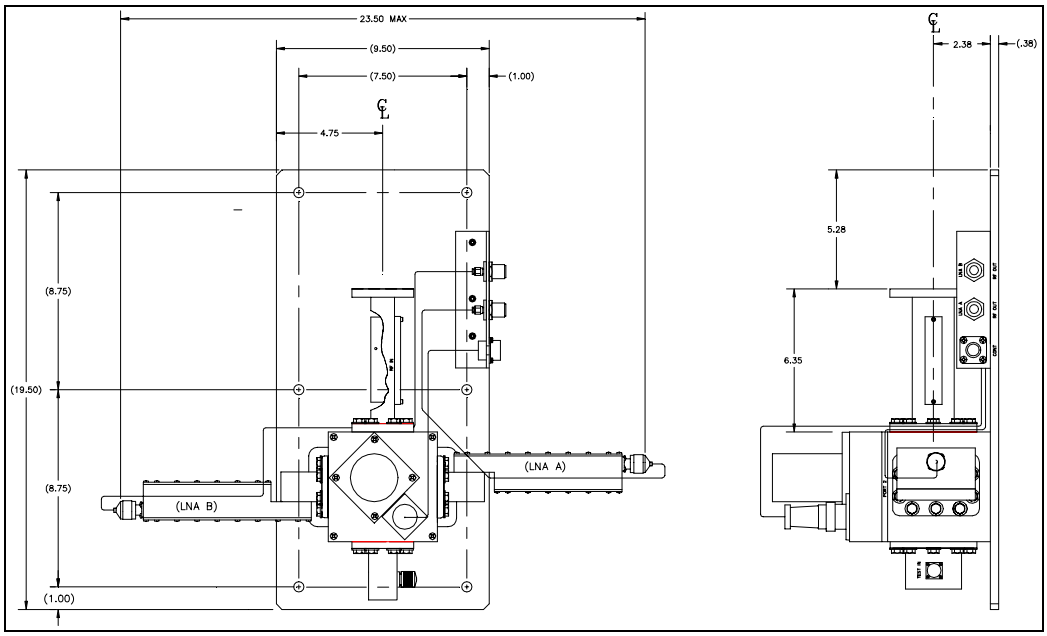


Figure 1-10. Standard Redundant Configuration Dimensional Requirements

Chapter 2. EXTERNAL CONNECTIONS

This chapter describes the external connections of the HPCST-5000 terminal system.

Be alert when handling electrical equipment. Severe bodily harm may be the result.

2.1 External Connections

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

2.1.1 RFT External Connections

Connections between the RFT-500 and other equipment are made through six connectors. These connectors are listed in Table 2-1 and their locations are shown in Figure 2-1. The use of each connector is described in the following paragraphs.

Cables for connectors J2, J4, and J5 are supplied by EFData. A connector kit for the remote connector, J6, also is supplied. All other connections are customer-supplied.

Table 2-1. Rear Panel Connectors

Name	REF DES	Connector Type	Function
TX/IF IN	J1	TNC	TX IF INPUT (70/140 MHz)
TX/RF OUT	J2	Type N	5.845 to 6.425 GHz Output
RX/IF OUT	J3	TNC	RX IF OUT (70/140 MHz)
RX/RF IN	J4	Type N	3.620 to 4.200 GHz Input
PRIME PWR	J5	3- or 4-pin CIR	Prime Power Input
REMOTE	J6	26-pin CIR	Remote Interface
GND	ERDE GND	#10-32 Stud	Chassis Ground

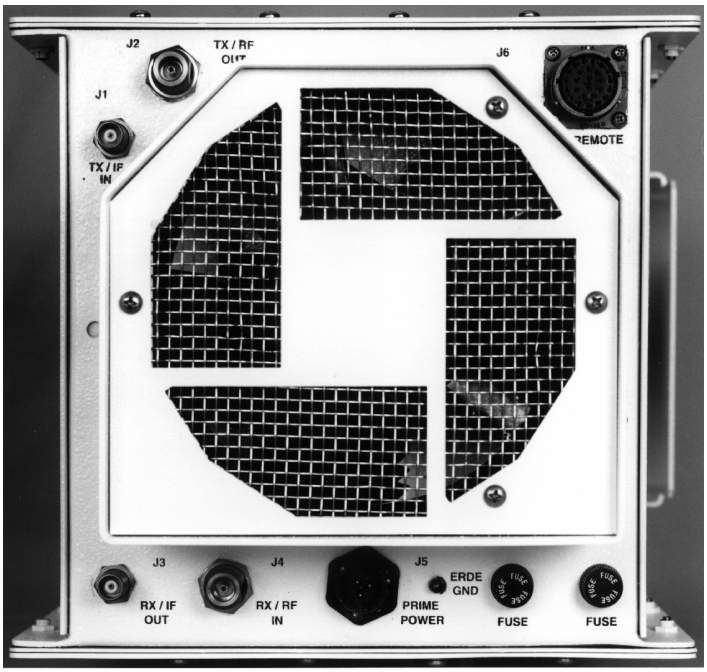


Figure 2-1. RFT External Connections

2.1.1.1 TX/IF Input (J1)

The TX/IF input is a TNC connector that receives the signal from the indoor unit. The input impedance is 50Ω, and the frequency is 70 ± 18 MHz (optional 140 ± 36 MHz).

The typical power level is from -45 to -25 dBm, depending on the configuration and application.

2.1.1.2 TX/RF Output (J2)

The TX/RF output is a type N connector that sends the signal to the antenna. The output impedance is 50Ω. The output frequency range is from 5.845 to 6.425 GHz. The output 1 dB compression point is +8 dBm.

2.1.1.3 RX/IF Output (J3)

The RX/IF output is a TNC connector that sends the received signal to the indoor unit. The output impedance is 50Ω, and the frequency is 70 ± 18 MHz (optional 140 ± 36 MHz).

The 1 dB output compression point is +15 dBm. Maximum output power operation is +9 dBm (-6 dB from 1 dB compression) to -50 dBm, depending on system gain requirements. The down converter has 26 to 47 dB of gain, and is adjustable by the customer from 0 to 21 dB of attenuation.

The typical system gain includes a 50 dB LNA, making the total system gain 76 to 97 dB.

Note: A 60 dB LNA is used only when there are extremely long cables from the LNA to the down converter and can be ordered as an option.

2.1.1.4 RX/RF Input (J4)

The RX/RF input is a type N connector that receives the signal from the LNA. The input impedance is 50Ω. The input frequency range is from 3.620 to 4.200 GHz. The input signal level ranges between -50 and -25 dBm, depending on LNA and antenna gain.

The input level should be set to give the required signal level at J3, the RX/IF Output.

2.1.1.5 Prime Power (J5)

The AC power is supplied to the RFT by a 3-pin circular connector.

Normal input voltage is 90 to 265 VAC, 47 to 63 Hz, and 90W.

The AC pinout is as follows:

Pin #	Name	Function	Wire Color
A	HI	Line	Brown
B	LO	Neutral/Line	Blue
C	GND	Ground	Green/Yellow

2.1.1.6 Serial Remote Control (J6)

The remote connector on the RFT is used to interface the M&C functions to a remote location. This interface can be either EIA-232 or EIA-485 (Figure 2-2).

When using an EIA-485 interface, the TX and RX signals are able to accommodate either type of remote equipment pinouts. As long as the polarities of the remote equipment TX and RX signals are correct, this remote interface will be completely compatible.

Refer to Table 2-2 for a list of pinouts for the J6 connector.

For standard EIA-232 or EIA-485 applications, an adapter cable must be used to connect the 26-pin connector (J6) to a standard 9-pin D.

Table 2-2. RFT Remote Control Connector, J6

Pin #	Name		Description
	EIA-232	EIA-485	
A	GND	-RX/TX	RX/TX Data
B		-RX/TX	RX/TX Data
C		+RX/TX	RX/TX Data
D	CTS	+RX/TX	Clear to Send *(see Note 1)*
E	RD/RX		Receive Data
F	RTS		Ready to Send *(see Note 1)*
G	TD/TX		Transmit Data
H	DSR		Data Set Ready
J		GND	Ground
K	LNA_PWR		Output, 10V for powering LNA *(see Note 2)*
L	EXT_PWR		Output voltage, 11V, to power RSU-503 and KP-10
M	EXT FLT		Input, logic 0 or 5V: 5V = FLT, 0V = normal *(see Note 3)*
N	N/C		
P	SPARE		N/C
R	GND		Ground
S	SPARE		N/C
T	PWR MON		EXT HPA PWR Level Monitor (Future)
U	UL_NC		Uplink fault relay, connects to uplink COM with fault
V	UL_COM		Uplink fault relay, COMMON
W	UL_NO		Uplink fault relay, opens with fault
X	DL_NC		Downlink fault relay, connects to DL_COM with fault
Y	DL_COM		Downlink fault relay, COMMON
Z	DL_NO		Downlink fault relay, opens with fault
a	LNA PWR RTN		Return for LNA Power *(see Note 2)*
b	EXT_TEMP		EXT HPA Temperature Monitor
c	ENAB/DISAB		EXT HPA RF Enable

Notes:

1. In EIA-232 mode, CTS is tied to RTS.
2. LNA can be powered from these pins instead of through the RF cable.
3. 5V is a floating level.

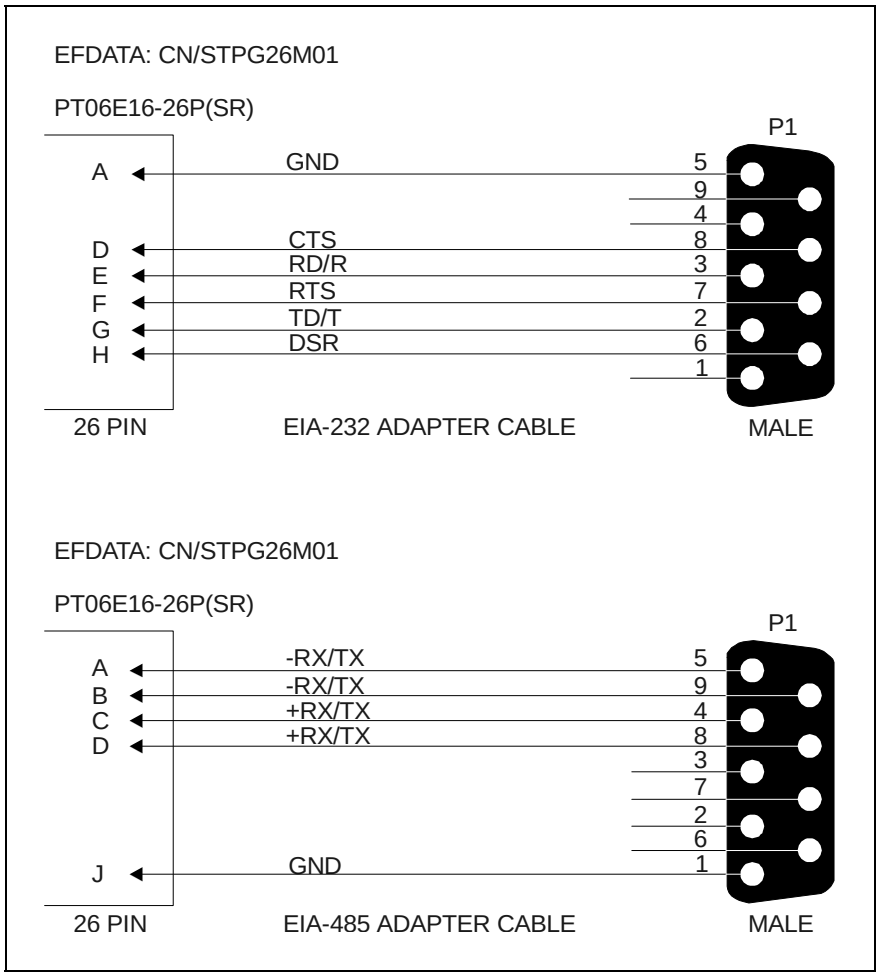


Figure 2-2. Serial Adapter Cables

2.1.1.7 Ground (GND)

A #10-32 stud is available on the rear of the unit for the purpose of connecting a common chassis ground among all of the equipment.

2.1.2 C-Band SSPA External Connections

Always terminate the output waveguide of the amplifier with an RF load capable of dissipating full CW RF power. Do not look into the output port of the powered RF amplifier. Severe bodily harm can be the result.

Connections between the C-Band SSPA and other equipment are made through five connectors. These connectors are listed in Table 2-3, and their locations are shown in Figure 2-3. The use of each connector is described in the following paragraphs.

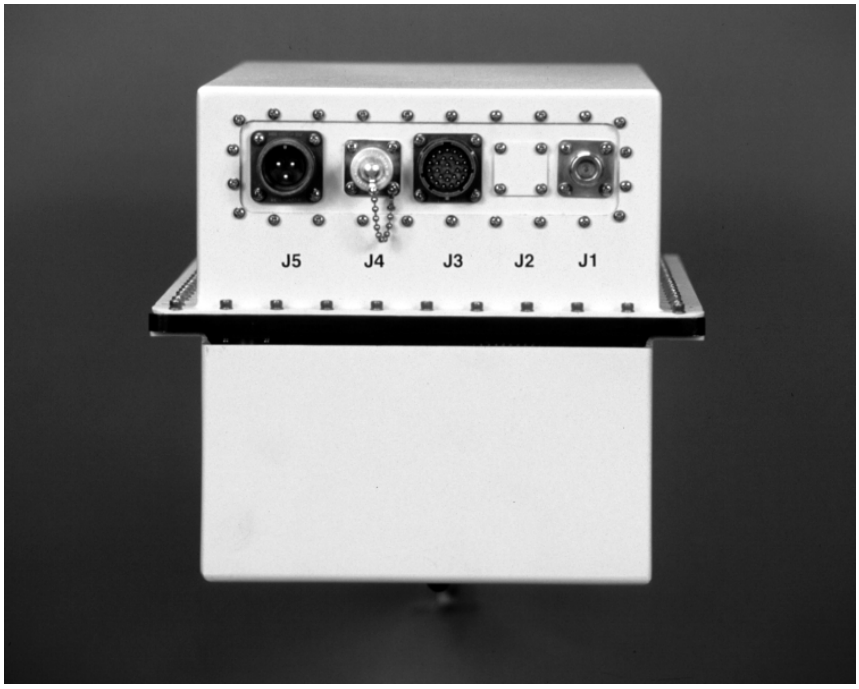


Figure 2-3. C-Band SSPA External Connections

Table 2-3. C-Band SSPA External Connections

Name	Ref Des	Connector Type	Function
RF Input	J1	N-Type, female	RF Input
Discrete Interface	J3	MS3112E16-26P (M)	M&C port for RFT500
RF Output Monitor Port	J4	N-Type, female	Independent M&C of output power levels (-40 dB coupled)
AC Line	J5	MS3102R16-10P (M)	Prime Power Supply
RF Output	J7	CPR-137G (Grooved)	W/G connection

2.1.2.1 RF Input (J1)

The RF Input is an N-type connector that receives the signal from the RF TX output of the RFT. The input impedance is 50Ω.

The input frequency range is from 5.845 to 6.425 GHz.

The input level should be set to give the required signal at J7, RF Output.

2.1.2.2 Gain Control (J2)

The potentiometer located under the cover is used to set nominal system gain. Adjustment range is 6 dB minimum.

Note: Gain Control shall be covered with a sealed metal cover and secured with screws and washers.

2.1.2.3 Discrete Interface (J3)

The SSPA is controlled using a discrete interface. Control commands to the SSPA are collected from the monitor and control system of the RFT-500. The following table lists the dedicated pin outs for the 26-pin monitor and control connector of the SSPA.

Type	Pin	Function
Control Command	H	RF Enable *(see Note 1)*
	R	System Common *(see Note 1)*
Status Command	D	Summary Fault (Open on Fault) *(see Note 2)*
	C	Thermistor Output *(see Note 3)*
	E	Future
	G	Status Common

Notes:

1. RF Enable (Pin H connected to Pin R) required to turn the RF Output ON. Disconnecting the RF Enable pin from the system control pin will cause the C-Band SSPA to reset. If default parameters must be reloaded, they will not affect the normal gain of the unit.
2. The Summary Fault contact will be in a NO FAULT condition (Pin D connected to Pin G), until a C-Band SSPA fault is detected. This is regardless of the RF Enable input state. When an internal summary fault is detected, the C-Band SSPA will automatically mute its output. When a summary fault condition clears the summary fault output, the RF Output will return to the NO FAULT condition after a RESET (AC power ON/OFF cycle).
3. A thermistor is mounted in order to accurately reflect the temperature of the C-Band SSPA's RF components. One lead is connected to Status Common (Pin G) and the other lead is connected to Thermistor Output (Pin C).

2.1.2.4 RF Output Monitor Port (J4)

This RF interface is used for independent monitoring of the C-Band SSPA's output power levels through the use of an external power meter.

2.1.2.5 Prime Power (J5)

The power supply portion of the C-Band SSPA supplies all the internal voltage necessary to operate the RF section and the Alarm/Interface board. The power supply is configured for 90 to 265 VAC.

Pin	Function	Wire Color
A	Line	Brown
B	Ground	Green/Yellow
C	Neutral	Blue

2.1.2.6 RF Output (J7)

Waveguide connection CPR-137R (grooved) is located on the side of the C-Band SSPA.

2.1.2.7 Alarm/Interface Board

The Alarm/Interface board provides:

- Status indicator by Form-C relay contacts:
  - Fault
  - Alarm
  - High reflected power (HRP)
  - RF mute
  - Output power level monitoring
- Mute mode which may be asserted by a remote current mode MUTE signal. A current rating of 20 mA may be a MUTE or ENABLE signal.
- Reset the HRP latch by remote current mode RESET signal. A current rating of 20 mA may reset the HRP latch if this condition occurred.
- The alarm/interface board is connected to the microwave power amplifier and to the customer's interface.

The Alarm/Interface board receives the analog signal from the reflected power sensor. The power amplifier will be muted when the input voltage is above the threshold level (with 1 second delay). When this event has occurred, HRP relay is de-energized and its Normal Close contact will become OPEN. It will indicate the fault condition on the customer interface.

Power up returns the system to the active condition if the amplifier is in the normal condition. The threshold level is set for VSWR of 2:1 maximum.

Prolonged operation without a load at the output may cause severe bodily harm. Do not operate the unit if the RF output is not connected to a load.

3 Chapter 3. Single Thread Configuration

This chapter provides installation information for single thread configuration (Figure 3-1) system, including:

- Unpacking and inspecting the parts
- Installing the RFT
- Installing the C-Band SSPA
- Installing the LNA
- External connections

High Voltage Hazards:

The HPCST-5000 utilizes high voltage that can be lethal if contacted. The terminal system components should not be operated without a cover unless the user is thoroughly familiar with its operation and experienced with high voltage.

RF Radiation Hazards:

Prior to operation of terminal system, ensure that all microwave connections are securely fastened. Check that there is no microwave leakage. Never operate the HPCST-5000 with an open waveguide. This amplifier is capable of generating high power microwave radiation, which can cause bodily harm.

Safety Summary:

Equipment of this nature has inherent hazards. Operator or service technicians should have training on the high-power satellite terminal systems. When the HPCST-5000 cover is removed, high voltage may be exposed. Use extreme care when operating the amplifier with its cover removed. Extreme physical injury may result if these warnings are not observed.

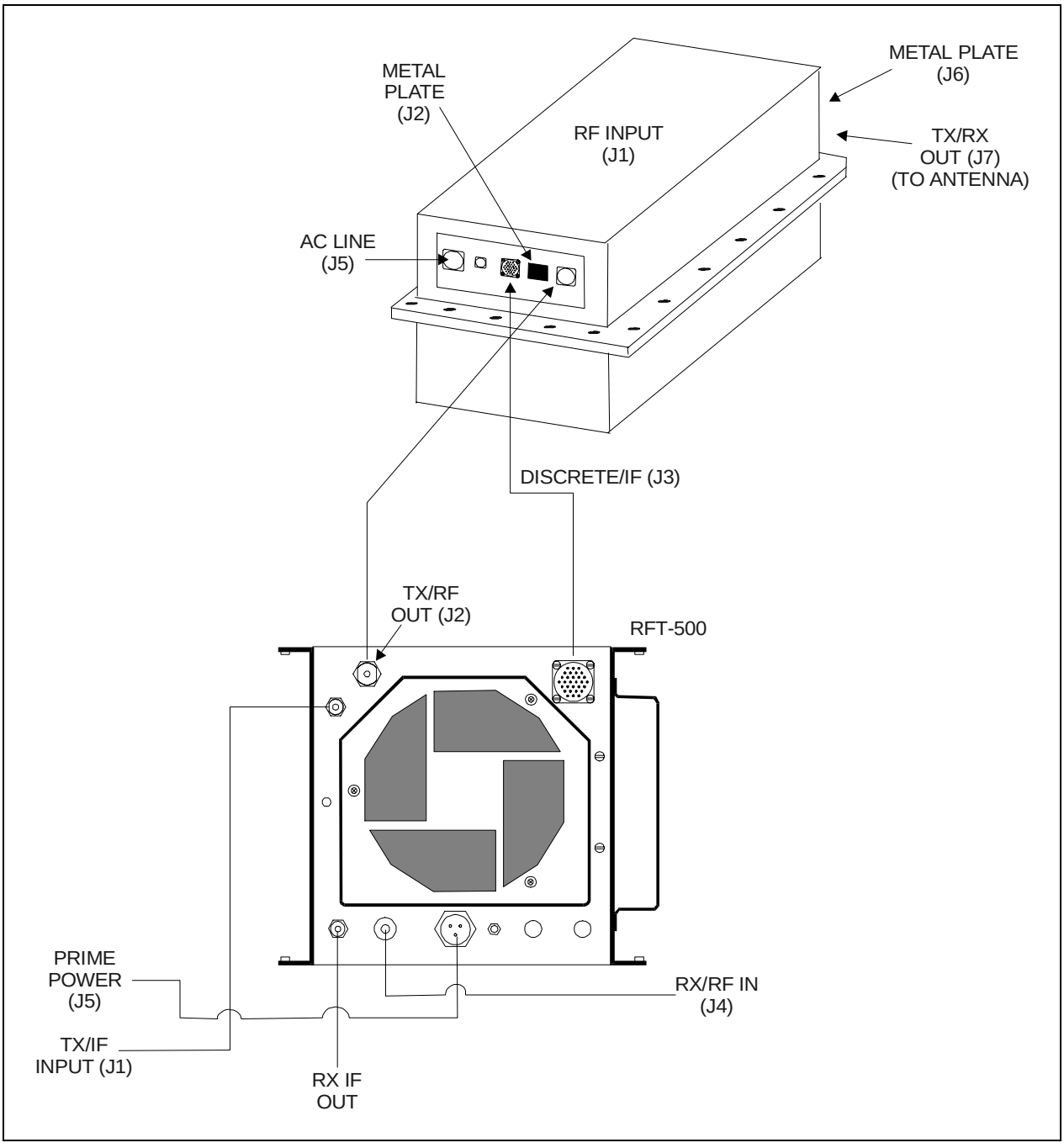


Figure 3-1. HPCST-5000 Single Thread Configuration Schematic

3.1 Unpacking

The HPCST-5000 terminal system is packaged in multiple, preformed, reusable foam inside a cardboard carton.

Before unpacking the carton components, ensure that there is plenty of room around the carton for workspace. A large work table is recommended.

To remove the parts:

1. Cut the tape at the top of the carton where it is indicated OPEN THIS END.
2. Lift out the cardboard/foam spacer covering the unit.
3. Remove each part from the carton.

Because the RFT and C-Band SSPA are heavy, assistance may be necessary to remove the unit from the box.

Note: Save the packing material for reshipment.

3.2 Inspecting the Equipment

1. Carefully check the equipment for possible damage incurred during shipment.

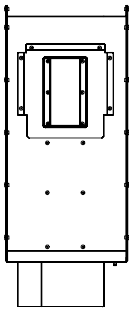
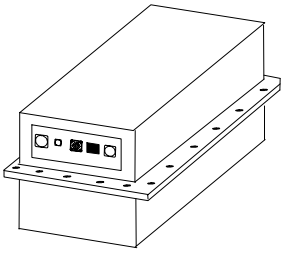
2. Carefully check the equipment against the packing list shipped with the equipment to ensure that the shipment is complete.

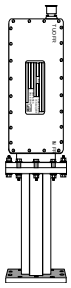
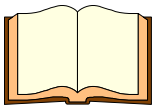
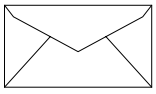
3.2.1 Included Parts

A typical HPCST-5000 single thread configuration contains the following components.

Notes:

1. Hardware required for this configuration is located in Chapter 8, Equipment List.
2. Because each system can be custom ordered, it is beyond the scope of this manual to provide the unlimited configuration possibilities.
3. This chapter does not describe the installation procedures for amplifiers, or high performance LNAs.

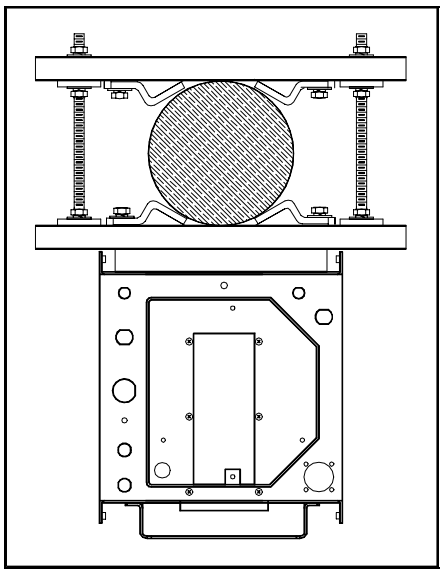
Qty.	Description
1	RFT outdoor unit 
1	C-Band SSPA 

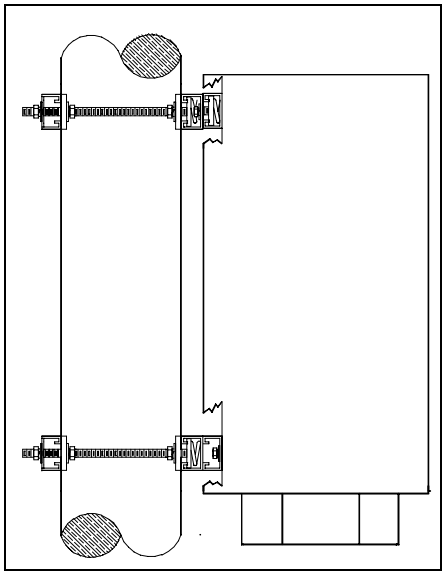
Qty.	Description
1	Low noise amplifier (LNA)  .
1	Installation and operation manuals for the following: • HPCST-5000 • Monitor and Control Software 
1	Envelope containing the test data sheet 

3.3 RFT Installation

At the customer's discretion, the RFT can be installed anywhere on or near the antenna. The supplied hardware allows the installer a wide range of installation alternatives, including:

- Vertical pole (e.g., mast) (either square or round). This is the most typical installation.





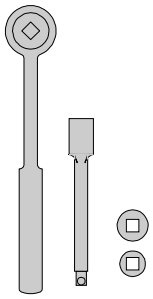
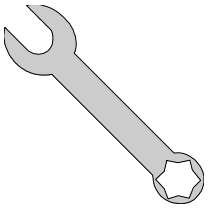
CAUTION

Ensure that all air inlets, exhausts, and fan guards are free of dirt, dust, and debris. Make certain that these areas are inspected on a regular basis. Damage to the equipment can be the result.

- Within the hub of a large antenna.
- Spar (i.e., square bar) on the antenna structure.

Note: EFData recommends that the RFT be mounted vertically, with the air inlet facing the ground.

3.3.1 Tools Required

Qty.	Description
1 1 1 1 1	3/8” drive ratchet 3” x 3/8” drive extension 1/4” x 3/8” drive socket *(Metric equivalent: 7mm, 6 pt)* 5/16” x 3/8” drive socket *(Metric equivalent: 9mm, 6 pt)* 3/8” x 3/8” drive socket *(Metric equivalent: 10mm, 6 pt)* 
1	3/8” combination wrench *(Metric equivalent: 10mm combination wrench with a 6 pt. box end)* 

3.3.2 Vertical Pole Installation

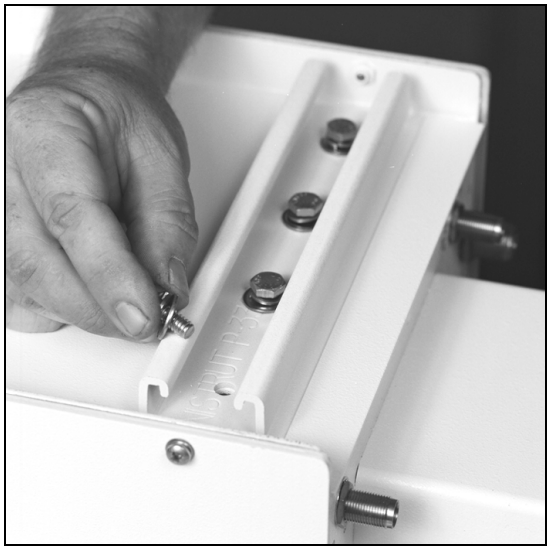
Refer to Section 8, Equipment List, Figure 8-4 for assistance in the installation of the RFT using Mounting Kit P/N KT/3576. Refer to Figure 8-2, Cabling Configuration, for cables necessary to connect the single thread configuration.

3.3.2.1 Round Pole

Note: The following process is for a typical installation.

Install the RFT to a round vertical pole as follows:

1. Set the unit on its side, with the mounting holes facing up.
2. Install the 8” unistruts as follows:
   a. Position an 8” unistrut (with the open side facing up) over one set of the mounting holes on the RFT.
   b. Using four 1/4-20 x 5/8” bolts, 1/4” split lockwashers, and 1/4” flat washers, attach an 8” unistrut to the RFT.



   c. Tighten the bolts firmly.
   d. Repeat Steps 2.a. and 2.b. for the second 8” unistrut.

3. Install the 14” unistruts as follows:

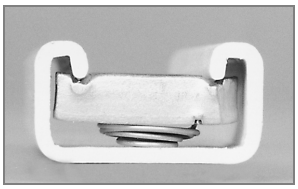
   a. Position a spring nut between the inner and outer bolts on both sides of each 8” unistrut.

   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

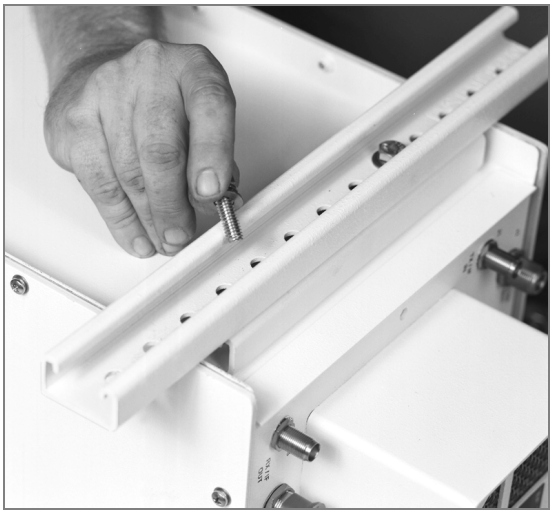
      

      (3) Release pressure on the spring nut.

      (4) Repeat Steps 3.b.(1) through 3.b.(3) for each spring nut.

c. Position a 14” unistrut (open side facing up) over one of the 8” unistruts.

Note: Ensure the 14” unistrut is centered over the RFT.



d. Using two 5/16-18 x 1-1/4” bolts, 5/16” split lockwashers, and 5/16” flat washers, attach the 14” unistrut to the 8” unistrut.

Note: The bolts should be installed in the fifth hole from each end, as illustrated.

e. Tighten the bolts firmly.

f. Attach the second 14” unistrut to the second 8” unistrut by repeating Steps 3.a. through 3.d.

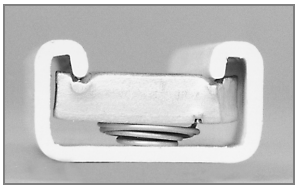
4. Install the pipe blocks as follows:

   a. Install two spring nuts in each of four 14” unistruts (the two just mounted on the RFT, and two additional).

      Note: Ensure the spring nuts in the unistruts are wide enough apart so that when the pipe blocks are installed, they will clear the pole when the unit is lifted into place for installation.

   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.



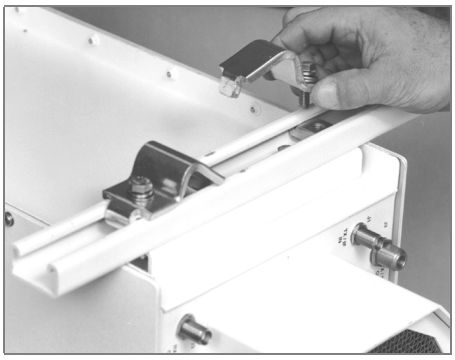
      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

      (3) Release pressure on the spring nut.

      (4) Repeat Steps 4.b.(1) through 4.b.(3) for each spring nut.

   c. Using four 5/16-18 x 1” bolts, 5/16” split lockwashers, and 5/16” flat washers, loosely secure the pipe blocks to the spring nuts.

      Note: Ensure the pipe blocks are installed with the long angle facing inward, toward the pipe.



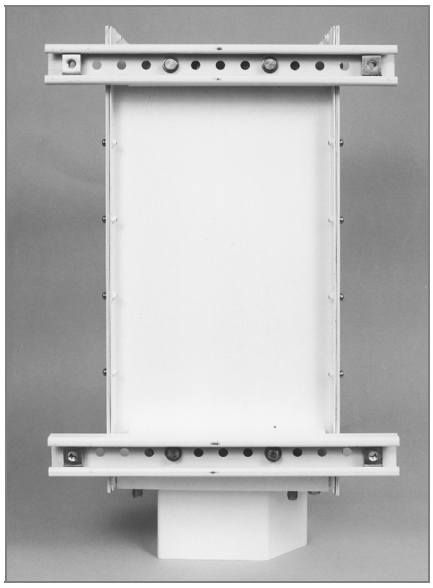
CAUTION

DO NOT tighten the pipe block bolts until after mounting the RFT on the vertical pole. (See Step 6.e.)

5. Install the threaded rods as follows:

   a. Install two spring nuts in both 14” unistruts mounted on the RFT.

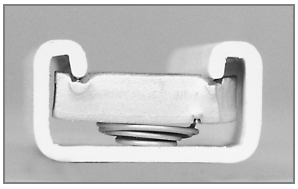
      Note: Ensure the spring nuts are positioned over the outer holes in the 14” unistruts.



   b. To install each spring nut:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

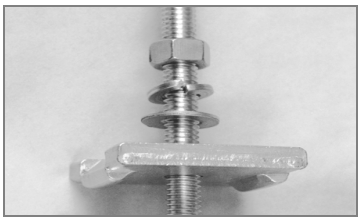
      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).



      (3) Release pressure on the spring nut.

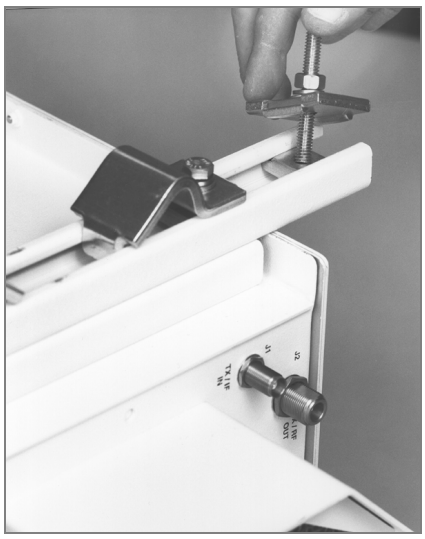
      (4) Repeat Steps 5.b.(1) through 5.b.(3) for each spring nut.

   c. Thread a 5/16-20 nut approximately 1-1/2” onto each threaded rod. (This will ensure that the threaded rods will extend beyond the spring nuts when installed.)



   d. Place a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate over each threaded rod.

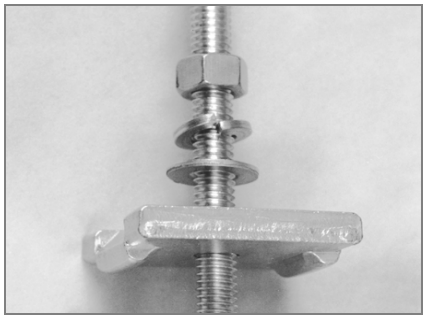
e. One threaded rod at a time, hold the washers and plate in place on the rod, and screw the rod into a spring nut, as illustrated.



Notes:

1. Be sure to position the flanges of the flat fitting plates in the grooves of the unistruts.
2. Before tightening the nuts on the threaded rods, ensure that the end of each rod is screwed in until it is flush with the backside of the unistruts. This ensures the rods are threaded completely through the spring nuts.

f. Thread a 5/16-18 nut about 2” onto the end of each threaded rod. Tighten each nut firmly.



g. Slip a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate (in that order) onto each threaded rod.

6. Mount the RFT as follows:

   a. Lift the RFT into position on the vertical pole.

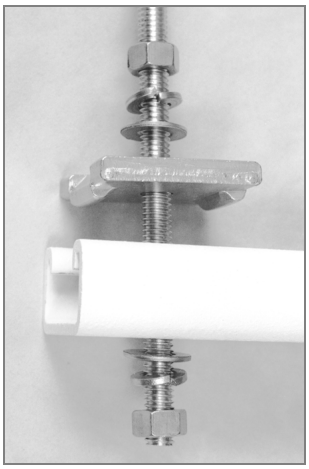
   b. Slip a 14” unistrut over each of pair of threaded rods (upper and lower).

   Note: Install the 14” unistruts with the open face toward the pole as illustrated below.

   c. Install a 5/16” flat washer, 5/16” split lockwasher, and 5/16-18 nut on each threaded rod.

   d. Position the RFT as desired, and tighten the 5/16-18 nuts installed in Step 6.c.

   e. Slide the pipe blocks inward until they contact the vertical pole, then firmly tighten the 5/16-18 bolts.



3.3.2.2 Square Pole

For square vertical pole installation, follow the steps in Section 2.3.2.1, with the following exceptions:

- Do not perform Step 4.
- Do not perform Step 6.e.

3.3.3 Spar Installation

Note: Refer to Section 8, Equipment List, Figure 8-3 for assistance in the installation.

Install the RFT to a spar as follows:

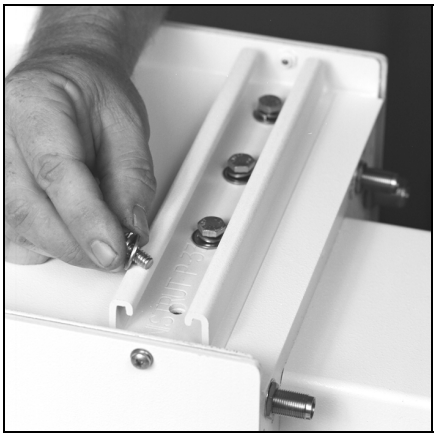
1. Set the unit on its side, with the mounting holes facing up.

2. Install the 8” unistruts as follows:

   a. Position an 8” unistrut (with the open side facing up) over one set of the mounting holes on the RFT.

   b. Using four 1/4-20 x 1” bolts, 1/4” split lockwashers, and 1/4” flat washers, attach an 8” unistrut to the RFT. Tighten the bolts firmly.

   c. Repeat Steps 2.a. and 2.b. for the second 8” unistrut.



3. Mount the RFT as follows:

   a. Position a spring nut between the inner and outer bolts on both sides of each 8” unistrut.

   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

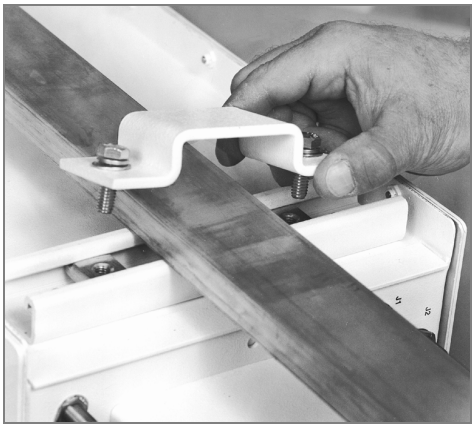
      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

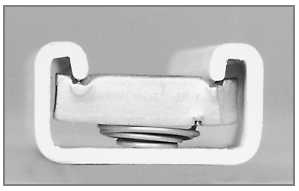
      (3) Release pressure on the spring nut.

      (4) Repeat Steps 3.b.(1) through 3.b.(3) for each spring nut.

   c. Lift the RFT into position.

   d. Using four 5/16-18 bolts, 5/16” split lockwashers, and 5/16” flat washers, bolt the two spar support brackets in place. Tighten the bolts firmly.





3.4 LNA Installation

Note: Refer to Section 8, Figure 8-1, for assistance in the installation of the LNA using the LNA Connector Kit P/N KT/2721.

To install a single LNA (Figure 3-2) to an antenna:

1. Remove the protective cover from the antenna mount location (if installed).
2. Remove the plastic cover from the antenna end (RF IN) of the LNA.
3. Remove the plastic cover from the RF OUT end of the LNA.

CAUTION

After removing the protective cover(s), ensure that no foreign material or moisture enters the antenna waveguide or LNA.

4. Install the appropriate gasket on the antenna end of the LNA:
   a. If the LNA has a groove, and the antenna flange does not, the thin gasket should be used.
   b. If both the LNA and the antenna flange have grooves, the thick gasket should be used.

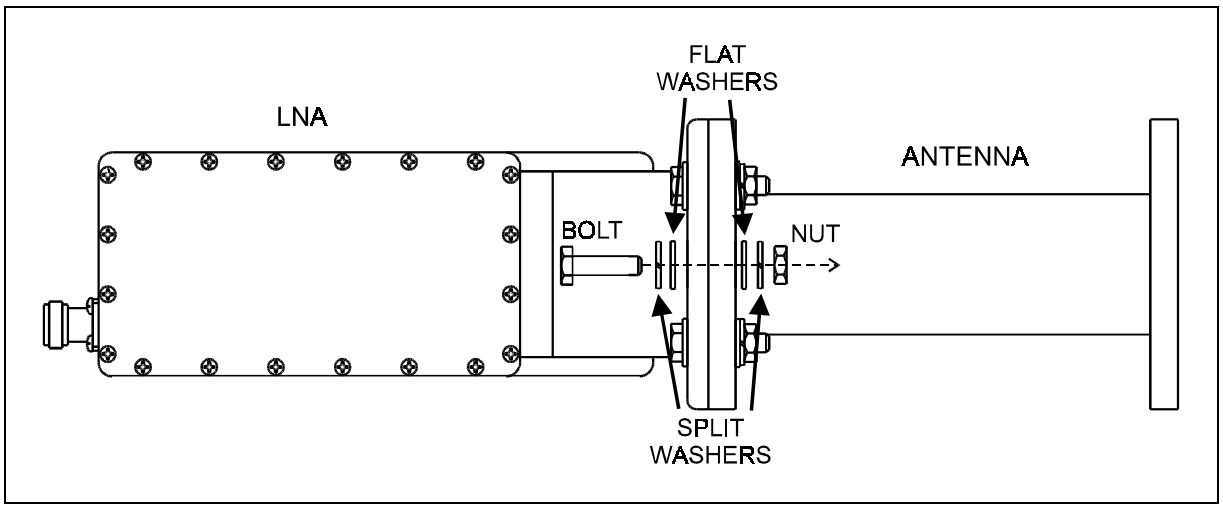


Figure 3-2. Installation of the LNA

5. Position the LNA in place on the antenna, and install the 1/4-20 x 1” bolts, washers, and nuts as shown in Figure 3-3. Do not tighten at this time.

Install the hardware exactly as shown. Failure to do so may cause damage to the LNA and/or waveguide.

6. After all the bolts, washers, and nuts have been installed, tighten them according to the following illustrated sequence.

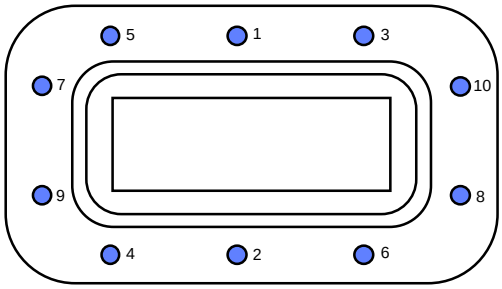


Figure 3-3. Procedures for Tightening the Waveguide Bolts

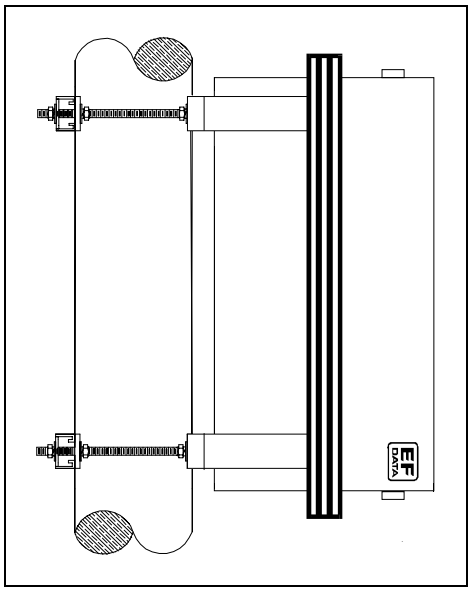
3.5 C-Band SSPA Installation

Refer to Section 8, Equipment List, Figure 8-4, for assistance in the installation of the C-Band SSPA using the Universal Mounting Kit P/N KT/6699. Refer to Figure 8-2 Cabling Configuration for cables necessary to connect the single thread configuration.

3.5.1 C-Band SSPA Installation

At the customer's discretion, the C-Band SSPA can be installed anywhere on or near the antenna. The supplied hardware allows the installer a wide range of installation alternatives, including:

- Vertical pole (e.g., mast) (either square or round). This is the most typical installation.



- Within the hub of a large antenna.
- Spar (i.e., square bar) on the antenna structure.

  Note: EFData recommends that the C-Band SSPA be mounted either vertically, as shown, or with the fan assembly facing the ground.

3.5.2 Vertical Pole Installation

3.5.2.1 Round Pole

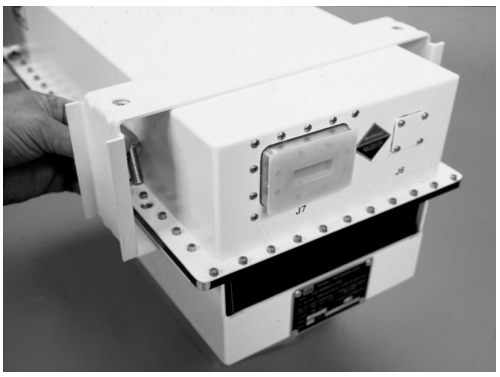
Note: The following process is for a typical installation.

Install the C-Band SSPA to a round vertical pole as follows:

1. Install mounting bracket as follows:

   a. Position two mounting brackets onto the C-Band SSPA.

   b. Secure the mounting brackets to the unit with four 3/8 x 1 1/4” bolts, 3/8” split lockwashers, 3/8 flat washers, and 3/8 hex nuts.

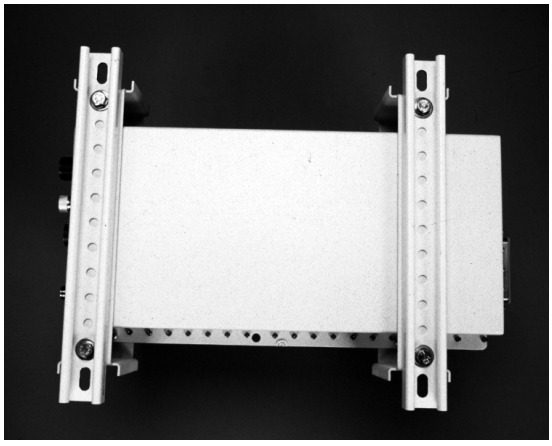


2. Install the 14” unistruts as follows:

   a. Position an 14” unistrut (with the open side facing up) over the mounting holes of the mounting bracket.

   b. Using four 3/8 x 1” bolts, 3/8” split lockwashers, and 3/8” flat washers, attach an 8” unistrut to the C-Band SSPA mount bracket. Tighten the bolts firmly.

   c. Repeat Steps 3.a. and 2.b. for the second 14” unistrut.

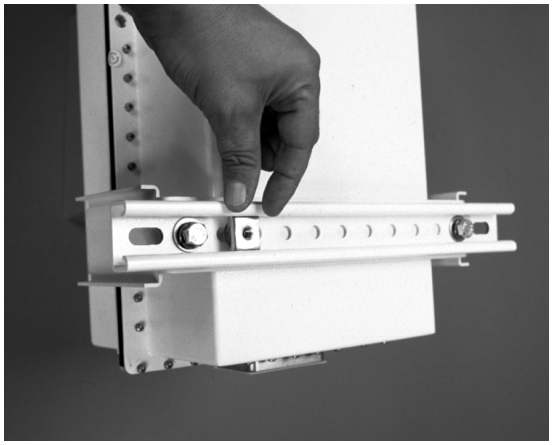


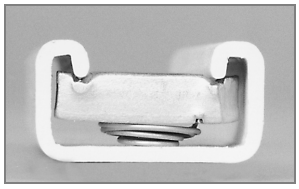
3. Install the spring nuts as follows:

   a. Position a spring nut between the inner and outer bolts on both sides of each 14” unistrut.

   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.





      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut.

      (3) Release pressure on the spring nut.

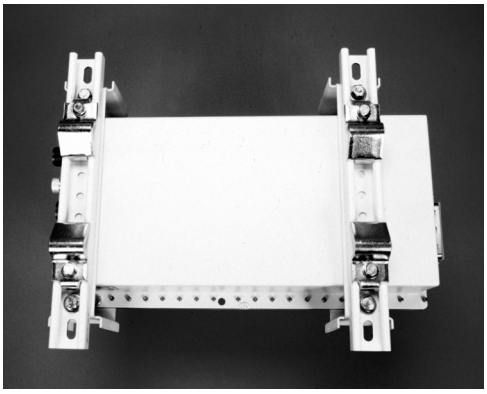
      (4) Repeat Steps 4.b.(1) through 4.b.(3) for each spring nut.

4. Install the pipe blocks as follows:

   Note: Be sure to position the spring nuts in the unistruts wide enough apart so that when the pipe blocks are installed they will clear the pole when the unit is lifted into place for installation.

   a. Using four 5/16-18 x 1” bolts, 5/16” split lockwashers, and 5/16” flat washers, loosely secure the pipe blocks to the spring nuts.

      Note: Ensure the pipe blocks are installed with the long angle facing inward, toward the pipe, as illustrated.

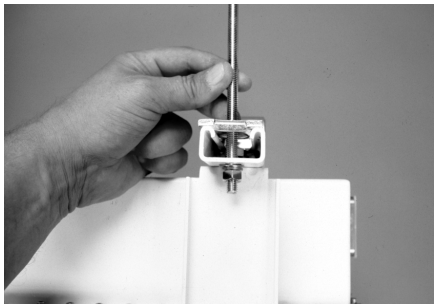


CAUTION

DO NOT tighten the pipe block bolts until after mounting the C-Band SSPA on the vertical pole. (See Step 6.e.)

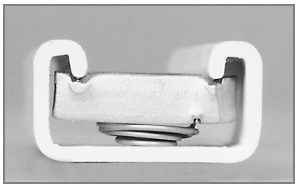
5. Install the threaded rods as follows:

   a. Install two spring nuts in both 14” unistruts mounted on the C-Band SSPA.

   Note: Ensure the spring nuts are positioned over the outer holes in the 14” unistruts, as illustrated.

   b. To install each spring nut:

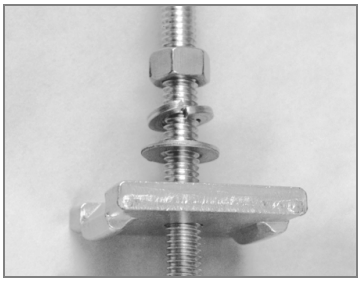
      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

      (3) Release pressure on the spring nut.

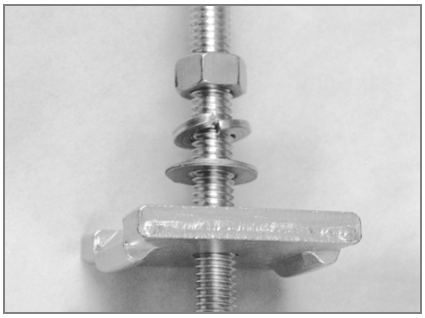
      (4) Repeat Steps 5.b.(1) through 5.b.(3) for each spring nut.

   c. Thread a 5/16-20 nut approximately 1-1/2” onto each threaded rod. (This will ensure that the threaded rods will extend beyond the unistrut when installed.)

   d. Place a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate over each threaded rod.

e. One threaded rod at a time, hold the washers and plate in place on the rod, and screw the rod into a spring nut, as illustrated.



Notes:

1. Be sure to position the flanges of the flat fitting plates in the grooves of the unistruts.
2. Before tightening the nuts on the threaded rods, ensure that the end of each rod is screwed in until it is flush with the backside of the unistruts. This ensures the rods are threaded completely through the spring nuts.

f. Tighten each nut firmly.

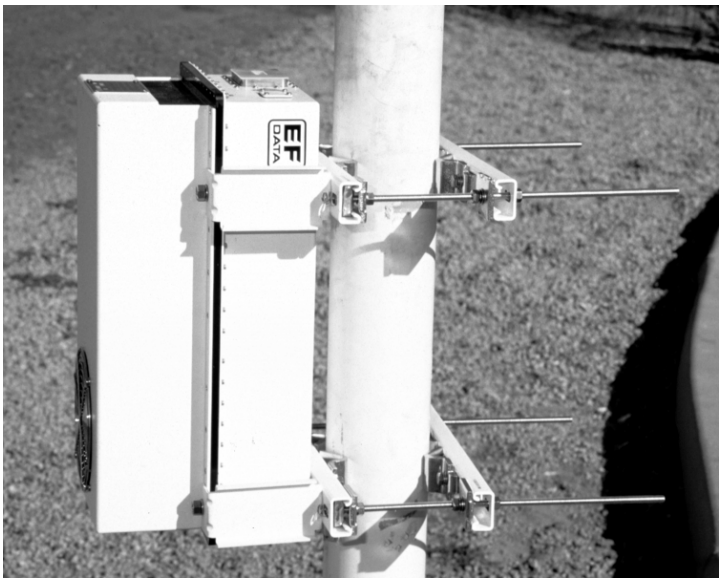
g. Thread a 5/16-18 nut about 2” onto the end of each threaded rod.

h. Slip a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate (in that order) onto each threaded rod.

6. Mount the C-Band SSPA as follows:

   a. Lift the C-Band SSPA into position on the vertical pole.

   b. Slip a 14” unistrut over each of pair of threaded rods (upper and lower).

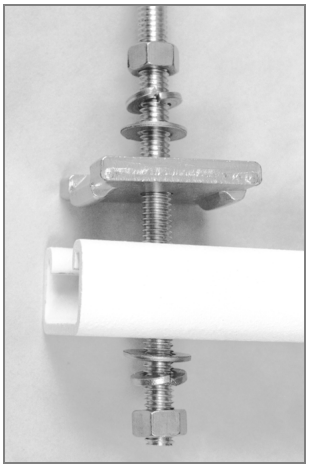


Note: Install the 14” unistruts with the open face toward the pole as illustrated below.

   c. Install a 5/16” flat washer, 5/16” split lockwasher, and 5/16-18 nut on each threaded rod.

   d. Position the RFT as desired, and tighten the 5/16-18 nuts installed in Step 6.c.

   e. Slide the pipe blocks inward until they contact the vertical pole, then firmly tighten the 5/16-18 bolts.



3.5.2.2 Square Pole

For square vertical pole installation, follow the steps in Section 2.3.2.1, with the following exceptions:

- Do not perform Step 4.
- Do not perform Step 6.e.

3.5.3 Spar Installation

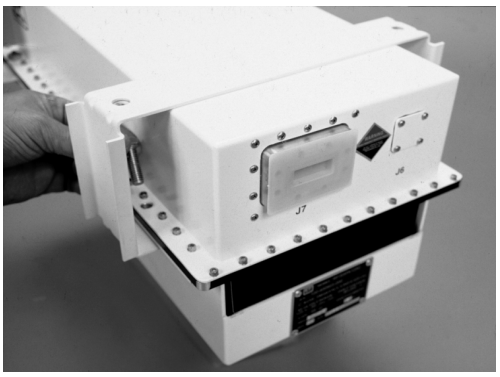
Note: Refer to Section 8, Equipment List, Figure 8-3 for assistance in the installation.

Install the C-Band SSPA to a spar as follows:

1. Install mounting bracket as follows:

   a. Position two mounting brackets onto the C-Band SSPA.

   b. Secure the mounting brackets to the unit with four 3/8 x 1 1/4" bolts, 3/8" split lockwashers, 3/8 flat washers, and 3/8 hex nuts.

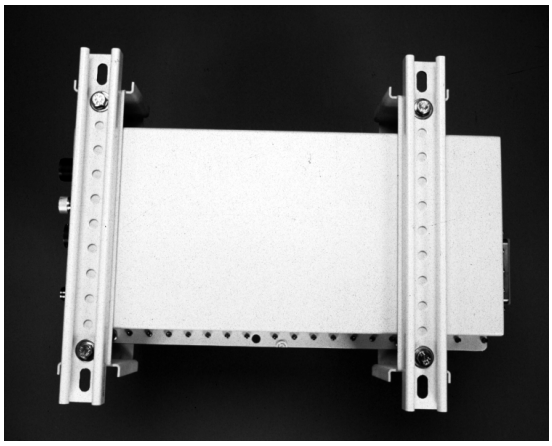


2. Install the 14" unistruts as follows:

   a. Position an 14" unistrut (with the open side facing up) over the mounting holes of the mounting bracket.

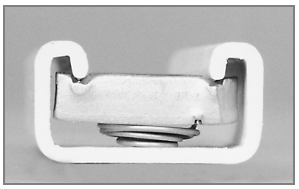
   b. Using four 3/8 x 1" bolts, 3/8" split lockwashers, and 3/8" flat washers, attach an 8" unistrut to the C-Band SSPA mount bracket. Tighten the bolts firmly.

   c. Repeat Steps 3.a. and 2.b. for the second 14" unistrut.



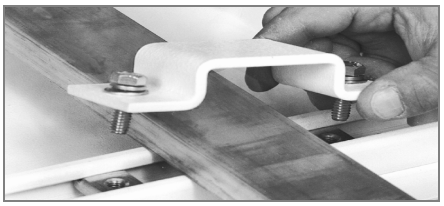
3. Mount the C-Band SSPA as follows:

   a. Position a spring nut between the inner and outer bolts on both sides of each 14” unistrut, as illustrated.



   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.



      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

      (3) Release pressure on the spring nut.

      (4) Repeat Steps 3.b.(1) through 3.b.(3) for each spring nut.

   c. Lift the C-Band SSPA into position.

   d. Using four 5/16-18 bolts, 5/16” split lockwashers, and 5/16” flat washers, bolt the two spar support brackets in place.

   e. Tighten the bolts firmly.

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Chapter 4. REDUNDANT SYSTEM INSTALLATION

This chapter provides installation information for redundant system (Figure 4-1) including:

- Unpacking and inspecting the parts
- Installing redundant RFTs
- Installing redundant C-Band SSPAs
- Installing the 1:1 redundant plate
- External connections

Note: Refer to Section 4.4 for the redundancy configuration cabling matrix.

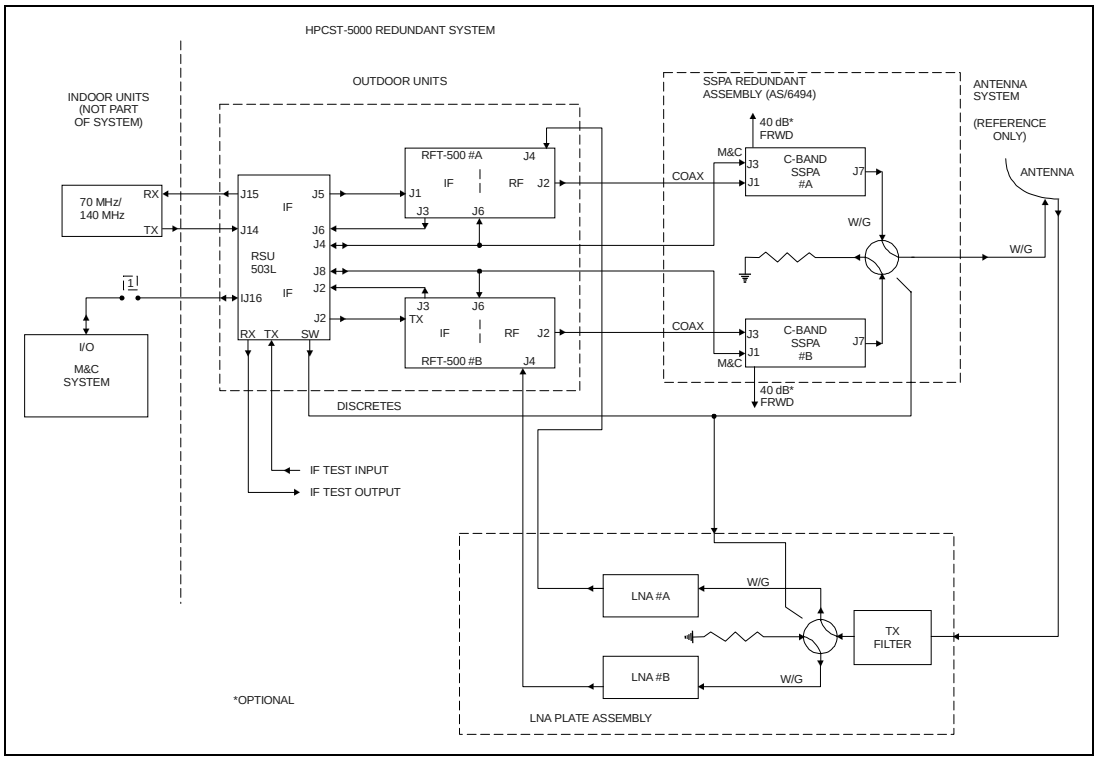


Figure 4-1. HPCST-5000 Redundant System Schematic Using SSPAs

4.1 Unpacking

Note: The HPCST-5000 terminal system is shipped in multiple cartons.

Remove the parts as follows:

1. Cut the tape at the top of each carton where it is indicated OPEN THIS END.
2. Lift out the cardboard/foam spacer covering the units.

1. *The redundant assembly may be too heavy to be removed by one individual, assistance may be required.*
2. *Do not lift the redundant SSPA assembly by the waveguide. Lift assembly by the mounting frame only. Extreme care shall be given to the waveguide assembly during removal. Damage to the redundant assembly may be the result.*

3. Remove the parts from the cartons. Refer to Section 4.2.1 for a parts breakdown.
4. If required, remove the screws from the lid of the wooden crate, and remove the lid.
5. Unbolt and remove the redundant LNA plate from the crate.
6. Remove the remainder of the parts from the crate. Refer to Section 4.2.1 for a parts breakdown.

   Note: Save the packing material for reshipment, if required.

4.2 Inspecting the Equipment

1. Carefully check the equipment for possible damage incurred during shipment.

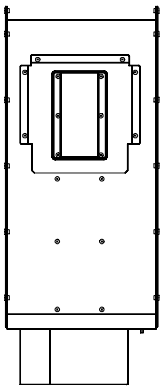
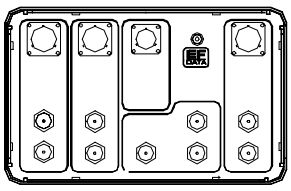
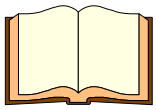
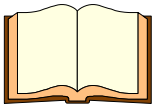
2. Carefully check the equipment against the packing list shipped with the equipment to ensure that the shipment is complete.

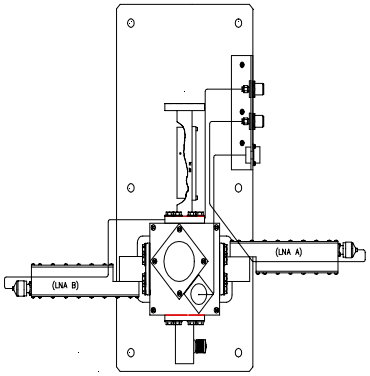
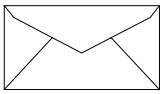
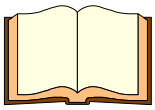
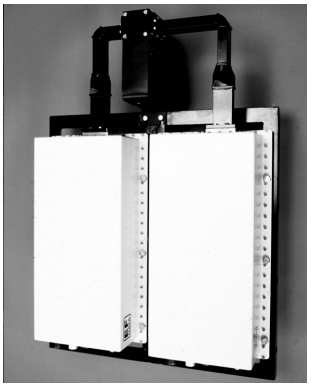
4.2.1 Included Parts

A typical redundant HPCST-5000 configuration contains the following components.

Notes:

1. Hardware required to perform this task is located in Chapter 8, Equipment List.
2. Because each system can be custom ordered, it is beyond the scope of this manual to provide the unlimited configuration possibilities.
3. This chapter does not describe the installation procedures for amplifiers, high performance LNAs, phase-locked LNBs, LNBs, and phase-locked block converters.

Qty.	Description
2	RFT outdoor unit 
1	RSU-503L 
1	Monitor and Control Software for EFData Satellite Terminals User's Guide 
1	RS-503 installation and operation manual 

Qty.	Description
1	Redundant LNA plate  **Note:** Pictured is a typical LNA. Other LNAs are available, and can be ordered from an EFData marketing representative.
1	Envelope containing the test data sheet 
1	HPCST-5000 installation and operation manual  **Note:** Can be obtained in CD or paper format.
1	Redundant Assembly 

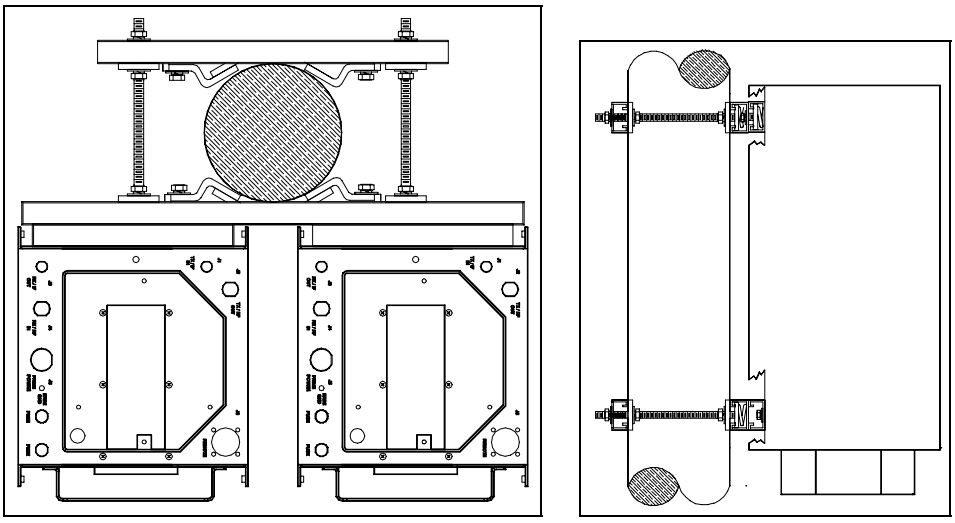
4.3 RFT Installation

CAUTION

Ensure that all air inlets, exhausts, and fan guards are free of dirt, dust, and debris. Make certain that these areas are inspected on a regular basis. Damage to the equipment can be the result.

Note: At the customer's discretion, the RFTs can be installed anywhere on or near the antenna. The supplied hardware allows the customer a wide range of installation alternatives, including:

- Vertical pole (e.g., mast) (either square or round). This is the most typical installation.

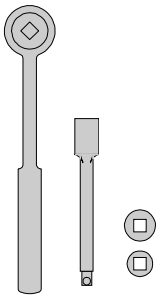
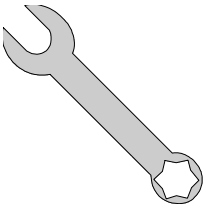


Note: This view is looking up at the RFT redundant assembly.

- Within the hub of a large antenna.
- Spar (i.e., rectangular bar) on the antenna structure.

Note: EFData recommends that the RFTs be mounted vertically, with the air inlets facing the ground.

4.3.1 Tools Required

Qty.	Description
1 1 1 1	3” x 3/8” drive extension 1/4” x 3/8” drive socket *(Metric equivalent: 7mm, 6 pt)* 5/16” x 3/8” drive socket *(Metric equivalent: 9mm, 6 pt)* 3/8” x 3/8” drive socket *(Metric equivalent: 10mm, 6 pt)* 
1	3/8” combination wrench *(Metric equivalent: 10mm combination wrench with a 6 pt. box end)* 

4.3.2 Vertical Pole Installation

Refer to Section 8, Equipment List, Figure 8-5, for assistance in the installation of the RFT. Refer to Figure 8-2 for the cabling configuration.

4.3.2.1 Round Pole

Note: The following process is a typical installation.

Install the RFTs to a round vertical pole as follows:

1. Set the units on their sides, with the mounting holes facing up.
2. Install the 8” unistruts as follows:
   a. Position an 8” unistrut (with the open side facing up) over one set of the mounting holes on the RFT.
   b. Using four 1/4-20 x 1” bolts, 1/4” split lockwashers, and 1/4” flat washers, attach an 8” unistrut to the RFT.

      Note: Tighten the bolts firmly.
   c. Repeat Steps 2.a. and 2.b. for each of the remaining 8” unistruts (four required).

3. Install the 20” unistruts as follows:

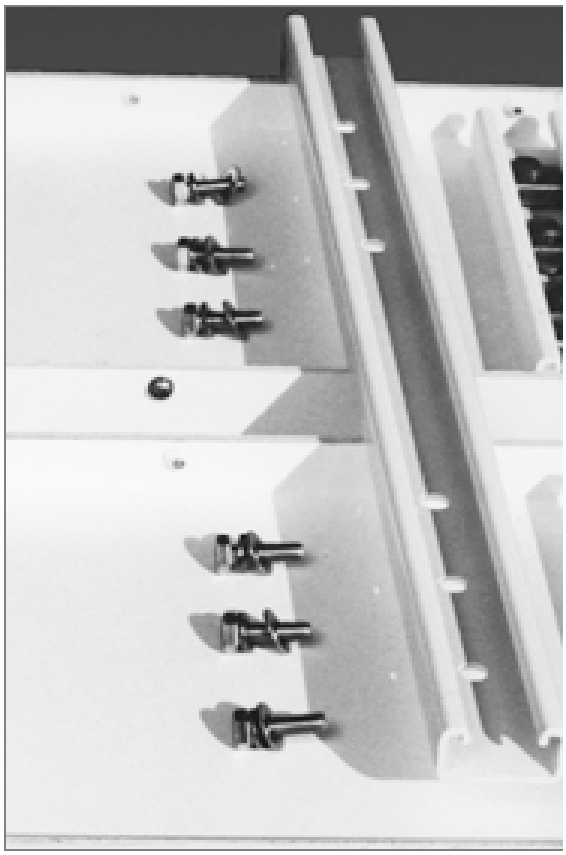
   Note: The placement of the pipe blocks may interfere with the inner or center unistrut attaching bolts. Be sure to determine the pipe block placement locations before bolting the 20” unistruts in place. It may be necessary to eliminate the center or inner 20” unistrut mounting spring nuts and bolts.

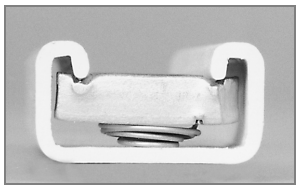
   a. Insert a spring nut between the unistrut mounting bolts on both RFTs.

   b. To install each spring nut:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).



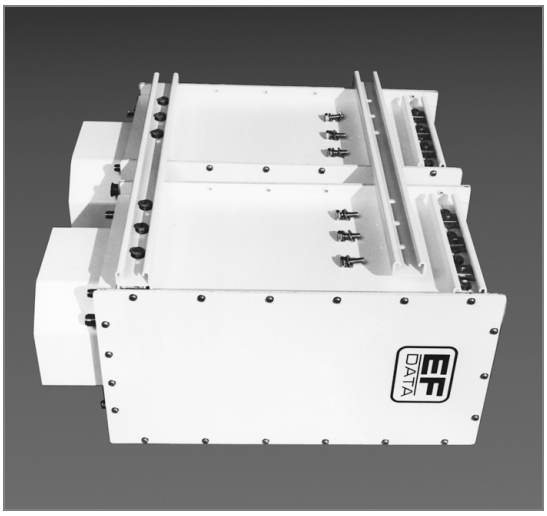


      (3) Release pressure on the spring nut.

      (4) Repeat Steps 3.b.(1) through 3.b.(3) for each spring nut.

c. With the RFTs side-by-side, position a 20” unistrut (open side facing up) in place over one pair of 8” unistruts.

Note: Ensure the long unistrut is centered over the RFT.



d. Using two or three 5/16-18 x 1-1/4” bolts, 5/16” split lockwashers, and 5/16” flat washers, attach the 20” unistrut to the 8” unistruts.

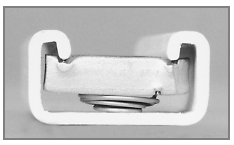
e. Tighten bolts firmly.

f. Attach the second 20” unistrut to the second set of 8” unistruts by repeating Steps 3.a. through 3.d.

4. Install the pipe blocks as follows:

   a. Install two spring nuts in each of the two 20” long unistruts and two 14” long unistruts (centered in the unistruts, and wide enough apart so the pipe blocks will clear the pole when the unit is installed).

   b. Install each spring nut as follows:



      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

      (3) Release pressure on the spring nut.

      (4) Repeat Steps 4.b.(1) through 4.b.(3) for each spring nut.

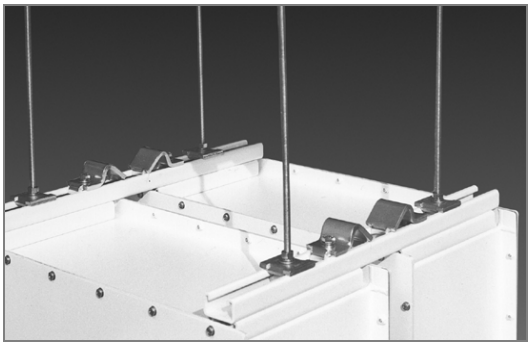
   c. Using eight 5/16-18 x 1” bolts, 5/16” split lockwashers, and 5/16” flat washers, loosely secure the pipe blocks to the spring nuts.

Notes:

1. Ensure the pipe blocks are installed with the long angle face inward, toward the pipe, as illustrated.
2. DO NOT tighten the pipe block bolts until after mounting the RFTs on the vertical pole. (See Step 6.e.)

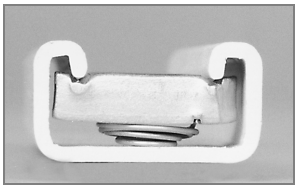
5. Install the threaded rods as follows:

   a. Install two spring nuts in both 20” unistruts mounted on the RFT.

   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

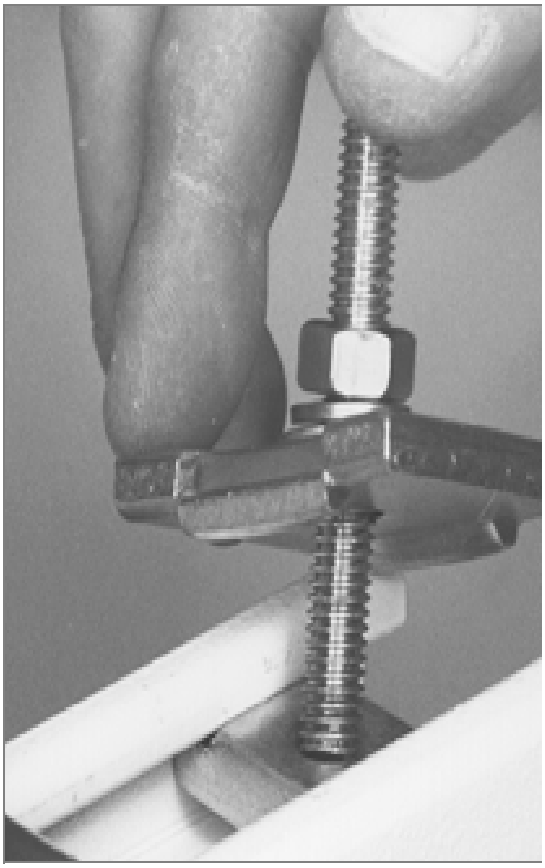
      (3) Release pressure on the spring nut.

      (4) Repeat Steps 5.b.(1) through 5.b.(3) for each spring nut.

   c. Thread a 5/16-20 nut approximately 1-1/2” onto each threaded rod. (This will ensure that the threaded rods will extend beyond the spring nuts when installed.)

   d. Place a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate over each threaded rod.

e. One threaded rod at a time, hold the washers and plate in place on the threaded rod and screw it into a spring nut.



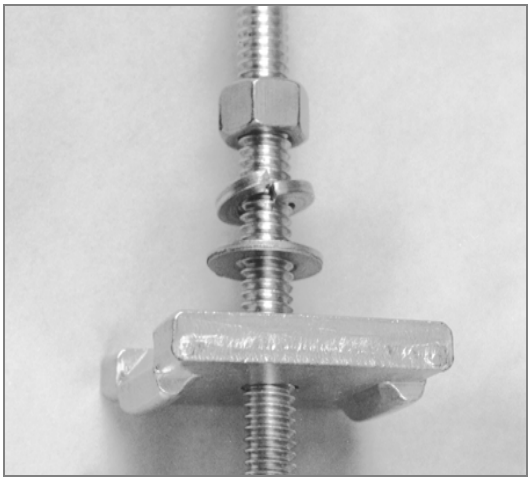
Notes:

1. Be sure to position the flanges of the flat fitting plates in the grooves of the unistruts.
2. Before tightening the nuts on the threaded rods, ensure that the end of each rod is screwed in until it contacts the unistrut. This ensures the rods are threaded completely through the spring nuts

f. Tighten each nut firmly.

g. Thread a 5/16-18 nut about 2” onto the end of each threaded rod.

h. Slip a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate (in that order) onto each threaded rod.



6. Mount the RFTs as follows:

   a. Lift the RFT into position on the vertical pole.

   b. Slip a 14” unistrut over each of pair of threaded rods (upper and lower).

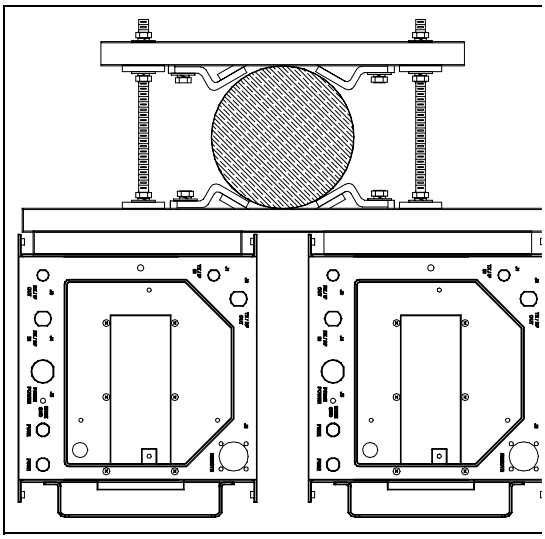
      Note: Install the 14” unistruts with the open face toward the pole, as illustrated.

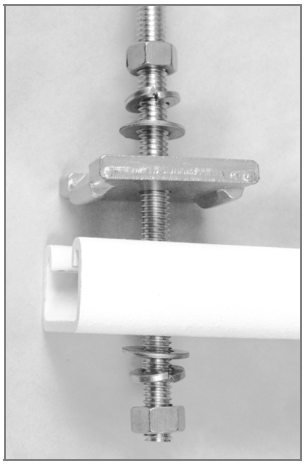
   c. Install a 5/16” flat washer, 5/16” split lockwasher, and 5/16-18 nut on each threaded rod.

   d. Position the RFT, as desired, and tighten the 5/16-18 nuts installed in Step 6.c.

   e. Slide the pipe blocks in until they contact the vertical pole.

   f. Then, firmly tighten the nuts.





4.3.2.2 Square Pole

For square, vertical pole installation, follow the steps in Section 3.3.2.1, with the following exceptions:

- Do not perform Step 4.
- Do not perform Step 6.e.

4.3.3 Spar Installation

Note: EFData does not recommend the unit be spar mounted.

Install the RFTs to a spar as follows:

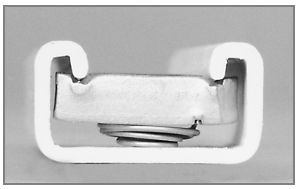
1. Set the units on their sides, with the mounting holes facing up.
2. Install the 8” unistruts as follows:
   a. Position an 8” unistrut (with the open side facing up) over one set of the mounting holes on the RFT.
   b. Using four 1/4-20 x 1” bolts, 1/4” split lockwashers, and 1/4” flat washers, attach an 8” unistrut to the RFT.

      Note: Tighten the bolts firmly.

   c. Repeat Steps 2.a. and 2.b. for the remaining 8” unistruts (for a total of four).

3. Install the 20” unistruts as follows:

   a. Position a spring nut between the 1/4-20 bolts in each 8” unistrut.



   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90°.

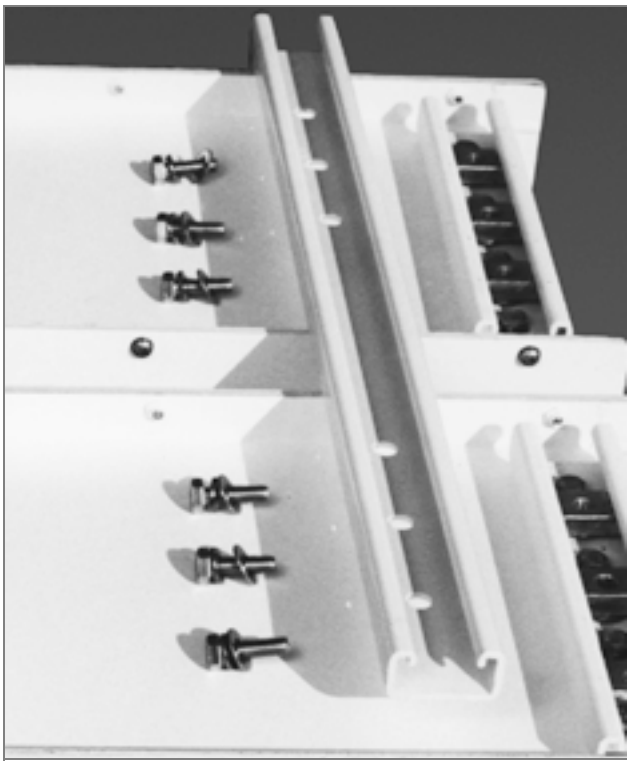
      (3) Release pressure on the spring nut.

   c. With the RFTs side by side, position a 20” unistrut in place over one pair of 8” unistruts (open side up).

   d. Using four 5/16-18 bolts, 5/16” split lockwashers, and 5/16” flat washers, bolt the 20” unistrut to the 8” unistruts.

   e. Tighten the bolts firmly.

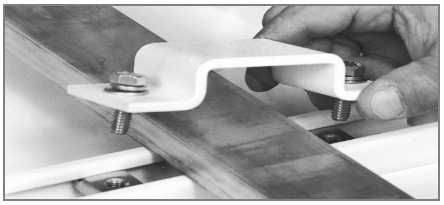
   f. Repeat Steps 3.c. through 3.e. for the second 20” unistrut.



4. Mount the RFT as follows:

   a. Lift the RFT into position.

   b. Using four 5/16-18 bolts, 5/16” split lockwashers, and 5/16” flat washers, bolt the two spar support brackets in place. Tighten the bolts firmly.



4.3.4 1:1 Redundant Plate Installation

Note: Refer to Section 8, Figure 8-2 for cabling configuration.

The 1:1 redundant plate is shown in Figure 4-2 as follows:

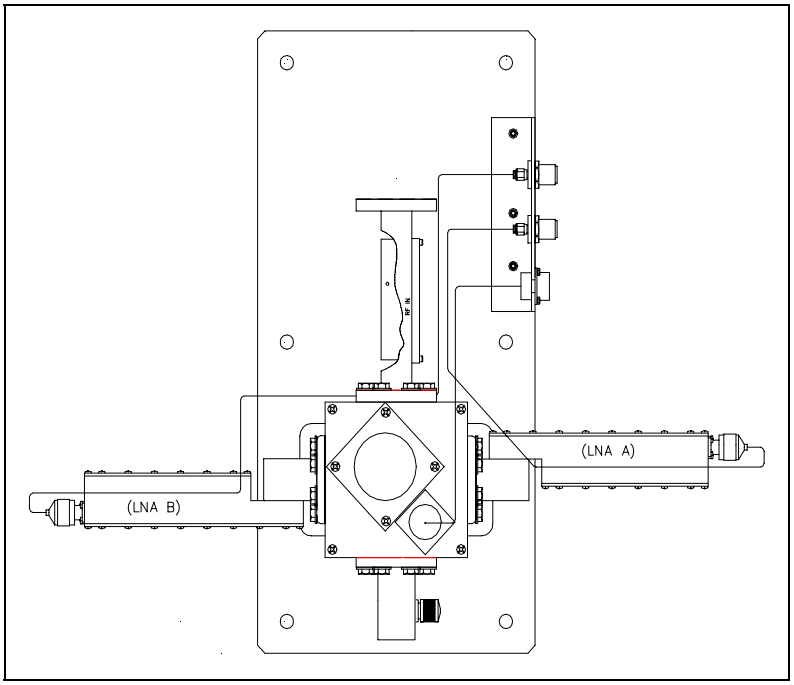


Figure 4-2. 1:1 Redundant Plate

Install the 1:1 redundant plate as follows:

1. Mount the 1:1 redundant plate to the antenna.

   Note: The type of mounting is determined by the brand of antenna on which the equipment will be installed.

2. Remove the plastic cover from the RF IN connector of the redundant plate.

   CAUTION

   After removing the protective cover, ensure that no foreign material or moisture enters the 1:1 redundant plate's waveguide.

3. Install the appropriate gasket on the RF IN connector of the redundant plate:

   a. If the TR Filter-Plate/waveguide has a groove, and the antenna flange does not, the thin gasket should be used.

   b. If both the TR Filter-Plate/waveguide and the antenna flange have grooves, the thick gasket should be used.

4. Position the antenna waveguide in place on the RF IN connector, and install the 1/4-20 x 1" bolts, 1/4" split lockwashers, 1/4" flat washers, and 1/4-20 nuts as shown in Figure 4-3.

   Note: Do not tighten the bolts at this time.

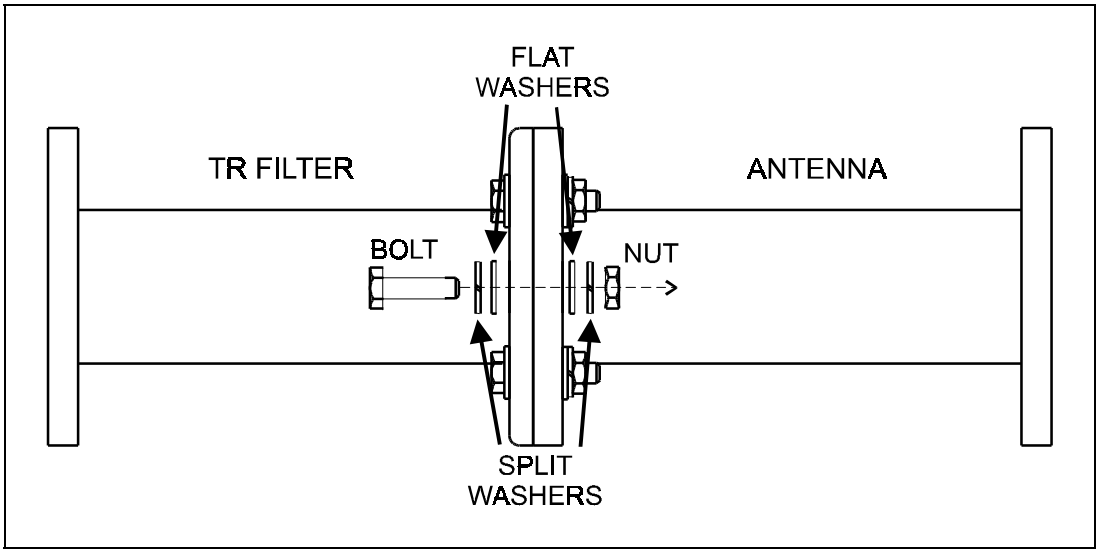


Figure 4-3. Installation of LNA to Waveguide

5. After all the bolts, washers, and nuts have been installed, tighten bolts according to Figure 4-4.

6. Remove the plastic covers from all the connectors, and attach the appropriate cables.

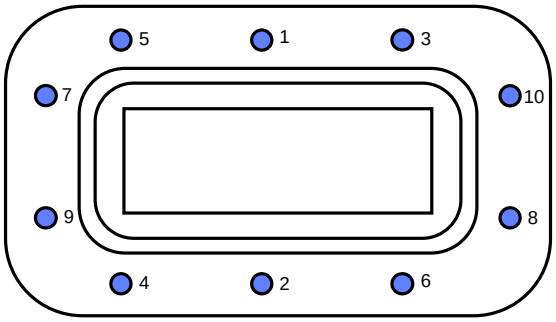


Figure 4-4. Procedures for Tightening LNA to Waveguide Bolts

4.3.5 1:1 Redundant C-Band SSPA Installation

Refer to Section 8, Equipment List, Figure 8-6 for assistance in the installation of the 1:1 Redundant System. Refer to Figure 8-2 for the cabling configuration.

4.3.5.1 Round Pole

Note: The following process is for a typical installation.

Install the 1:1 redundant assembly C-Band SSPAs to a round vertical pole as follows:

1. Set the units on a suitable work bench with the cooling fan side up.
2. Install the mounting bracket as follows:
   a. Position the mounting brackets. Align the mounting brackets with the mounting bolt holes.

CAUTION

Do not block the cooling fans with the mounting bracket. Damage to the unit may be the result

   b. Install four 3/8 x 11/4” bolts 3/8” split washers, and 3/8” flat washers.
   c. Tighten bolts firmly.

3. Install 20” unistrut as follows:

   Note: The placement of the pipe blocks may interfere with the inner or center unistrut attaching bolts. Be sure to determine the pipe block placement locations before bolting the 20” unistrut in place. It may be necessary to eliminate the inner or center mounting spring nuts and bolts.

   a. Position an 20” unistrut (with the open side facing up) over one set of the mounting holes on the C-Band SSPAs.

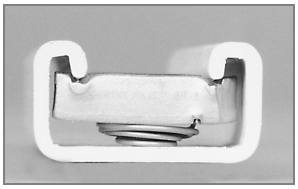
   

   b. Using six 3/8-20 x 1” bolts, 3/8” split lockwashers, and 3/8” flat washers, attach the 20” unistrut to the mounting bracket.

      Note: Tighten the bolts firmly.

   c. Repeat Steps 3.a. and 3.b. for each of the remaining 20” unistruts (two required).

   d. Insert a spring nut between the unistrut mounting bolts.

   e. To install each spring nut:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.

      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

      (3) Release pressure on the spring nut.

      (4) Repeat Steps 3.b.(1) through 3.b.(3) for each spring nut.

4. Install the pipe blocks as follows:

   Note: Be sure to position the spring nuts in the unistruts wide enough apart so that when the pipe blocks are installed they will clear the pole when the unit is lifted into place for installation.

   a. Using four 5/16-18 x 1” bolts, 5/16” split lockwashers, and 5/16” flat washers, loosely secure the pipe blocks to the spring nuts.

      Note: Ensure the pipe blocks are installed with the long angle facing inward, toward the pipe, as illustrated.

DO NOT tighten the pipe block bolts until after mounting the C-Band SSPA on the vertical pole. (See Step 6.e.)

Notes:

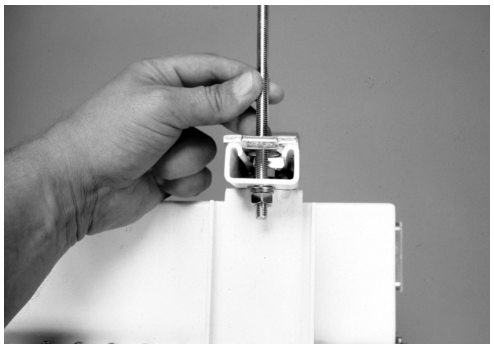
1. Ensure the pipe blocks are installed with the long angle face inward, toward the pipe, as illustrated.
2. DO NOT tighten the pipe block bolts until after mounting the RFTs on the vertical pole. (See Step 6.e.)

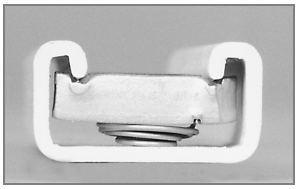
5. Install the threaded rods as follows:

   a. Install two spring nuts in both 20” unistruts mounted on the C-Band SSPAs.

   b. Install each spring nut as follows:

      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.





      (2) Press down on the spring nut to compress the spring, and rotate the nut 90° (i.e., perpendicular to the unistrut).

      (3) Release pressure on the spring nut.

      (4) Repeat Steps 5.b.(1) through 5.b.(3) for each spring nut.

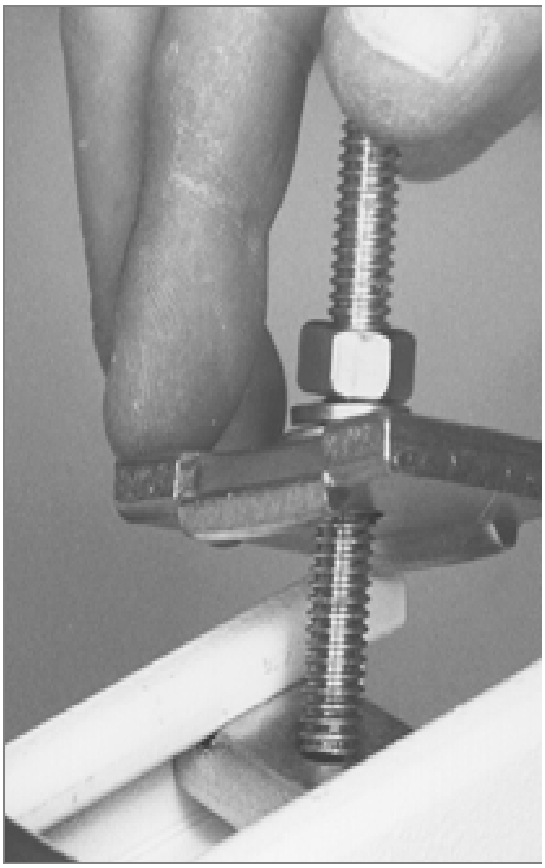
   c. Thread a 5/16-20 nut approximately 1-1/2” onto each threaded rod. (This will ensure that the threaded rods will extend beyond the unistrut when installed.)

   d. Place a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate over each threaded rod.

Notes:

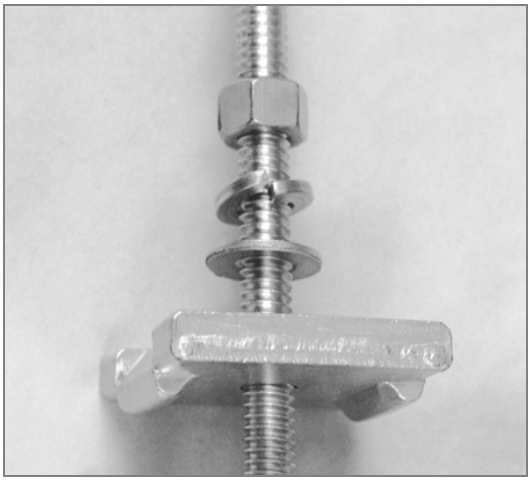
1. Ensure the flanges of the flat fitting plates are in the grooves of the unistruts.
2. Before tightening the nuts on the threaded rods, ensure that the end of each rod is screwed in until it contacts the unistrut. This ensures the rods are threaded completely through the spring nuts.

e. One threaded rod at a time, hold the washers and plate in place on the threaded rod and screw it into a spring nut, as illustrated.



f. Thread a 5/16-18 nut about 2” onto the end of each threaded rod. Tighten each nut firmly.

g. Slip a 5/16” split lockwasher, 5/16” flat washer, and flat fitting plate (in that order) onto each threaded rod.



6. Mount the C-Band SSPAs as follows:

   a. Lift the configuration into position on the vertical pole.

   b. Slip a 14” unistrut over each of pair of threaded rods (upper and lower).

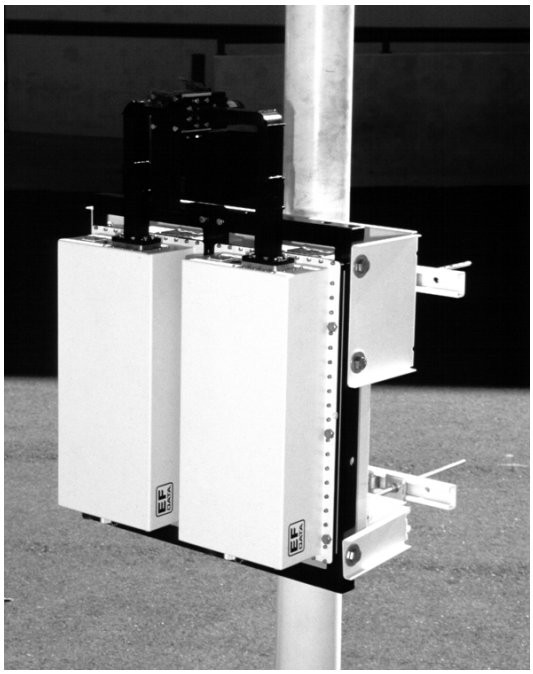
      Note: Install the 14” unistruts with the open face toward the pole, as illustrated.

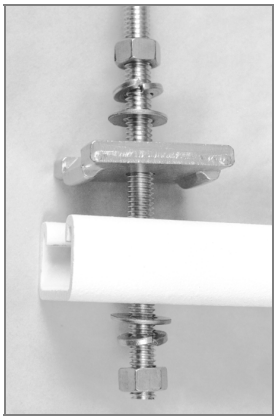
   c. Install a 5/16” flat washer, 5/16” split lockwasher, and 5/16-18 nut on each threaded rod.

   d. Position the configuration, as desired, and tighten the 5/16-18 nuts installed in Step 6.c.

   e. Slide the pipe blocks in until they contact the vertical pole.

   f. Tighten the 5/16-18 bolts.





4.3.5.2 Square Pole

For square, vertical pole installation, follow the steps in Section 4.3.2.1, with the following exceptions:

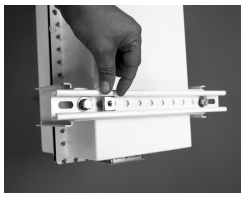
- Do not perform Step 4.
- Do not perform Step 6.e.

4.3.6 Spar Installation

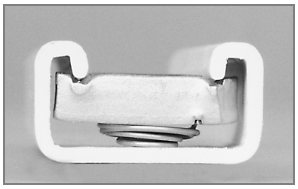
Note: EFData does not recommend the unit be spar mounted.

Install the C-Band SSPA to a spar as follows:

1. Set the C-Band SSPAs on their sides, with the mounting holes facing up.
2. Install the mounting bracket as follows:
   a. Position the C-Band SSPA into the mounting bracket. Secure with four 3/8 x 1.25” bolts, 3/8 split lock washers, and 3/8 flat washers. Tighten bolts firmly.



3. Install the 20” unistruts as follows:
   a. Position the 20” unistrut on the mounting bracket and secure with six 3/8 x 1.25 bolts, 3/8” split lock washers, and 3/8” flat washers.
   b. Install each spring nut as follows:
      (1) Place the spring nut in the unistrut channel, spring side down, with its wide side parallel with the unistrut channel.



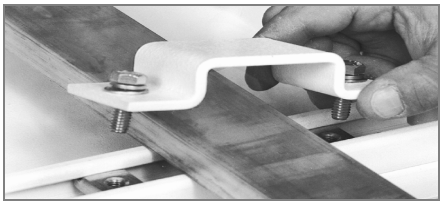
      (2) Press down on the spring nut to compress the spring, and rotate the nut 90°.

4. Release pressure on the spring nut. Mount the configuration as follows:

   a. Lift the C-Band SSPA into position.

   b. Using four 5/16-18 bolts, 5/16" split lockwashers, and 5/16" flat washers, bolt the two spar support brackets in place.

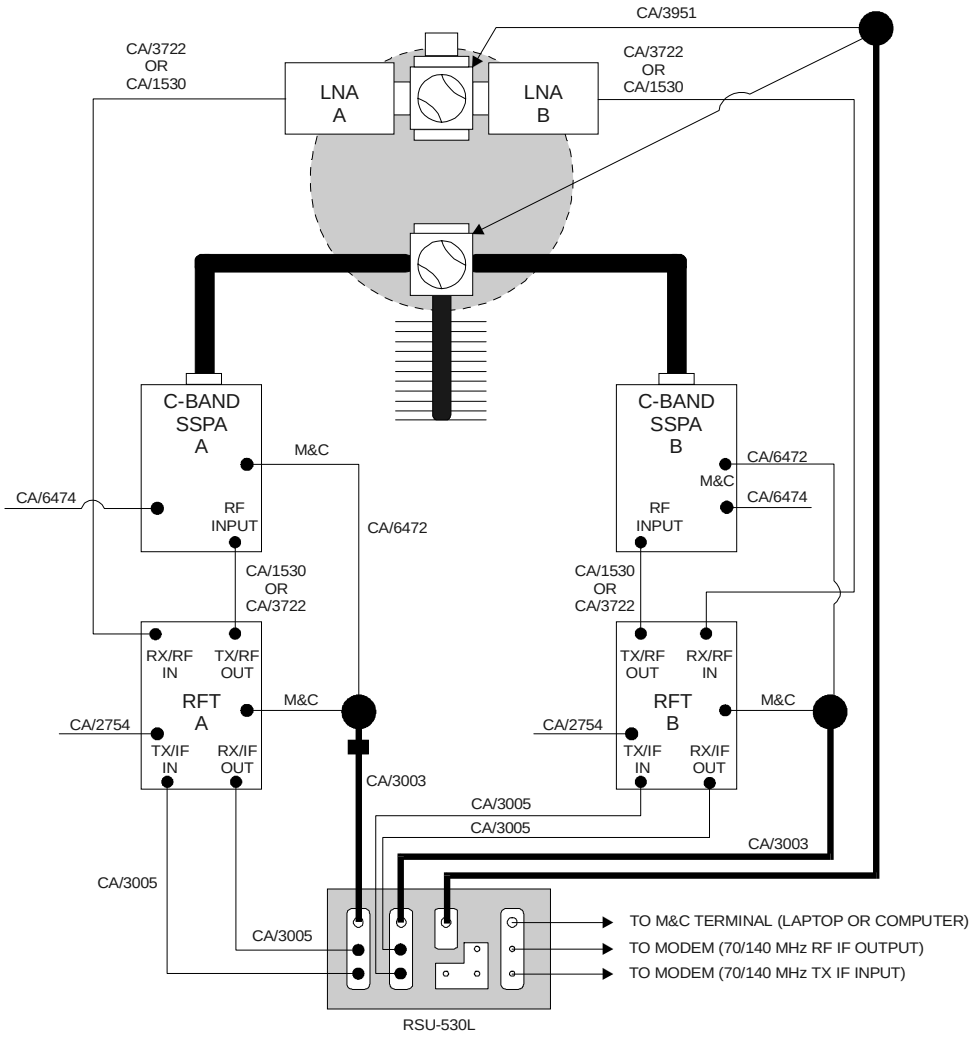
   c. Tighten the bolts firmly.



4.4 Redundancy Configuration Cabling Matrix

Refer to Figure 4-5 to determine the proper length of cable assemblies needed to connect the redundant configuration.

Note: Refer to Chapter 8 for the part number corresponding to the length of cable required for the redundant configuration. Contact EFData Customer Support for obtaining the required cable assemblies.



DETERMINE LENGTH OF THE FOLLOWING CABLES:

CABLE PIN	FROM	TO
CA/1530	SSPA RF/INPUT	RFT TX/RF OUT
CA/2754	RFT PRIME POWER	POWER SOURCE
CA/3003	RSU (JA)	CA/6472 (SIDE A)
CA/3005	RSU TX/RX IF	RFT TX/RX IF
CA/3722	RFT RX IN	LNA RF OUT
CA/3951	RSU ANTENNA	TX/RX SW
CA/6472	RFT M&C	SSPA M&C
CA/6474	SSPA PRIME POWER	POWER SOURCE

NOTE: REFER TO SECTION 8 FOR CABLE DESCRIPTION.

Figure 4-5. Redundant Configuration Cable Assembly Matrix

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5 Chapter 5. OPERATION

This chapter provides operation information for the HPCST-5000 terminal system.

5.1 System Operation

There are three methods of operating the RFT-500:

- Connect a PC running DOS to the EIA-232/EIA-485 remote control port, and run the M&C system monitor software. This software is DOS-based and provides an interface to the remote commands.

  For information on the remote commands, refer to Appendix B.

  For more information on the M&C system monitor program, refer to the *Monitor and Control Software for EFData Satellite Terminals User's Guide*.

- Connect the optional KP-10 hand-held keypad. For more information, refer to the *KP-10 External Keypad Installation and Operation Manual*.

- Use the optional front panel display/keypad (refer to Section 5.3).

5.2 Remote Control

Refer to Appendix B for information on remote control operation.

5.3 Front Panel Display/Keypad

The optional front panel (Figure 5-1) provides the local user interface, which can be used to configure and monitor the status of the terminal.

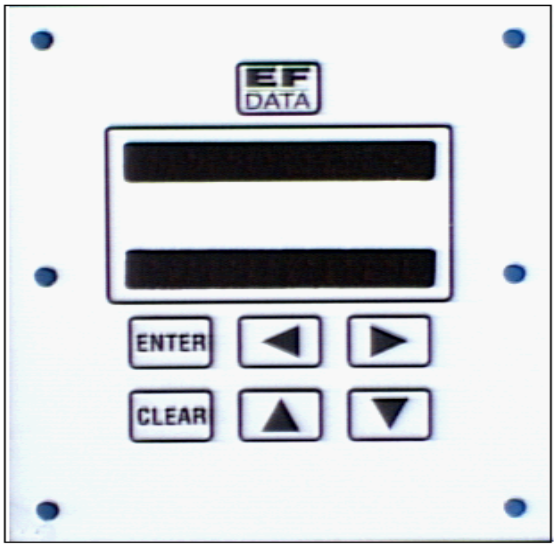

Figure 5-1. Optional RFT-500 Terminal Keypad

The front panel features a 16-character, 2-line LED display and a 6-key keypad. All functions are accessible at the front panel by entering one of three predefined “SELECT” categories or levels:

- Configuration (CONFIG)
- Monitor
- Faults

5.3.1 Front Panel Controls

The terminal is locally operated by using the front panel keypad. The keypad consists of six keys. Each key has its own logical function or functions.

Key	Description
[ENTER]	This key is used to select a displayed function or to execute a change to the terminal's configuration.
[CLEAR]	This key is used for backing out of a selection or to cancel a configuration change which has not been executed using [ENTER]. Pressing [CLEAR] generally returns the display to the previous selection.
[←] and [→]	These keys are used to move to the next selection, or to move the cursor for certain functions.
[↑] and [↓]	These keys are used primarily to change configuration data (numbers), but are also used at times to move from one section to another.

The terminal front panel control uses a tree-structured menu system (Figure 5-2 through Figure 5-5) to access and execute all functions. The base level of this structure is the sign-on message, which is displayed at the front panel upon terminal power-up.

- Line 1 of the sign-on message displays the terminal model number.
- Line 2 displays the version number of the firmware implemented in the terminal.

The main level of the menu system is the SELECT menu, which may be accessed from the base level by pressing any of the arrow keys. From the SELECT menu, any one of three functional categories may be selected:

- Configuration functions
- Monitor functions
- Fault functions

Press [←] or [→] to move from one selection to another.

When the desired function is displayed on line 2, that level can be entered by pressing [ENTER]. Once the functional level has been entered, move to the desired function by pressing [←] or [→].

5.4 Main Menu

Refer to Figure 5-2.

The following sections contain information about individual menu categories and their functions.

Note: The firmware/software referenced in this manual may be an earlier version of the actual firmware/software supplied with the unit.

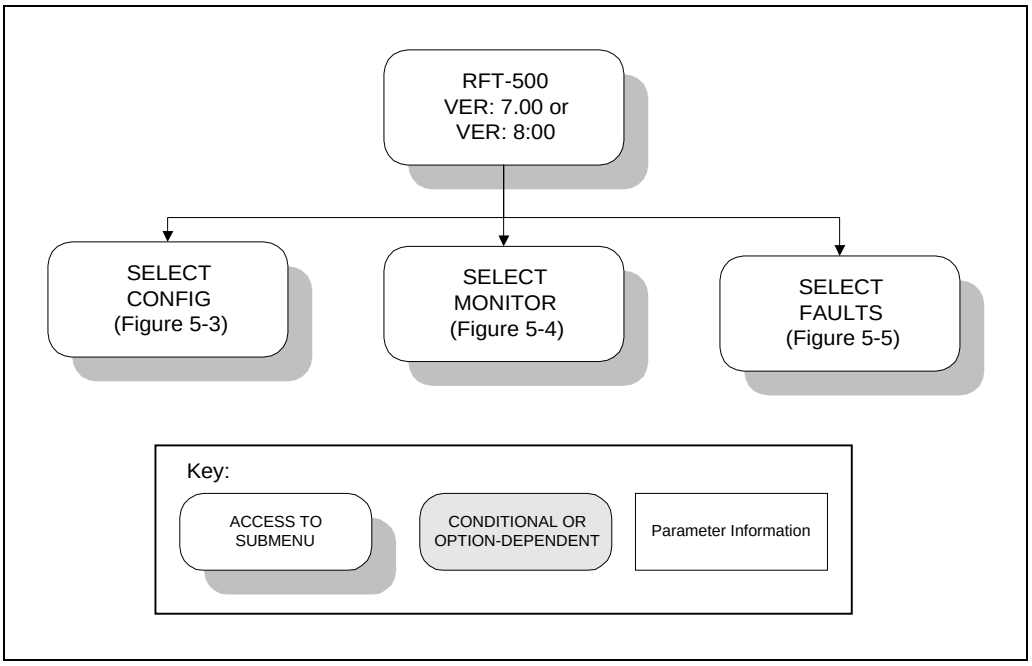

Figure 5-2. Main Menu

5.4.1 Configuration

Refer to Figure 5-3.

Terminal configuration may be viewed or changed by entering the CONFIG menu from the SELECT menu on the front panel.

Enter the selected configuration menu by pressing [ENTER]. Press [←] or [→] to view the selected configuration parameters. To change a configuration parameter, press [ENTER] to begin the change process, at which point the arrow keys can be used to make the changes.

After the changes are made and the display represents the correct parameters, execute the change by pressing [ENTER]. When [ENTER] is pressed, the necessary programming is initiated by the RFT-500.

To undo a parameter change prior to executing it, simply press [CLEAR].

The following table describes each configuration function in detail.

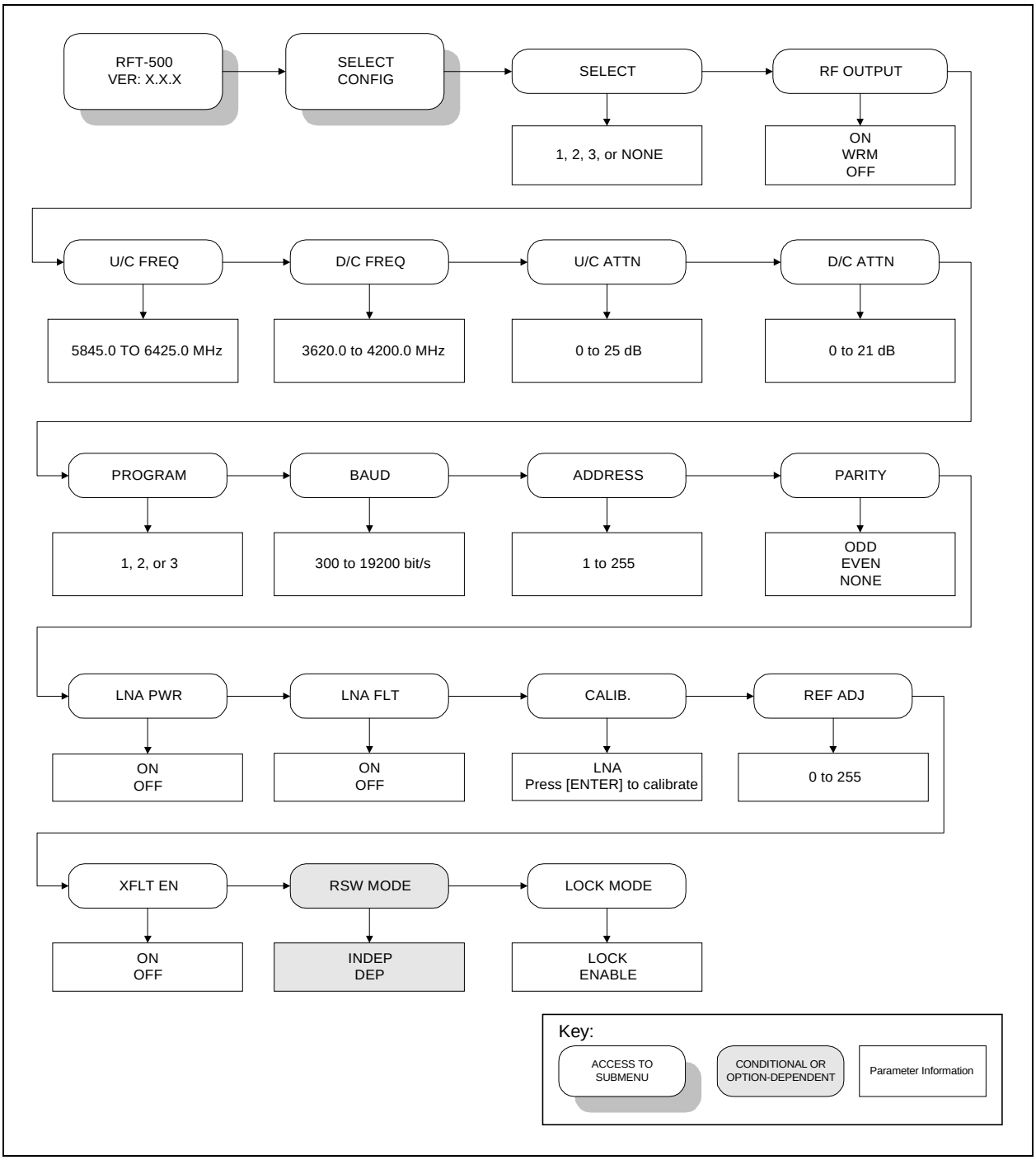

Figure 5-3. Select Configuration Menu

Function	Description
SELECT	Selects any one of the "preset" configurations. The user must first program (store) configuration parameters in the PROGRAM menu. On entry, the current Select parameter will appear in the menu. Press [↑] or [↓] to select 1, 2, 3, or None. Press [ENTER] to execute the change. If no parameters have been selected in the PROGRAM menu, default configurations will be loaded.
RF OUTPUT	Programs the RF output to ON, WRM, or OFF. On entry, the current status of the output is displayed. Press an Arrow key to select ON, WRM, or OFF. Press [ENTER] to execute the change.
U/C FREQ	Programs the up converter frequency between 5845 and 6425 MHz, in: VER: 7.00: 2.5 MHz steps. VER: 8.00: 125 kHz steps On entry, the current up converter frequency is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press [ENTER] to execute the change. **Note:** The frequency is programmable within the specified range. When the transmitter frequency is changed, the transmitter is automatically turned OFF to prevent the possible swamping of other channels. To turn the transmitter ON, use the RF OUTPUT menu.
D/C FREQ	Programs the down converter frequency between 3620 and 4200 MHz, in: VER: 7.00: 2.5 MHz steps. VER: 8.00: 125 kHz steps On entry, the current down converter frequency is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press [ENTER] to execute the change.
U/C ATTN	Programs the up converter output power attenuation from 0 to 25 dB, in 0.5 dB steps. On entry, the current up converter attenuation is displayed with the flashing cursor on the first character. Press [↑] or [↓] to increase or decrease the output power attenuation in 0.5 dB steps. Press [ENTER] to execute the change.
D/C ATTN	Programs the down converter input power attenuation from 0 to 21 dB, in 0.5 dB steps. On entry, the current down converter attenuation is displayed with the flashing cursor on the first character. Press [↑] or [↓] to increase or decrease the output power attenuation in 0.5 dB steps. Press [ENTER] to execute the change.
PROGRAM	Programs or clears the current frequency and attenuator settings as one of the three "preset" selections. On entry, 1*, 2*, or 3* will appear in the window. Press [←] or [→] to move the cursor from left to right. When the flashing cursor is on any of the "*"s, press [↑] or [↓] to turn the "*" ON or OFF. When the "*" is ON, press [ENTER] to clear stored parameters in the preset location to the left of the "*". When the "*" is OFF, press [ENTER] to store the current frequency and attenuation parameters in the preset location at the cursor. To recall any of the present selections, use the SELECT menu, and select 1, 2, or 3. Press [ENTER].

BAUD	Programs the baud rate of the terminal. On entry, the currently selected baud rate of the terminal will be displayed with the flashing cursor on the first digit on the second line of the display. To change the baud rate, press [↑] or [↓] to select a baud rate from 300 to 19200 kbit/s. Press [ENTER] to execute the changes.
ADDRESS	Programs the terminal remote address. On entry, the currently selected address of the terminal is displayed with the flashing cursor on the first character. Press [↑] or [↓] to select the desired address of the terminal from 1 to 255. Press [ENTER] to execute the change.
PARITY	Programs the parity bit to EVEN, ODD, or NONE. On entry, the currently selected parity is displayed. Press an Arrow key to select EVEN, ODD, or NONE. Press [ENTER] to execute the change.
LNA PWR	"ON" means LNA power will be available on the center conductor of the coax cable (J4). "OFF" means DC power will be removed from the coax cable.
LNA FLT	"ON" means the system will declare an LNA fault when applicable. "OFF" means all LNA faults will be ignored by the system.
CALIB.	Enables the user to calibrate the LNA. If [ENTER] is pressed, the M&C will perform an analog-to-digital conversion of the LNA current, and store the value in the Electrically-Erasable Programmable Read-Only Memory (EEPROM). During the normal operation, the M&C will monitor the recent LNA current, and compare it to the stored value. If the LNA deviates by ± 30%, a fault will be declared.
REF ADJ	Allows adjustment of the 10.000 MHz reference frequency to account for long term drift. The setting varies from 0 to 255.
XFLT EN	Enables or disables the external fault input. For use with external TWTs or SSPAs. On entry, the currently selected parameter will appear. Press an Arrow key to select ON or OFF. Press [ENTER] to execute the change. When ON is selected, all of the uplink external faults will appear in the front panel monitoring menus and fault menus. When OFF is selected, all of the uplink external faults will be masked in the front panel monitoring menus and fault menus.
RSW MODE	For use in a redundant system only (with an RSU-503L switch). INDEP TX and RX switch independently on fault to the backup terminal. DEP switches both TX and RX on fault to the backup terminal.
LOCK MODE	If the system is placed in the LOCK mode, none of the above parameters can be changed. This is to prevent accidental changes of the operation conditions by unauthorized personnel. The mode must be changed to ENABLE in order to change the existing configuration.

5.4.2 Monitor

Refer to Figure 5-4.

The MONITOR menu is accessible from the SELECT menu. When the MONITOR menu is entered, press [←] or [→] to select the desired function.

Each monitor function is displayed in real time as long as it is selected.

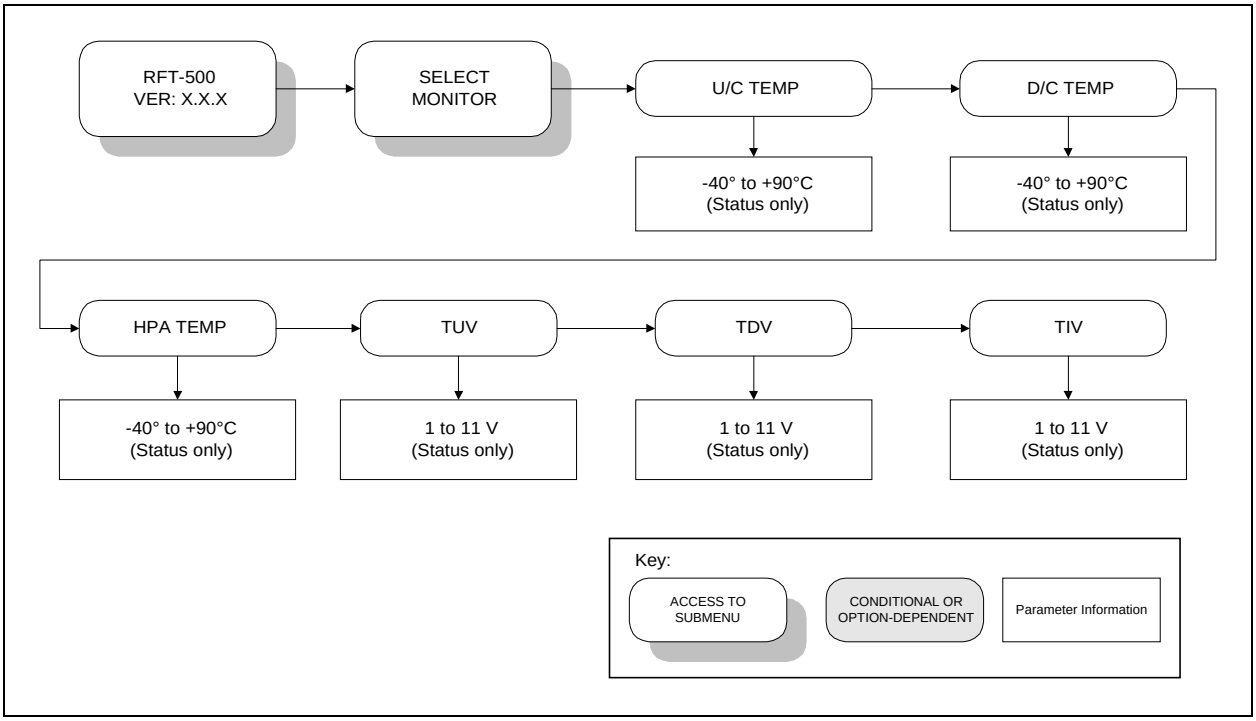

Figure 5-4. Select Monitor Menu

Function	Description
U/C TEMP	Up converter temperature monitor Range: -40 to +90°C (-40 to 194°F)
D/C TEMP	Down converter temperature monitor Range: -40 to +90°C (-40 to 194°F)
HPA TEMP	HPA temperature monitor Range: -40 to +90°C (-40 to 194°F)
TUV	Tuning voltage monitor for up converter synthesizer Range: 1 to 11V
TDV	Tuning voltage monitor for down converter synthesizer Range: 1 to 11V
TIV	Tuning voltage monitor for the IF LO Range: 1 to 11V

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5.4.3 Faults

Refer to Figure 5-5.

The FAULTS menu is accessible from the SELECT menu. Faults are similar to monitor functions, as they display the current fault status of the group being displayed.

Press [←] or [→] to move between the faults.

The current fault status is displayed as “OK” or “FLT” for each parameter monitored. “OK” indicates that no fault exists, while “FLT” indicates that a fault exists.

Press [CLEAR] to exit this level of operation and return to the previous level.

The following list outlines the faults monitored in the FAULTS menu. Refer to Chapter 7 for troubleshooting procedures for each displayed fault.

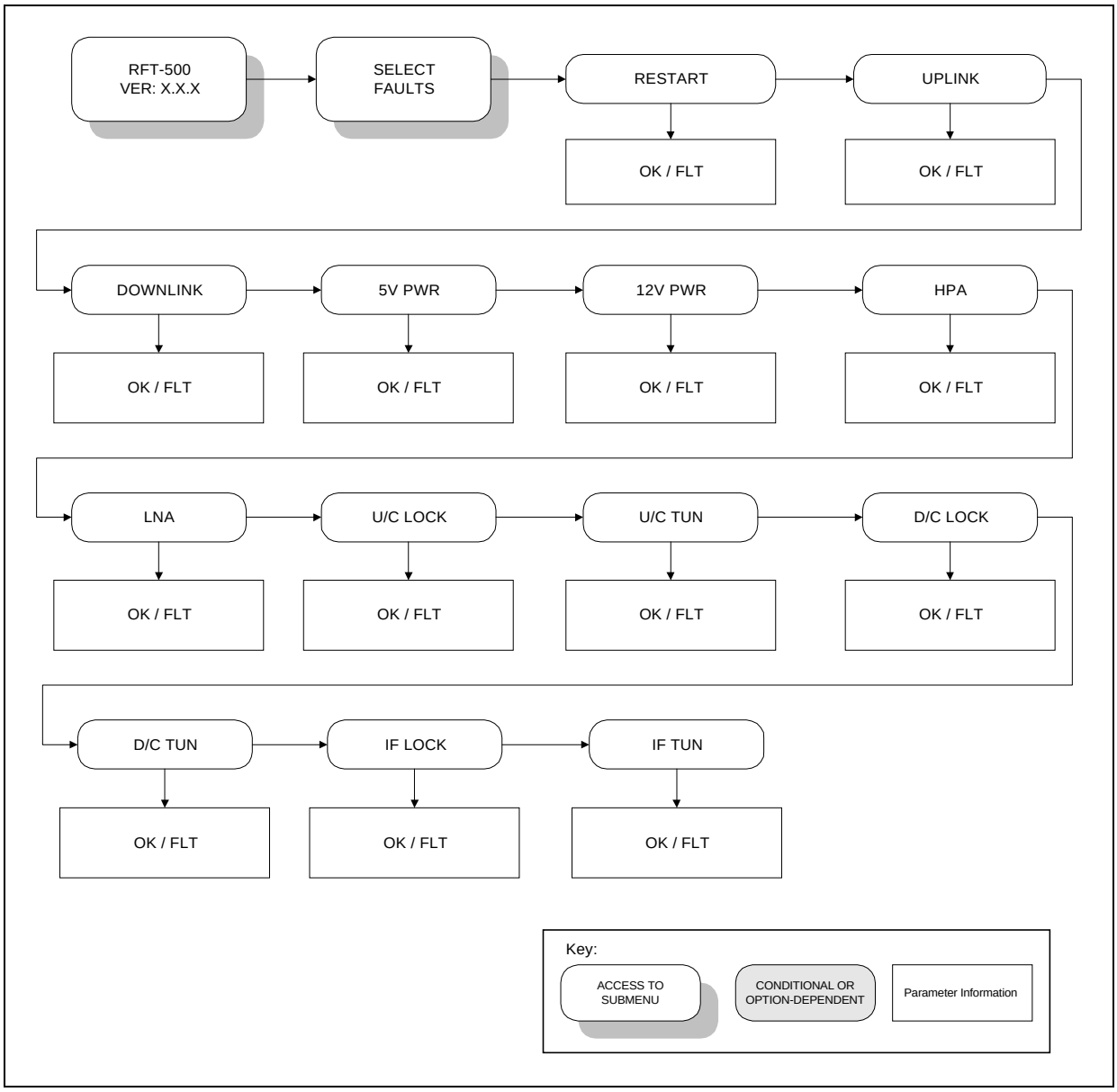

Figure 5-5. Select Faults Menu

Fault	Description
RESTART	M&C microprocessor experienced a restart due to power failure or watchdog timer time-out.
UPLINK	U/L fault caused by synth, U/C, IFLO, or HPA.
DOWNLINK	D/L fault caused by synth, D/C, IFLO, or LNA.
5V PWR	+5V power supply fault. This is a status-only fault, and will not turn the transmitter OFF.
12V PWR	+12V power supply fault. This is a status-only fault, and will not turn the transmitter OFF.
HPA	High Power Amplifier fault. Typically indicates that the HPA is not present or is not operating. This fault will turn the RF transmitter off.
LNA	Low noise amplifier fault. Typically indicates that the LNA is not present, has failed, or exceeded the high or low fault window trip point. This fault will not turn the transmitter off.
U/C LOCK	Up converter lock fault. Indicates the up converter is not locked up. This fault will turn the transmitter off.
U/C TUN	Up converter tuning fault.
D/C LOCK	Down converter lock fault. Indicates the down converter is not locked up. This fault will NOT turn the transmitter off.
D/C TUN	Down converter tuning fault.
IF LOCK	IF synthesizer lock fault. This fault will turn the transmitter OFF.
IF TUN	IF tuning fault.

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Chapter 6. THEORY OF OPERATION

This chapter provides the basic theory of operation for the Monitor and Control (M&C) board, high stability oscillator, IFLOs synthesizers, and the up and down converters.

Note: Refer to Appendix A for 140 MHz configuration.

6.1 Monitor and Control

The RFT-500 uses a sophisticated microcontroller module to perform the M&C functions of the terminal. This board (Figure 6-1) is located inside of the RFT-500, on top of the other assemblies.

The M&C monitors the RFT-500 and provides configuration updates to other modules within the terminal when necessary.

Terminal configuration parameters are maintained in EEPROMs, which provides for total recovery after a power-down situation.

Fault monitoring and status gathering are also provided.

All RFT-500 functions are accessible through the local front panel keypad/display or a remote communications interface.

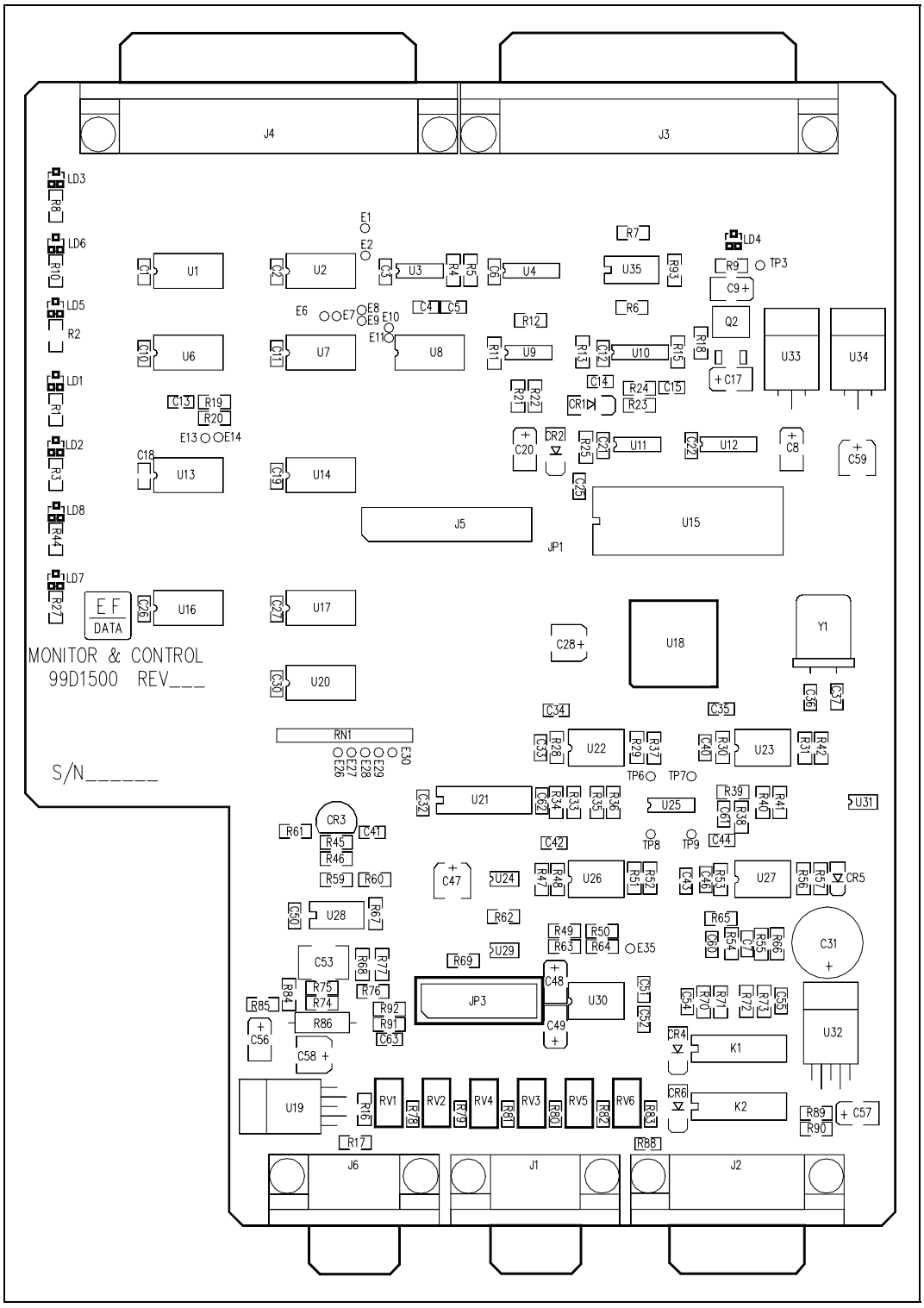

Figure 6-1. M&C Board

6.1.1 EEPROM Memory

EEPROM memory on the M&C module allows it to retain configuration information without prime power for at least one year. If the terminal is powered down, the following sequence will be carried out by the M&C microcontroller:

1. When power is reapplied, the microcontroller checks the EEPROM's Random Access Memory (RAM) to see if valid data has been retained. If valid data has been retained, the terminal is reconfigured to the configuration maintained in EEPROM.

2. If EEPROM memory fails the valid data test, a default configuration from Read Only Memory (ROM) is loaded into the system.

6.1.2 Remote Interface

The functions of the RFT-500 can be remotely controlled and monitored via an EIA-485 or EIA-232 communications link. The M&C module must be hardware configured to one of the two interfaces.

The EIA-485 interface makes it possible to operate 255 terminals on a common communications link.

The EIA-232 interface is used to communicate with a single terminal.

Refer to Figure 6-2 for the jumper placement at JP3.

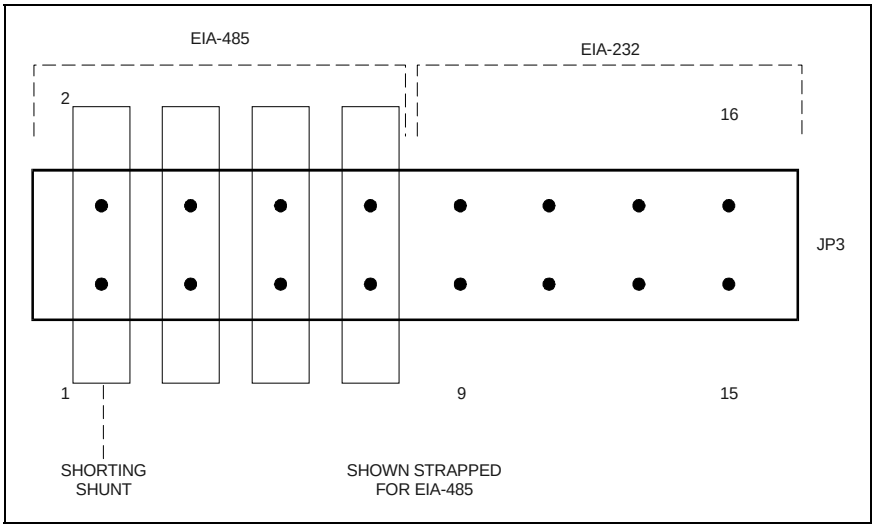

Figure 6-2. M&C Jumper Placement at JP3

6.1.2.1 Remote Interface Specification

Refer to Appendix B for information on remote control operation.

6.1.3 Terminal Default Conditions

On initial power-up, the unit will default to the following parameters:

Parameter	Default
Baud Rate	9600
Parity	Even
Device Address	1
U/C Gain	Minimum
D/C Gain	Minimum
RF Output	OFF
U/C Frequency	6135.00 MHz
D/C Frequency	3925.00 MHz

6.1.4 Theory of Operation

Refer to Figure 6-3 for a functional block diagram of the M&C.

The M&C board performs the following operations:

- Receives the desired frequency from either the remote EIA-232/EIA-485 or local keypad, and after converting it to a synthesizer setting, stores it to the applicable synthesizer output latch.
- Reads the thermistors located in the up converter, down converter, and HPA, and converts them to temperatures for display.
- Reads the characterization EEPROMs in the up converter, down converter, and HPA, and calculates an Automatic Gain Control (AGC) voltage based on frequency and temperature to linearize the respective module.
- Turns the cooling fan ON or OFF, depending on the temperature.
- Receives fault inputs from all modules, and presents them to the remote EIA-232/EIA-485 and the optional local keypad display.
- Performs an initial current sense on the LNA, and stores the reading in the EEPROM. Subsequent current sense readings are taken and compared to the initial reading to determine a fault.

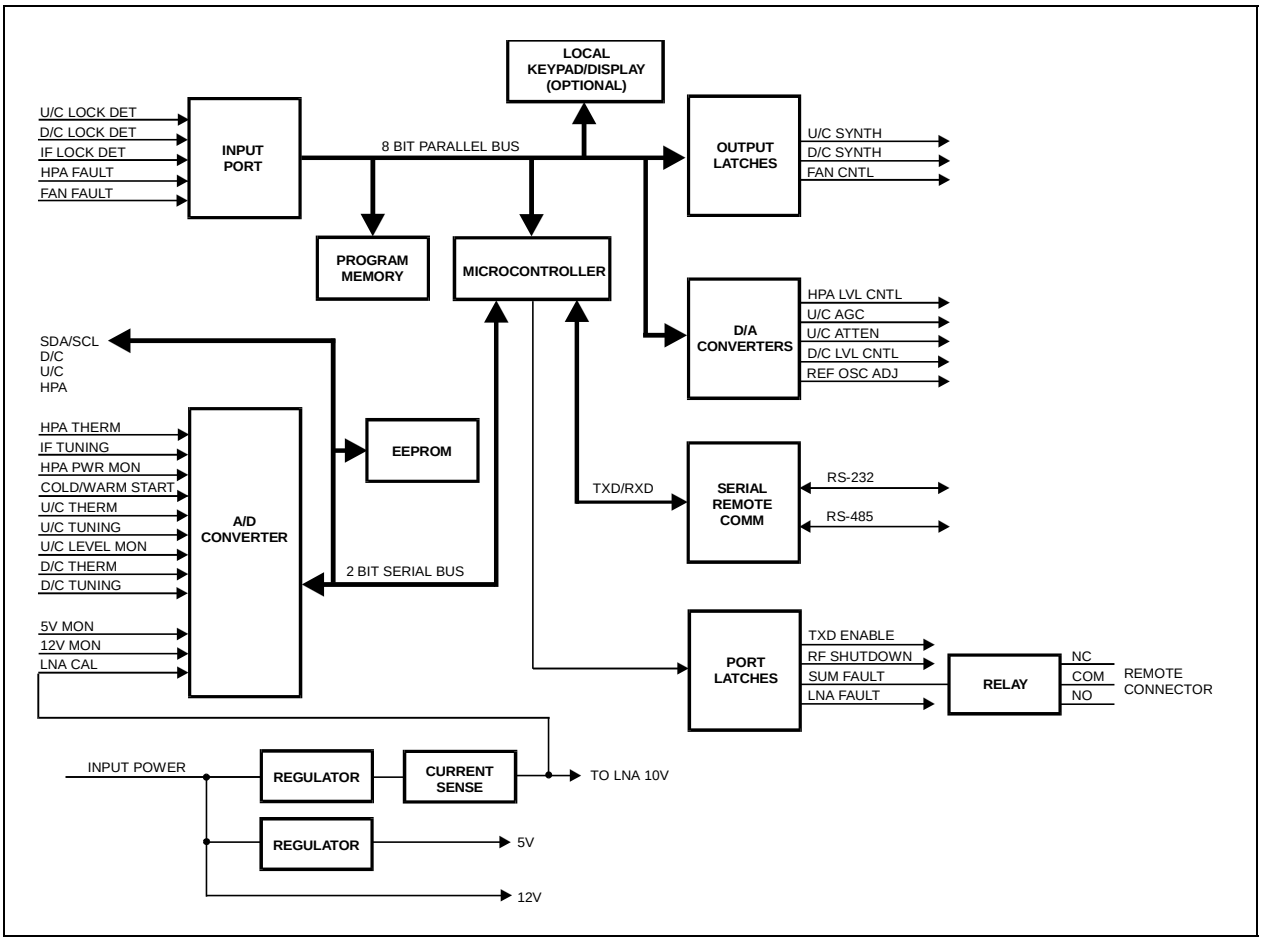

Figure 6-3. M&C Functional Block Diagram

6.1.5 M&C Board Connector Pinouts

6.1.5.1 EIA-232/EIA-485 Remote Control (J1)

The remote interface is provided on a 9-pin female D connector (Table 6-1). The remote connector is a Data Circuit Terminating Equipment (DCE) interface.

Table 6-1. EIA-232/EIA-485 Remote Control (J1)

Pin #	EIA-232	EIA-485	Description
1	GND	GND	Ground
2	TD/TX		Transmit Data
3	RD/RX		Receive Data
4		+RX/TX	Plus Transmit or Receive
5	GND	-RX/TX	Negative Transmit or Receive
6	DSR		Data Set Ready
7	RTS		Ready to Send
8	CTS	+RX/TX	Clear to Send (EIA-485 — Plus Transmit or Receive)
9		-RX/TX	Negative Transmit or Receive Data

Notes:

1. Clear to Send (CTS) is tied to Ready to Send (RTS) in EIA-232 mode.
2. The pinout for Data Terminal Equipment (DTE) interface is provided for EIA-232.

6.1.5.2 Remote Relay Control, J2 DB15-Female

Refer to Table 6-2 for pin assignments.

Table 6-2. Remote Relay Control, J2 DB15-Female

Pin #	Name	Description
1	EXT PWR	Output voltage, 11V, 1A
9	LNA_PWR	10V to LNA
2	NO A	Summary fault relay A
10	COM A	Normal operation, common connects to NO
3	NC A	Fault mode, common connects to NC
11	NO B	Summary fault relay B
4	COM B	Normal operation, common connects to NO
12	NC B	Fault mode, common connects to NC
5	SPARE	
13	SPARE	
6	ALOG TST	Analog voltage output, TBD
14	LNA_PWR_RTN	Ground Return for LNA
7	EXT INPUT2	Input, logic 0 (normal) or 5V (fault)
15	EXT TWT FLT	Input, logic 0 or 5V, used for TWT.FLT
8	GND	Ground

6.1.5.3 HPA, PS, U/C, and D/C, J3 DB37-Male

Refer to Table 6-3 for pin assignments.

Table 6-3. HPA, PS, U/C, and D/C, J3 DB37-Male

Pin #	Name	Description
1	12.5V PWR	Input power to M&C, 12.5V, 220 mA
20	12.5V PWR	Input power to M&C, 12.5V, 220 mA
2	DC LNA PWR	Output power to DC, 10V, 100 mA
21	GND	M&C ground
3	GND	M&C ground
22	FAN TACH	Input pulse, 0 to 12V, 9 millisecond period
4	FREQ CNTRL	Output, voltage 0 to 10V
23	FAN CNTRL	Output, NPN OC Transistor with resistor to 5V
5	SPARE	
24	EXT OUTPUT1	Output, digital CMOS level — function TBD
6	EXT INPUT3	Input, digital CMOS — function TBD
25	HPA FLT COM	Output, ground connection to relay common
7	HPA FLT NO	Input from HPA, contact to COM during normal operation
26	SPARE	
8	SPARE	
27	HPA THERM	Input, 5K thermistor to ground located in HPA
9	HPA LEVEL CON	Output, 0 to 4 VDC for AGC control of HPA output
28	HPA SHUTDOWN	Output, NPN OC transistor to GND, low produces shut-off
10	HPA PWR MON	Input from HPA, 0 to 4V
29	SPARE	
11	SPARE	
30	SPARE	
12	DC LEVEL CON	Output, analog voltage 0 to 4V, AGC control of D/C output
31	DC LEVEL MON	Input, 0 to 4V
13	DC THERM	Input, 5K thermistor to ground located in D/C
32	SPARE	
14	HPA SDA	Bi-directional serial data
33	DC SDA	Bi-directional serial data
15	UC SDA	Bi-directional serial data
34	HPA SCL	Output, serial clock
16	DC SCL	Output, serial clock
35	UC SCL	Output, serial clock
17	SPARE	
36	UC LEVEL MON	Input, 0 to 4V
18	UC THERM	Input, 5K thermistor to ground located in U/C
37	UC ATT (FLC)	Output, analog voltage 0 to 4V, attenuator control
19	UC AGC (CLC)	Output, analog voltage 0 to 4V, AGC control

6.1.5.4 Synthesizers (DC/UC/LO), J4 DB37-Female

Refer to Table 6-4 for pin assignments.

Table 6-4. Synthesizers (DC/UC/LO), J4 DB37-Female

Pin #	Name	Description
1	UC LO A0	Output CMOS level, LSB *(selects the 2nd*
20	UC LO A1	Output CMOS level, 2LSB *divide-by number)*
2	UC LO A2	Output CMOS level, 2MSB
21	UC LO A3	Output CMOS level, MSB
3	UC LO G0	Output CMOS level, LSB *(selects gain over*
22	UC LO G1	Output CMOS level, 2LSB *frequency)*
4	UC LO G2	Output CMOS level, 2MSB
23	UC LO G3	Output CMOS level, MSB
5	UC LO N0	Output CMOS level, LSB *(selects the first*
24	UC LO N1	Output CMOS level, 2LSB *divide-by number*
6	UC LO N2	Output CMOS level, 3LSB *in the synthesizer)*
25	UC LO N3	Output CMOS level, 3MSB
7	UC LO N4	Output CMOS level, 2MSB
26	UC LO N5	Output CMOS level, MSB
8	DC LO LCK DET	Input, 0V = locked, 5V = unlocked
27	DC LO T_MON	Input, 0 to 11V, nominal reading = 6V
9	SPARE	
28	SPARE	
10	IF LCK DET	Input, 0V = locked, 5V = unlocked
29	IF T_MON	Input, 0 to 11V, nominal reading = 6V
11	SPARE	
30	DC LO A0	Output CMOS level, LSB *(selects the 2nd*
12	DC LO A1	Output CMOS level, 2LSB *divide-by number)*
31	DC LO A2	Output CMOS level, 2MSB
13	DC LO A3	Output CMOS level, MSB
32	DC LO G0	Output CMOS level, LSB *(selects gain*
14	DC LO G1	Output CMOS level, 2LSB *over frequency)*
33	DC LO G2	Output CMOS level, 2MSB
15	DC LO G3	Output CMOS level, MSB
34	DC LO N0	Output CMOS level, LSB *(selects the first*
16	DC LO N1	Output CMOS level, 2LSB *divide by number*
35	DC LO N2	Output CMOS level, 3LSB *in the synthesizer)*
17	DC LO N3	Output CMOS level, 3MSB
36	DC LO N4	Output CMOS level, 2MSB
18	DC LO N5	Output CMOS level, MSB
37	UC LO LCK DET	Input, 0V = locked, 5V = unlocked
19	UC LO T_MON	Input, 0 to 11V, nominal reading = 6V

6.1.5.5 Keypad Display, 24-Pin (12 x 2) Ribbon Connector (J5)

The front panel/display keypad is an optional feature which allows the user to configure and monitor status of the terminal locally.

All functions are also accessible from the remote port.

When this option has been installed, the 24-pin ribbon connector will be routed from J5 of the M&C board to the keypad/display assembly.

Refer to Table 6-5 for pin assignments.

Table 6-5. Keypad Display, 24-Pin Ribbon Connector (J5)

Pin #	Name	Description
1	/A0	Address Data Line 0 Inverted
3	/A1	Address Data Line 1 Inverted
5	A2	Address Data Line 2
7	A3	Address Data Line 3
9	A4	Address Data Line 4
11	A5	Address Data Line 5
13	/D0000	Address D000 Inverted
15	/BFR READ	Buffered Read Inverted
17	/BFR WRITE	Buffered Write Inverted
19	SPARE	
21	/KB INTRPT	Reserved For KB Interrupt
23	GND	Ground
2	+5V	+5V
4	SPARE	
6	BFRD AD0	Buffered Address Data Line 0
8	BFRD AD1	Buffered Address Data Line 1
10	BFRD AD2	Buffered Address Data Line 2
12	BFRD AD3	Buffered Address Data Line 3
14	BFRD AD4	Buffered Address Data Line 4
16	BFRD AD5	Buffered Address Data Line 5
18	BFRD AD6	Buffered Address Data Line 6
20	BFRD AD7	Buffered Address Data Line 7
22	SPARE	
24	SPARE	

6.1.6 Test Points and LEDs

Refer to Section 7.1.

6.2 High Stability Oscillator

The high stability oscillator provides a low phase noise, frequency-stable 10 MHz source for the up converter, down converter, synthesizers, and IFLO.

The internal oven, which is provided for additional stability, operates directly from the 12V power source. The electronic control circuitry is buffered by an active filter.

The sinewave output is converted to a CMOS square wave before being output to the synthesizers.

Refer to Figure 6-4 for a block diagram of the high stability oscillator.

6.2.1 Specifications

Refer to Table 6-6 for specifications.

Table 6-6. High Stability Oscillator Specifications

Parameter	Specification
Frequency	10 MHz
Frequency Stability (-40° to +70°C [-40° to +158°F])	$\pm 1 \times 10^{-8}$
Output Level	CMOS voltages (+5V)
Output Waveform	Square Wave
Input Voltage	12.5V
Input Current	600 mA at turn-on, 250 mA after warm-up at +25°C (+77°F)
Warm-up	minutes to within 1×10^{-7} of final frequency at +25°C (+77°F)
Phase Noise (Maximum) 1 Hz Measurement bandwidth measured at 10 MHz: 10 Hz 100 Hz 1 kHz 10 kHz	 -120 dBc -150 dBc -160 dBc -165 dBc
Vibrational Sensitivity	1×10^{-9}/g
Aging	5×10^{-10}/day, 1×10^{-1}/year
Frequency Deviation (mechanical)	To compensate for 10 years aging
Frequency Deviation (electrical)	$\pm 2 \times 10^{-6}$ minimum, 0 to 10 VDC

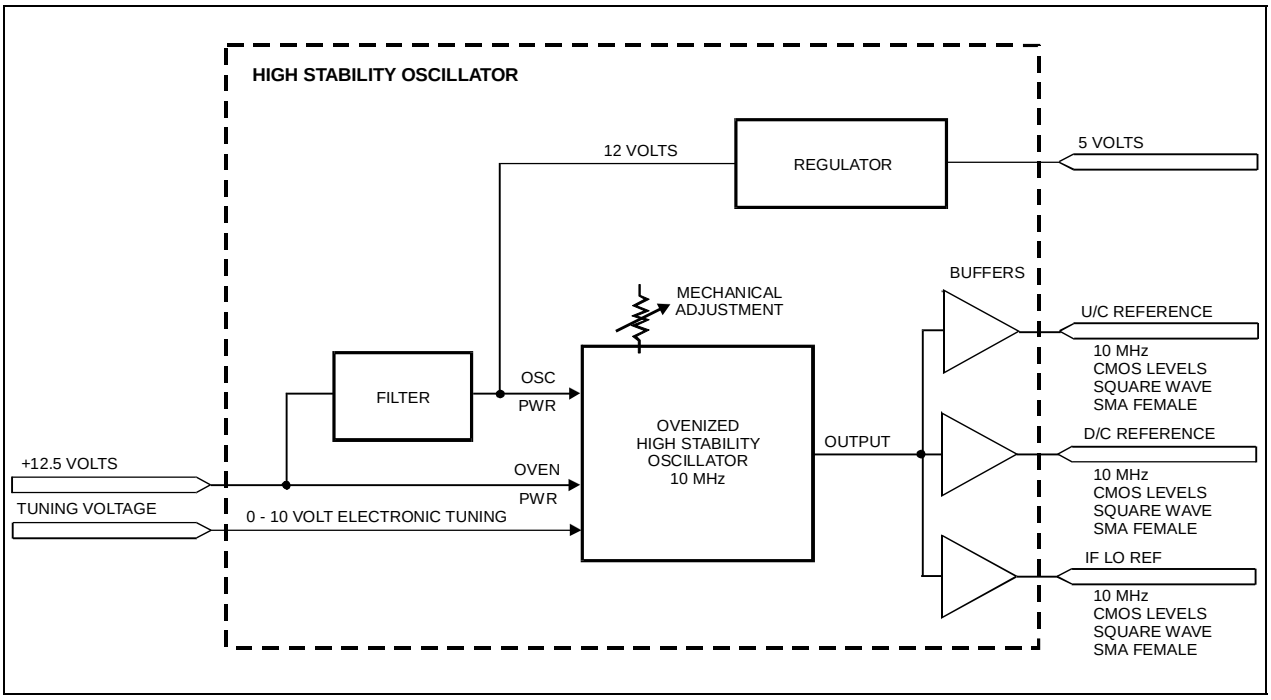

Figure 6-4. High Stability Oscillator Block Diagram

6.3 IF Local Oscillator

The IF local oscillator (IFLO) contains:

- Voltage Controlled Oscillator (VCO)
- Loop filter
- Divide-down chain

The 10 MHz input reference is multiplied up to 2120 MHz in three steps (2 x 2 x 53), then distributed to both synthesizers.

The 10 MHz output reference is multiplied by 106, and is sent to both the up and down converters.

The loop tracking voltage is sent to the M&C board, where it is monitored along with the lock detect fault.

Refer to Figure 6-5 for a block diagram of the IFLO.

6.3.1 Specifications

Refer to Table 6-7 for specifications.

Table 6-7. IL Local Oscillator Specifications

Parameter	Specifications
Input	10 MHz square wave, CMOS levels
Output	1060 MHz (2 each), 2120 MHz (2 each)
Connectors	SMA
Output Impedance	50Ω
Output Level	+7 dBm min

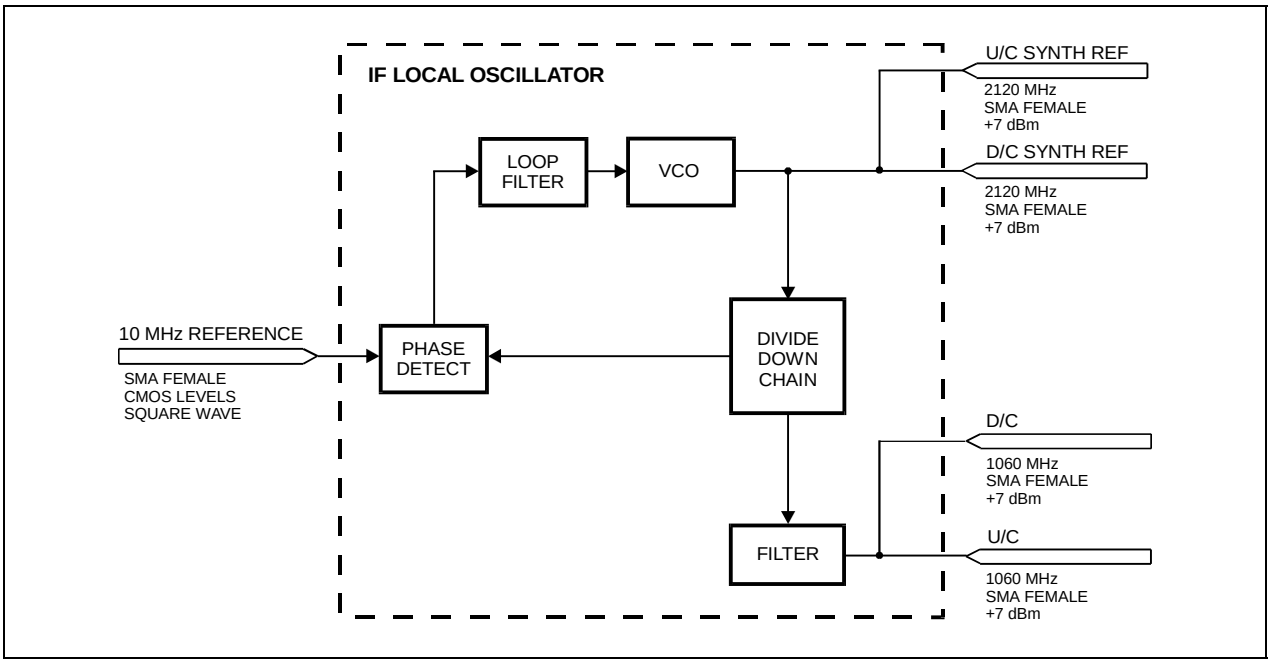

Figure 6-5. IF Local Oscillator Block Diagram

6.4 Synthesizer

The RFT-500 uses two synthesizers (optional single synthesizer):

- One for the down converter to convert the RF input to a 70 MHz IF output
- One for the up converter to convert the 70 MHz input to the RF output

The purpose of the synthesizer module is to convert the 10 MHz reference signal to a variable frequency to perform the conversion. A single synthesizer option is available. When the up converter is programmed, the down converter frequency is automatically selected.

6.4.1 Specifications

Refer to Table 6-8 for specifications.

Table 6-8. Synthesizer Specifications

Parameter	Specification
RF Inputs:	10 MHz CMOS square wave 2120 MHz reference (from IFLO)
Connector type	SMA
Impedance	50Ω
Input level	+7 dBm
RF Outputs:	U/C frequencies 4715 to 5295 MHz D/C frequencies 4610 to 5190 MHz Single 4662.5 to 5242.5 MHz
Connector type	SMA
Impedance	50Ω
Level	+7 dBm

6.4.2 Theory of Operation

The synthesizer module multiplies the 10 MHz reference clock to a variable clock by use of:

- VCOs
- Loop filters
- Phase detectors
- Variable divide-down chain

The divide-down chain is controlled by the M&C board through the use of 14 parallel CMOS signals. The down converter divide-down chain varies from 150 to 380. The up converter divide-down chain varies from 222 to 422. A frequency doubler is then applied to produce the final output.

The VCO tuning voltage is sent to the M&C for monitoring, as well as a lock detect fault.

Refer to Figure 6-6 and Figure 6-7 for block diagrams of the down and up converter LO synthesizers.

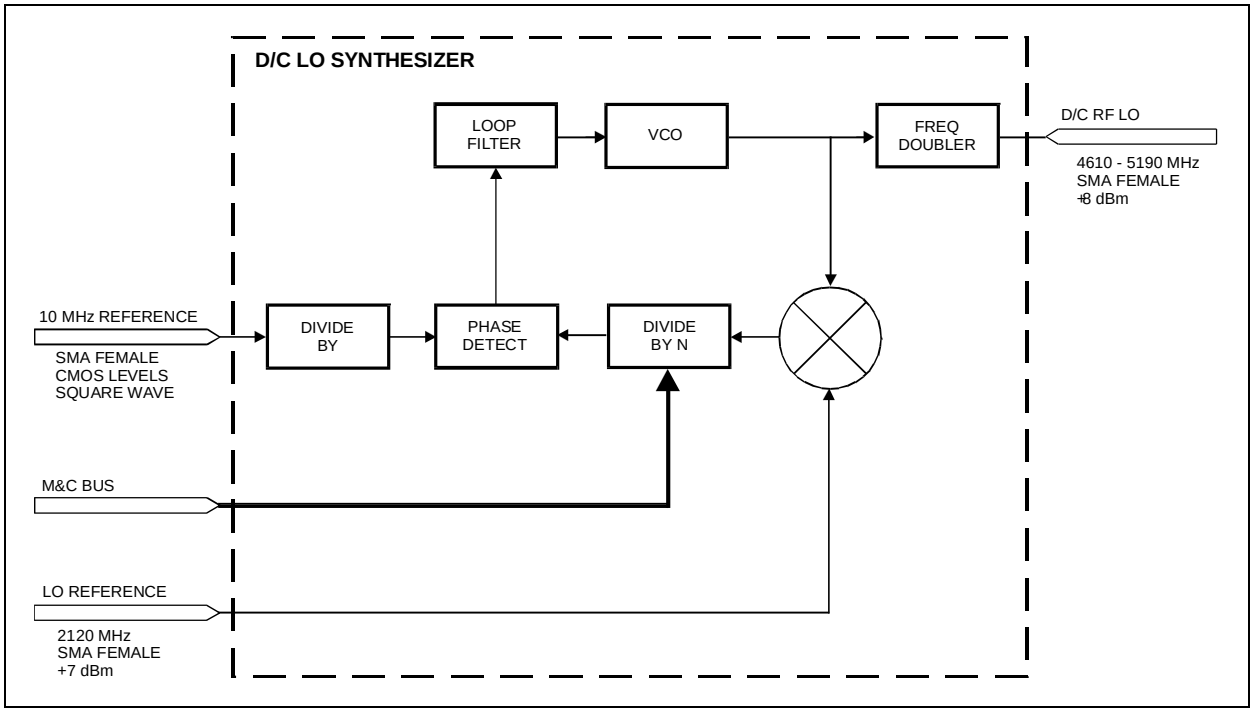

Figure 6-6. Down Converter Synthesizer Block Diagram

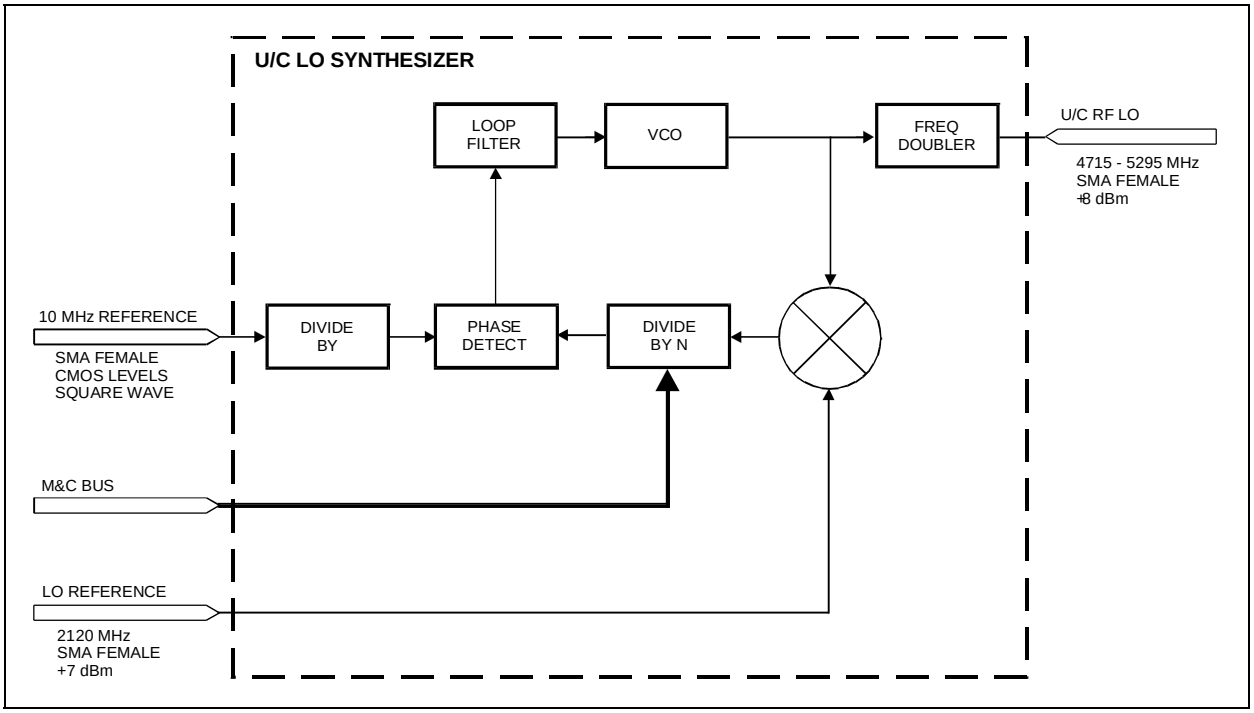

Figure 6-7. Up Converter Synthesizer Block Diagram

6.5 Down Converter

The function of the down converter is to convert the C-Band signal from the LNA to a 70 MHz IF signal for use in the modem.

Refer to Figure 6-8 for a functional block diagram of the down converter.

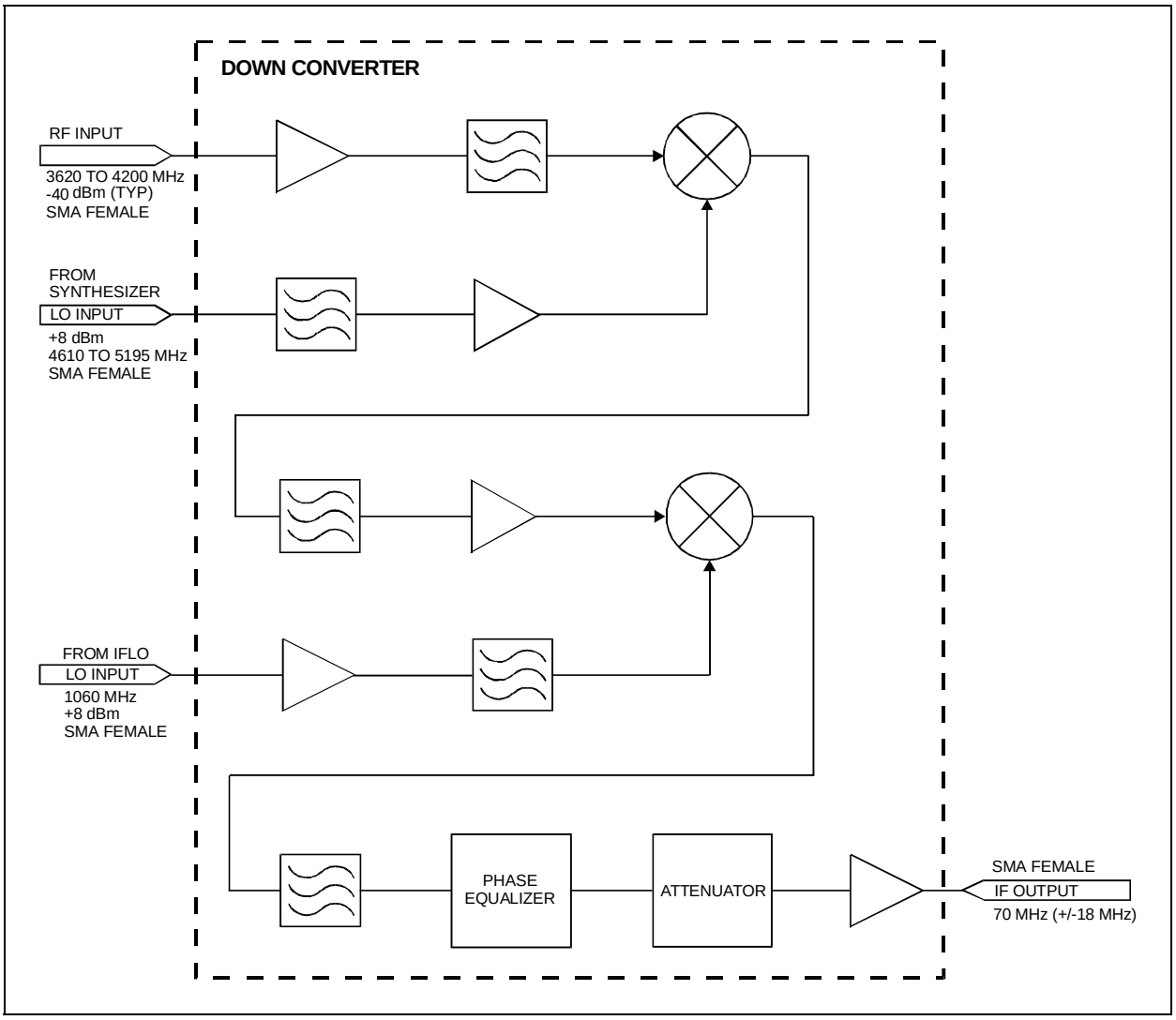

Figure 6-8. Down Converter Block Diagram

6.5.1 Specifications

Refer to Table 6-9 for specifications.

Table 6-9. Down Converter Specifications

Down Converter	
Input Frequency	3620 to 4200 MHz
Input Connector	SMA Female
Input Impedance	50Ω
Input VSWR	1.5:1
Output Frequency	70 MHz, ± 18 MHz
Output Connector	SMA Female
Output VSWR	1.3:1
1 dB Compression	+17 dBm
1st IF Synthesizer Input	
Frequency	4610 to 5195 MHz
Level	+8 dBm
Connector	SMA Female
Return Loss	14 dB
Impedance	50Ω
2nd IFLO Input	
Frequency	1060 MHz
Level	+8 dBm
Connector	SMA Female
Return Loss	14 dB
Impedance	50Ω

6.5.2 Theory of Operation

The RFT-500 down converter utilizes a dual conversion process to convert from an input RF frequency band of 3620 to 4200 MHz, to an output baseband 70 MHz IF signal.

The first conversion requires a down converter synthesizer frequency input to mix with the RF input. The M&C board controls the frequency selection of the synthesizer. The synthesizer output frequency band is from 4610 to 5190 MHz, in 2.5 MHz steps (optional 125 kHz step size available).

The output of the first mixing process is at a frequency of 990 MHz. The 990 MHz output is applied to the second mixer, which mixes with an IFLO frequency input at 1060 MHz from the IFLO module. The output of the second mixer is the desired baseband 70 MHz IF signal.

The M&C board interpolates the factory preset compensation data that is stored in an EEPROM inside the down converter. This data allows the M&C board to command and compensate the down converter's output power, ensuring proper output power levels over the entire frequency and temperature range.

The M&C board also supplies the DC power for the LNA, which is subsequently injected into the RF input connector.

6.6 Up Converter

The function of the up converter is to convert the 70 MHz IF signal used in the indoor unit modem to a C-Band signal to be sent to the HPA.

Refer to Figure 6-9 for a functional block diagram of the up converter.

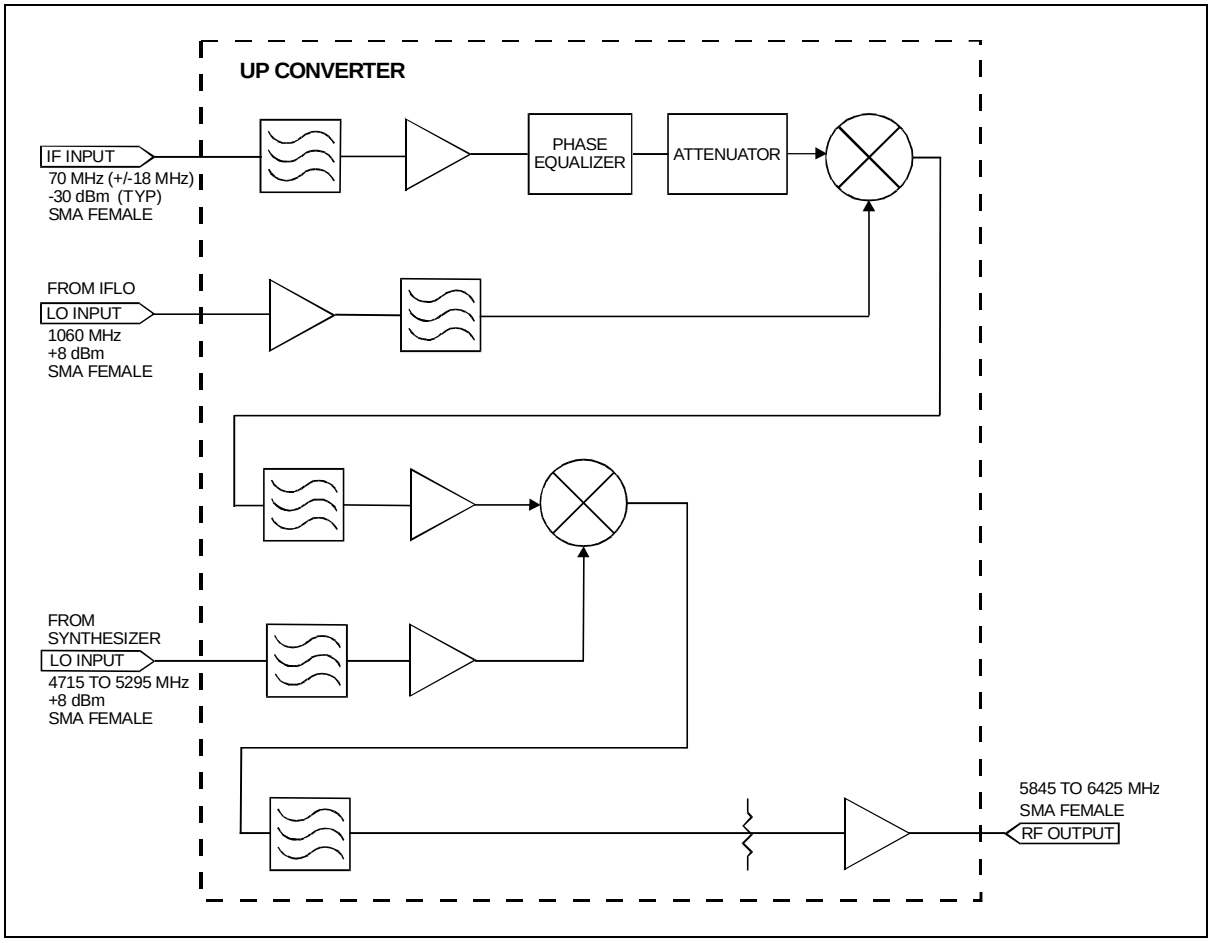

Figure 6-9. Up Converter Block Diagram

6.6.1 Specifications

Refer to Table 6-10 for up converter specifications.

Table 6-10. Up Converter Specifications

Up Converter	
Input Frequency	70 MHz ± 18 MHz
Input Connector	SMA Female
Input Impedance	50Ω
Input VSWR	1.3:1
Output Frequency	5845 to 6425 MHz
Output Connector	SMA Female
Output VSWR	1.5:1
1 dB Compression	+10 dBm
1st RF Local Oscillator Input	
Frequency	1060 MHz
Level	+8 dBm
Connector	SMA Female
Return Loss	14 dB
Impedance	50Ω
2nd RF Synthesizer Input	
Frequency	4715 to 5295 MHz
Level	+8 dBm
Connector	SMA Female
Return Loss	14 dB
Impedance	50Ω

6.6.2 Theory of Operation

The RFT-500 up converter utilizes a dual conversion process to convert from a baseband 70 MHz IF signal to the output RF frequency band.

The first conversion requires an IFLO frequency input at 1060 MHz from the IFLO module. The output of the first mixing process is at a frequency of 1130 MHz.

The 1130 MHz output is applied to the second mixer which mixes with the synthesizer frequency input. The up converter synthesizer output frequency band is from 4715 to 5295 MHz, in 2.5 MHz steps (optional 125 kHz steps). The M&C board controls the frequency selection of the synthesizer.

The output of the second mixer is the desired RF frequency band of 5845 to 6425 MHz.

The M&C board interpolates the factory preset compensation data that is stored in an EEPROM inside the up converter. This data allows the M&C board to command and compensate the up converter's output power, ensuring proper output power levels over the entire frequency and temperature range.

The M&C also controls the up converter attenuator.

7 Chapter 7. MAINTENANCE

This chapter provides information on how to use test points and LEDs on the M&C board for troubleshooting. In addition, this chapter provides guidelines for troubleshooting faults.

7.1 Test Points and LEDs

Test points and LEDs are included on the M&C board for quick troubleshooting references. The LEDs are a visual reference. Test points are used when more troubleshooting is required.

Refer to Table 7-1 for a list of LEDs and their functions. Refer to Table 7-2 for a list of test points on the M&C board.

Table 7-1. M&C LEDs

Name	Color	Description
HPA FLT	Red	Illuminates when the HPA is faulted or turned off. This fault will cause the transmitter to turn off.
LD IF	Red	Illuminates when the IF local oscillator is out of lock. This fault will cause the transmitter to turn off.
LD UC	Red	Illuminates when the up converter local oscillator is out of lock. This fault will cause the transmitter to turn off.
LD DC	Red	Illuminates when the down converter local oscillator is out of lock. This fault will cause the transmitter to turn off.
LNA FLT	Red	Illuminates when the LNA is faulted, or LNA has not been calibrated.
RF ON	Yellow	Illuminates when the HPA is turned on.
12.5V	Green	Illuminates when 12.5V is applied to board.
5V	Green	Illuminates when 5V is applied to board.

Table 7-2. Test Points

Test Point	Description
TP3	12.5V input power voltage
TP6	Down converter AGC voltage (0 to 4V)
TP7	Up converter attenuator voltage (0 to 4V)
TP8	HPA AGC voltage (0 to 4V)
TP9	Up converter AGC voltage (0 to 4V)

7.2 Fault Isolation

Once the terminal has been set up for operation, troubleshooting faults can be accomplished by monitoring the terminal faults either remotely or via the optional front panel/keypad and display.

System faults are reported in the FAULT menu.

Table 7-3 should be used in isolating a problem and deciding the appropriate action to be taken.

Refer to Figure 7-1 and Figure 7-2 for the locations of the various modules mentioned in this list.

Table 7-3. Fault Isolation

Fault	Possible Problem and Action
+5 VOLT	+5V power supply fault. Indicates the +5V power supply on the M&C board is at a high or a low voltage condition. Allowable level variation is ± 5%. Check for a short on the +5V line, or faulty connection at P3 on the M&C.
+12 VOLT	+12V supply fault. Indicates the +12V supply is at a high or low voltage condition. Check for a short on the +12V line, or faulty connections between any of the internal modules.
HPA	High Power Amplifier fault. Check for a loose connections at P12 or that XFE has not been turned on, then replace the HPA. The HPA is not intended to be opened in the field. Once the problem has been isolated, the transmitter must be turned back on.
LNA	Low Noise Amplifier fault. Check the RF cable to the LNA and that LFE is not on with no LNA attached. If acceptable, replace the LNA.
U/C LOCK	Up converter lock fault. Check for loose connections at P7, P8, and P4. Also, check all RF coaxial connectors on the U/C synthesizer and U/C board before replacing modules. Once the problem has been isolated, the transmitter must be turned back on.
U/C TUN	Up converter tuning fault. Check for loose connections at P7, P8, and P4. Also, check all RF coaxial connectors on the U/C synthesizer and U/C board before replacing the modules. Once the problem has been corrected, the transmitter must be turned back on.
D/C TUN	Down converter tuning fault. Check for loose connections at P10, P11, and P4. Also, check all RF coaxial connectors on the D/C synthesizer and D/C board before replacing the modules. Once the problem has been corrected, the transmitter must be turned back on. **Note:** Not available in single synthesizer option.

Table 7-3. Fault Isolation (Continued)

Fault	Possible Problem and Action
D/C LOCK	Down converter lock fault. Check for loose connections at P10, P11, and P4. Also, check all RF coaxial connectors on the D/C synthesizer and D/C before replacing the modules. Once the problem has been corrected, the transmitter must be turned back on. **Note:** Not available in single synthesizer option.
IF LOCK	IF Lock fault. Check for loose connections at P9 and P4. Also, check all RF coaxial connectors on the IF Local Oscillator module. If all connections are good, replace the IFLO module. Once the problem has been corrected, the transmitter must be turned back on.
IF TUN	IF Tuning fault. Check for loose connections at P9 and P4. Also, check all RF coaxial connectors on the IFLO module. If all connections are good, replace the IF local oscillator module. Once the problem has been corrected, the transmitter must be turned back on.

Figure 7-1. RFT-500 Inside Front View

Figure 7-2. RFT-500 Inside Rear View

Chapter 8. EQUIPMENT LIST

This chapter describes the equipment required for installing the HPCST-5000 terminal system.

8.1 Equipment List

Refer to Table 8-1 and Table 8-2 for EFData MOD kit part numbers. The following kits required to perform the tasks specified in this manual can be obtained from EFData Corporation, Customer Support Department.

Table 8-1. Single Thread System

Description	EFData P/N	Note
RFT-500 (No HPA):	.RFT500...	Optional
Universal Mounting Kit	KT/3576	Optional
Spar Mount Kit	KT/4061	Optional
LNA Assembly, Standard, CST	.CA...	Optional
SSPA-500:		
75W	RF/SSPA75C	Optional
100W	RF/SSPA100C	Optional
125W	RF/SSPA125C	Optional
150W	RF/SSPA150W	Optional
Universal Mount Kit	KT/6698	Optional
Spar Mount Kit	KT/6699	Optional
Cable Accessories:		
Waveguide Kit, C-Band	KT/5115	Optional
Line Cord, RFT-500	CA/2754	Optional
Line Cord, SSPA-500	CA/6474	Optional
M&C (RFT to SSPA)	CA/6472	Optional
1/2” Heliax (TX)	CA/1530	Optional
1/2” Heliax (RX)	CA/3722	Optional

Table 8-2. Redundant System

Description	EFData P/N	QTY	Note
RFT-500 (No HPA);	RFT500...	2	Optional
Universal Mount Kit	KT/3577	1	Optional
LNA Plate Assembly	.CSRED...	1	Optional
LNA Assembly, STD, CST	.CA...	2	Optional
Redundant SSPA-500:	AS/6494		
75W	RF/SSPA75C	2	Optional
100W	RF/SSPA100C	2	Optional
125W	RF/SSPA125C	2	Optional
150W	RF/SSPA150W	2	Optional
Universal Mount Kit	KT/6700	1	Optional
Cable Accessories			
Waveguide Kit, C-Band	KT/5115	1	Optional
Line Cord, RFT-500	CA/2754-	2	Optional
Line Cord, SSPA-500	CA/6474-	2	Optional
M&C (RFT to SSPA)	CA/6472-	2	Optional
M&C (RSU to RFT)	CA/3003-	2	Optional
Switch ‘Y’	CA/3951-	1	Optional
IF (RSU to RFT)	CA/3005-1	4	Optional
1/2” Heliax (TX)	CA/1530-	2 or 4	Optional
1/2” Heliax (RX)	CA/3722-	2 or 4	Optional

8.2 Detail Equipment List

8.2.1 LNA Connector Kit

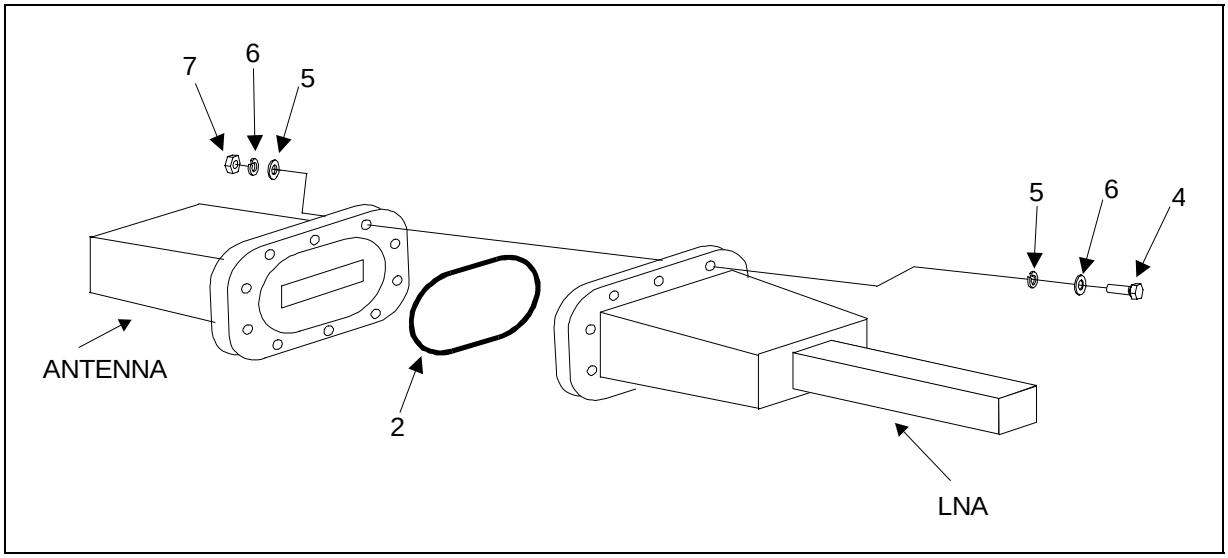

Figure 8-1. Exploded View of a Typical LNA Connector Kit

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-1 -1	KT/2721	Kit, LNA Connector	Ref
2	32P1040	. Gasket, Thick (Select at installation)	1
-3	32D1002	. Gasket, Thin (Select at installation)	1
4	03P1079	. Bolt, 1/4-20 x 1”	10
5	04P1022	. Washer, Flat	20
6	HW/1/4-SPLIT	. Washer, Spit Lock	20
7	HW/1/4HEXNUT	. Nut, 1/4-20	10

-Item Not Illustrated

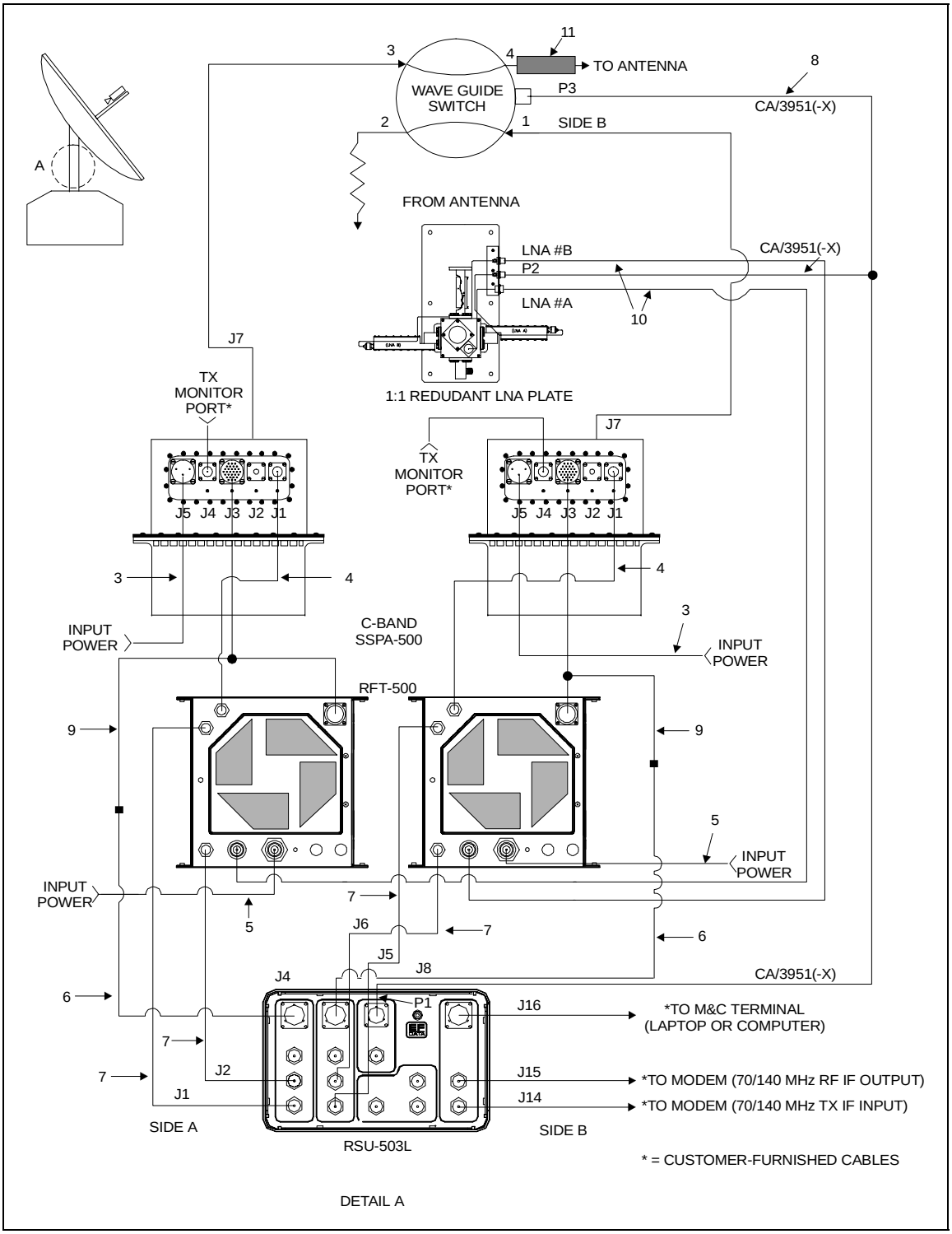

Figure 8-2. 1:1 Redundant Configuration Cabling

8.2.2 Cable Kit

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-2 -1	3272-1	Cable Kit, AC	Ref
-1A	3272-2	Cable Kit, DC	Ref
-2	CN/STPG26M01	. Connector Kit	1
3	PL/6474-1	. Cable, AC Prime Power, (SSPA) 15.0 ± 0.6 ft (Select at order entry)	AR
-3A	PL/6474-2	. Cable, AC Prime Power, (SSPA) 30.0 ± 1.0 ft (Select at order entry)	AR
4	CA/1530	. Cable Assy, .50 Heliax 17.0 ± 1.0 ft (Select at order entry)	AR
-4A	CA/1530-1	. Cable Assy, .50 Heliax, 4.0 ± 0.15 ft (See CA/3722-1 for ALT part) (Select at order entry)	AR
-4B	CA/1530-2	. Cable Assy, .50 Heliax, 5.0 ± 0.2 ft (See CA/3722-2 for ALT part) (Select at order entry)	AR
-4C	CA/1530-3	. Cable Assy, .50 Heliax, 8.0 ± 0.3 ft (Select at order entry)	AR
-4D	CA/1530-4	. Cable Assy, .50 Heliax, 12.0 ± 0.4 ft (See CA/3722 for ALT part) (Select at order entry)	AR
-4E	CA/1530-5	. Cable Assy, .50 Heliax, 16 ± 0.6 ft (Select at order entry)	AR
-4F	CA/1530-6	. Cable Assy, .50 Heliax, 20.0 ± 0.7 ft (See CA/3722-7 for ALT part) (Select at order entry)	AR
-4G	CA/1530-7	. Cable Assy, .50 Heliax, 24.0 ± 0.9 ft (See CA/3722 -5 for ALT part) (Select at order entry)	AR
5	CA/2754	. Cable Assy, AC Input, 15.0 ± 0.3 ft	2
6	CA/3003	. Cable Assy, Redundancy , 4.0 ± 0.15 ft	2
7	CA/3005	. Cable Assy, TNC-to-TNC, 50Ω, 4.0 ± 0.1 ft (Select at order entry)	AR
-7A	CA/3005-1	. Cable Assy, TNC-to-TNC, 50Ω, 1.5 ± 0.1 ft (Select at order entry)	AR

- Item Not Illustrated

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-2 8	CA/3951	Cable Assy, "Y" to Waveguide Switches P1 to P2: 12.0 ± 0.6 ft P1 to P3: 4.0 ± 0.6 ft (Select at order entry)	AR
-8A	CA/3951-1	. Cable Assy, "Y" to Waveguide Switches P1 to P2: 15.0 ± 0.6 ft P1 to P3: 15.0 ± 0.6 ft (Select at order entry)	AR
-8B	CA/3951-2	. Cable Assy, "Y" to Waveguide Switches P1 to P2: 35.0 ± 0.6 ft P1 to P3: 5.0 ± 0.2 ft (Select at order entry)	AR
-8C	CA/3951-3	. Cable Assy, "Y" to Waveguide Switches P1 to P2: 20 ± 0.6 ft P1 to P2: 20 ± 0.6 ft (Select at order entry)	AR
9	CA/6472-5	. Cable Assy, RFT-SSPA M&C Harness 5.0 ± 0.2 ft (Select at order entry)	AR
-9A	CA/6472-8	. Cable Assy, RFT-SSPA M&C Harness 8.0 ± 0.3 ft (Select at order entry)	AR
-9B	CA/6472-12	. Cable Assy, RFT-SSPA M&C Harness 12.0 ± 0.6 ft (Select at order entry)	AR
-9C	CA/6472-16	. Cable Assy, RFT-SSPA M&C Harness 16.0 ± 1.0 ft (Select at order entry)	AR
-9D	CA/6472-20	. Cable Assy, RFT-SSPA M&C Harness 20.0 ± 1.0 ft (Select at order entry)	AR
-9E	CA/6472-24	. Cable Assy, RFT-SSPA M&C Harness 24.0 ± 1.0 ft (Select at order entry)	AR
10	CA/3722	. Cable Assy, 1/4" Heliax Coax 12.0 ± 0.4 ft (Select at order entry)	AR
-10A	CA/3722-1	. Cable Assy, 1/4" Heliax Coax 4.0 ± 0.15 ft (Select at order entry)	AR
-10B	CA/3722-2	. Cable Assy, 1/4" Heliax Coax 5.0 ± 0.2 ft (Select at order entry)	AR
-10C	CA/3722-3	. Cable Assy, 1/4" Heliax Coax 7.5.0 ± 0.2 ft (Select at order entry)	AR
-10D	CA/3722-4	. Cable Assy, 1/4" Heliax Coax 22.0 ± 0.4 ft (Select at order entry)	AR
-10E	CA/3722-5	. Cable Assy, 1/4" Heliax Coax 24.0 ± 0.4 ft (Select at order entry)	AR
-10F	CA/3722-6	. Cable Assy, 1/4" Heliax Coax 6.0 ± 0.2 ft (Select at order entry)	AR
-10G	CA/3722-7	. Cable Assy, 1/4" Heliax Coax 20.0 ± 4.0 (Select at order entry)	AR
11	KT/5115	Kit, Flexible Wave Guide 5.0 ft (Optional)	1

- Item Not Illustrated

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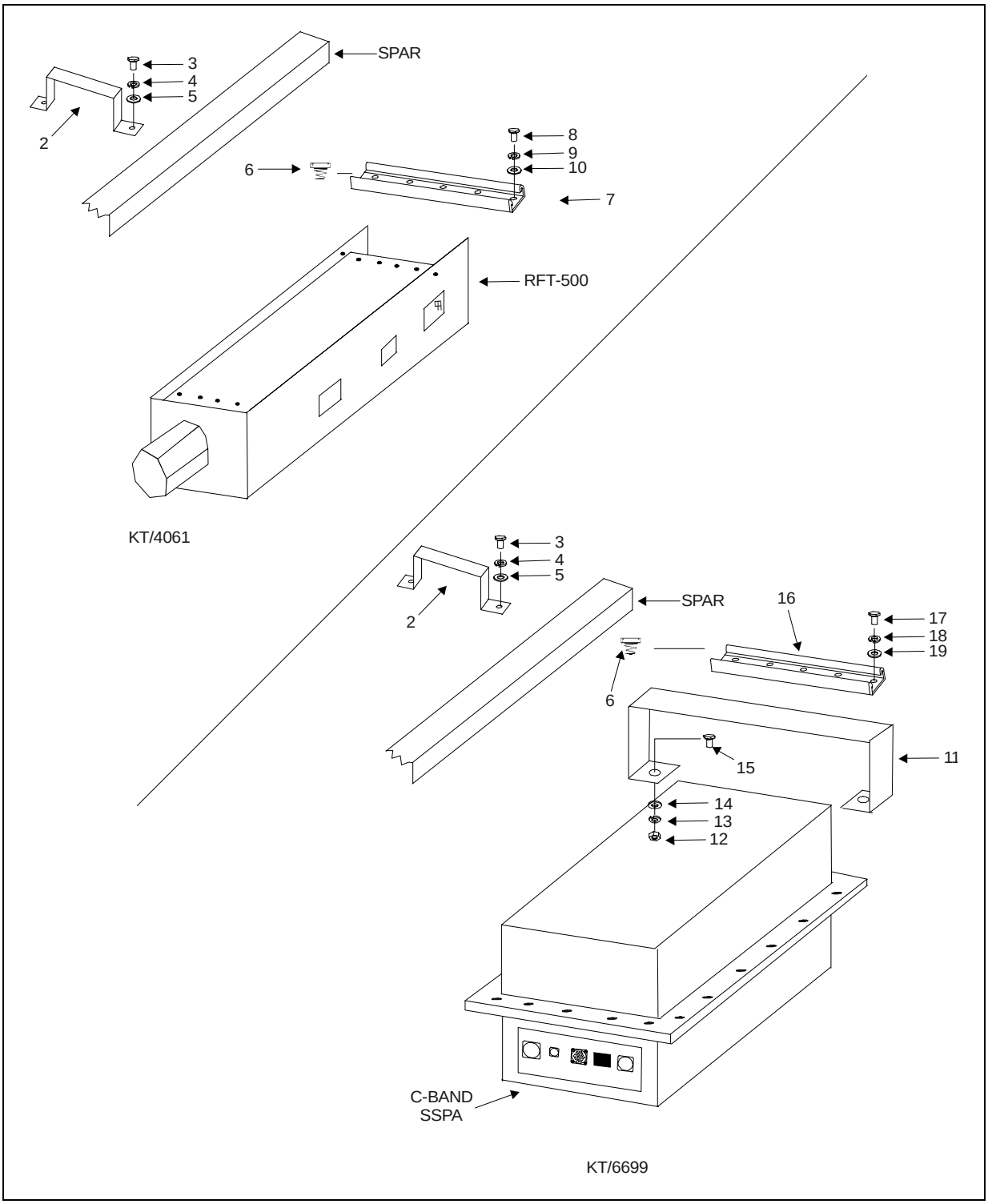

Figure 8-3. Exploded View of Spar Mounting Kit (Single Thread Configuration)

8.2.3 Spar Mounting Kit

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-3 -1	KT/4061	Kit, Spar Mounting, Single Thread Configuration	Ref
-1A	KT/6699	Kit, Spar Mounting, Single Thread Configuration	Ref
2	FP/3175	. Bracket, Spar	4
3	HW/5/16-18 x 1BLT	. Bolt, 5/16-18 x 1 Hex Head (AP)	8
4	HW/5/16-SPLIT	. Washer, Split (AP)	8
5	HW/5/16-FLT	. Washer, Flat (AP)	8
6	HW/5/16-18SPNUT	. Nut, Spring (AP)	8
7	FP/3481	. Unistrut, 8”-Long	2
8	HW/1/4-20 x 5/8 BLT	. Bolt, 1/4-20 x 5/8 (AP)	8
9	HW/1/4-SPLIT	. Washer, Split Lock (AP)	8
10	HW1/4-FLT	. Washer, Flat (AP)	8
11	FP/6487-1	. Bracket, Mounting	2
12	HW/3/8-16 x 1.25B	. Bolt, 3/8 x 1 1/4 (AP)	4
13	HW/3/8-SPLIT	. Washer, Split (AP)	8
14	HW/3/8-FLT	. Washer, Flat (AP)	8
15	HW/3/8-16-HEXNUT	. Nut, Hex	8
16	FP/3595	. Unistrut, 14”-Long	2
17	HW/3/8-16-1 BLT	. Bolt, 3/8 x 1 (AP)	4
18	HW/3/8-SPLIT	. Washer, Split Lock (AP)	4
19	HW/3/8-FLT	. Washer, Flat (AP)	4

- Item Not Illustrated
AP = Attaching Parts

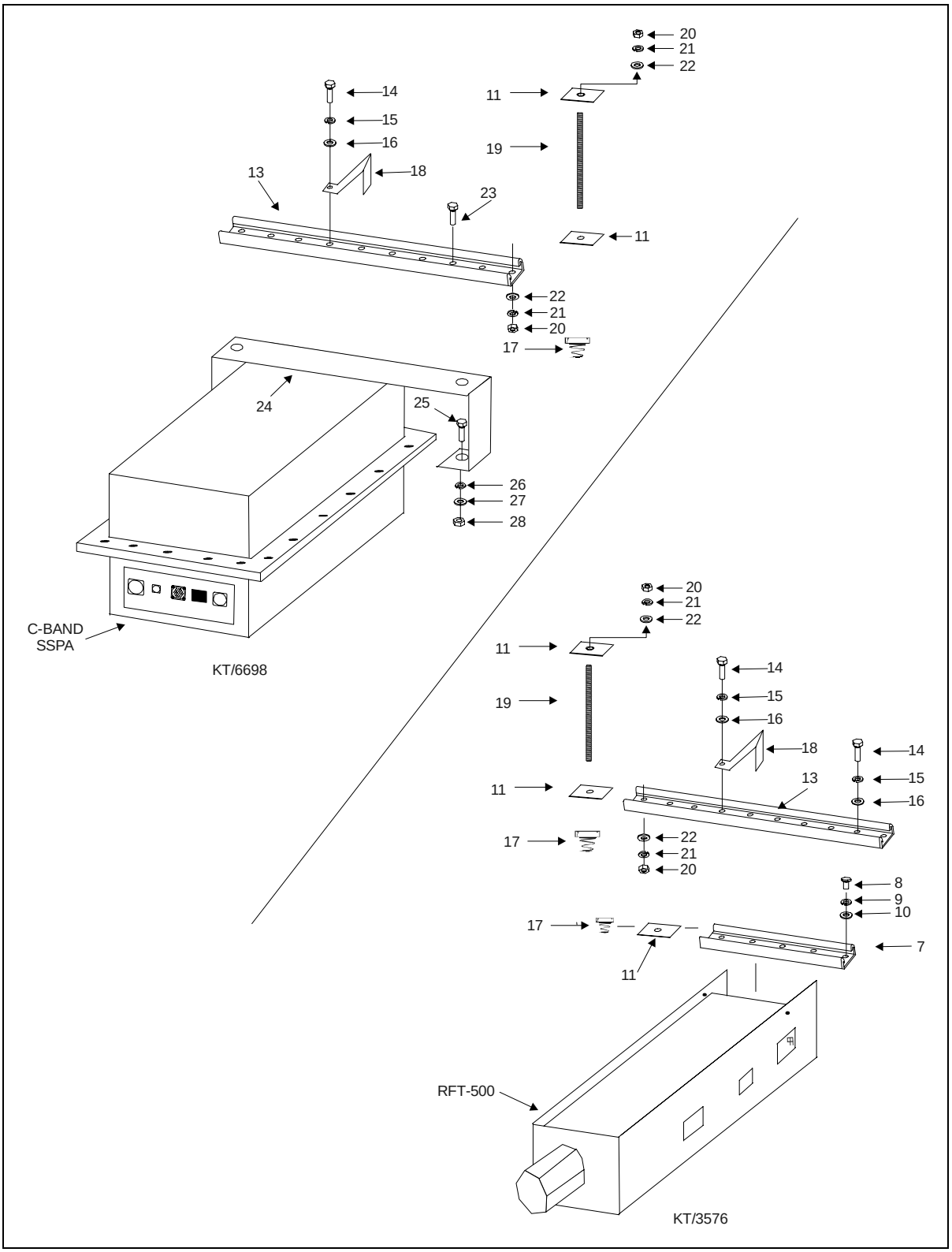

Figure 8-4. Exploded View of Universal Mounting Kit

8.2.4 Universal Mounting Kit

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-4 -1	KT/3576	Kit, Universal Mounting	Ref
-1A	KT/6698	Kit, Universal Mounting	Ref
-2	FP/3175	. Bracket, Spar Mounting (See Figure 8-3)	4
-3	HW/5/16-18 x 1BLT	. Bolt, 5/16-18 x 1" (AP)	8
-4	HW/5/16-SPLIT	. Washer, Split Lock (AP)	8
-5	HW/5/16-FLT	. Washer, Flat (AP)	8
-6	HW/5/16-18SPNUT	. Nut, Spring (AP)	8
7	FP/3481	. Unistrut, 8"-Long	4
8	HW/1/4-20 x 5/8BT	. Bolt, 1/4-20 x 5/8" (AP)	8
9	HW/1/4-SPLIT	. Washer, Split Lock (AP)	8
10	HW/1/4-FLT	. Washer, Flat (AP)	8
11	HW/FIT-PLT-5/16	. Plate, Flat Fitting	16
12	HW/5/16-18SPNUT	. Nut, Spring Nut	32
13	FP3595	. Unistrut, 14"-Long	8
14	HW/5/16-18 x 1BLT	. Bolt, 5/16-18-1" (AP)	24
15	HW/5/16-SPLIT	. Washer, Split Lock (AP)	36
16	HW/5/16-FLT	. Washer, Flat (AP)	36
17	HW/5/16-18SPNUT	. Nut, Spring (AP)	8
18	HW/BLK-PIPE2-8	. Block, Pipe, 2-8 inch, 1 5/8 UNI Channel	16
19	HW/RD5/16-18 x 14	. Rod, Threaded, 5/16-18 x 14"	8
20	HW/5/16-18HEXNT	. Nut, Hex, 5/16-18	24
21	HW/5/16-SPLIT	. Washer, Split Lock	12
22	HW/5/16-FLT	. Washer, Flat	12
23	HW/3/8-16 x 1 BLT	. Bolt, 3/8 x 1"	4
24	FP/6487-1	. Bracket, Mounting, Single Thread	1
25	HW/3/8-16 x 1.25B	. Bolt, 3/8 x 1 1/4" (AP)	4
26	HW/3/8-SPLIT	. Washer, Split Lock (AP)	8
27	HW/3/8-FLT	. Washer, Flat (AP)	8
28	HW/3/8-16HEXNUT	. Nut, Hex, 3/8-16 (AP)	4

-Item Not Illustrated
AP = Attaching Parts

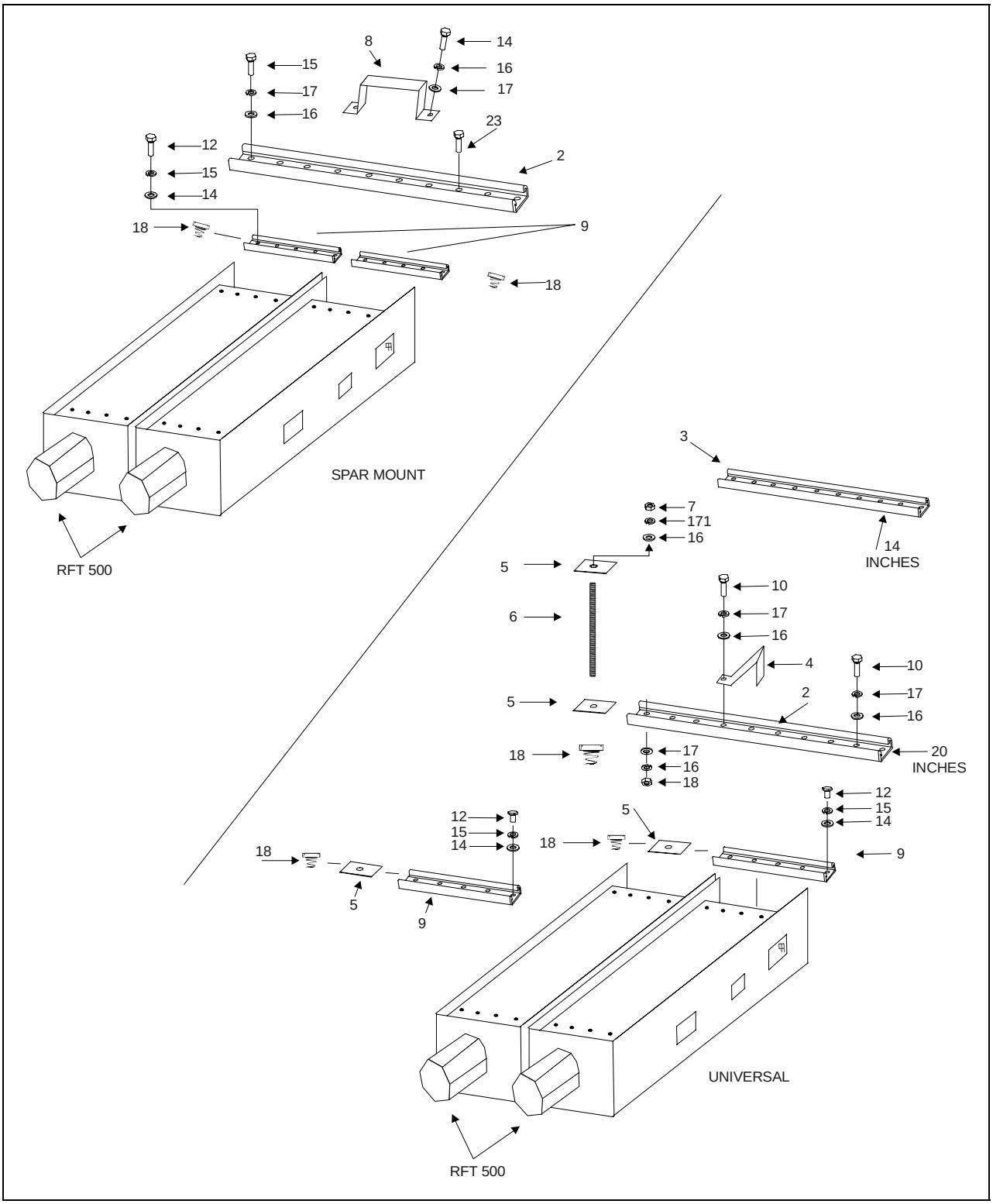

Figure 8-5. 1:1 Redundant System Universal Mounting Kit/3577

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-5 -1	KT/3577	Kit, Universal, MTG, 1:1 Redundant System	Ref
2	FP/3482	. Unistrut, 20-inch long	2
3	FP/3595	. Unistrut, 14-inch long	2
4	HW/BLK-PIPE2-8	. Pipe Blocks, 2-8 inch, 1 5/8 unistrut channel	12
5	HW/FIT-PLT-5/16	. Plate, Flat Fitting 5/16 X 18	12
6	HW/RDS/16-18X14	. Rod, Threaded , 5/16-18 x 14	6
7	HW/5/16-18HEXNT	. Nut, Hex 5/16-18	12
8	FP/31756	. Bracket, Support, 1 x 2 Spar	8
9	FP/3481	. Unistrut, 8-inch long, Prodlin Spar	4
10	HW5/16-18XBLT	. Bolt, 5/16-18 x 1	28
-11	Not Used	.	
12	HW/1/4-20X5/8BT	. Bolt, 1/4-20 x 5/8	19
-13	Not Used		
14	HW/1/4-FLT	. Washer, Flat, 1/4-inch	19
15	HW-1/4-SPLIT	. Washer, Split Lock, 1/4-inch	19
16	HW/5/16-FLT	. Washer, Flat, 5/16-18	42
17	HW/5/16-SPLIT	. Washer, Split Lock, 5/16	42
18	HW/5/16-18SPNUT	. Nut, Spring, 5/16-18	30

- Item Not Illustrated

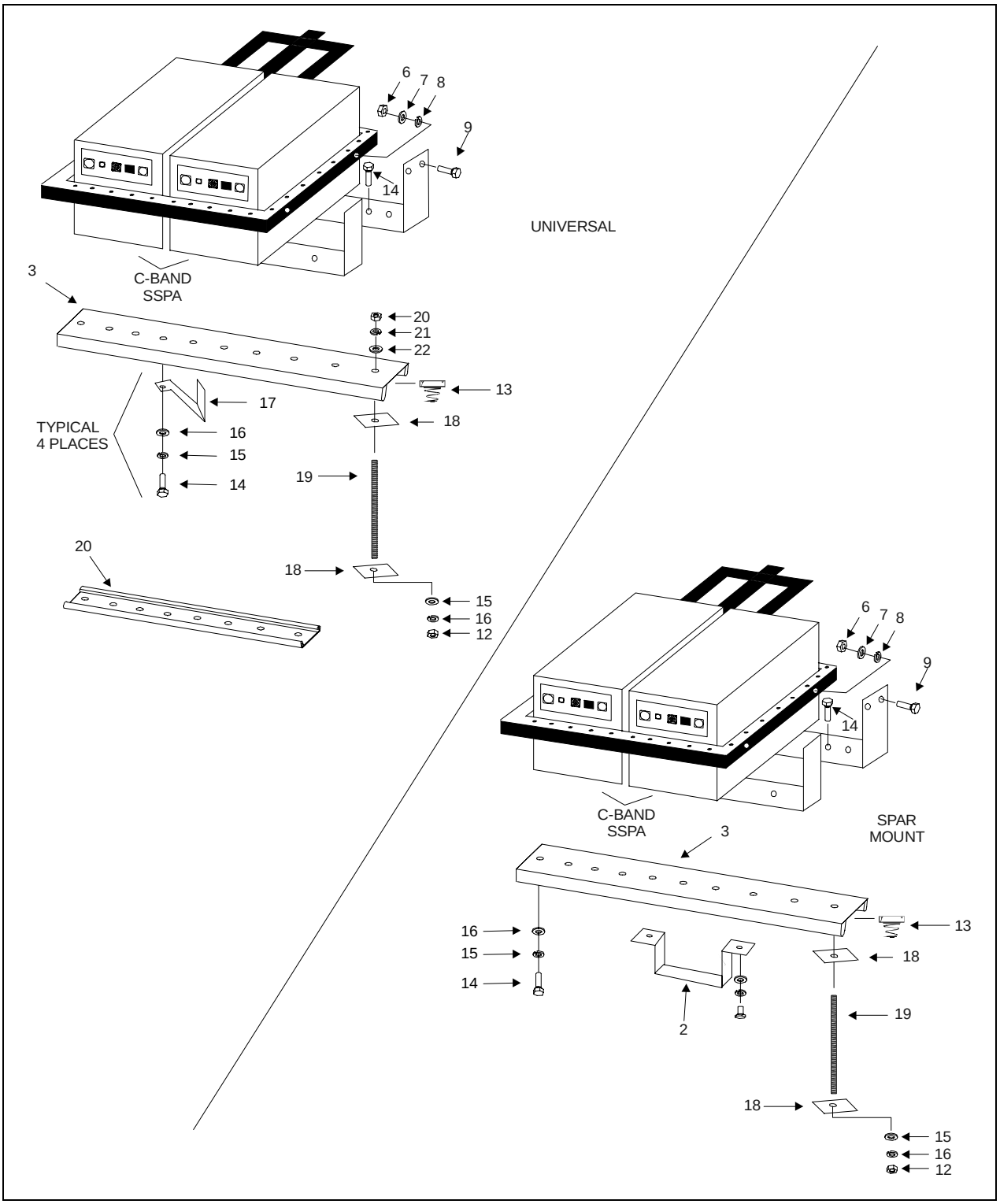

Figure 8-6. 1:1 Redundant System Universal Mounting Kit (KT/6700)

Fig. & Item No.	Part No.	1234567 Nomenclature	Qty
8-6 -1	KT-6700	Kit, Redundant, Universal Mounting, SSPA	REF
2	FP/3175	. Bracket, Support, 1 x 2 Spar	2
3	FP/3482	. Unistrut, 20-inch long	2
4	FP/6488-1	. Bracket, Mounting, Redundant	1
5	FP/6488-2	. Bracket, Mounting, Redundant	1
6	HW/1/2-13HEXNUT	. Nut, Hex,	6
7	HW/1/2-FLT	. Washer, Flat.	6
8	HW/1/2-SPLIT	. Washer, Split Lock,	6
9	HW/3/8-16x3/4B	. Bolt, Hex Head,	12
10	HW/3/8-FLT	. Washer, Flat,	12
11	HW/3/8-SPLIT	. Washer, Split Lock	12
12	HW/5/16-18HEXNT	. Nut, Hex, 5/16-18	12
13	HW/5/16-18SPNUT	. Nut, Spring	8
14	HW/5/16-18X1BLT	. Bolt, , Hex Head	8
15	HW/5/16-FLT	. Washer, Flat	20
16	HW/5/16-SPLIT	. Washer, Split Lock	20
17	HW/BLK-PIPE2-8	. Pipe, Blocks	8
18	HW/FIT-PLT-5/16	. Plate, Fitting Plate	8
19	HW/RDS/16-18X14	. Rod, Threaded	4
20	FP/3595	. Unistrut, 14-inch long	2

- Item Not Illustrated

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Appendix A. CONFIGURATIONS

This appendix describes the 140 MHz IF configuration.

A.1 140 MHz Configuration

This section describes the 140 MHz IF configuration, which enables the user to double the available band width. Specifically, instead of the standard 70 ± 18 MHz IF, this configuration allows a 140 ± 36 MHz IF.

A.1.1 IF 1112.5 MHz Local Oscillator

The IF Local Oscillator (IFLO) contains:

- Voltage-Controlled Oscillator (VCO)
- Loop filter
- Divide-down chain

The IFLO provides a fixed frequency of 1112.5 MHz to both the up and down converters. The loop tracking voltage is sent to the M&C board, where it is monitored along with the lock detect fault.

Refer to Figure A-1 for a block diagram of the 1112.5 MHz IFLO.

A.1.1.1 Specifications

Refer to Table A-1 for specifications.

Table A-1. IF 1112.5 MHz Local Oscillator Specifications

Parameter	Specifications
Input	10.0 MHz Square Wave, CMOS levels
Output	1112.5 MHz (2 each) 2225.0 MHz (2 each)
Connectors	SMA, female
Output Impedance	50Ω
Output Level	+7.0 dBm

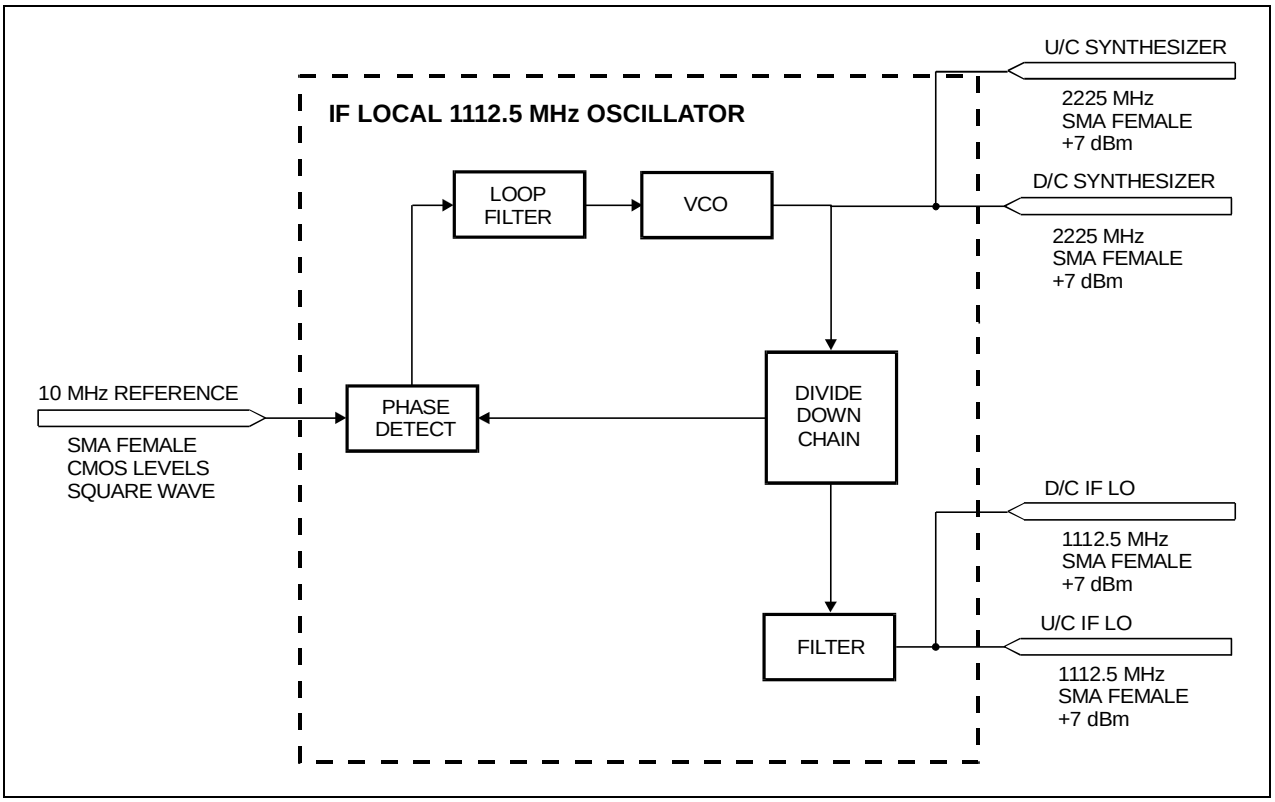

Figure A-1. IF Local Oscillator Block Diagram

A.1.2 Synthesizer

The 140 MHz IF terminal requires two synthesizers:

- One for the down converter to convert the RF input to 140 MHz output
- One for the up converter to convert 140 MHz input to the RF output

The purpose of the synthesizer module is to convert the 10 MHz reference signal to a variable frequency to perform the conversion.

A.1.2.1 Specifications

Refer to Table A-2 for specifications.

Table A-2. Synthesizer Specifications

Parameter	Specifications
RF Inputs	10 MHz CMOS square wave
Connector type	SMA
Impedance	50Ω
Input level	+7 dBm
RF Outputs	Frequencies 4592.5 to 5172.5 MHz
Connector type	SMA
Impedance	50Ω
Level	+7 dBm

A.1.2.2 Theory of Operation

The synthesizer module multiplies the 10 MHz reference clock to a variable clock by use of a VCO, loop filter, phase detector, and a variable divide-down chain. The divide-down chain is controlled by the M&C board through the use of three serial signals. A frequency tripler is then applied to produce the final output.

The VCO tuning voltage is sent to the M&C for monitoring, as well as a lock detect fault.

Refer to Figure A-2 for a block diagram of the LO synthesizer. Refer to Figure A-3 for a block diagram of the U/C LO synthesizer.

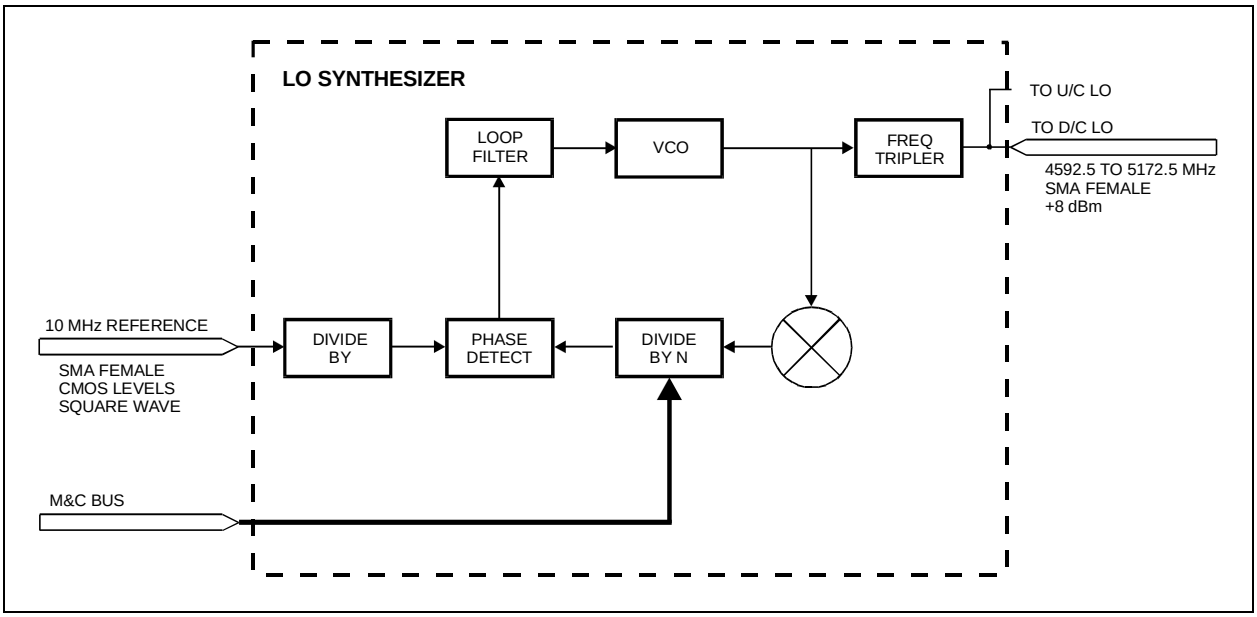

Figure A-2. LO Synthesizer Block Diagram

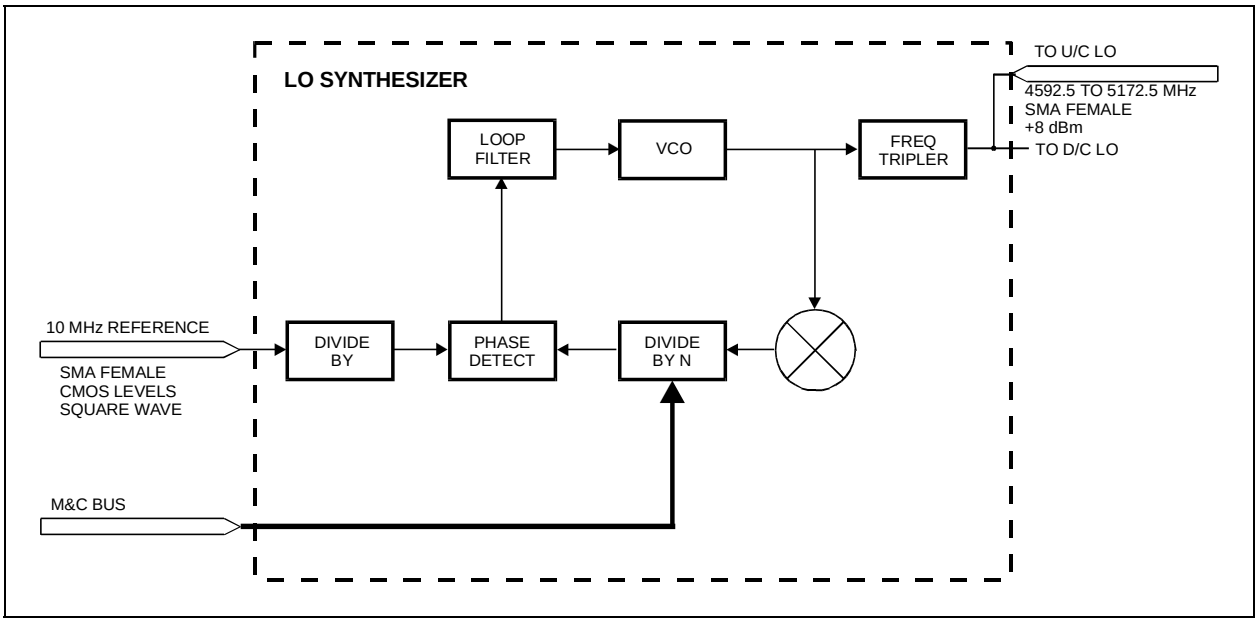

Figure A-3. U/C LO Synthesizer Block Diagram

A.1.3 Down Converter

The function of the down converter is to convert the C-Band signal from the LNA to a 140 MHz IF signal for use in the modem.

Refer to Figure A-4 for a functional block diagram of the down converter.

A.1.3.1 Specifications

Refer to Table A-3 for specifications.

Table A-3. Down Converter Specifications

Down Converter	
Input Frequency	3620.0 to 4200.0 MHz
Input Connector	SMA Female
Input Impedance	50Ω
Input VSWR	1:5:1
Output Frequency	140.0 MHz, ± 36.0 MHz
Output Connector	SMA Female
Output VSWR	1:3:1
1.0 dB Compression	+17 dBm
IF Synthesizer Input	
Frequency	4592.5 to 5172.5 MHz
Level	+8.0 dBm
Connector	SMA Female
Return Loss	14.0 dB
Impedance	50Ω
IF Local Oscillator Input	
Frequency	1112.5 MHz
Level	+8.0 dBm
Connector	SMA Female
Return Loss	14.0 dB
Impedance	50Ω

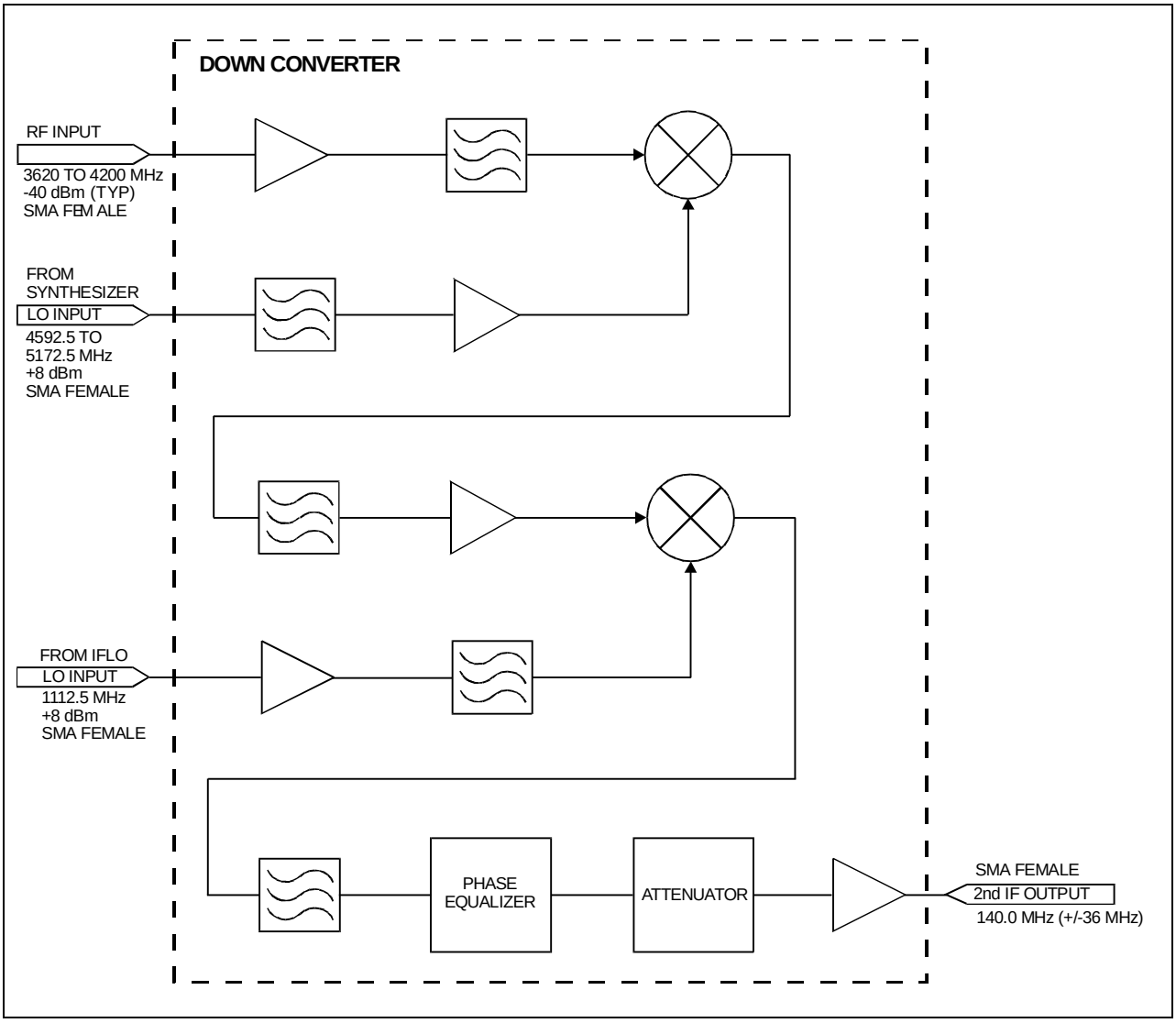

Figure A-4. Down Converter Block Diagram

A.1.3.2 Theory of Operation

The RFT-500 down converter utilizes a dual conversion process to convert from an input frequency band of 3620 to 4200 MHz, to an output baseband 140 MHz IF signal.

The first conversion requires a synthesizer frequency input to mix with the RF input. The M&C board controls the frequency selection of the synthesizer. The synthesizer output frequency band is 4592.5 to 5172.5 MHz, in 2.5 MHz steps.

The output of the first mixing process is at a frequency of 972.5 MHz. The 972.5 MHz is applied to the second mixer, which mixes with an IFLO frequency input at 1112.5 MHz from the IFLO module.

The output of the second mixer is the desired baseband 140 MHz IF signal.

The M&C board interpolates the factory present compensation data that is stored in an EEPROM inside the down converter. This data allows the M&C board to command and compensate the down converter's output power, ensuring proper output levels over the entire frequency and temperature range. The M&C board also supplies the DC power for the LNA, which is subsequently injected into the RF input connector.

A.1.4 Up Converter

The function of the up converter is to convert the 140 MHz IF signal used in the indoor unit modem to a C-Band signal sent to the HPA.

Refer to Figure A-5 for a functional block diagram of the up converter.

A.1.4.1 Specifications

Refer to Table A-4 for specifications.

Table A-4. Up Converter Specifications

Down Converter	
Input Frequency	140.0 MHz, ± 36 MHz
Input Connector	SMA Female
Input Impedance	50Ω
Input VSWR	1:3:1
Output Frequency	5845.0 to 6425.0 MHz
Output Connector	SMA Female
Output VSWR	1:5:1
1.0 dB Compression	+10.0 dBm
RF Local Oscillator Input	
Frequency	1112.5 MHz
Level	+8.0 dBm
Connector	SMA Female
Return Loss	14.0 dB
Impedance	50Ω
RF Synthesizer Input	
Frequency	4592.5 to 5172.5 MHz
Level	+8.0 dBm
Connector	SMA Female
Return Loss	14.0 dB
Impedance	50Ω

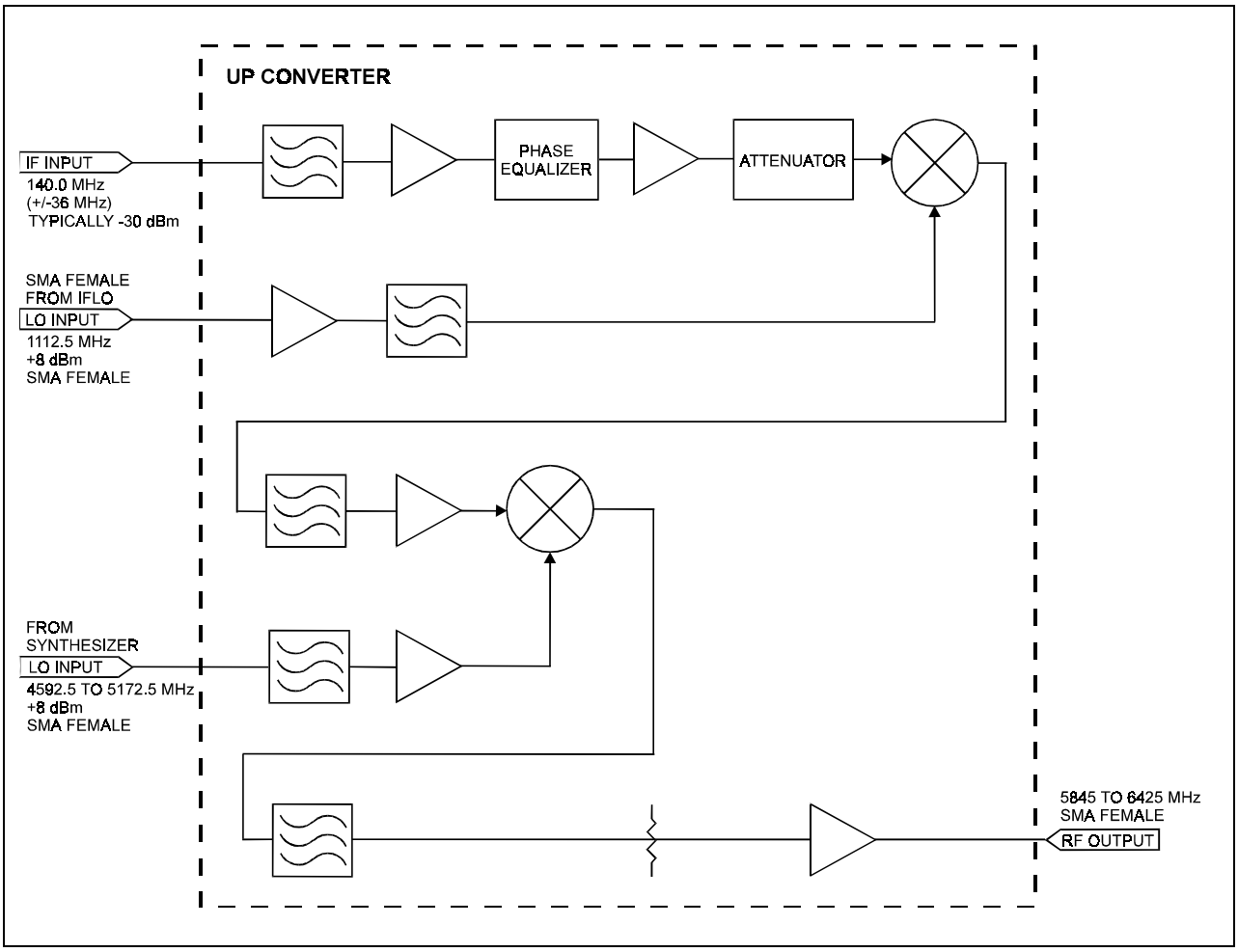

Figure A-5. Up Converter Block Diagram

A.1.4.2 Theory of Operation

The RF-500 up converter utilizes a dual conversion process to convert from a baseband 140 MHz IF signal to the output frequency band.

The first conversion requires an IFLO frequency at 1112.5 MHz from the IFLO module. The output of the first mixing process is at a frequency of 1252.5 MHz. The 1252.5 MHz output is applied to the second mixer which mixes the synthesizer frequency input. The M&C board controls the frequency selection of the synthesizer. The output frequency is from 4592.5 to 5172.5 MHz, in 2.5 MHz steps.

The output frequency of the second mixer is the desired RF frequency band of 5845 to 6425 MHz.

The M&C board interpolates the factory present compensation data that is stored in an EEPROM inside the up converter. This data allows the M&C board to command and compensate the up converter's output power, ensuring proper output levels over the entire frequency and temperature range.

The M&C also controls the up converter attenuator.

Appendix B.
REMOTE CONTROL OPERATION

This appendix describes the remote control operation of the RFT-500.

- Firmware number: FW/3059-8-
- Software version: 8.00

Operation of the RFT-500 terminal is normally done from a remote terminal. If you have ordered the optional keypad, operation at the keypad is described in Chapter 5.

B.1 General

Remote controls and status information are transferred via an EIA-485 (optional EIA-232C) serial communications link.

Commands and data are transferred on the remote control communications link as US ASCII-encoded character strings.

The remote communications link is operated in a half-duplex mode.

Communications on the remote link are initiated by a remote controller or terminal. The RFT-500 never transmits data on the link unless it is commanded to do so.

B.2 Message Structure

The ASCII character format used requires 11 bits/character:

- 1 start bit
- 7 information bits
- 1 parity bit
- 2 stop bits

Messages on the remote link fall into the categories of commands and responses.

Commands are messages which are transmitted to a satellite modem, while responses are messages returned by the RFT-500 in response to a command.

The general message structure is as follows:

- Start Character
- Device Address
- Command/Response
- End of Message Character

B.2.1 Start Character

A single character precedes all messages transmitted on the remote link. This character flags the start of a message. This character is:

- "<" for commands
- ">" for responses

B.2.2 Device Address

The device address is the address of the RFT-500 which is designated to receive a transmitted command, or which is responding to a command.

Valid device addresses are 1 to 3 characters long, and in the range of 1 to 255. Address 0 is reserved as a global address which simultaneously addresses all devices on a given communications link. Devices do not acknowledge global commands.

Each RFT-500 which is connected to a common remote communications link must be assigned its own unique address. Addresses are software selectable at the modem, and must be in the range of 1 to 255.

Note: Global address '*' is reserved for EXTERNAL KEYPAD commands.

B.2.3 Command/Response

The command/response portion of the message contains a variable-length character sequence which conveys command and response data.

If the RFT-500 receives a message addressed to it which does not match the established protocol or cannot be implemented, a negative acknowledgment message is sent in response. This message is:

- >add/?ER1_parity error'cr''lf']
  (Error message for received parity errors.)
- >add/?ER2_invalid parameter'cr''lf']
  (Error message for a recognized command which cannot be implemented or has parameters which are out of range.)
- >add/?ER3_unrecognizable command'cr''lf']
  (Error message for unrecognizable command or bad command syntax.)
- >add/?ER4_modem in local mode'cr''lf']
  (Modem in local error; send the REM command to go to remote mode.)
- >add/?ER5_hard coded parameter'cr''lf']
  (Error message indicating that the parameter is hardware dependent and may not be changed remotely.)

  Note: "add" is used to indicate a valid 1 to 3 character device address in the range between 1 and 255.

B.2.4 End Character

Each message is ended with a single character which signals the end of the message:

- "cr" Carriage return character for commands
- "]" End bracket for responses

B.3 Configuration Commands/Responses

Up Converter Frequency Select	Command: Response: Status: Response:	<add/UCF_nnnn.nnn'cr' >add/UCF_nnnn.nnn'cr' RF_OFF'cr"lf'] <add/UCF'cr' >add/UCF_nnnn.nnn'cr"lf']	Where: nnnn.n = 5845.000 to 6425.000 MHz, in 125 kHz steps.
Down Converter Frequency Select	Command: Response: Status: Response:	<add/DCF_nnnn.nnn'cr' >add/DCF_nnnn.nnn'cr"lf'] <add/DCF'cr' >add/DCF_nnnn.nnn'cr"lf']	Where: nnnn.n = 3620.000 to 4200.000 MHz, in 125 kHz steps.
RF Output	Command: Response: Status: Response:	<add/RF_xxx'cr' >add/RF_xxx'cr"lf'] <add/RF_'cr' >add/RF_xxx'cr"lf']	Where: xxx = ON, WRM, or OFF. The OFF command will keep the RF output turned off under all conditions, the WRM command is a conditional ON command telling the RF output to come on after the unit is warmed up and meets the stability requirements, while the ON command is an override instructing the output to be on and ignores the warm start.
UP Converter Attenuator	Command: Response: Status: Response:	<add/UCA_nn.n'cr' >add/UCA_nn.n'cr"lf'] <add/UCA_'cr' >add/UCA_nn.n'cr"lf']	Where: nn.n = 0.0 to 25.0 dB, in 1/2 dB steps.
Down Converter Attenuator	Command: Response: Status: Response:	<add/DCA_nn.n'cr' >add/DCA_nn.n'cr"lf'] <add/DCA_'cr' >add/DCA_nn.n'cr"lf']	Where: nn.n = 0.0 to 21.0 dB, in 1/2 dB steps.

Select Preset Config.	Command: Response: Status: Response:	<add/SEL_n'cr' >add/SEL_n'cr''lf'] <add/SEL_'cr' >add/SEL_'cr' 1 UCF_nnnn.nnn'cr' DCF_nnnn.nnn'cr' UCA_nn.n'cr' DCA_nn.n'cr' 2 UCF_nnnn.nnn'cr' DCF_nnnn.nnn'cr' UCA_nn.n'cr' DCA_nn.n'cr' 3 UCF_nnnn.nnn'cr' DCF_nnnn.nnn'cr' UCA_nn.n'cr' DCA_nn.n'cr''lf']	Where: n = 1, 2, or 3. 1 nnnn.nnn = 5845.000 to 6425.000 MHz. nnnn.nnn = 3620.000 to 4200.000 MHz. nn.n = 0.0 to 25.0 dB (UC Fine Adj). nn.n = 0.0 to 21.0 dB (DC Fine Adj). 2 nnnn.nnn = 5845.000 to 6425.000 MHz. nnnn.nnn = 3620.000 to 4200.000 MHz. nn.n = 0.0 to 25.0 dB (UC Fine Adj). nn.n = 0.0 to 21.0 dB (DC Fine Adj). 3 nnnn.nnn = 5845.000 to 6425.000 MHz. nnnn.nnn = 3620.000 to 4200.000 MHz. nn.n = 0.0 to 25.0 dB (UC Fine Adj). nn.n = 0.0 to 21.0 dB (DC Fine Adj). Allows the user to select any one of three 'PreSet' configurations. The users must first program (store) a configuration using the PGM_n command defined below. This command used without the 'PreSet' number (n) will provide the current programming of each of the three 'PreSets'.
Program Preset Config.	Command: Response: Status: Response:	<add/PGM_n'cr' >add/PGM_n'cr''lf'] <add/PGM_'cr' >add/PGM_'cr' 1 xxxxxxxxxx'cr' 2 xxxxxxxxxx'cr' 3 xxxxxxxxxx'cr''lf']	Where: n = 1, 2, or 3. xxxxxxxxxx = 'Programmed' or 'None'. Allows the user to store (program) the current frequency and attentuator setting as one of three 'PreSet' selections.
Clear Program Preset Config.	Command: Response: Status: Response:	<add/CPGM_n'cr' >add/CPGM_n'cr''lf'] <add/CPGM_'cr' >add/CPGM_'cr''lf'] 1 xxxxxxxxxx'cr' 2 xxxxxxxxxx'cr' 3 xxxxxxxxxx'cr''lf']	Where: n = 1, 2, or 3. xxxxxxxxxx = 'Programmed' or 'None'. Allows the user to clear (unprogram) the frequency and attentuator setting for one of three 'PreSet' selections.

B.4 System

Lock Mode	Command: Response: Status: Response:	<add/LM_xx'cr' >add/LM_xx'cr''lf'] <add/LM_'cr' >add/LM_xx'cr''lf']	Where: xx = LK (lock) or EN (enable) (Default = Enable). Lock mode prevents the current settings from being changed.
EIA232 Address Select	Command: Response: Status: Response:	<add/AS_xxx'cr' >add/AS_xxx'cr''lf'] <add/AS_'cr' >add/AS_xxX'cr''lf']	Where: add = Current address. xxx = New address, 1 to 255 (Default address = 1).
EIA232 Baud Rate Select	Command: Response: Status: Response:	<add/BR_xxxx'cr' >add/BR_xxxx'cr''lf'] <add/BR_'cr' >add/BR_xxxx'cr''lf']	Where: xxxx = 300 to 19200 (In standard settings of 300, 600, 1200, 2400, 800, 9600, and 19200 kbit/s) (Default value = 9600).
EIA232 Parity Select	Command: Response: Status: Response:	<add/PS_xx'cr' >add/PS_xx'cr''lf'] <add/PS_'cr' >add/PS_xx'cr''lf']	Where: xx = OD (odd), EV(even), or NO (none - 8 bit) (Default value = EV (even)).
Reference Frequency Adjust	Command: Response: Status: Response:	<add/RFJ_nnn'cr' >add/RFJ_nnn'cr''lf'] <add/RFJ_'cr' >add/RFJ_nnn'cr''lf']	Where: nnn = DAC setting from 0 to 255. nnn = Current DAC setting.
LNA Calibration	Command: Response:	<add/CLNA_'cr' >add/CLNA_'cr''lf']	Performs a current windowing calibration on the LNA. Note: This is only done once during the initial installation.
LNA Fault Enable	Command: Response: Status: Response:	<add/LFE_xxx'cr' >add/LFE_xxx'cr''lf'] <add/LFE_'cr' >add/LFE_xxx'cr''lf']	Where: xxx = ON or OFF (Default = ON, enable monitor).
External Fault Enable	Command: Response: Status: Response:	<add/XFE_xxx'cr' >add/XFE_xxx'cr''lf'] <add/XFE_'cr' >add/XFE_xxx'cr''lf']	Where: xxx = ON or OFF (Default = ON, enable monitor).
LNA Power Enable	Command: Response: Status: Response:	<add/LPE_xxx'cr' >add/LPE_xxx'cr''lf'] <add/LPE_'cr' >add/LPE_xxx'cr''lf']	Where: xxx = ON or OFF (Default = ON, enable power).
Redundant Switch Mode	Command: Response: Status: Response:	<add/RSW_xxxxx'cr' >add/RSW_xxxxx'cr''lf'] <add/RSW_'cr' >add/RSW_xxxxx'cr''lf']	Where: xxxxx = INDEP or DEP (Default = INDEP). Note: For use in redundant system only with RSU-503 switch. (INDEP TX and RX switch independently on fault to backup terminal. DEP switches both TX and RX on fault to backup terminal.)

B.5 Status Commands/Responses

Config. Status	Command: Response:	<add/OS_'cr' >add/OS_'cr' UCF_nnnn.nnn'cr' DCF_nnnn.nnn'cr' RF_xxx'cr' DCA_nn.n'cr' UCA_nn.n'cr' SEL_n'cr''lf']	 nnnn.nnn = 5845.000 to 6425.000 MHz. nnnn.nnn = 3620.000 to 4200.000 MHz. xxx = ON, WRM, or OFF. nn.n = 0.0 to 21.0 dB (DC Fine Adj). nn.n = 0.0 to 25.0 dB (UC Fine Adj). n = 1, 2, 3, or NONE. The converter configuration status command causes a block of data to be returned by the addressed RFT-500. The block of data reflects the current configuration status.
Fault Status	Command: Response:	<add/FS_'cr' >add/FS_'cr' RST_xxx'cr' UL_xxx'cr' DL_xxx'cr' PS5_xxx'cr' P12_xxx'cr' HPA_xxx'cr' LNA_xxx'cr' ULD_xxx'cr' UTM_xxx'cr' DLD_xxx'cr' DTM_xxx'cr' ILD_xxx'cr' ITM_xxx'cr''lf']	 Unit Experienced a Restart (OK/FLT) Uplink Fault (OK/FLT) Downlink Fault (OK/FLT) +5V Power Supply (OK/FLT) +12V Power Supply (OK/FLT) Power Amp Fault (OK/FLT) LNA Fault (OK/FLT) UC LO Lock Detect (OK/FLT) UC LO Tuning Voltage Out of Range (OK/FLT) DC LO Lock Detect (OK/FLT) DC LO Tuning Voltage Out of Range(OK/FLT) IF LO Lock Detect (OK/FLT) IF LO Tuning Voltage Out of Range(OK/FLT) This command returns a block of data reflecting the current and logged faults. Logged faults will be reset when receiving this command while current faults can be read on the second request.
Summary Fault Status	Command: Response:	<add/SF_'cr' >add/SF_xxx'cr''lf']	Returns status of current faults only.
Maintenance Status	Command: Response:	<add/MS_'cr' >add/MS_'cr' UCT_nn'cr' DCT_nn'cr' HPT_nn'cr' TUV_nn.n'cr' TDV_nn.n'cr' TIV_nn.n'cr''lf']	 nn = UC temperature in deg C. nn = DC temperature in deg C. nn = Power Amp temp in deg C. nn.n = Tuning voltage of UC LO. nn.n = Tuning voltage of DC LO. nn.n = Tuning voltage of IF LO. This command returns a block of data from the RFT-500 reflecting the status of certain internal parameters for the purpose of troubleshooting.
Equipment Type Status	Command: Response:	<add/ET_'cr' >add/ET_xx'cr''lf']	Where: xx = RFT-500 SW_8.00. This command returns the equipment type polled and software version.

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Glossary

The following is a list of acronyms and abbreviations that may be found in this manual.

Acronym/ Abbreviation	Definition
Ω	Ohms
5V	Internal 5 VDC Power
A	Ampere
AC	Alternating Current
AP	Attaching Parts
AR	As Required
ASA	Address Select Unit A
ASB	Address Select Unit B
ASCII	American Standard Code for Information Interchange
bit/s	bits per second
C	Celsius
CAL	Calibrate
CLNA	Calibrated LNA
CLR	CLEAR
COMP	Compensation
CR	Carriage Return
D/C	Down Converter
dB	Decibels
dBc	Decibels referred to carrier
dBm	Decibels referred to 1.0 milliwatt
DC	Direct Current
DCA	Down Converter Attenuation
DCF	Down Converter Frequency
DCT	Down Converter Temperature
DL	Down Link Fault
DLA	Down Link Fault — Unit A
DLB	Down Link Fault — Unit B
DLD	Down Converter Lock Detect Fault
DLM	Down Link Mode (Auto or Manual)
DLS	Down Link Switch (A or B)

DTM	Down Converter Tuning Voltage Fault
EIRP	Equivalent Isotropically Radiated Power
EN	Enable
ERR	Error
ESC	Escape
EXE	Executable
FLT	Fault
G/T	Gain Over Temperature
GHz	Gigahertz (10^9 Hertz)
GND	Ground
HPA	High Power Amplifier
HPT	HPA Temperature
HPV	HPA Internal 12 VDC Power
Hz	Hertz (cycle per second)
IF	Intermediate Frequency
IF TUN	Intermediate Frequency Tuning
ILD	IF LO Lock Detect Fault
INI	Initialize
ITM	IF LO Tuning Voltage Fault
k	kilo (10^3)
KΩ	kilo-ohms
kbit/s	Kilobits per second (10^3 bits per second)
kHz	Kilohertz (10^3 Hertz)
LCD	Liquid Crystal Display
LFE	LNA Fault Enable
LK	Lock
LNA	Low Noise Amplifier
LO	Local Oscillator
m	Milli (10^{-3})
M&C	Monitor and Control
mA	Milliampere
Max	Maximum
Mbit/s	Megabits per second
MHz	Megahertz (10^6 Hertz)
Min	Minimum or Minute
ns	Nanosecond (10^{-9} second)
P-P	Peak-to-Peak
P05	Internal 5 VDC Power Fault
PCB	Printed Circuit Board
PLO	Phase Locked Oscillator
PROG	Program
PS	Power Supply
PSIG	Pressure per Square Inch Gauge
RAM	Random Access Memory
REF	Reference
RF	Radio Frequency
RFJ	Reference Frequency Adjust (10 MHz)
RFT	Radio Frequency Terminal
RH	Relative Humidity
RMA	Return Material Authorization
RST	Restart Fault
RSU	Redundancy Switch Unit
RX	Receive (Receiver)
SEL	Select
SSPA	Solid State Power Amplifier
TDV	Down Converter Tuning Voltage

TIV	IF LO Tuning Voltage
TRF	Transmit Reject Filter
TUV	Up Converter Tuning Voltage
TWT	Traveling Wave Tube
TX	Transmit (Transmitter)
U/C	Up Converter
U/C TUN	Up Converter Tuning
UCA	UP Converter Attenuation
UCF	Up Converter Frequency
UCT	Up Converter Temperature
UL	Up Link Fault
ULA	Up Link Fault — Unit A
ULB	Up Link Fault — Unit B
ULD	Up Converter Lock Detect Fault
ULM	Up Link Mode (Auto or Manual)
ULS	Up Link Switch (A or B)
UTM	Up Converter Tuning Voltage Fault
V	Volts
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VSAT	Very Small Aperture Terminal
VSWR	Voltage Standing Wave Ration
W	Watt
WRM	Warm
XFE	External Fault Enable
XVA	External Input Power from Unit A
XVB	External Input Power from Unit B

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Index

Chapter 2. EXTERNAL CONNECTIONS

This chapter describes the external connections of the HPCST-5000 terminal system.

Be alert when handling electrical equipment. Severe bodily harm may be the result.

2.1 External Connections

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

2.1.1 RFT External Connections

Connections between the RFT-500 and other equipment are made through six connectors. These connectors are listed in Table 2-1 and their locations are shown in Figure 2-1. The use of each connector is described in the following paragraphs.

Cables for connectors J2, J4, and J5 are supplied by EFData. A connector kit for the remote connector, J6, also is supplied. All other connections are customer-supplied.

Table 2-1. Rear Panel Connectors

Name	REF DES	Connector Type	Function
TX/IF IN	J1	TNC	TX IF INPUT (70/140 MHz)
TX/RF OUT	J2	Type N	5.845 to 6.425 GHz Output
RX/IF OUT	J3	TNC	RX IF OUT (70/140 MHz)
RX/RF IN	J4	Type N	3.620 to 4.200 GHz Input
PRIME PWR	J5	3- or 4-pin CIR	Prime Power Input
REMOTE	J6	26-pin CIR	Remote Interface
GND	ERDE GND	#10-32 Stud	Chassis Ground

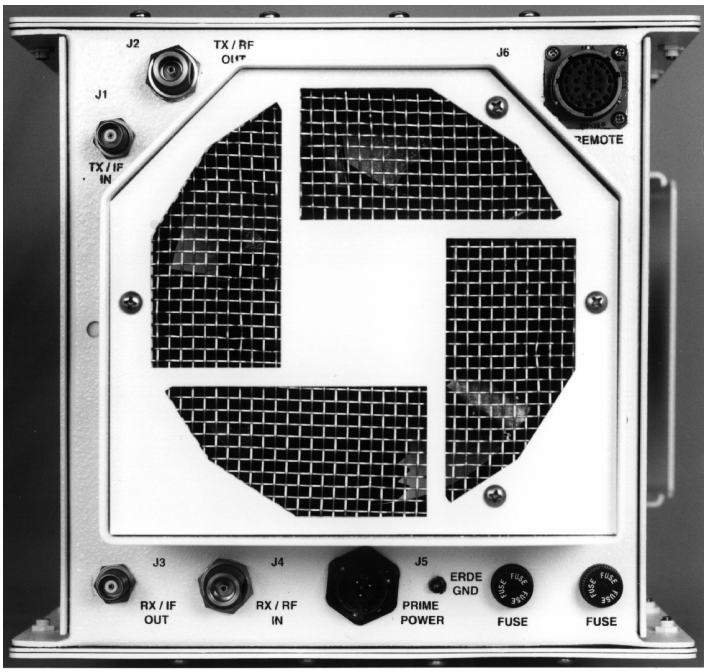

Figure 2-1. RFT External Connections

2.1.1.1 TX/IF Input (J1)

The TX/IF input is a TNC connector that receives the signal from the indoor unit. The input impedance is 50Ω, and the frequency is 70 ± 18 MHz (optional 140 ± 36 MHz).

The typical power level is from -45 to -25 dBm, depending on the configuration and application.

2.1.1.2 TX/RF Output (J2)

The TX/RF output is a type N connector that sends the signal to the antenna. The output impedance is 50Ω. The output frequency range is from 5.845 to 6.425 GHz. The output 1 dB compression point is +8 dBm.

2.1.1.3 RX/IF Output (J3)

The RX/IF output is a TNC connector that sends the received signal to the indoor unit. The output impedance is 50Ω, and the frequency is 70 ± 18 MHz (optional 140 ± 36 MHz).

The 1 dB output compression point is +15 dBm. Maximum output power operation is +9 dBm (-6 dB from 1 dB compression) to -50 dBm, depending on system gain requirements. The down converter has 26 to 47 dB of gain, and is adjustable by the customer from 0 to 21 dB of attenuation.

The typical system gain includes a 50 dB LNA, making the total system gain 76 to 97 dB.

Note: A 60 dB LNA is used only when there are extremely long cables from the LNA to the down converter and can be ordered as an option.

2.1.1.4 RX/RF Input (J4)

The RX/RF input is a type N connector that receives the signal from the LNA. The input impedance is 50Ω. The input frequency range is from 3.620 to 4.200 GHz. The input signal level ranges between -50 and -25 dBm, depending on LNA and antenna gain.

The input level should be set to give the required signal level at J3, the RX/IF Output.

2.1.1.5 Prime Power (J5)

The AC power is supplied to the RFT by a 3-pin circular connector.

Normal input voltage is 90 to 265 VAC, 47 to 63 Hz, and 90W.

The AC pinout is as follows:

Pin #	Name	Function	Wire Color
A	HI	Line	Brown
B	LO	Neutral/Line	Blue
C	GND	Ground	Green/Yellow

2.1.1.6 Serial Remote Control (J6)

The remote connector on the RFT is used to interface the M&C functions to a remote location. This interface can be either EIA-232 or EIA-485 (Figure 2-2).

When using an EIA-485 interface, the TX and RX signals are able to accommodate either type of remote equipment pinouts. As long as the polarities of the remote equipment TX and RX signals are correct, this remote interface will be completely compatible.

Refer to Table 2-2 for a list of pinouts for the J6 connector.

For standard EIA-232 or EIA-485 applications, an adapter cable must be used to connect the 26-pin connector (J6) to a standard 9-pin D.

Table 2-2. RFT Remote Control Connector, J6

Pin #	Name		Description
	EIA-232	EIA-485	
A	GND	-RX/TX	RX/TX Data
B		-RX/TX	RX/TX Data
C		+RX/TX	RX/TX Data
D	CTS	+RX/TX	Clear to Send *(see Note 1)*
E	RD/RX		Receive Data
F	RTS		Ready to Send *(see Note 1)*
G	TD/TX		Transmit Data
H	DSR		Data Set Ready
J		GND	Ground
K	LNA_PWR		Output, 10V for powering LNA *(see Note 2)*
L	EXT_PWR		Output voltage, 11V, to power RSU-503 and KP-10
M	EXT FLT		Input, logic 0 or 5V: 5V = FLT, 0V = normal *(see Note 3)*
N	N/C		
P	SPARE		N/C
R	GND		Ground
S	SPARE		N/C
T	PWR MON		EXT HPA PWR Level Monitor (Future)
U	UL_NC		Uplink fault relay, connects to uplink COM with fault
V	UL_COM		Uplink fault relay, COMMON
W	UL_NO		Uplink fault relay, opens with fault
X	DL_NC		Downlink fault relay, connects to DL_COM with fault
Y	DL_COM		Downlink fault relay, COMMON
Z	DL_NO		Downlink fault relay, opens with fault
a	LNA PWR RTN		Return for LNA Power *(see Note 2)*
b	EXT_TEMP		EXT HPA Temperature Monitor
c	ENAB/DISAB		EXT HPA RF Enable

Notes:

1. In EIA-232 mode, CTS is tied to RTS.
2. LNA can be powered from these pins instead of through the RF cable.
3. 5V is a floating level.

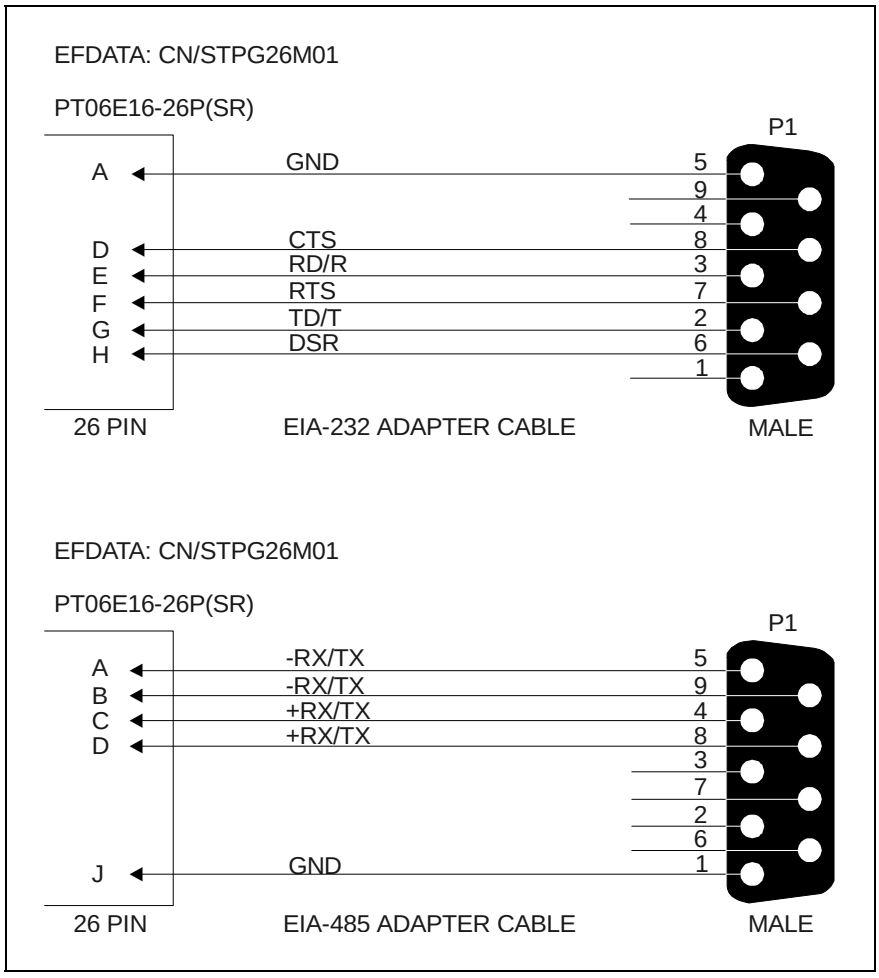

Figure 2-2. Serial Adapter Cables

2.1.1.7 Ground (GND)

A #10-32 stud is available on the rear of the unit for the purpose of connecting a common chassis ground among all of the equipment.

2.1.2 C-Band SSPA External Connections

Always terminate the output waveguide of the amplifier with an RF load capable of dissipating full CW RF power. Do not look into the output port of the powered RF amplifier. Severe bodily harm can be the result.

Connections between the C-Band SSPA and other equipment are made through five connectors. These connectors are listed in Table 2-3, and their locations are shown in Figure 2-3. The use of each connector is described in the following paragraphs.

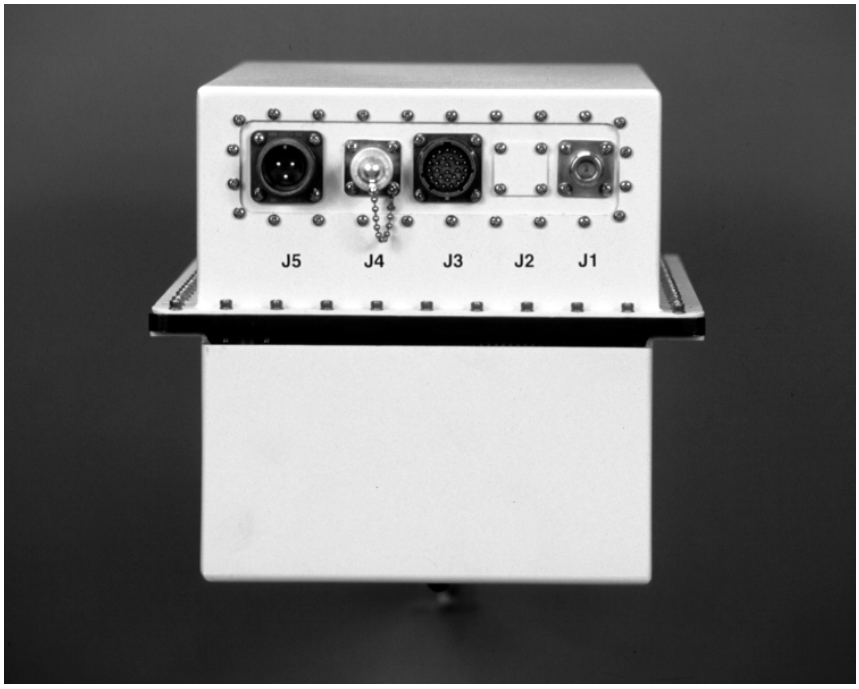

Figure 2-3. C-Band SSPA External Connections

Table 2-3. C-Band SSPA External Connections

Name	Ref Des	Connector Type	Function
RF Input	J1	N-Type, female	RF Input
Discrete Interface	J3	MS3112E16-26P (M)	M&C port for RFT500
RF Output Monitor Port	J4	N-Type, female	Independent M&C of output power levels (-40 dB coupled)
AC Line	J5	MS3102R16-10P (M)	Prime Power Supply
RF Output	J7	CPR-137G (Grooved)	W/G connection

2.1.2.1 RF Input (J1)

The RF Input is an N-type connector that receives the signal from the RF TX output of the RFT. The input impedance is 50Ω.

The input frequency range is from 5.845 to 6.425 GHz.

The input level should be set to give the required signal at J7, RF Output.

2.1.2.2 Gain Control (J2)

The potentiometer located under the cover is used to set nominal system gain. Adjustment range is 6 dB minimum.

Note: Gain Control shall be covered with a sealed metal cover and secured with screws and washers.

2.1.2.3 Discrete Interface (J3)

The SSPA is controlled using a discrete interface. Control commands to the SSPA are collected from the monitor and control system of the RFT-500. The following table lists the dedicated pin outs for the 26-pin monitor and control connector of the SSPA.

Type	Pin	Function
Control Command	H	RF Enable *(see Note 1)*
	R	System Common *(see Note 1)*
Status Command	D	Summary Fault (Open on Fault) *(see Note 2)*
	C	Thermistor Output *(see Note 3)*
	E	Future
	G	Status Common

Notes:

1. RF Enable (Pin H connected to Pin R) required to turn the RF Output ON. Disconnecting the RF Enable pin from the system control pin will cause the C-Band SSPA to reset. If default parameters must be reloaded, they will not affect the normal gain of the unit.
2. The Summary Fault contact will be in a NO FAULT condition (Pin D connected to Pin G), until a C-Band SSPA fault is detected. This is regardless of the RF Enable input state. When an internal summary fault is detected, the C-Band SSPA will automatically mute its output. When a summary fault condition clears the summary fault output, the RF Output will return to the NO FAULT condition after a RESET (AC power ON/OFF cycle).
3. A thermistor is mounted in order to accurately reflect the temperature of the C-Band SSPA's RF components. One lead is connected to Status Common (Pin G) and the other lead is connected to Thermistor Output (Pin C).

2.1.2.4 RF Output Monitor Port (J4)

This RF interface is used for independent monitoring of the C-Band SSPA's output power levels through the use of an external power meter.

2.1.2.5 Prime Power (J5)

The power supply portion of the C-Band SSPA supplies all the internal voltage necessary to operate the RF section and the Alarm/Interface board. The power supply is configured for 90 to 265 VAC.

Pin	Function	Wire Color
A	Line	Brown
B	Ground	Green/Yellow
C	Neutral	Blue

2.1.2.6 RF Output (J7)

Waveguide connection CPR-137R (grooved) is located on the side of the C-Band SSPA.

2.1.2.7 Alarm/Interface Board

The Alarm/Interface board provides:

- Status indicator by Form-C relay contacts:
  - Fault
  - Alarm
  - High reflected power (HRP)
  - RF mute
  - Output power level monitoring
- Mute mode which may be asserted by a remote current mode MUTE signal. A current rating of 20 mA may be a MUTE or ENABLE signal.
- Reset the HRP latch by remote current mode RESET signal. A current rating of 20 mA may reset the HRP latch if this condition occurred.
- The alarm/interface board is connected to the microwave power amplifier and to the customer's interface.

The Alarm/Interface board receives the analog signal from the reflected power sensor. The power amplifier will be muted when the input voltage is above the threshold level (with 1 second delay). When this event has occurred, HRP relay is de-energized and its Normal Close contact will become OPEN. It will indicate the fault condition on the customer interface.

Power up returns the system to the active condition if the amplifier is in the normal condition. The threshold level is set for VSWR of 2:1 maximum.

Prolonged operation without a load at the output may cause severe bodily harm. Do not operate the unit if the RF output is not connected to a load.