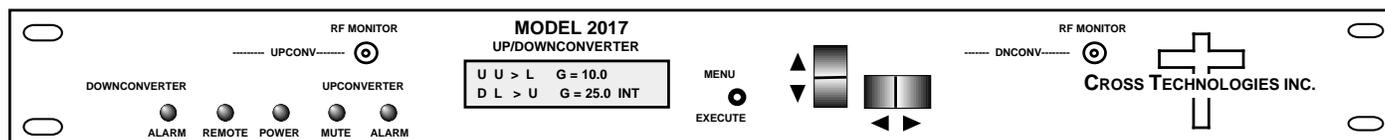


Instruction Manual

Model 2017-14

UHF, L-Band, Up/Downconverter

March 2017, Rev. A



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INSTRUCTION MANUAL

MODEL 2017-14 UHF, L-Band, Up/Downconverter

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MODEL 2017-14 UHF, L-Band, Up/Downconverter

1.0 General

1.1 Equipment Description

The 2017-14 UHF, L-band Up/Downconverter converts **0.2-0.4 GHz to 1.2-1.4 GHz (Up)** and **1.2-1.4 GHz to 0.2-0.4 GHz (Down)**. Multi-function switches select the gain (0 to +30 dB range for the upconverter and downconverter), and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow), and Upconverter mute (yellow). Remote operation allows selection of gain and external 10 MHz Reference (**OPTION E1**). Gain settings appear on the LCD display. Standard connectors are BNC female, 75Ω for UHF and the optional external reference input and output (**OPTION E1**), and Type F female for L-band. A high stability (**±0.01 ppm OPTION H**) option is also available. It is powered by a 100-240 ±10% VAC power supply and housed in a 1.75" X 19" X 16" 1RU chassis.

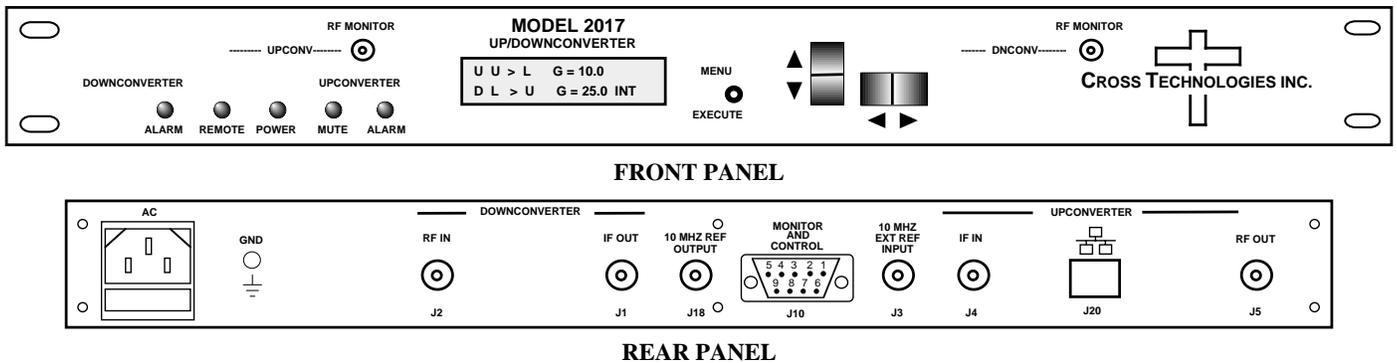


Figure 1.1 Model 2017-14 Front and Rear Panels

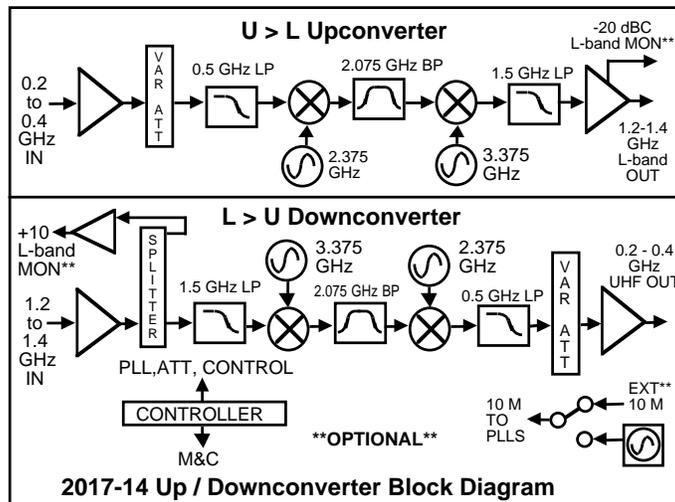


Figure 1.2 Model 2017-14 Up/Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.0 2017-14 UHF, L-Band, Up/Downconverter Specifications*

UPCONVERTER (Shown for Option M Connectors)		DOWNCONVERTER (Shown for Option M Connectors)			
Input Characteristics (UHF to L)		Input Characteristics (L to UHF)			
Impedance/Return Loss	50Ω / 14 dB	Impedance/Return Loss	50Ω / 14 dB		
Frequency	0.2 to 0.4 GHz	Frequency	1.2 to 1.4 GHz		
Noise Figure, maximum	20 db @ max. gain	Noise Figure, maximum	15 @ max. gain		
Input Level Range	-40 to -25 dBm	Input Level Range	-50 to -30 dBm		
Output Characteristics		Output Characteristics			
Impedance/Return Loss	50Ω / 14 dB	Impedance/Return Loss	50Ω / 14 dB		
Frequency (GHz)	1.2 to 1.4 GHz	Frequency (GHz)	0.2 to 0.4 GHz		
Output Level Range	-15 to 0 dBm	Output Level Range	-20 to 0 dBm		
1 dB Comp, maximum gain	+10 dBm	1 dB Comp, maximum gain	+10 dBm		
Mon. Level (Option W78)	-20 dBC OUT (±3 DB)	Mon. Level (Option W78)	+10 dBm IN (±3 DB)		
Mute @ 0 dBm Out	> 60 dB	Mute @ 0 dBm Out	N/A		
Channel Characteristics		Channel Characteristics			
Gain, Maximum at Fc	+30 ± 3 dB	Gain, Max at Fc	+30 ± 3 dB		
Gain, Range, 0.5dB steps	+30 to 0 dB	Gain, Range, 0.5dB steps	+30 to 0 dB		
Image Rejection	< -55 dBC, minimum	Image Rejection	> 50 dB, minimum		
Spurious, in Band, Signal rel.	< -55 dBC, 0 dBm	Spurious, in Band, Signal rel.	< -50 dBC, 0 dBm		
Spurious, in Band, Signal ind..	< -60 dBm	Spurious, in Band, Signal ind.	< -60 dBm		
Spurious, Out of Band	< -55 dBm	Spurious, Out of Band	< -45 dBm		
Intermod - 2 Carriers	< -50 dBm	Intermod - 2 Carriers	< -50 dBm		
Frequency Response Band	± 2 dB	Frequency Response Band	± 2 dB		
Frequency Response, 40 MHz	± 0.5 dB	Frequency Response, 40 MHz	± 0.5 dB		
Frequency Sense	Non-inverting	Frequency Sense	Non-inverting		
Downconverter 2nd Harm					
≥ -40 dBc @ maximum input level		.2 - .4 GHz Out			
Synthesizer Characteristics					
Frequency Accuracy	± 1.0 ppm internal reference (±0.01 ppm, Option -H)				
Frequency Step	NONE, Fixed Frequency				
Phase Noise @ Frequency	100 MHz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-75	-80	-85	-100	-110
10 MHz Level In/Out Level	3 dBm ± 3 dB, 75 ohms (Option E1)				
Controls, Indicators					
Gain Selection	Direct readout LCD; pushbutton switches or remote selection				
Power/Alarm/Remote	Green LED, Red LED, Yellow LED				
Remote	RS232C, 9600 baud; (RS485, Option Q, Ethernet Optional)				
Other					
RF/IF (UHF) Connector	Type F (female) / BNC (female)				
10 MHz Connectors	BNC (female), 50Ω/75Ω				
Alarm/Remote Connector	DB9 - NO or NC contact closure on Alarm				
Size	19 inch, 1 RU Standard Chassis, 1.75" high X 16.0" deep				
Power	100-240 ± 10% VAC, 47-63 Hz, 45 watts maximum				
*+10°C to +40°C; Specifications subject to change without notice.				© 2013 Cross Technologies, Inc.	

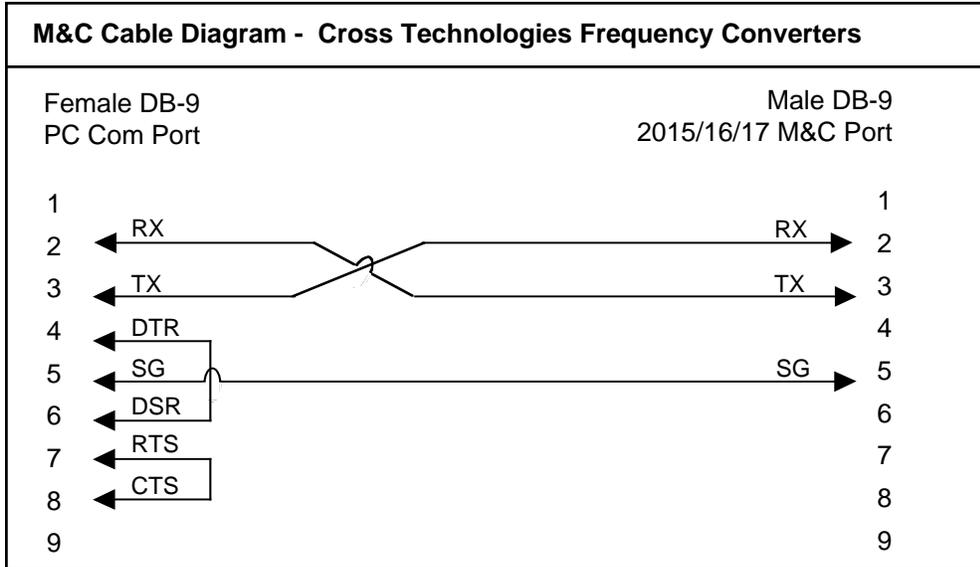
1.2 Technical Characteristics continued...

Available Options: UHF, L-Band Up/Downconverter	
- E1	External 10 MHz Reference / Auto Switch
- H	High stability (± 0.01 ppm) Internal Reference
- W78	RF/RF Monitor Ports (Front Panel)
- W31	External Temperature 0C to +50C
Remote M&C Interfaces	
- Q	RS485/422
- W8	Ethernet; with Web Browser
- W18	Ethernet; with Web Browser and SNMP
- W28	Ethernet; with TCP/IP, Telnet [®]
Connectors/Impedance	
- B	75 Ω BNC (RF), 75 Ω BNC (IF)
- C	50 Ω BNC (RF), 75 Ω BNC (IF)
- D	50 Ω BNC (RF), 50 Ω BNC (IF)
- J	75 Ω F-Type (RF), 50 Ω BNC (IF)
- N	50 Ω N-Type (RF), 75 Ω BNC (IF)
- M	50 Ω N-Type (RF), 50 Ω BNC (IF)
- S	SMA, 50 Ω (RF), 50 Ω BNC (IF)
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1.3 Monitor and Control Interface

A) Remote serial interface

Protocol: RS-232C, 9600 baud rate, no parity, 8 data bits, 1 start bit, and 1 stop bit.
(RS-232C, RS-422, or **RS-485 - option -Q**)



Connector: Rear panel, DB-9 male

J10 Pinouts (RS-232C/422/485)	
Pin	Function
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

B) Status Requests

Table 1.1 lists the status requests for the 2017-14 and briefly describes them.

* PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

Table 1.1 2017-14 Status Requests		
Command	Syntax*	Description
Command Status	{aaS1}	Returns {aaS1bbbcccdefg} where:
		• bbb = Upconverter Gain (000 to 300) 00.0 to 30.0 dB
		• ccc = Downconverter Gain (000 to 300) 00.0 to 30.0 dB
		• d - Receiver synth alarm: 0 = normal, 1 = alarm
		• e - Transmitter synth alarm: 0 = normal, 1 = alarm
		• f - Summary alarm: 0 = normal, 1 = alarm
		• g - Transmit signal disabled: 0 = muted, 1 = not muted
External 10MHz (option -E)	{aaS2}	Returns {aaS2bc} where:
		• b - Reference Mode where:
		1 = Internal, 2 = External, 3 = Auto
		• c = Current Reference where:
		1 = Internal, 2 = External

C) Commands

Table 1.2 lists the commands for the 2017-14 and briefly describes them. After a command is sent the 2017-14 sends a return “>” indicating the command has been received and executed.

General Command Format - The general command format is {aaCND...}, where:

- { = start byte
- aa = address (RS-485 only **option -Q**)
- C = 1 character, either C (command) or S (status)
- N = 1 character command or status request
- D = 1 character or more of data (depends on command)
- } = stop byte

* PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

Table 1.2 2017-14 Commands		
Command	Syntax*	Description
Set Transmit Gain	{aaC3xxx}	where: <ul style="list-style-type: none"> • xxx = 3 characters • Range: 000 to 300 (00.0 to 30.0 in 0.5 dB steps)
Set Receiver Gain	{aaC4xxx}	where: <ul style="list-style-type: none"> • xxx = 3 characters • Range: 000 to 300 (00.0 to 30.0 in 0.5 dB steps)
Enable Tx	{aaCAx}	where x =: <ul style="list-style-type: none"> • 0 to disable Tx signal • 1 to enable Tx signal
10MHz Reference (option -E1)	{aaCEx}	where x =: <ul style="list-style-type: none"> • 1 = Internal Reference • 2 = External Reference • 3 = Auto Reference
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}*}	{CR and zero}

1.4 Environmental Use Information

- A. **Rack-Mounting** - To mount this equipment in a rack, please refer to the installation instructions located in the user manual furnished by the manufacturer of your equipment rack.
- B. **Mechanical Loading** - Mounting of equipment in a rack should be such that a hazardous condition does not exist due to uneven weight distribution.
- C. **Elevated Operating Ambient Temperature** - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack may be greater than room ambient temperature. Therefore, consideration should be given to Tmra.
- D. **Reduced Air Flow** - Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised. Additional space between units may be required.
- E. **Circuit Overloading** - Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of circuits could have on over current protection and supply wiring. Appropriate consideration of equipment name plate rating should be used when addressing this concern.
- F. **Reliable Earthing** - Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connection to the Branch (use of power strips).
- G. **Top Cover** - There are no serviceable parts inside the product so, the Top Cover should not be removed. If the Top Cover is removed the ground strap and associated screw **MUST BE REINSTALLED** prior to Top Cover screw replacement. **FAILURE TO DO** this may cause **INGRESS** and/or **EGRESS** emission problems.

2.0 Installation

2.1 Mechanical

The 2017-14 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching, ± 12 , +24, +5 VDC power supply provides power for the assemblies. The 2017-14 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2017-14 is assembled.

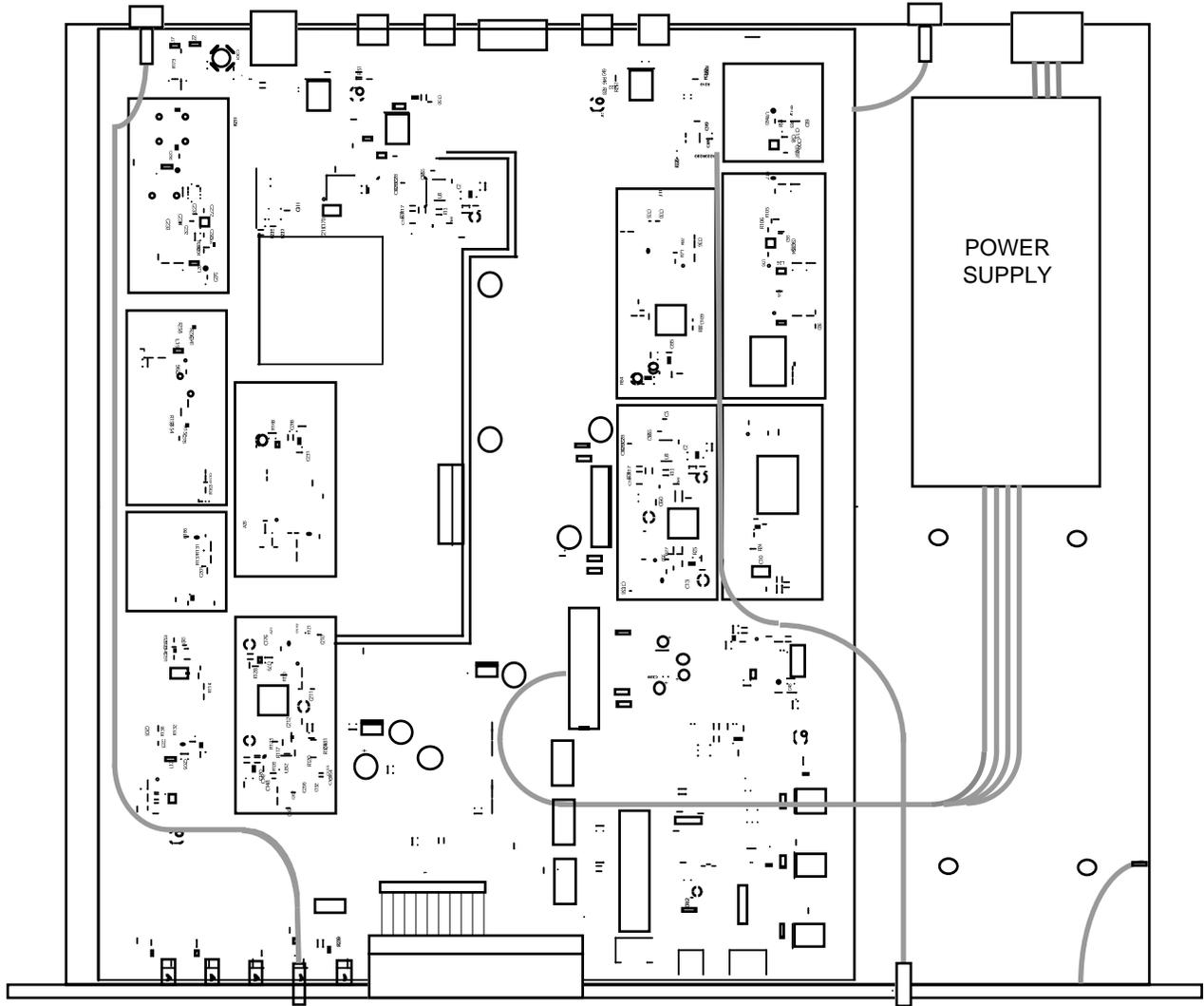


Figure 2.0 Model 2017-14 Mechanical Assembly

2.2 Rear Panel Input/Output Signals and Control -

Figure 2.2 shows the input and output connectors on the rear panel.

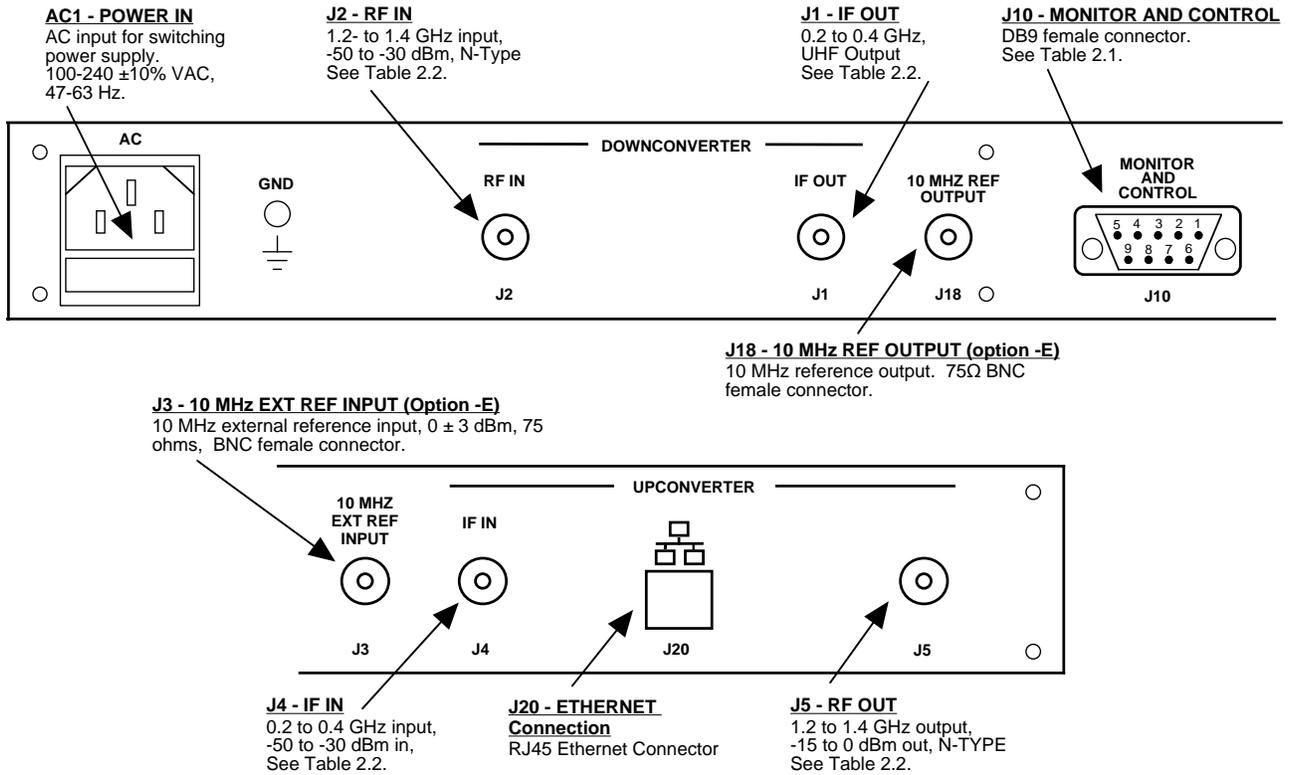


Figure 2.1 Model 2017-14 Rear Panel I/O's

Tables 2.1 & 2.2 shows the input and output connectors on the rear panel.

TABLE 2.1 J10 Pinouts (RS-232C/422/485*)	
Pin	Function
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

***Remote Serial Interface**

Interface: DB-9 Male -- Protocol: RS-232C (RS-232C/422/485 **option -Q**),
9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.

TABLE 2.2 IF/RF Connector Options		
Option	IF	RF
STD	BNC, 75Ω	Type F, 75Ω
-B	BNC, 75Ω	BNC, 75Ω
-C	BNC, 75Ω	BNC, 50Ω
-D	BNC, 50Ω	BNC, 50Ω
-J	BNC, 50Ω	Type F, 75Ω
-N	BNC, 75Ω	Type N, 50Ω
-M	BNC, 50Ω	Type N, 50Ω
-S	BNC, 50Ω	SMA, 50Ω

2.3 Front Panel Controls and Indicators -

The following are the front panel controls and indicators.

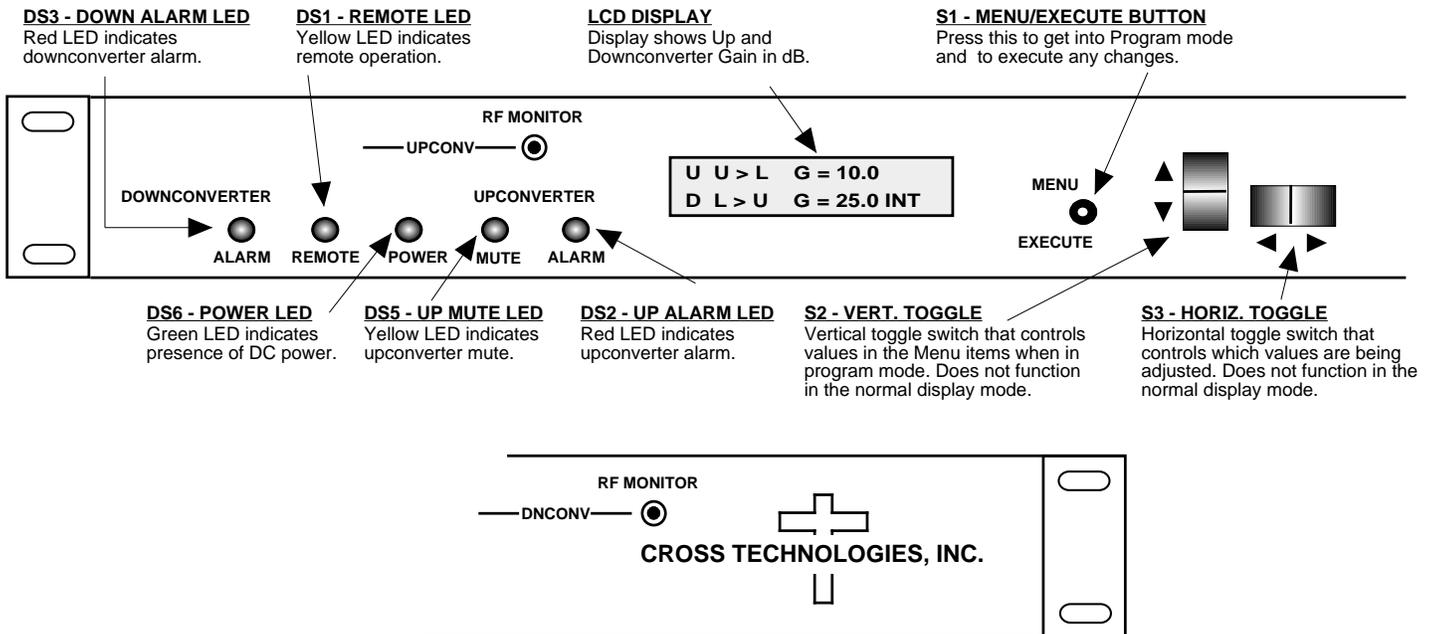


Figure 2.2 Model 2017-14 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2017-14, Upconverter Section

- 1.) Connect a -40 dBm to -25 dBm signal to IF In, J4 (Figure 2.1).
- 2.) Connect the RF OUT, J5, to the external equipment.
- 3.) Connect 100-240 \pm 10% VAC, 47 - 63 Hz to AC on the back panel.
- 4.) Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.2).

2.4.2 Installing and Operating the 2017-14, Downconverter Section

- 1.) Connect a -50 dBm to -30 dBm signal to RF In, J2 (Figure 2.1).
- 2.) Connect the IF OUT, J1, to the external equipment.
- 3.) Connect 100-240 \pm 10% VAC, 47 - 63 Hz to AC on the back panel.
- 4.) Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.2).
- 5.) **AC Fuse** - The fuse is a 5 mm X 20 mm, 2 amp slow blow (Type T) and is inserted in the far slot in the drawer below the AC input as shown in Figure 2.3. There is a spare fuse in the near slot.
If a fuse continues to open, the power supply is most likely defective.

2.4.3 External 10 MHz Reference Operation

The External Reference Option is required if the unit is to synch to a 10 MHz reference from an *external* source. The unit will still have an internal 10 MHz reference as a ‘back-up’ should the external reference be removed or fail. Described below are the two (2), 10 MHz External Reference Options, Option E & E1.

Option E

Internal Reference Mode

When the internal reference mode is selected, the unit's internal 10 MHz reference will become the ‘primary’ source and the unit’s synthesizers will lock to this internal 10 MHz reference. The unit will ignore any external 10 MHz signal present on the external reference input (J13). The unit will also buffer the internal 10 MHz signal and provide it on the Reference Out connector (J14) at +3 dBm, +/- 3 dB.

External Reference Mode

When the external reference mode is selected, the external 10 MHz reference (received on J13) will become the ‘primary’ source and the unit’s synthesizers will lock to this external 10 MHz reference. The unit *must* have a 10 MHz signal connected to the external reference input (J13) on the rear panel. The external 10 MHz signal must be +3 dBm, +/- 3 dB. The unit will also buffer the external 10 MHz signal and provide it on the Reference Out connector (J14) at +3 dBm, +/- 3 dB.

NOTE: There is no “auto-detect” capability in Option E. [See Option E1 below if this capability is required.] If the External Reference Mode is selected and the external reference fails or is removed, the unit will ALARM, but it will NOT automatically switch to the internal reference. The user will be required to manually select Internal Reference Mode (via the front panel LCD or Remote M&C) for the *internal* 10 MHz reference to become the ‘primary’ source for the unit.

Once the external 10 MHz reference is restored (on J13), the user must again manually (via the front panel LCD or Remote M&C) reselect External Reference Mode for the *external* 10 MHz reference to become the ‘primary’ source.

L-band units with option E also have the ability to ‘insert’ the (internal or external) 10 MHz signal that has been buffered (as described above) on the center pin of the L-band (RF) connector(s).

Option E1

Units with option E1 operate as described above but also have an Auto mode. When in auto mode the unit will detect and select the external 10 MHz signal if it is present and at least +3 dBm. If the external 10 MHz signal falls below 1 dBm (+/- 1 dB) the unit will automatically switch to the internal 10 MHz reference. The reference out connector (J14) provides a buffered rendition of the selected 10 MHz signal at +3 dBm, +/- 3 dB.

Units with option E1 do not have the ability to insert a buffered rendition of the selected 10 MHz signal on the center pin of the (RF) connector.

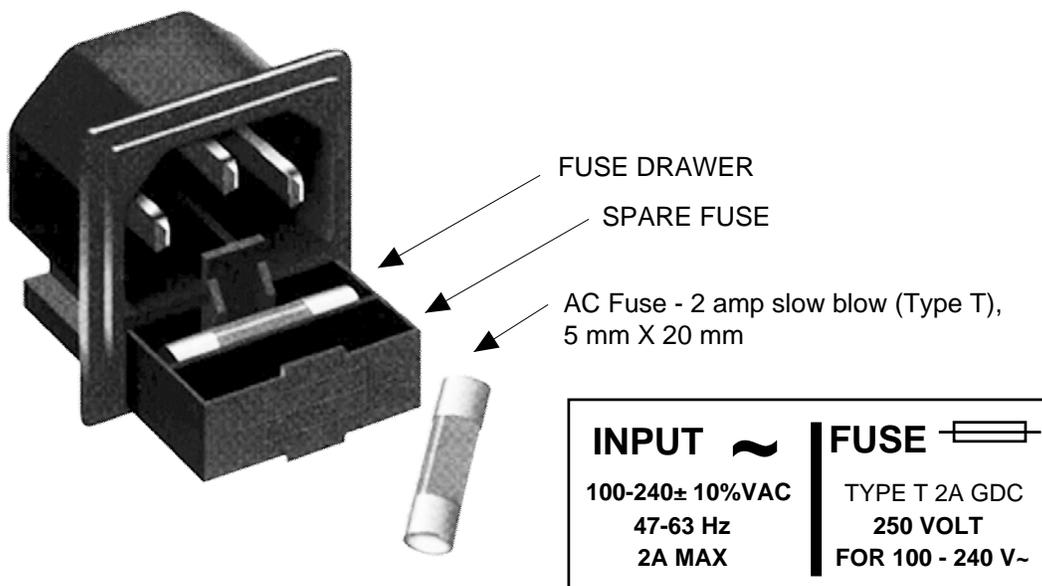


Figure 2.3 Fuse Location and Spare Fuse

2.5 Menu Settings

2.5.1 Functions - This section describes operation of the front panel controls. There are three operator switches, the LCD display and alarm indicator LEDs. All functions for the equipment are controlled by these components. The functions are (See Figure 2.2):

Power Up

Normal Display

- Menu 1** Up Gain (+30 to 0)
- Menu 2** Down Gain (+30 to 0)
- Menu 3** Select External 10 MHz Ref (option -E)
- Menu 4** Up Mute
- Menu 5** Set Unit to Remote Operation
- Menu 6** Select Ethernet

Save Menu At the end or when “R” is selected from any of the above menus

Alarm indications appear on the LEDs (see figure 2.2).

All program changes must start with the operation of the Menu/Execute switch and must also end with the operation of the Menu/Execute switch verified by the “Save Settings?” Menu. If this sequence is not followed, none of the changes will take effect. If programming is initiated and no operator action takes place for approximately 12 seconds (before the final press of the Menu/Execute switch) the display will revert to its previous status and you will need to start over.

2.5.2 Power-On Settings

NOTE: THE LAST STATUS OF A UNIT IS RETAINED EVEN WHEN POWER IS REMOVED. WHEN POWER IS RESTORED, THE UNIT WILL RETURN TO IT'S PREVIOUS SETTINGS.

When power is first applied, the LCD display goes through three steps.

1. The IP address is displayed
2. The software version and model number will be displayed.

192.168.123.002

2017-14
REV. 5.00

3. The present frequency and gain of the up and Downconverter is shown.

U U > L	G=+10.0
D L > U	G=25.0 INT

The unit is now operational and ready for any changes the operator may desire.

2.5.3 Control Switches

1. Menu/Execute - Any change to the programming of the unit must be initiated by pressing the Menu/Execute switch and completed by pressing the Menu/Execute switch.
2. Horizontal Switch - This switch is mounted so its movement is horizontal and moves the cursor left or right.
3. Vertical Switch - This switch is mounted so its movement is vertical and has two functions:
 - a. During frequency , gain, input level changes, the vertical movement will raise or lower the number in the direction of the arrows.
 - b. For other functions such Mute on/off, the vertical switch will alternately turn the function on or off regardless of the direction operated.

2.5.4 Gain Changes

When you get to this menu note that the gain changes will be made as you make them but if you do not wish to save the changes you have made, scroll to “**R**” and push the menu/Execute switch and select “**NO**” in the “**SAVE SETTINGS?**” window or **do not press the Menu/Execute switch**; simply do nothing for approximately 12 seconds, and the system will return to the normal operating mode.

2.5.4.1 Upconverter Gain

To set the Upconverter gain, first push the Menu/Execute switch to get to the gain setting:

Operate the Menu/Execute switch until you get to the menu item you want to change see Figure 2.4 for the sequence of menu options.

UP G = + <u>2</u> 5.5	R
-----------------------	---

By using the horizontal rocker switch the cursor can be moved left or right .

Pressing the Up/Down switch down will toggle the display digit selected until you have the desired gain.

NOTE: THE GAIN WILL BE CHANGED AS YOU ADJUST THE NUMBERS. HOWEVER, THE VALUE WILL NOT BE STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW. DO NOT SET A GAIN THAT WOULD EXCEED A 0 dBm OUTPUT LEVEL.

When the display indicates the value desired you can push the Menu/Execute switch to the next item OR you can scroll to “**R**”, push the Menu/Execute switch to get to:

SAVE SETTINGS?	<u>Y</u> N
----------------	------------

Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.

Pushing the Menu/Execute switch then takes you to the :

U U > L	G=+10.0
D L > U	G=25.0 INT

Figure 2.4 shows all the menu items and how to make changes.

2.5.4.2 Downconverter Gain

To set the Downconverter gain, first push the Menu/Execute switch to get to the gain setting:

Operate the Menu/Execute switch until you get to the menu item you want to change see Figure 2.4 for the sequence of menu options.

The following display is for changing the Downconverter gain. This is an important setting to optimize spurious and should be made as accurately as possible to provide an output in the -20 to 0 dBm level range:

DN G = + <u>3</u> 0.0	R
-----------------------	---

Pressing the Up/Down switch to change the level in 0.5, 1, or 10 dB steps. By using the horizontal rocker switch the cursor can be moved left or right. Pressing the Up/Down switch down will toggle the display digit selected until you have the desired gain.

NOTE: THE GAIN WILL BE CHANGED AS YOU ADJUST THE NUMBERS. HOWEVER, THE VALUE WILL NOT BE STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW.

When the display indicates the value desired you can push the Menu/Execute switch to the next item OR you can scroll to “R”, push the Menu/Execute switch to get to:

SAVE SETTINGS?	<u>Y</u> N
----------------	------------

Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.

Pushing the Menu/Execute switch then takes you to the :

U U > L	G=+10.0
D L > U	G=25.0 INT

Figure 2.4 shows all the menu items and how to make changes.

2.5.4.3 Alarm Indications

An alarm condition will occur if any local oscillator phase lock loop (PLL) comes out of lock.

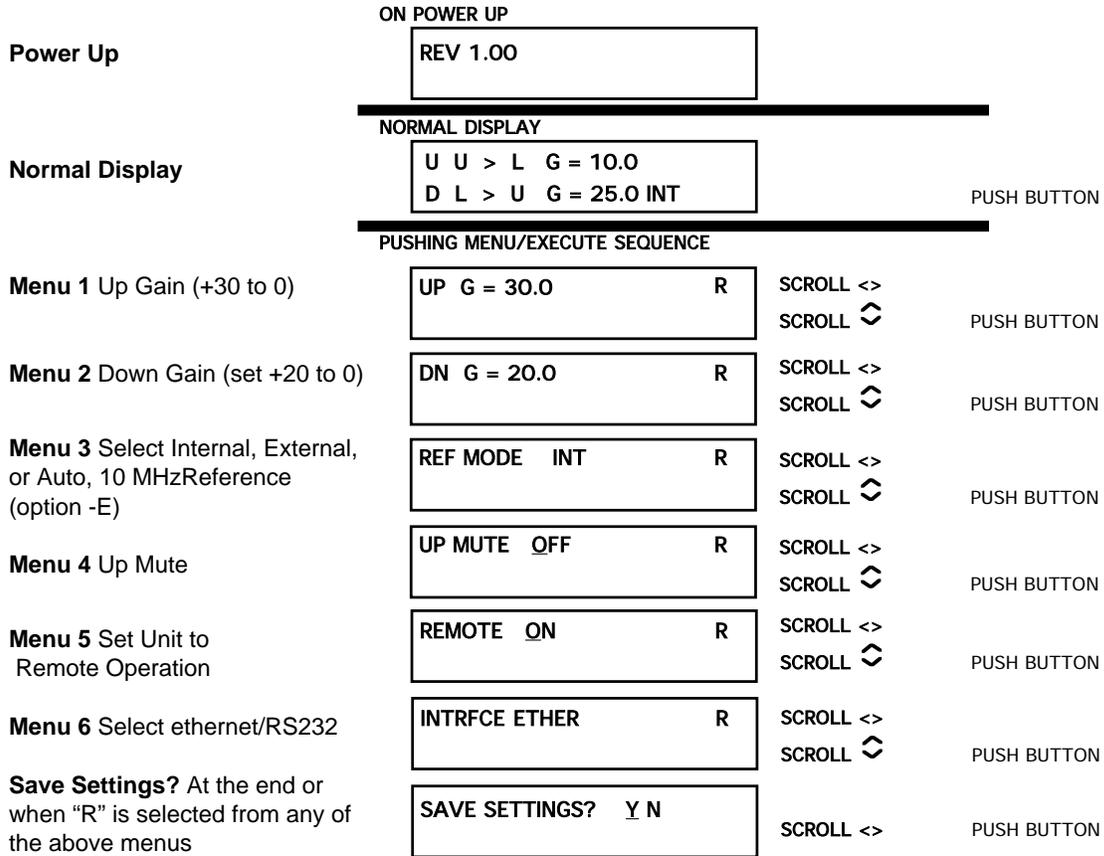


Figure 2.4 Menu Display and Sequence



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