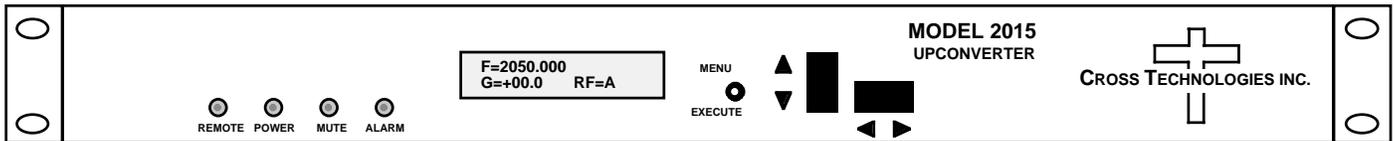


# Instruction Manual

# Model 2015-123 Upconverter

November 2009 Rev A



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# INSTRUCTION MANUAL

## MODEL 2015-123 Upconverter

<b><u>TABLE OF CONTENTS</u></b>	<b><u>PAGE</u></b>
<b>Warranty</b>	<b>2</b>
<b>1.0 General</b>	<b>3</b>
1.1 Equipment Description	<b>3</b>
1.2 Technical Characteristics	<b>4</b>
1.3 Monitor & Control Interface	<b>5</b>
<b>2.0 Installation</b>	<b>8</b>
2.1 Mechanical	<b>8</b>
2.2 Rear Inputs & Outputs	<b>9</b>
2.3 Front Panel Controls & Indicators	<b>9</b>
2.4 Operation	<b>10</b>
2.5 Menu Settings	<b>11</b>
<b>3.0 Environmental Use Information</b>	<b>16</b>

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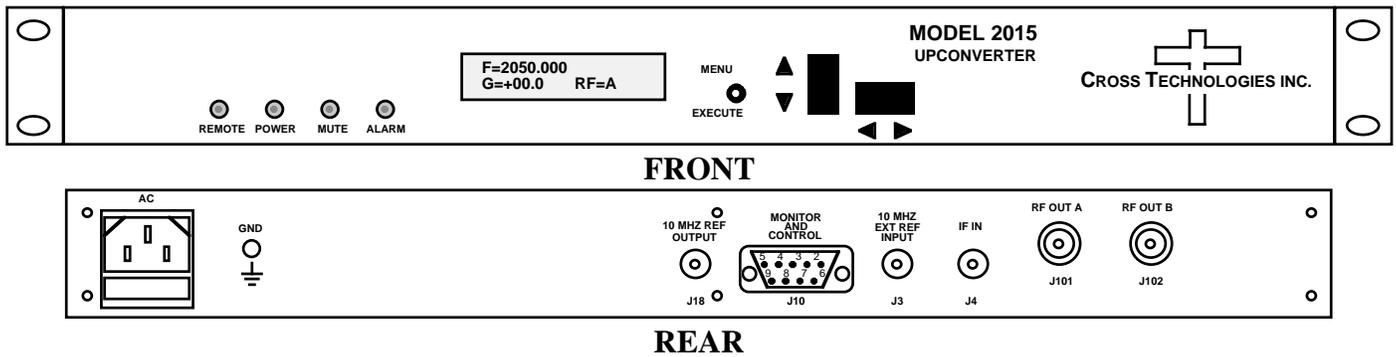
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# MODEL 2015-123 Upconverter

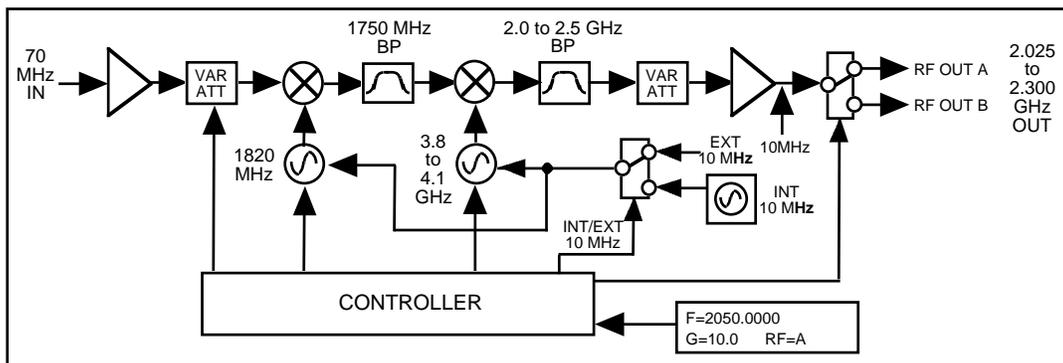
## 1.0 General

### 1.1 Equipment Description

The 2015-123 Upconverter converts  $70 \pm 18$  MHz to 2025 to 2300 MHz in 1kHz, 10kHz, or 125kHz steps (user selectable) with low group delay and flat frequency response. Synthesized local oscillators (LO) provide very low phase noise and  $\pm 0.01$  ppm stability frequency selection. Multi-function push button switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow) or the TX carrier is muted (yellow). Variable attenuators for the IF input and output provide a gain range of -10 to +30 dB as adjusted by the front panel multi-function push-button switches. Remote operation allows selection of frequency and gain. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are BNC female for IF Input, RF outputs and the 10MHz external reference input and 10MHz reference output. The 10MHz reference signal (internal or external) can be sent to the 10MHz reference output connector and/or to the RF OUT connectors. The RF signal can be switched between two RF outputs (A and B) via an integrated, remotely controlled RF switch. The unit is powered by a 100-240  $\pm 10\%$  VAC power supply, and is housed in a 1.75" X 19" X 16" rack mount chassis.



**FIGURE 1.1 Model 2015-123 Front and Rear Panels**



**FIGURE 1.2 Model 2015-123 Upconverter Block Diagram**

## 1.2 Technical Characteristics

**TABLE 1.1 2015-123 Upconverter Specifications\***

### Input Characteristics

Impedance/Return Loss	50 Ω /18 dB
Frequency	70 ± 18 MHz
Input Level	-40 to -10 dBm

### Output Characteristics

Impedance/Return Loss	50 Ω/10 dB
Frequency	2025 to 2300 MHz
Output level	0 to -20 dBm
Output level/1 dB	+5 dBm

### Channel Characteristics

Gain range (adjustable)	-10.0 to +30.0 dB (0.1 dB steps)
Spurious Response	<-50 dBC
Frequency Response	±1.5 dB, 2025 to 2300 MHz; ± 0.5 dB, 36 MHz BW
Group Delay, max	3 ns, 30 MHz, 5 ns, 36 MHz BW
Frequency Sense	Non-inverting

### Synthesizer Characteristics

Frequency Accuracy	± 0.01 ppm max over temp internal reference; external ref. input
Frequency Step	1 kHz, 10 kHz, or 125 kHz (selectable)

Phase Noise @ Freq	100 MHz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-75	-90	-97	-107	-117

10 MHz Level (In or Out) 0 dBm, ± 3 dB, 75 ohms

### Controls, Indicators

Frequency Selection	direct readout LCD; pushbutton switches or remote selection
Gain Selection	direct readout LCD; pushbutton switches or remote selection
Power	Green LED
Alarm	Red LED
Mute	Yellow LED
Remote	Yellow LED, RS232C/RS422/RS485 (selectable), 9600 baud

### Other

RF Connectors	BNC (female), 50 Ω
IF Connector	BNC (female), 50 Ω
10 MHz Connectors	BNC (female), 75 Ω
Alarm/Remote Connector	DB9 (female), NO or NC contact closure on Alarm
Size	19 inch, 1RU standard chassis 1.75" high X 16.0" deep
Power	100-240 ±10% VAC, 47-63 Hz, 45 W max

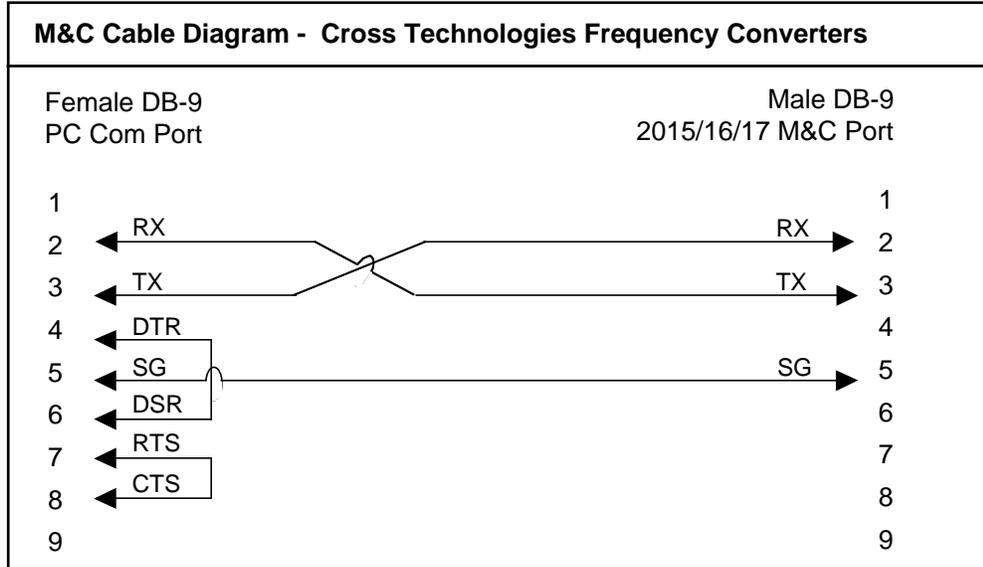
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\*+10°C to +40°C; Specifications subject to change without notice

### 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 1.3 lists the status requests for the 2015-95 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.

<b>Table 1.3 2015-123 Status Requests</b>		
<b>Command</b>	<b>Syntax</b>	<b>Description</b>
Command Status	{aaS1}*	Returns {aaS1bbbbbbccdddMIERA} where:
		• bbbbbbb = Tx frequency
		• cc = Input Level
		• dddd = Tx Gain
		• M = Tx RF Status (1 = Normal, 0 = Muted)
		• I = Ref Insertion Status (1 = Ref On, 0 = Ref Off)
		• E = External Ref Status (1 = Ext Off, 0 = Ext On)
		• R = RF Output Status (0 = RF Out A, 1 = RF Out B)
		• A = Alarm Status (0 = NO Alarm, 1 = Alarm)

**C) Commands** - Table 1.2 lists the commands for the 2015-123 and briefly describes them. After a command is sent the 2015-123 sends a return “>” indicating the command has been received and executed.

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

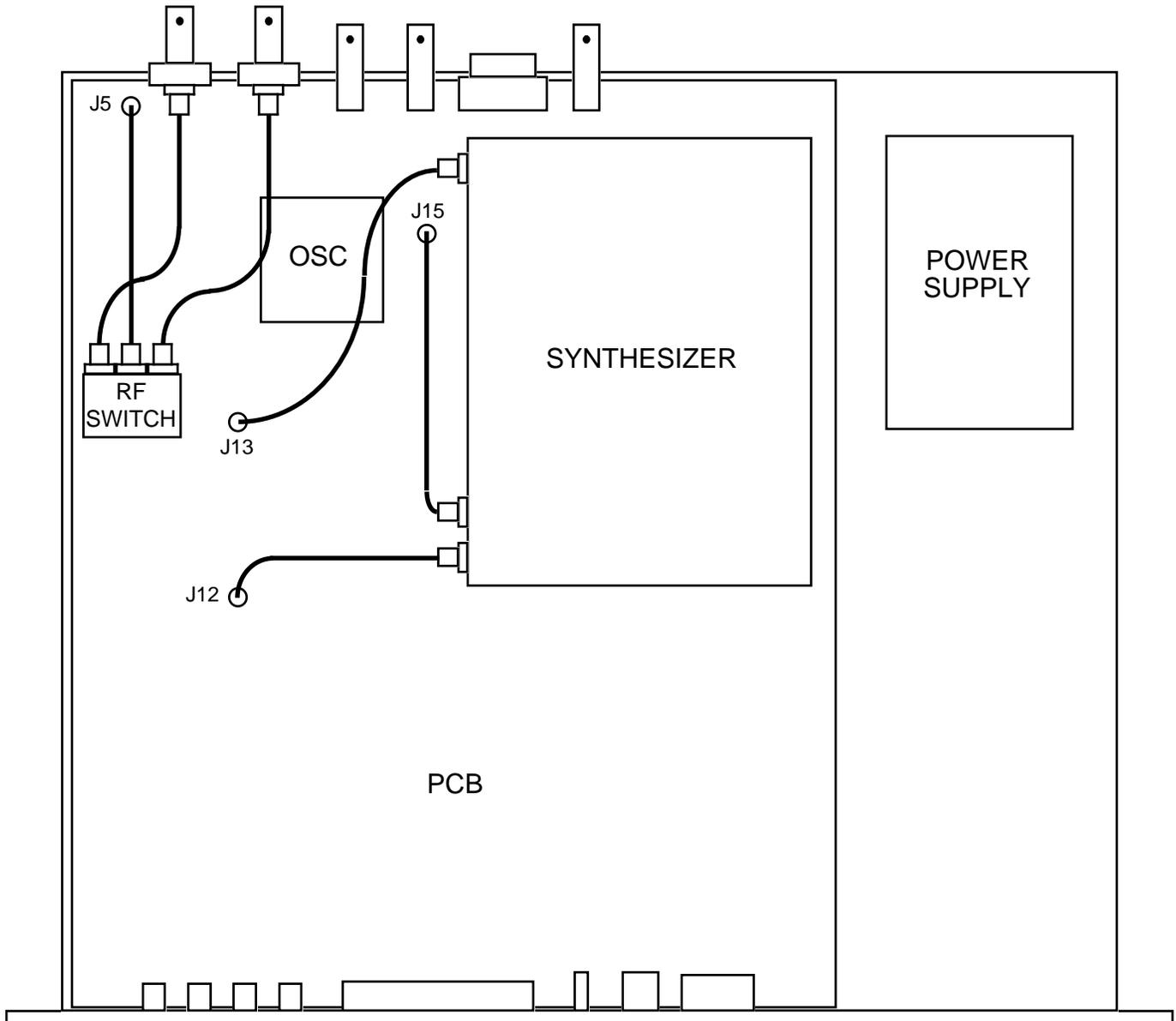
- { = start byte
- aa = address (**RS-485 only - option Q**)
- C = 1 character, either C (command) or S (status)
- N = 1 character command or status request
- D = 1 character or more of data (depends on command)
- } = stop byte

\* 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 2015-123 Commands		
Command	Syntax	Description
Set Transmitter Frequency	{aaC1xxxxxxx}* where:	<ul style="list-style-type: none"> <li>• xxxxxxx = 7 characters</li> <li>• Range: 2000000 to 2500000 kHz, 1kHz steps</li> </ul>
Set Input Level	{aaClxx}* where:	<ul style="list-style-type: none"> <li>• xx = 2 characters</li> <li>• Range: 10 to 40 (-10 dB to -40 dB, in 1 dB steps)</li> </ul>
Set Transmit Gain	{aaC3xxxx}* where:	<ul style="list-style-type: none"> <li>• xxxx = 3 or 4 characters (use 4 char for negative gain)</li> <li>• Range: -100 to 300 (-10.0 dB to 30.0 dB, in 0.1 dB steps)</li> </ul>
Enable 10MHz insertion/out	{aaC6x}* where x =:	<ul style="list-style-type: none"> <li>• 0 to disable reference out</li> <li>• 1 to enable reference out</li> </ul>
Set RF Output	{aaC7x}* where x =:	<ul style="list-style-type: none"> <li>• 0 RF Output = A</li> <li>• 1 RF Output = B</li> </ul>
Enable Tx	{aaCAx}* where x =:	<ul style="list-style-type: none"> <li>• 0 to disable Tx signal</li> <li>• 1 to enable Tx signal</li> </ul>
Enable External 10MHz	{aaCEx}* where x =:	<ul style="list-style-type: none"> <li>• 0 to disable External 10MHz ref signal</li> <li>• 1 to enable External 10MHz ref signal</li> </ul>
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}* {CR and zero}	

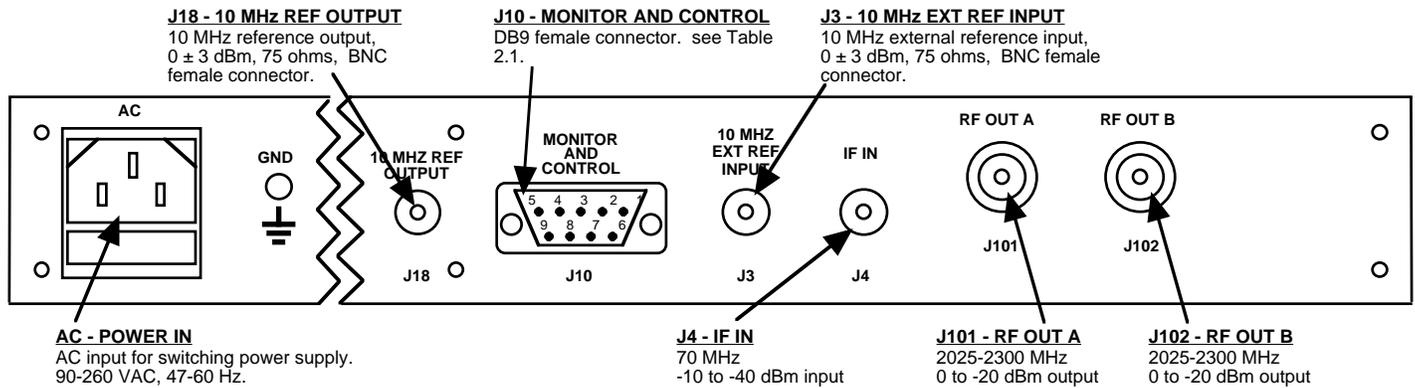
## 2.0 Installation

**2.1 Mechanical** - The 2015-123 consists of one RF/Controller PCB which is housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching,  $\pm 12$ , +24, +5 VDC power supply provides power for the assembly. The 2015-123 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2015-123 is assembled.



**FIGURE 2.1 2015-123 Mechanical Assembly**

**2.2 Rear Panel Input / Output Signals** - Figure 2.2 shows the input and output connectors on the rear panel.

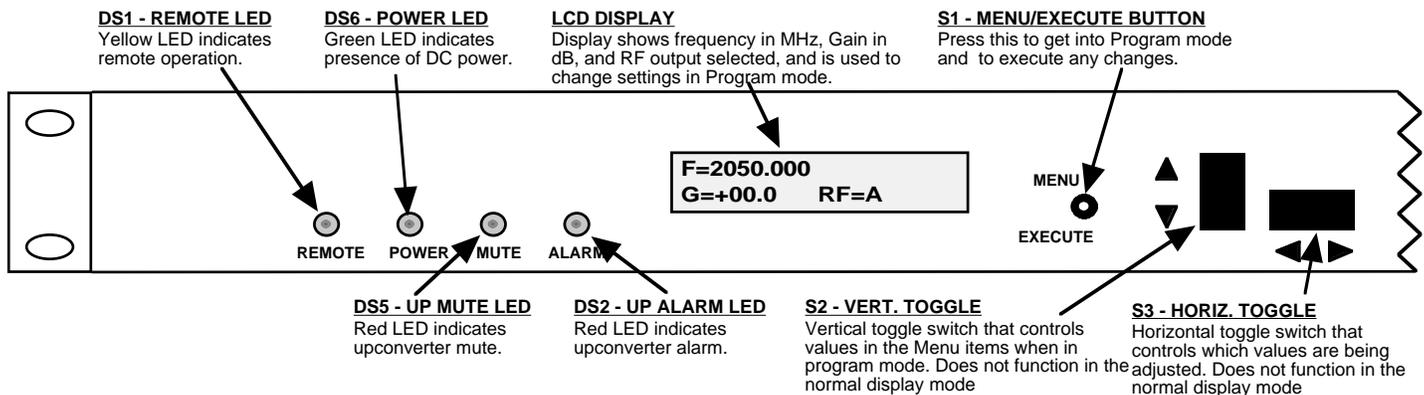


**FIGURE 2.2 2015-123 Rear Panel Inputs and Outputs**

Pin	Description
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	Ground
6	Alarm Relay - Common
7	Alarm Relay - Normally Open
8	Not Used
9	Alarm Relay - Normally Closed

\***Interface:** DB-9 Female; **Protocol:** RS-485, RS-422, or RS-232C (selectable), 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit

**2.3 Front Panel Controls and Indicators** -The following are the front panel controls and indicators.

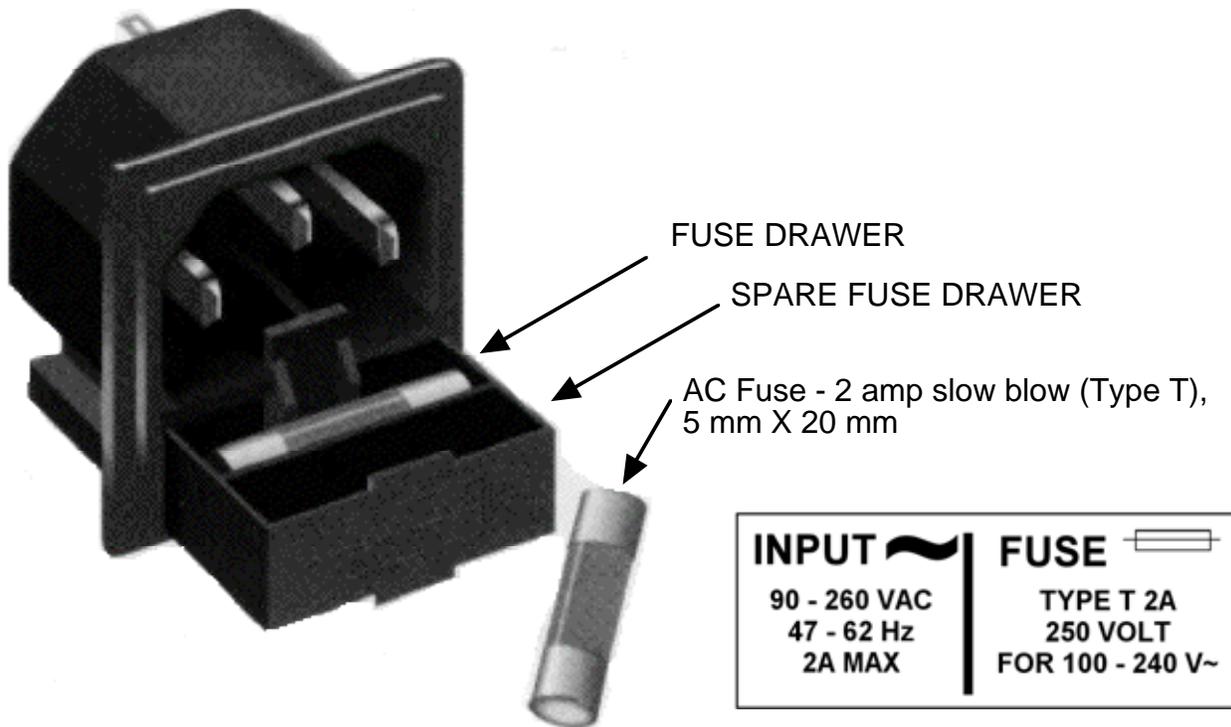


**FIGURE 2.3 2015-123 Front Panel Controls and Indicators**

## 2.4 Installation / Operation

### 2.4.1 Installing and Operating the 2015-123 Upconverter

- 1.) Connect a -10 dBm to -40 dBm, 70MHz signal to IF IN, J4 (Figure 2.2)
- 2.) Connect the RF OUT A, J101, and RF OUT B, J102, to the external equipment.
- 3.) Connect 90- 260 VAC, 47 - 63 Hz to AC input on the back panel.
- 4.) Set the desired output frequency (See Section 2.5 Menu Settings).
- 5.) Set the input level (See Section 2.5 Menu Settings).
- 6.) Set the gain for -10 to +30 dB. Make sure the output stays within -20 to 0 dBm with the gain selected and the input level provided. The firmware will prevent setting gain and input level outside this range. (See Section 2.5 Menu Settings).
- 7.) Select the RF Output (A or B) (See Section 2.5 Menu Settings).
- 8.) Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3).
- 9.) **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 2.4. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.



**FIGURE 2.4 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 2.5):

**Power Up  
Normal Display**

<b>Menu 1</b>	Frequency in MHz
<b>Menu 2</b>	Input Level (-40 to -10)
<b>Menu 3</b>	Gain (-10.0 to +30.0)
<b>Menu 4</b>	Mute
<b>Menu 5</b>	Select RF Output (A or B)
<b>Menu 6</b>	For Other Settings (see below)
<b>Save Menu</b>	When go to "R" or at end

**IF OTHER = Y**

<b>Menu 7</b>	Set Unit to Remote Operation (Note: the local controls still function when in REMOTE)
<b>Menu 8</b>	Select Frequency Step Size (1kHz, 10kHz, 100kHz, or 125kHz)
<b>Menu 9</b>	Select External 10 MHz Ref
<b>Menu 10</b>	Select 10 MHz Output
<b>Menu 11</b>	Select RS232, RS422, or RS 485 Remote Operation
<b>Menu 12</b>	Select Remote Address for Unit (RS485 only)

**Save Menu** When go to end

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

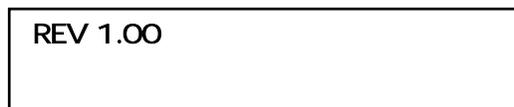
All program changes must start with the operation of the Menu/Execute switch and must also end with the operation of the Menu/Execute switch verified by the "Save Settings?" Menu. If this sequence is not followed, none of the changes will take effect. If programming is initiated and no operator action 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

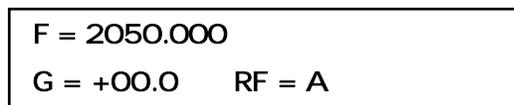
**NOTE:** The last status of a unit is retained even when power is removed. When power is restored, the unit will return to its previous settings.

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

- 1.The LCD goes black to show all segments are functioning.
- 2.The software version will be displayed.



- 3.The present frequency, gain, and selected RF output of the upconverter is shown.



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 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 Frequency Changes

At any time during the modification process, if you have made a mistake and do not wish to save the changes you have made, **do not press the Menu/Execute switch**; simply do nothing for approximately 12 seconds, and the system will return to the normal operating mode or scroll to “**R**” and push the menu/Execute switch and select “**NO**” in the “**SAVE SETTINGS?**” window.

To change the FREQUENCY:

1. Operate the Menu/Execute switch until you get to the menu item you want to change see Figure 2.5 for the sequence of menu options. The following display is for changing the upconverter frequency:

F = 2050.000	R
--------------	---

Pressing the Up/Down switch down will toggle the display to:

F = 2150.000	R
--------------	---

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

F = 215 <u>0</u> .000	R
-----------------------	---

**NOTE: CHANGES DO NOT TAKE PLACE ON FREQUENCY UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES. THE CARRIER IS MUTED WHEN FREQUENCY IS CHANGED.**

When the display indicates the value desired you can push the Menu/Execute switch to the next item:

UP INLVL = -2 <u>0</u>	R
------------------------	---



**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 0 dBm OR HAVE LESS THAN -20 dBm OUTPUT LEVEL. THE FIRMWARE PREVENTS YOU FROM THIS.**

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:

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

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

Pushing the Menu/Execute switch then takes you to:

<b>F = 2150.000</b>
<b>G = +10.0    RF = A</b>

Figure 2.5 gives the menu items and how to make changes

### **2.5.5 Alarm Indications**

An alarm condition will occur if the local oscillator phase lock loop (PLL) comes out of lock. The Mute LED will light if you select to mute the Tx Signal and the Remote LED will light when you select the Remote mode.

<b>Power Up</b>	ON POWER UP REV 1.00		
<b>Normal Display</b>	NORMAL DISPLAY F = 2050.000 G = +00.0 RF=A		PUSH BUTTON
<b>Menu 1 Up Frequency</b>	PUSHING MENU/EXECUTE SEQUENCE F = 2050.000 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 2 Up Input Level (Set from -40 to -10)</b>	UP INLVL = -20 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 3 Up Gain (-10 to +30)</b>	G = +00.0 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 4 Mute</b>	UP MUTE OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 5 Select RF Output</b>	RF OUT = A R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 6 For Other Settings (below)</b>	OTHER? Y N R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Save?</b> When go to "R" or at end	SAVE SETTINGS? Y N	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>IF OTHER = Y</b>			
<b>Menu 7 Set Unit to Remote Operation</b>	REMOTE OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 8 Select frequency step size</b>	STEP = 1 kHz R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 9 Select External 10 MHz Reference</b>	EXT REF OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 10 Select 10MHz Output</b>	UP REF OUT OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 11 Select RS232, RS422, or RS485 remote control</b>	RS232 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 12 Select remote address for unit (RS485 only)</b>	ADDRESS = 00 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Save?</b> When go to end	SAVE SETTINGS? Y N	SCROLL <>	PUSH BUTTON

**FIGURE 2.5 Menu Display and Sequence**

### 3.0 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 unit 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.



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