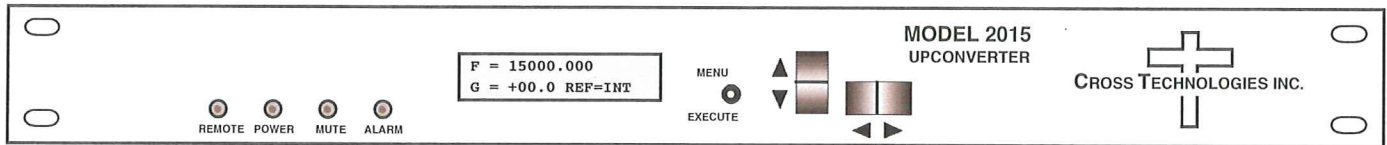


Instruction Manual

Model 2015-154-130 Upconverter

May 2020, Rev. 0



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INSTRUCTION MANUAL

MODEL 2015-154-130 Upconverter

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MODEL 2015-154-130 Upconverter

1.0 General

1.1 Equipment Description

The Model 2015-154-130 Upconverter converts 130 ±18 MHz to 14.8 to 15.4 GHz in 125 kHz steps with low group delay and flat frequency response. Synthesized local oscillators (LO) provide very low phase noise, ±0.01 ppm stability frequency selection. Push button switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of PLL alarm (red), remote operation (yellow) or the TX carrier is Muted (red). Variable attenuators for the IF input and RF output provide a gain range of 0 to +15 dB as adjusted by the front panel 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, external reference input and 10MHz reference output, and SMA (female) for the RF output. The unit is powered by a 100-240 ±10% VAC power supply, and housed in a 1.75" x 19" x 16" 1RU chassis.

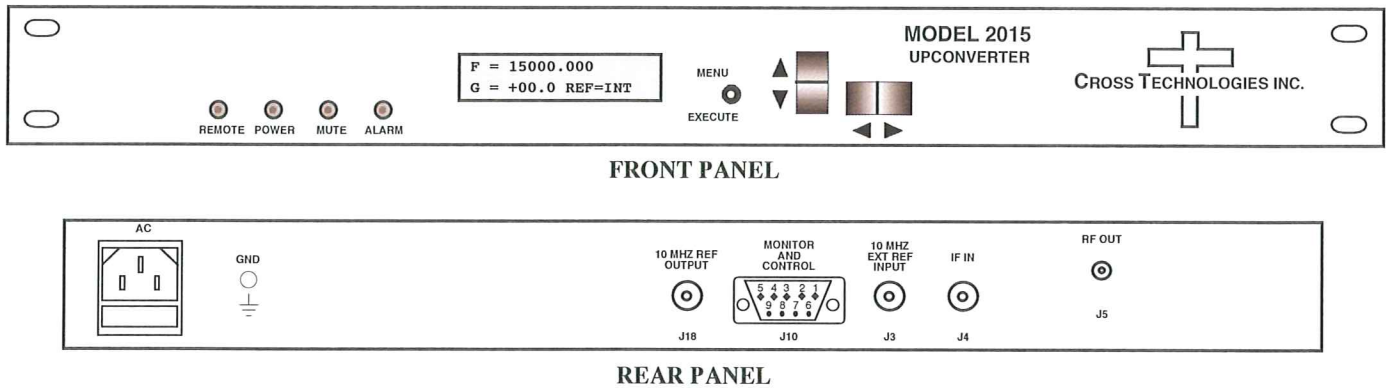


FIGURE 1.1 Model 2015-154-130 Front and Rear Panels

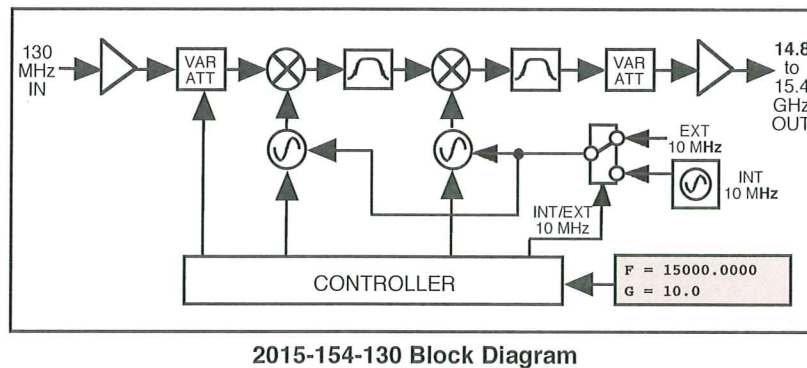


FIGURE 1.2 Model 2015-154-130 Upconverter Block Diagram

1.2 Technical Characteristics

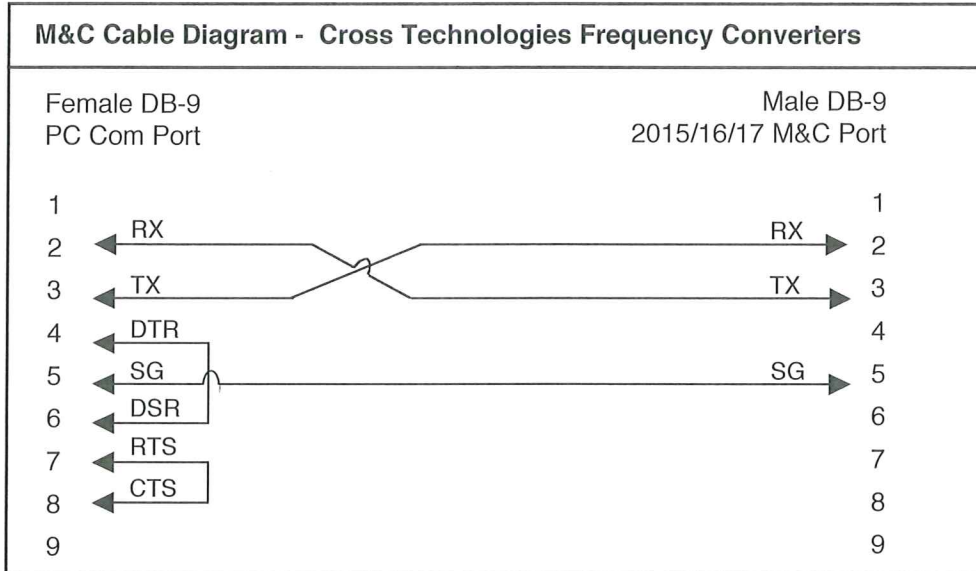
TABLE 1.1 2015-154-130 Upconverter Specifications*

Input Characteristics					
Impedance / Return Loss	75Ω / 18 dB				
Frequency	130 ±18 MHz				
Input Level	-10 to 0 dBm				
Output Characteristics					
Impedance / Return Loss	50Ω / 14 dB				
Frequency (See Models)	14.8 to 15.4 GHz				
Output Level	-5 to +5 dBm				
Output 1 dB Compression	+10 dBm, at max. gain				
Mute	>50 dB @ +5 dBm out				
Channel Characteristics					
Gain Max. / range	+15.0 ± 1 dB at Fc; adjustable from 0 to +15.0 dB, 0.5 ±0.5 dB steps				
Spurious, Inband	< -50 dBc, at max. gain, +5 dBm out				
Intermod	< -45 dBc for two carriers spaced at Fc ±2 Mhz apart each at 0 dBm out, at max. gain				
Spurious, Out of band	< -50 dBm, 10.0 - 14.8 and 15.4 - 20 GHz, at max. gain				
Frequency Response	±1.5 dB, 14.8 - 15.4 GHz; ±0.5 dB, 36 MHz BW				
Group Delay, Maximum	0.015 ns/MHz ² , parabolic, 0.035 ns/MHz, Linear, 1 ns ripple				
Frequency Sense	Non-inverting				
Synthesizer Characteristics					
Frequency Accuracy	± 0.01 ppm max. over temp external reference; ext ref. input				
Frequency Step	125 kHz minimum				
10 MHz In/Out Level	3 dBm, ± 3 dB				
Phase Noise @ F (Hz) >	100 MHz	1 kHz	10 kHz	100 kHz	1 MHz
dBc/Hz	-70	-70	-80	-95	-105
Controls, Indicators					
Frequency/Gain Selection	Direct Readout LCD, Pushbutton Switches or Remote Selection				
Power; Alarm; Remote; Mute	Green LED, Red LED, Yellow LED, Yellow LED				
Remote	RS232C, 9600 baud (options; RS485, Q; Ethernet)				
Other					
RF / IF Connector	SMA (female) / BNC (female), 75Ω				
10 MHz Connectors	BNC (female), 75Ω works with 50 or 75 ohms				
Alarm/Remote Connectors	DB9 - 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 watts maximum				
Available Options					
- Z	Attenuator 0.1 dB on Upconverter				
Remote M&C Interfaces:					
- Q	RS485/422				
- W8	Ethernet with Web Browser				
- W18	Ethernet with Web Browser & SNMP				
- W28	Ethernet with TCP/IP, Telnet®				
- W828	W8 + W18 + 28				
Contact Cross Technologies for other available options.					
*10°C to 40°C; Specifications subject to change without notice.					
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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 female

Pinouts (RS-485/422/232C)

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

B) Status Requests -

Table 1.3 lists the status requests for the 2015-154-130 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.**

Status Requests specific to a switch must be preceded by *i where i is the switch number.

Table 1.3 2015-154-130 Status Requests		
Command	Syntax	Description
Get Unit Settings	{aaS1}	returns: {aaS1bbbbbbcccdddddMEA} aa = unit address, range = 00 to 31, only used if interface is RS485 1 = command code bbbbbbb = output frequency in kHz. ccc = input level in dBm. ddddd = gain in dB. M = Tx output status (1 = normal, 0 = muted). E = External Reference Status (1 = external reference on, 0 = external reference off). A = Alarm Status (0 = no alarm, 1 = alarm). The unit will append the '>' character if the command is successfully processed.
Get Frequency	{aaSF}	returns: {aaSFxxxxxxx} aa = unit address, range = 00 to 31, only included if the interface is RS485. F = command code xxxxxxx = output frequency in kHz. The unit will append the '>' character if the command is successfully processed.
Get Gain	{aaSG}	returns: {aaSGxxxx} aa = unit address, range = 00 to 31, only included if the interface is RS485. G = command code xxxxx = gain in dB. The unit will append the '>' character if the command is successfully processed.
Get Input Level	{aaSI}	returns: {aaSIxxx} aa = unit address, range = 00 to 31, only included if the interface is RS485. I = command code xxx = input level in dBm. The unit will append the '>' character if the command is successfully processed.
Get Alarm Status	{aaSA}	returns: {aaSAx} aa = unit address, range = 00 to 31, only included if the interface is RS485. A = command code x = Alarm status: 0 = off, 1 = on. The unit will append the '>' character if the command is successfully processed.

Table 1.3 2015-154-130 Status Requests Continued

Command	Syntax	Description
Get Mute Status	{aaSM}	returns: {aaSMx} where: aa = unit address, range = 00 to 31, only included if the interface is RS485. M = command code x = 0 if the output is muted. x = 1 if the output is un-muted. The unit will append the '>' character if the command is successfully processed.
Get External Reference Status	{aaSE}	returns: {aaSEx} where: aa = unit address, range = 00 to 31, only included if the interface is RS485. E = command code x = 1 if the external reference is selected. x = 0 if the internal reference is selected. The unit will append the '>' character if the command is successfully processed.
Get Temperature (option T)	{aaST}	returns: {aaSTxxx} where: aa = unit address, range = 00 to 31, only included if the interface is RS485. T = command code xxx = unit temperature in degrees celsius. The unit will append the '>' character if the command is successfully processed.
Get IP Address (Ethernet Option only)	{aaSi}	returns: {aaSixxx.xxx.xxx.xxx} where: aa = unit address, range = 00 to 31, only included if the interface is RS485. i = command code xxx.xxx.xxx.xxx = unit IP Address The unit will append the '>' character if the command is successfully processed.
Get Subnet Mask (Ethernet Option only)	{aaSs}	returns: {aaSsxxx.xxx.xxx.xxx} where: aa = unit address, range = 00 to 31, only included if the interface is RS485. s = command code xxx.xxx.xxx.xxx = unit Subnet Mask The unit will append the '>' character if the command is successfully processed.

C) Commands -

Table 1.2 lists the commands for the 2015-154-130 and briefly describes them.

After a command is sent the 2015-154-130 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**)

C = 1 character, either C (command) or S (status)

N = 1-digit command or status character

D = 1 character or more of data (depends on command)

} = stop byte

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

Table 1.2 2015-154-130 Commands

Command	Syntax	Description
Set Frequency (Legacy)	{aaC1xxxxxxx}	where: aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit 1 = command code xxxxxxx = desired switch output frequency in kHz. This value must be a multiple of 125 kHz. Range: 14800000 to 15400000 example: {C115250375} Will set the output frequency to 15250.375 MHz The unit will reply with the '>' character if the command is successfully processed.
Set Frequency	{aaCFxxxxxxx}	where: aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit F = command code xxxxxxx = desired switch output frequency in kHz. This value must be a multiple of 125 kHz. Range: 14800000 to 15400000 example: {CF15250375} Will set the output frequency to 15250.375 MHz The unit will reply with the '>' character if the command is successfully processed.
Set Gain (Legacy)	{aaC3xxx}	where: aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise 3 = command code xxx = Gain in dB. This value must be in 0.5 dB steps. The decimal may be on Range: 0 to 15.0 dB in 0.5 dB steps. example: {C3125} Will set the gain to 12.5 dB. The unit will reply with the '>' character if the command is successfully process
Set Gain	{aaCGxxx}	where: aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise G = command code xxx = Gain in dB. This value must be in 0.5 dB steps. The decimal may be on Range: 0 to 15.0 dB in 0.5 dB steps. example: {CG125} Will set the gain to 12.5 dB. The unit will reply with the '>' character if the command is successfully process

Table 1.2 2015-154-130 Commands Continued

Command	Syntax	Description
Set Mute	{aaCMx}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		M = command code
		x = 0 or 1.
		A value of 0 will enable (un-mute) the output signal.
		A value of 1 will disable (mute) the output signal.
		example: {CM1}
		Will disable (mute) the output signal.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set External Reference	{aaCEx}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		E = command code
		x = 0 or 1.
		A value of 0 will disable the external reference and set the unit to Internal reference mode.
		A value of 1 will disable the external reference and set the unit to Enternal reference mode.
		example: {CE0}
		Will disable the external reference. The unit will use its internal reference.
		The unit will reply with the '>' character if the command is sucessfully processed.

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 multiunit rack assembly, the operating ambient temperature of the rack may be greater than room ambient temperature. Therefore, consideration should be given to Tmra (Maximum Recommended Ambient Temperature).
- 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 2015-154-130 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, ± 12 , +24, +5 VDC power supply provides power for the assembly. The 2015-154-130 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2015-154-130 is assembled.

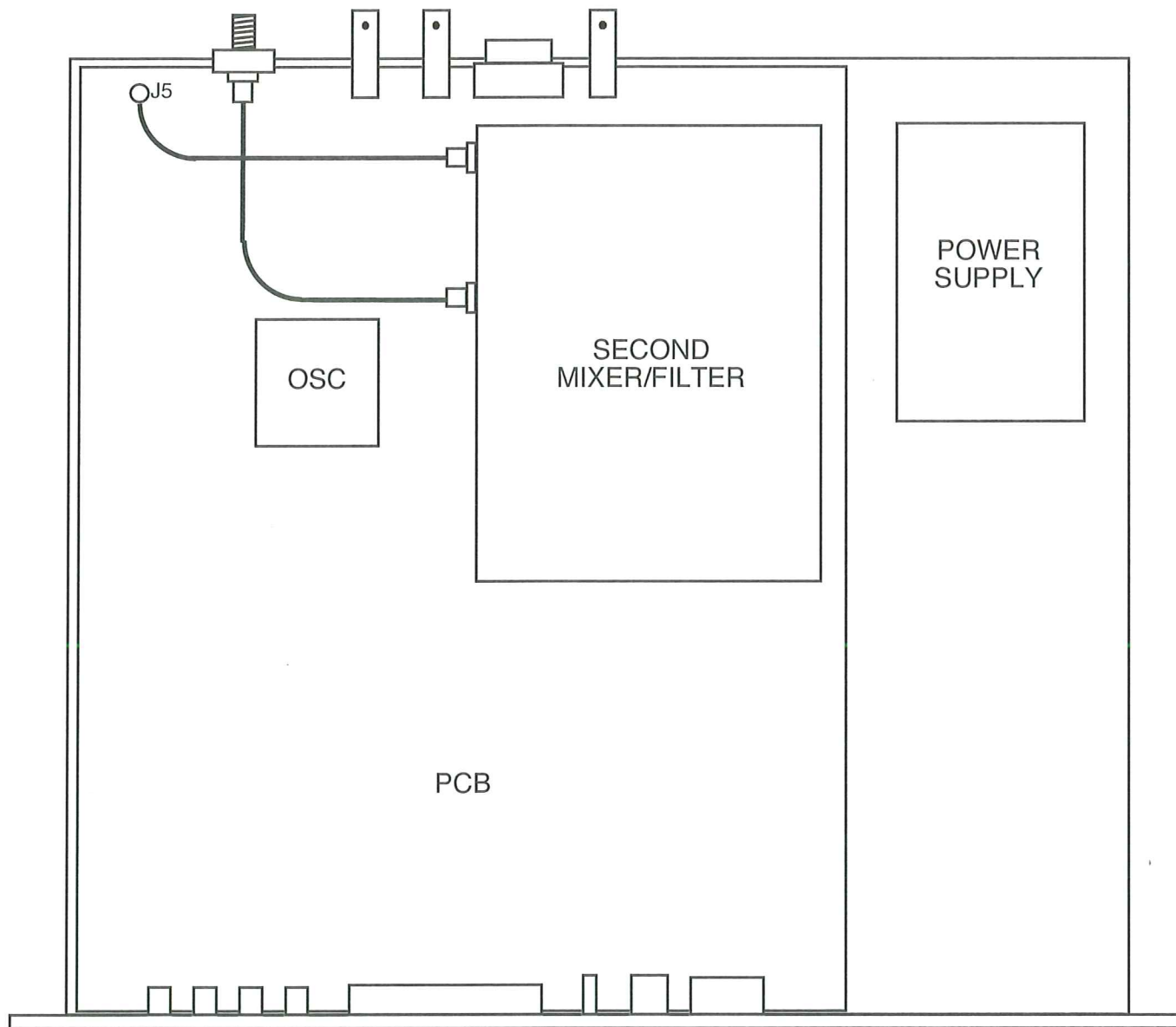


FIGURE 2.1 2015-154-130 Mechanical Assembly

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

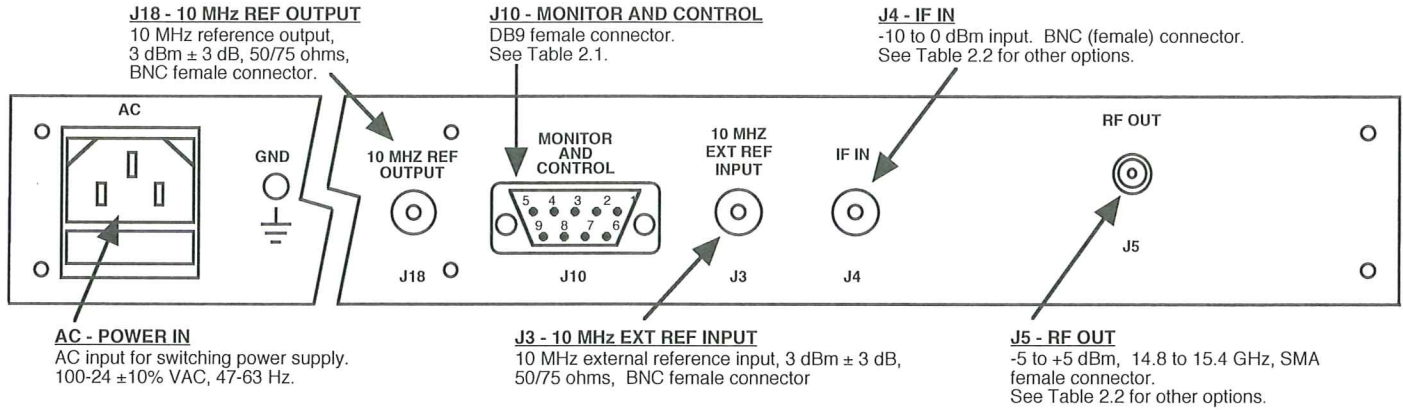


FIGURE 2.2 2015-154-130 Rear Panel Inputs and Outputs

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

TABLE 2.2 IF/RF Connector Options		
Option	IF	RF
STD	BNC, 75Ω	SMA, 50Ω
-S	BNC, 50Ω	SMA, 50Ω
-SS	SMA, 50Ω	SMA, 50Ω
-N	BNC, 75Ω	N-Type, 50Ω
-M	BNC, 50Ω	N-Type, 50Ω

*Interface: DB-9 Female
Protocol: RS485, RS422, or RS232C (selectable), 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit

2.3 Front Panel Controls and Indicators - Figure 2.3 shows the front panel controls and indicators.

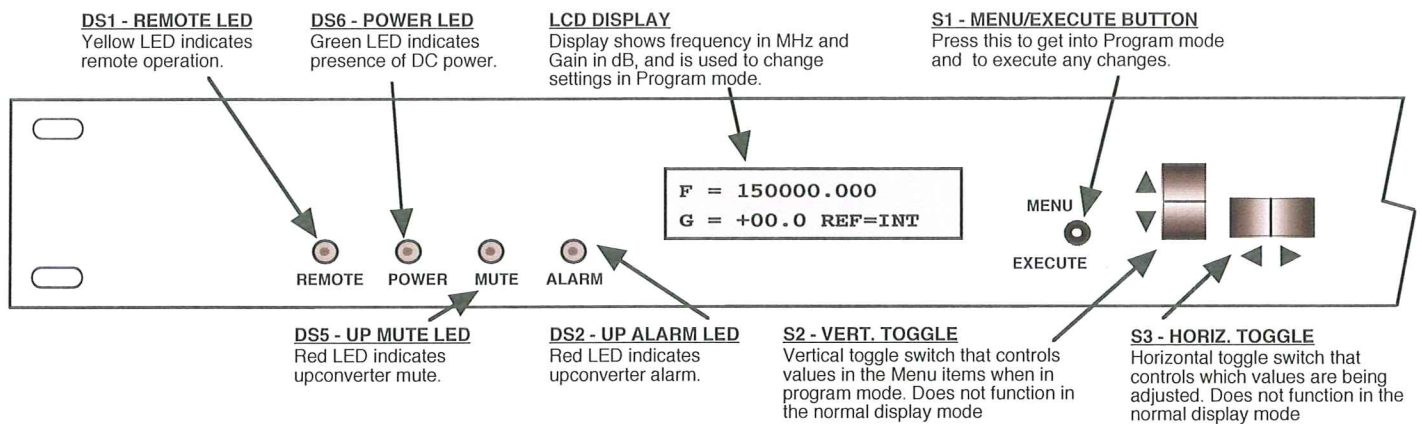


FIGURE 2.3 2015-154-130 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2015-154-130 Upconverter

1. Connect a -10 dBm to 0 dBm, 130 MHz signal to IF IN, J4 (Figure 2.2)
2. Connect RF OUT, J5, to the external equipment.
3. Connect 100- 240 \pm 10% 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 0 to +15 dB. *Make sure the output stays within -5 to +5 dBm with the gain selected and the input level provided. If the combination of gain and input level settings produce an output outside of the -5 to +5 dBm range than the spurious and 1dB compression performance may be compromised.*
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3).
8. 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.

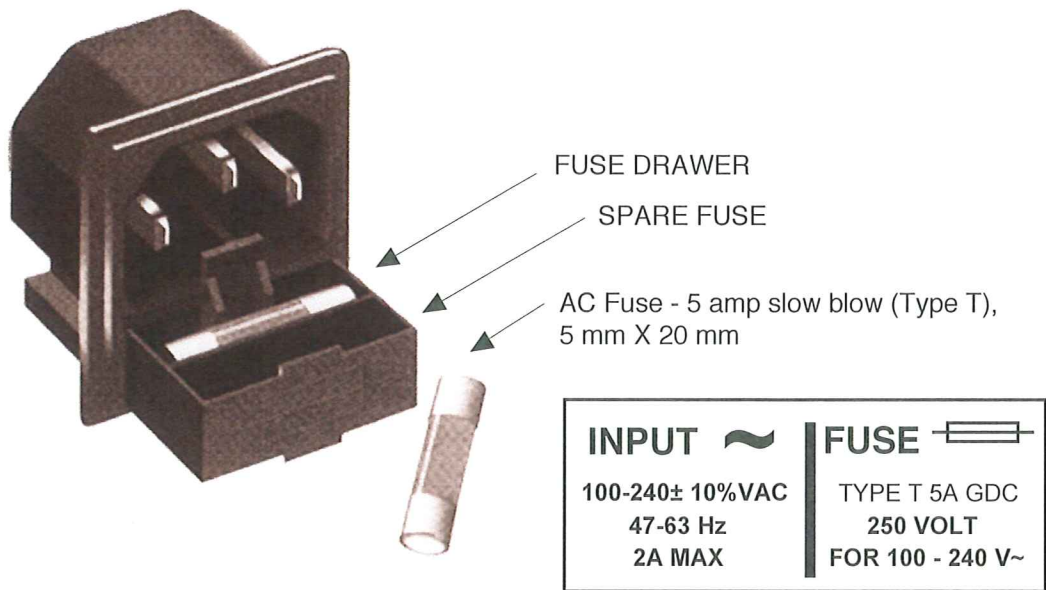


FIGURE 2.4 Fuse Location and Spare Fuse

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

Menu 1	Frequency in MHz
Menu 2	Input Level in dBm (-10 to 0)
Menu 3	Gain in dB (0 to +15 dB)
Menu 4	Mute TX Signal
Menu 5	Set Unit to Remote Operation
Menu 6	Select External 10 MHz Reference
Menu 7	Select RS232, RS422, or RS485 Remote Operation (option Q)
Menu 8	Select RS485 Remote Address for Unit (option Q)

Save Menu When “R” is selected in any of the above menus or when operator reaches the end

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

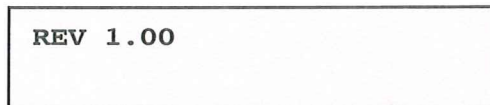
All program changes must start with the operation of the Menu/Execute switch and must also end with the operation of the Menu/Execute switch verified by the “Save Settings?” Menu. If this sequence is not followed, none of the changes will take effect. If programming is initiated and no operator action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

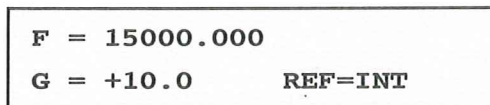
When power is first applied, the LCD display goes through three steps.

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



REV 1.00

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



F = 15000.000
G = +10.0 REF=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 changes, the vertical movement will raise or lower the number in the direction of the arrows.
 - B. For other functions such as 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:

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 = 15050.000      R
```

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

```
F = 15150.000      R
```

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

```
F = 15150.000      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:

```
INLVL = -10      R
```

OR you can scroll to “R”, push the Menu/Execute switch to get to:

```
SAVE SETTINGS?   Y 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 default display:

```
F = 15000.000  
G = +10.0      REF=INT
```

Figure 2.5 shows all the menu items and how to make changes.

2.5.5 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.

To change the 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 2.5 for the sequence of menu options). The following display is for changing the upconverter input level. This is an important setting to optimize spurious and should be made as accurately as possible:

INLVL = -10	R
--------------------	----------

NOTE: CHANGES TAKE PLACE ON LEVEL AND GAIN IMMEDIATELY BUT DO NOT GET SAVED UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

Press the Up/Down switch to change the level in 1 dB steps and then push the Menu/Execute switch to get to the Gain setting:

G = +10.0	R
------------------	----------

Press the Up/Down switch to change the gain in 1 or 10 dB steps:

G = +15.0	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 -10 dBm OR HAVE LESS THAN -30 dBm OUTPUT LEVEL. THE FIRMWARE DOES PREVENT 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:

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:

F = 15000.000
G = +10.0 REF=INT

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.

	ON POWER UP		
Power Up	REV 1.00		
<hr/>			
	NORMAL DISPLAY		
Normal Display	F = 15000.000 G = +00.0 REF=INT		PUSH BUTTON
<hr/>			
	PUSHING MENU/EXECUTE SEQUENCE		
Menu 1 Set Frequency	F = 15 <u>0</u> 50.000 R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 2 Set Input Level (from -10 to 0)	INLVL = - <u>1</u> 0 R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 3 Set Gain (0 to +15)	G = + <u>1</u> 0 R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 4 Mute TX signal	MUTE <u>O</u> FF R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 5 Set Unit to Remote Operation	REMOTE <u>O</u> FF R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 6 Select External 10 MHz Reference	EXT REF <u>O</u> FF R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 7 Set Remote Mode (option -Q ONLY)	<u>R</u> S 485 R	SCROLL <> SCROLL ↻	PUSH BUTTON
Menu 8 Set RS-485 Address (option -Q ONLY)	ADDRESS = <u>0</u> 0 R	SCROLL <> SCROLL ↻	PUSH BUTTON
Save Settings? At the end or when "R" is selected from any of the above menus	SAVE SETTINGS? <u>Y</u> N	SCROLL <>	PUSH BUTTON

FIGURE 2.5 Menu Display and Sequence

**FCC COMPLIANCE NOTICE
INSTALLATION REQUIREMENTS**

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the instructions listed in this user's manual, may cause interference to radio and television reception.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

NOTE: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to insure compliance.

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