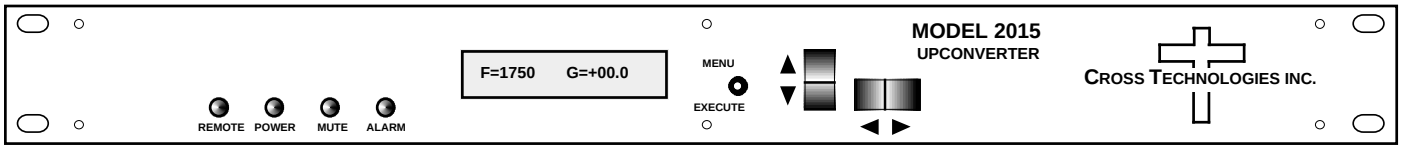
Instruction Manual

Model 2015-02U59
Upconverter

December 2014, Rev. 0



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INSTRUCTION MANUAL

MODEL 2015-02U59 Upconverter

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2015-02U59 Upconverter

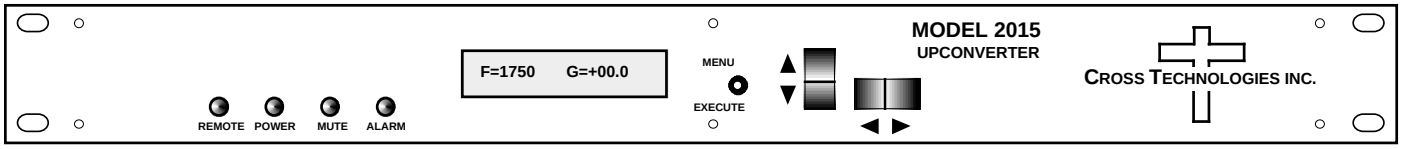
1.0 General

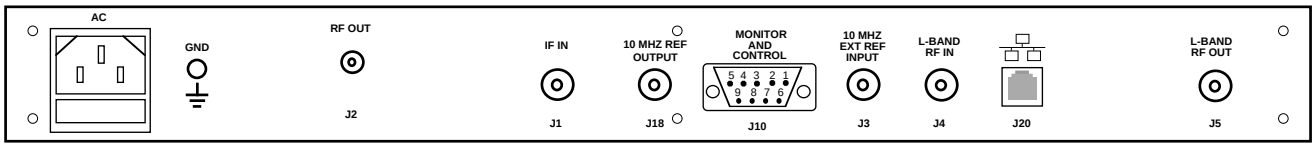
1.1 Equipment Description

The 2015-02U59 Upconverter consists of an agile IF to L-band upconverter (in 1 MHz steps;125 kHz and 100 kHz step options available) and a 950 to 1750 MHz to 5.85-6.65 GHz block upconverter with a fixed frequency LO and fixed gain.

For the agile IF to L-band upconverter, the front panel push button switches select the RF frequency, gain (-10 to +30 dB), and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow) and TX carrier MUTE (yellow). Remote operation allows selection of frequency and gain. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are 75Ω, BNC (female) for the IF input and the external reference input and output, 50Ω, BNC (female) for the L-band RF output and L-band input, and SMA for the C band RF output. It has a high stability (±0.01 ppm) 10 MHz reference. The 10 MHz output connector contains either the internal or external 10 MHz reference signal as selected locally or remotely. The unit is powered by a 100-240 ± 10% VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.

FRONT PANEL





REAR PANEL

FIGURE 1.1 Model 2015-02U59 Front and Rear Panels (shown with optional Ethernet)

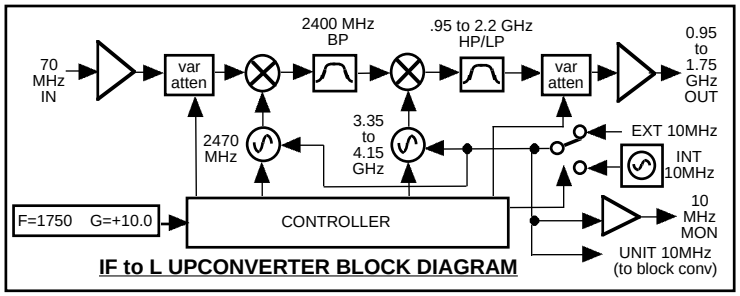


FIGURE 1.2 Model 2015-02U59 IF to L Block Diagram

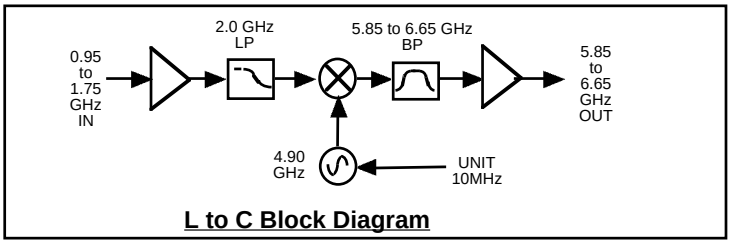


FIGURE 1.3 Model 2015-02U59 L to C Block Diagram

1.2 Technical Characteristics

TABLE 1.1 2015-02U59 Upconverter Specifications*		
Input Characteristics	**IF to L**	**L to C Block**
Impedance/Return Loss	75Ω/18 db	50Ω/14 db
Frequency	70 ± 18 MHz	0.95 - 1.75 GHz
Noise Figure, Maximum	20 dB at maximum gain	15 dB at maximum gain
Input Level Range	-40 to -10 dBm	-40 to -20 dBm
Output Characteristics		
Impedance/Return Loss	50Ω/12 dB	50Ω/14 dB
Frequency (GHz)	0.95 - 1.750 GHz	5.85 - 6.65
Output Level Range	-30 to -10 dBm	-20 to 0 dBm
1 dB comp., maximum gain	+0 dBm	+10 dBm
Mute @ 0 dBm Out	> 55 dB	N/A
Channel Characteristics		
Gain, maximum at Fc	+30 ± 2 dB	+20 to ±1 dB
Gain, range, 1 ± 1 dB steps	-10 to +30 dB	None
Frequency Response band	± 1.5 dB	± 1.0 dB
Frequency Response 36/40 MHz	± 0.5 / ± 1 dB	± 0.5 dB
Spurious, inband, signal rel. @ out	< -50 dBC, 0 dBm	-50 dBC, 0 dBm
Spurious, inband, signal independent	< -60 dBm	< -60 dBm
Spurious,Out of band (FL-0.5 GHz & FH+0.5	< -50 dBm	< -50 dBm
Intermod - 2 carriers 4 MHz space @ -10 dBm out each	< -50 dBC	< -55 dBm
Lo Frequency	1 MHz Step, variable	4.90 GHz
Frequency Sense	Non-inverting	Non-inverting

Synthesizer Characteristics	
Frequency Accuracy	± 0.01 ppm
Frequency Step, L-Band	1.0 MHz (125 kHz and 100 kHz step options available)
10 MHz Level (In or Out)	3 dBm, ± 3 dB, 75 ohms

Phase Noise @ F (Hz) >	*10*	*100*	*1K*	*10K*	*100K*	*1M*
L-Band -1 MHz steps: dBC/Hz	*-55*	*-70*	*-70*	*-80*	*-90*	*-110*
C Block fixed LO: dBC/Hz	*-55*	*-70*	*-80*	*-85*	*-100*	*-110*

Controls, Indicators, L-Band Converter	
Frequency / Gain Selection	Direct readout LCD; manual or remote selection
Power, Alarm, Remote, Mute	Green LED, Red LED, Yellow LED, Yellow LED
Remote	RS232C, 9600 baud (RS485, Ethernet Optional)

Technical Characteristics continued on page 4...

Technical Characteristics continued...

Other	
RF, IF Connectors	L-Band Converter, RF-50Ω, BNC (female), IF-75Ω, BNC (female)
RF, L-Band Connectors	C-Band Block Converter, RF-SMA (female), L-50Ω, BNC (female)
10 MHz Connectors	BNC (female), 75Ω works with 50 or 75 ohms(Option E)
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 watts max. (24, 48 VDC Optional)

Available Options - IF to L-Band Converter	
X or X 1	125 kHz or 100 kHz step size
Z or Z5	Attenuator 0.1 dB or 0.5 dB Steps
Communication Interface/Standard RS232	
Q	RS485 Remote Interface
W8	Ethernet, with Web Browser
W18	Ethernet, with Web Browser and SNMP
W28	Ethernet, with TCP/IP, Telnet®

*10˚C to 40˚C; Specifications subject to change without notice.

Connectors/Impedance

IF to L-Band Converter Options:

B - 75Ω BNC (RF), 75Ω BNC (IF)
D - 50Ω BNC (RF), 50Ω BNC (IF)
N - 50Ω N-Type (RF), 75Ω BNC (IF)
M - 50Ω N-Type (RF), 50Ω BNC (IF)
S7 - 50Ω SMA (RF), 75Ω BNC (IF)

L-Band to C Block Converter Options

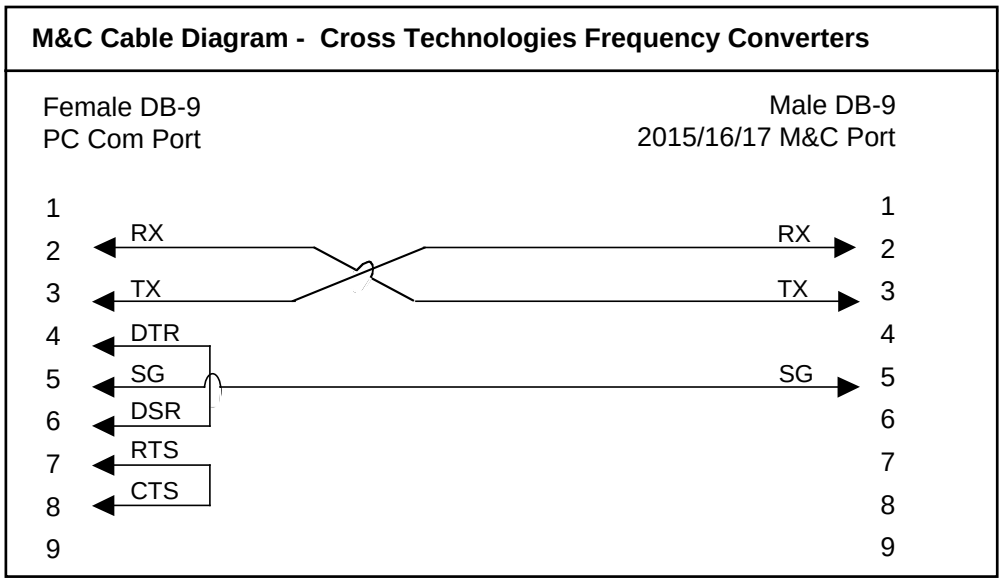
M - 50Ω N-Type (RF), 50Ω BNC (L-Band)
N - 50Ω N-Type (RF), 75Ω BNC (L-Band)
NN - 50Ω N-Type (RF), 50Ω N-Type (L-Band)
S7 - 50Ω SMA (RF), 75Ω BNC (L-Band)
SN - 50Ω SMA (RF), 50Ω N-Type (L-Band)
SS - 50Ω SMA (RF), 50Ω SMA (L-Band)

Contact Cross for other options.

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 2015-02U59 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 2015-02U59 Status Requests

Command	Syntax *	Description
Command Status	{aaS1}	Returns {aaS1bbbbcccddAM} where:
		• bbbb = Tx frequency (L-Band)
		4 characters - standard (7 characters - Option-X)
		• ccc = Tx gain
		• dd = Tx input level (10 to 40 => -10 to -40 dBm)
		• A = 0 - summary alarm
		• M = Tx RF Status (1 = Normal, 0 = Muted)
10 MHz Reference Status	{aaS2}	Returns {aaS2ER} where:
		• E = Ext 10MHz Status (1 = on, 0 = off)
		• R = 10MHz RF insertion status (1 = inserted, 0 = NOT inserted)

C) Commands Table 1.2 lists the commands for the 2015-02U59 and briefly describes them. After a command is sent the 2015-02U59 sends a return ">" indicating the command has been received and executed.

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

{ = start byte
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 2015-02U59 Commands

Command	Syntax*	Description
Set Transmitter Frequency	{aaC1xxxx}	where:
		• xxxx = 4 characters standard (7 characters -Option-X)
		• Range: 0950 to 1750 MHz, in 1 MHz steps
		0950.000 to 1750.000 in 1 kHz steps (option-X)
Set Input Level	{aaCIxx}	where:
		• xx = 2 characters
		• Range: 40 to 10 (-40 to -10 dBm, in 1 dB steps)
Set Transmit Gain	{aaC3xxx}	where:
		• xxx = 2 characters (0 to 30dB), 3 characters (-10 to -1dB)
		• Range: -10 to 30 (-10 dB to +30 dB, in 1 dB steps)
Enable 10MHz RF Insertion	{aaC5x}	where x =:
		• 0 to disable 10MHz RF insertion
		• 1 to enable 10MHz RF insertion
Enable Tx	{aaCAx}	where x =:
		• 0 to disable Tx signal
		• 1 to enable Tx signal
Enable External 10MHz	{aaCEx}	where x =:
		• 0 to disable External 10MHz ref signal
		• 1 to enable External 10MHz ref signal
Enable Remote	#	Just # sign
Disable Remote	{aaCR0}	{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 2015-02U59 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 2015-02U59 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2015-02U59 is assembled.

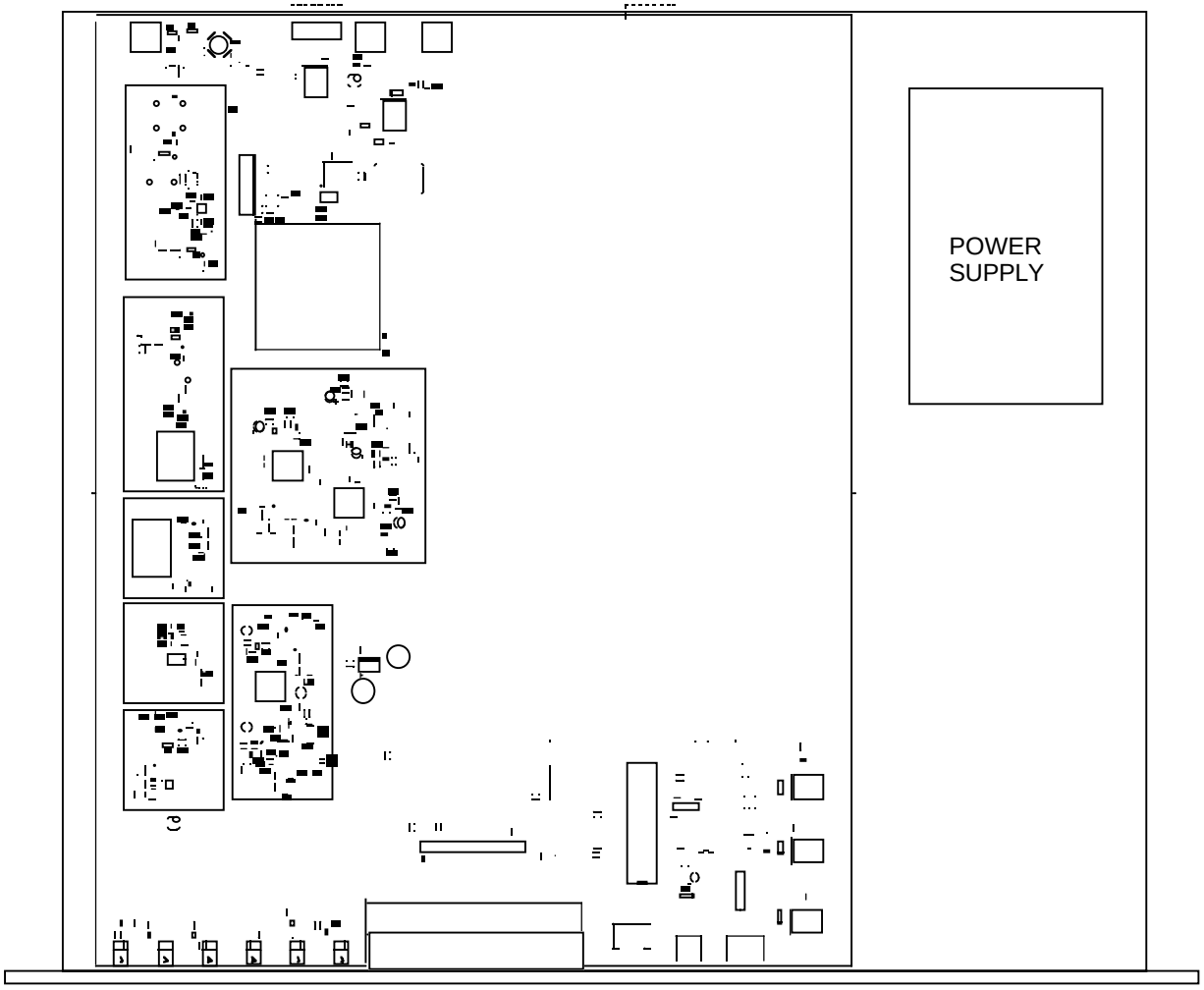


FIGURE 2.0 2015-02U59 Mechanical Assembly

2.2 Rear Panel Input/Output Signals - Figure 2.1 shows the input and output connectors on the rear panel.

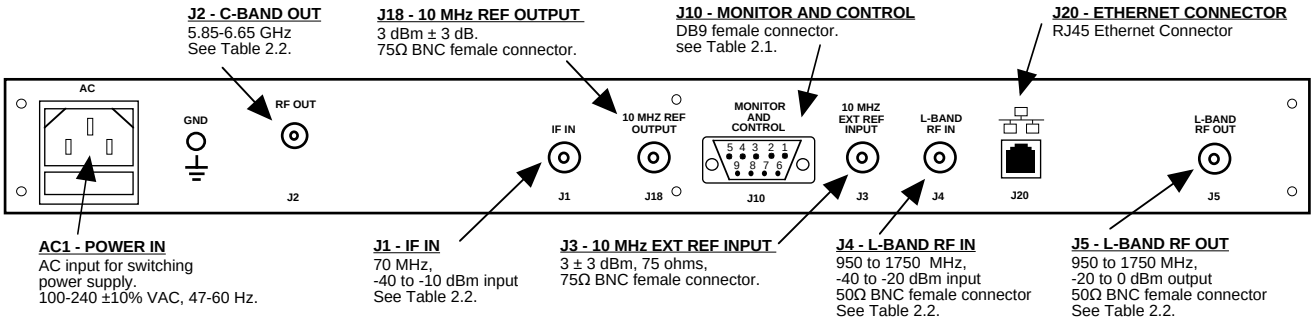


FIGURE 2.1 2015-02U59 Rear Panel I/O's

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 to L-Band Connector Options		
Option	**IF**	**RF**
STD	BNC, 75Ω	Type F, 75Ω
-B	BNC, 75Ω	BNC, 75Ω
-D	BNC, 50Ω	BNC, 50Ω
-N	BNC, 75Ω	Type N, 50Ω
-M	BNC, 50Ω	Type N, 50Ω
-S7	BNC, 75Ω	SMA, 50Ω

TABLE 2.2 L-Band to C Block Converter Options		
Option	**IF**	**RF**
STD	BNC, 50Ω	Type F, 75Ω
-M	BNC, 50Ω	Type N, 50Ω
-N	BNC, 75Ω	Type N, 50Ω
-NN	N-Type, 50Ω	Type N, 50Ω
-S7	BNC, 75Ω	SMA, 50Ω
-SN	Type N, 50Ω	SMA, 50Ω
-SS	SMA, 50Ω	SMA, 50Ω

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

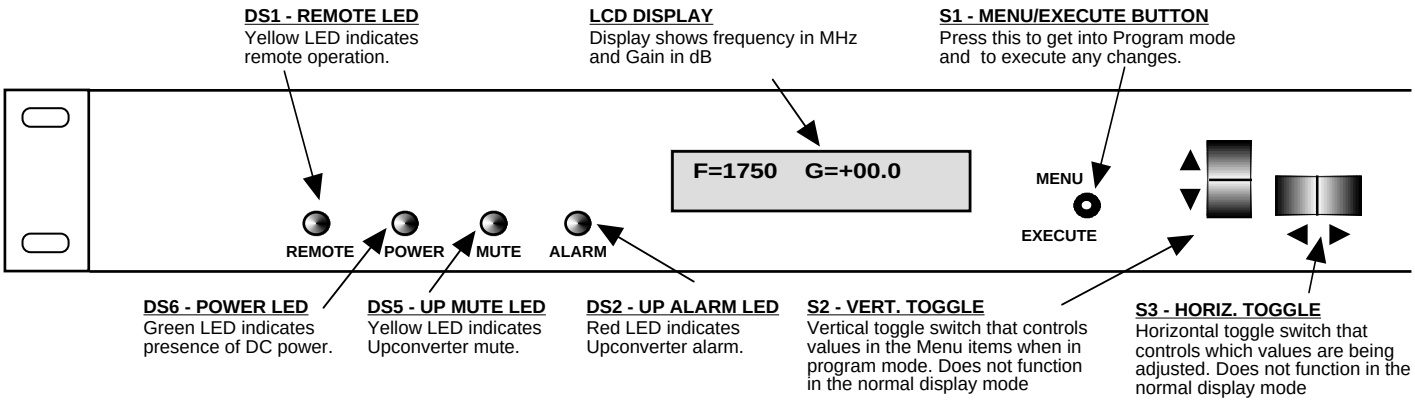


FIGURE 2.2 2015-02U59 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2015-02U59, Upconverter Section

1. Connect a -40 dBm to -10 dBm signal to IF In, J1 (Figure 2.1).
2. Connect the RF OUT, J5, to the L-Band RF In, J4.
3. Connect the Ku-Band RF Out, J2, to the external equipment.
4. Connect the 100-240 ±10% VAC, 47 - 63 Hz to AC1 on the back panel.
5. Set the desired output frequency (See Section 2.5 Menu Settings).
6. Set the input level (See Section 2.5 Menu Settings).
7. 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).
8. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.2).
9. Options -V, -V41, -V48 only - To insert SSPB Voltage, +24, +V48 VDC on the RF center pin install 2.5A fast blo fuse in F2 and check that DS7 lights yellow (Figure 2.1).
10. **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.

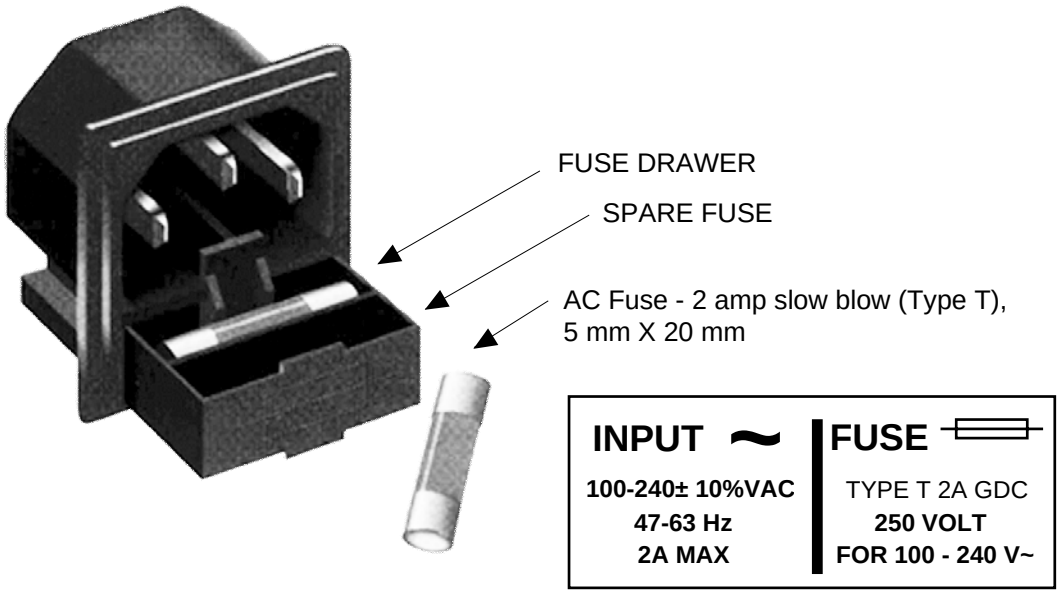


FIGURE 2.3 Fuse Location and Spare Fuse

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 2.4):

Power Up
Normal Display

Menu 1 Frequency in MHz
Menu 2 Input Level (Set from -40 to -10)
Menu 3 Gain (-10 to +30, 1dB steps (0.1dB steps, option -Z))
Menu 4 Up Mute
Menu 5 Set Unit to Remote Operation
Menu 6 Select External 10 MHz Reference
Menu 7 Select Reference Out
Menu 8 Set Remote mode (option -Q)
Menu 9 Set RS-485 address (option -Q)
Menu 10 View PCB Temperature (option -T)
Menu 11 View SSPB Current (option -V)

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.

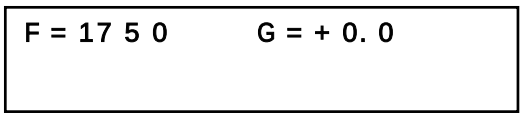
2.5.2. Power On Settings

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

3. The present frequency and gain 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:

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 Upconverter frequency:

```
FREQ=1750          R
```

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

```
FREQ=1650          R
```

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

```
FREQ=1650          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=-20      R
```

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

```
SAVE SETTINGS? YN
```

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 :

```
F=1750      G=+0.0
```

Figure 2.4 gives 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.

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:

```
UP INLVL=-20      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:

```
GAIN =+20         R
```

Pressing the Up/Down switch to change the gain in 1 or 10 dB steps and then push the Menu/Execute switch to get to the Gain setting:

```
GAIN =+20         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 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:

```
SAVE SETTINGS? YN
```

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 :

```
F=1750      G=+0.0
```

Figure 2.4 gives the menu items and how to make changes

2.5.5 Alarm Indications

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

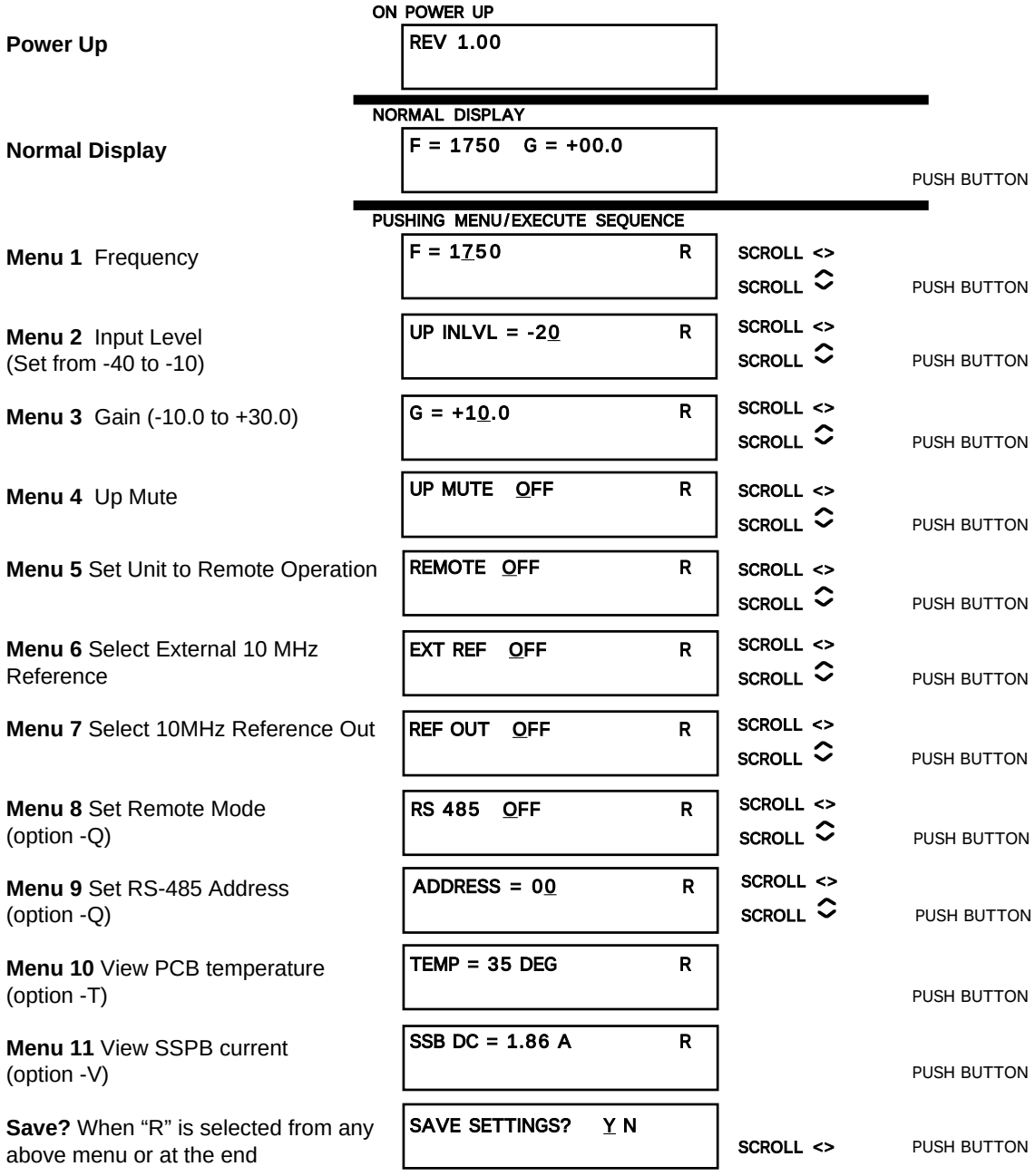
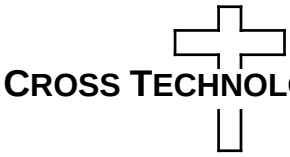


FIGURE 2.4 Menu Display and Sequences



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