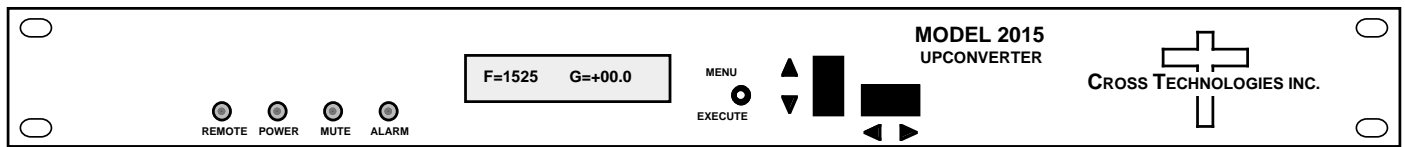


Instruction Manual

Model 2015-04-720 Upconverter

December 2018, Rev. 0



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INSTRUCTION MANUAL

MODEL 2015-04-720 Upconverter

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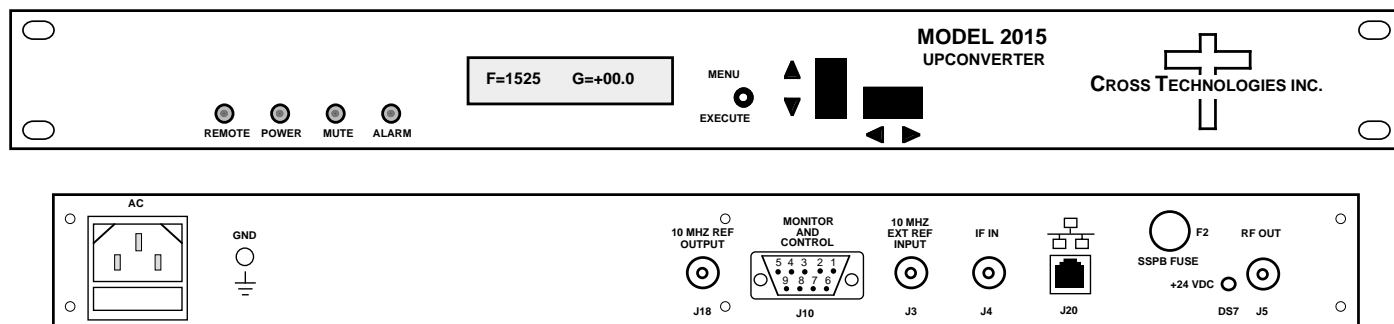
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MODEL 2015-04-720 Upconverter

1.0 General

1.1 Equipment Description

The 2015-04-720 L-band Upconverter converts 720 ± 36 MHz to 950 to 2150 MHz in 1 MHz steps (125 kHz to 1 kHz step options available). Synthesized local oscillators (LO) provide frequency selection. 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) and TX carrier MUTE (yellow). Variable attenuators for the IF input and RF output provide a gain range of 0 to +40 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 and the optional external reference input and output, and 75Ω BNC for the RF output. SSPB +24 or +48 VDC inserted on the RF line is optional. External 10 MHz option E includes a 10 MHz output connector which contains either the internal or external 10 MHz reference signal that can also be inserted on the RF line. A high stability option H (± 0.01 ppm) is also available. It is powered by a $100\text{-}240 \pm 10\%$ VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.



2015-04-720 Front and Rear Panels (Shown with Options E, V, W8)

FIGURE 1.1 Model 2015-04-720 Front and Rear Panels

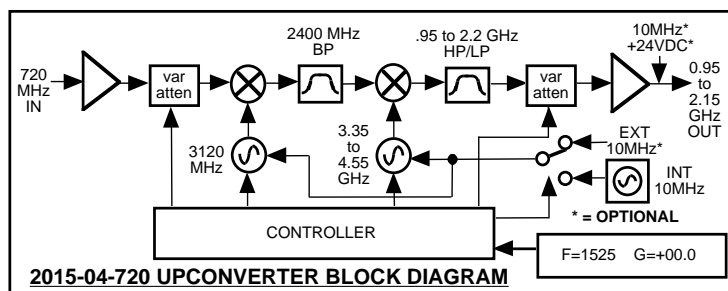


FIGURE 1.2 Model 2015-04-720 Upconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.0 2015-04-720 Upconverter Specifications*

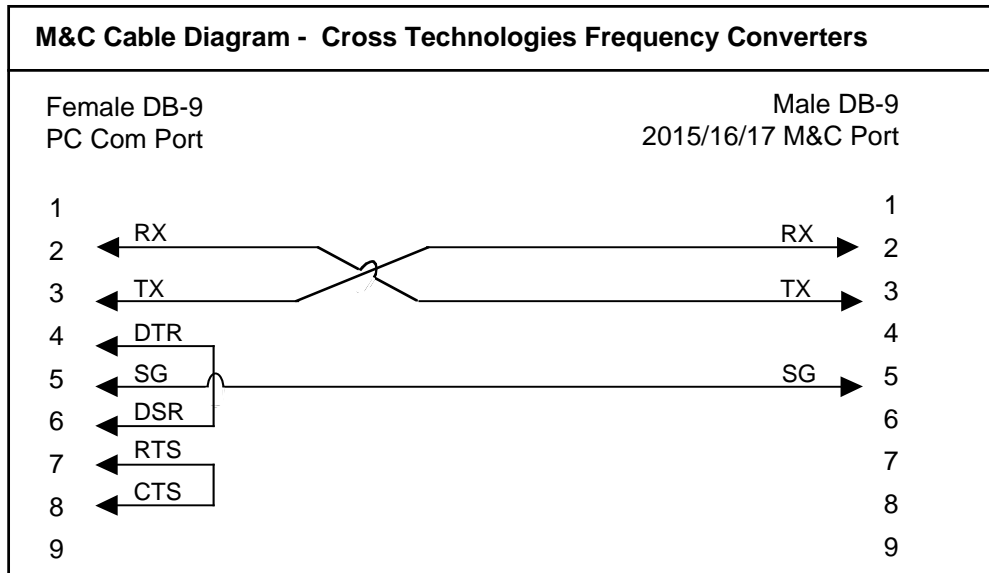
Input Characteristics (IF)						
Impedance / Return Loss	50Ω / 14 dB, 16 dB typical					
Frequency	720 ±36 MHz					
Input Level Range	-50 to -20 dBm					
Output Characteristics (RF)						
Impedance / Return Loss	75Ω / 12 dB					
Frequency	950 to 2150 MHz					
Output Level	0 to -20 dBm					
Output 1 dB Compression	+10 dBm					
Channel Characteristics						
Gain, maximum	+40.0 ±1 dB at 1.45 GHz					
Gain range (adjustable)	0 to 40 dB, 1 ±1 dB steps					
Spurious Response	< -50 dBC, in band					
Group Delay, max.	0.0035 ns/MHz ² parabolic; 0.035 ns/MHz linear; 1 ns ripple					
Frequency Sense	Non-inverting					
Synthesizer Characteristics						
Frequency Accuracy	± 1.0 ppm max over temp (+0.01 ppm, option H)					
Frequency Step	1.0 MHz (125 kHz to 1 kHz step options available)					
10 MHz Level (In or Out)	3 dBm , ± 3 dB, 75 ohms (option - E)					
Phase Noise @ F (Hz) >	10	100	1K	10K	100K	1M
dBC/Hz	-55	-70	-70	-80	-90	-110
Controls, Indicators						
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)					
Other						
RF, IF Connectors	75 Ω BNC (female), 50 Ω 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	100-24 ±10% VAC, 47-63 Hz, 25 watts maximum					
Available Options			Communication Interface/Std. RS232			
- E	External 10 MHz Ref. In & Out; RF Ins.		- Q	RS485 Remote Interface		
- H	High Stability (± 0.01ppm) internal ref.		- W8	Ethernet; with Web Browser		
- V	SSPB Voltage, +24 VDC, 2.5 amps		- W18	Ethernet; with Web Browser & SNMP		
- V48	SSPB Voltage, +48 VDC, 1.25 amps		- W28	Ethernet; with TCP/IP, Telnet®		
- Z	Attenuator 0.1 dB Steps, Upconverter		- W828	Ethernet; W8 +W18 +W28		
- X or X1	125 kHz Step or 100 kHz Step Size		Connectors/ Impedance			See page10
- X1002	1 kHz Step, includes Option -H					

*+0 to +50 degrees 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 1.1 lists the status requests for the 2015-04-720 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 2015-04-720 Status Requests		
Command	Syntax*	Description
Command Status	{aaS1}	Returns {aaS1bbbbccddAM} where:
		• bbbb = Tx frequency
		4 characters - standard (7 characters - Option-X)
		• ccc = Tx gain (0 to 40)
		• dd = Tx input level (20 to 50 => -20 to -50 dBm)
		• A = 0 - Summary alarm
		• M = 0 - Transmit signal disabled (muted)
External 10MHz (option -E)	{aaS2}	Returns {aaS2bcd} where:
		• b = 1 - External 10MHz selected
		• c = 1 - 10MHz inserted on upconverter RF (J5)
		• d = 1 - 10MHz inserted on downconverter RF (J2)
SSPB Current (option -V)	{aaS4}	Returns {aaS4bbb} where:
		• bbb = SSPB current, range 000 to 250 (0 to 2500 ma)

C) Commands

Table 1.2 lists the commands for the 2015-04-720 and briefly describes them. After a command is sent the 2015-04-720 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 2015-04-720 Commands		
Command	Syntax*	Description
Set Transmitter Frequency	{aaC1xxxx}	where: <ul style="list-style-type: none"> • xxxx = 4 characters standard (7 characters -Option-X) • Range: 0950 to 2150 MHz, in 1 MHz steps 0950.000 to 2150.000 in 1 kHz steps (option-X)
Set Input Level	{aaC1xx}	where: <ul style="list-style-type: none"> • xx = 2 characters • Range: -50 to -20 (-50 to -20 dBm)
Set Transmit Gain	{aaC3xxx}	where: <ul style="list-style-type: none"> • xxx = 2 or 3 characters • Range: (0 dB to 40 dB, in 1 dB steps)
Enable Tx	{aaCAx}	where x =: <ul style="list-style-type: none"> • 0 to disable Tx signal • 1 to enable Tx signal
Insert 10MHz on RF (option -E)	{aaC5x}	where x =: <ul style="list-style-type: none"> • 0 to disable 10MHz upconverter insertion on RF (J5) • 1 to enable 10MHz upconverter insertion on RF (J5)
External 10MHz (option -E)	{aaCEx}	where x =: <ul style="list-style-type: none"> • 0 to disable External 10MHz ref signal • 1 to enable External 10MHz ref signal
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}*}	{CR and zero}

1.4 Environmental Use Information

- A. 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 T_{mra} .
- B. 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.
- C. Mechanical loading** - Mounting of equipment in a rack should be such that a hazardous condition does not exist due to uneven weight distribution.
- D. 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.
- E. 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).
- F. 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 2015-04-720 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 2015-04-720 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2015-04-720 is assembled.

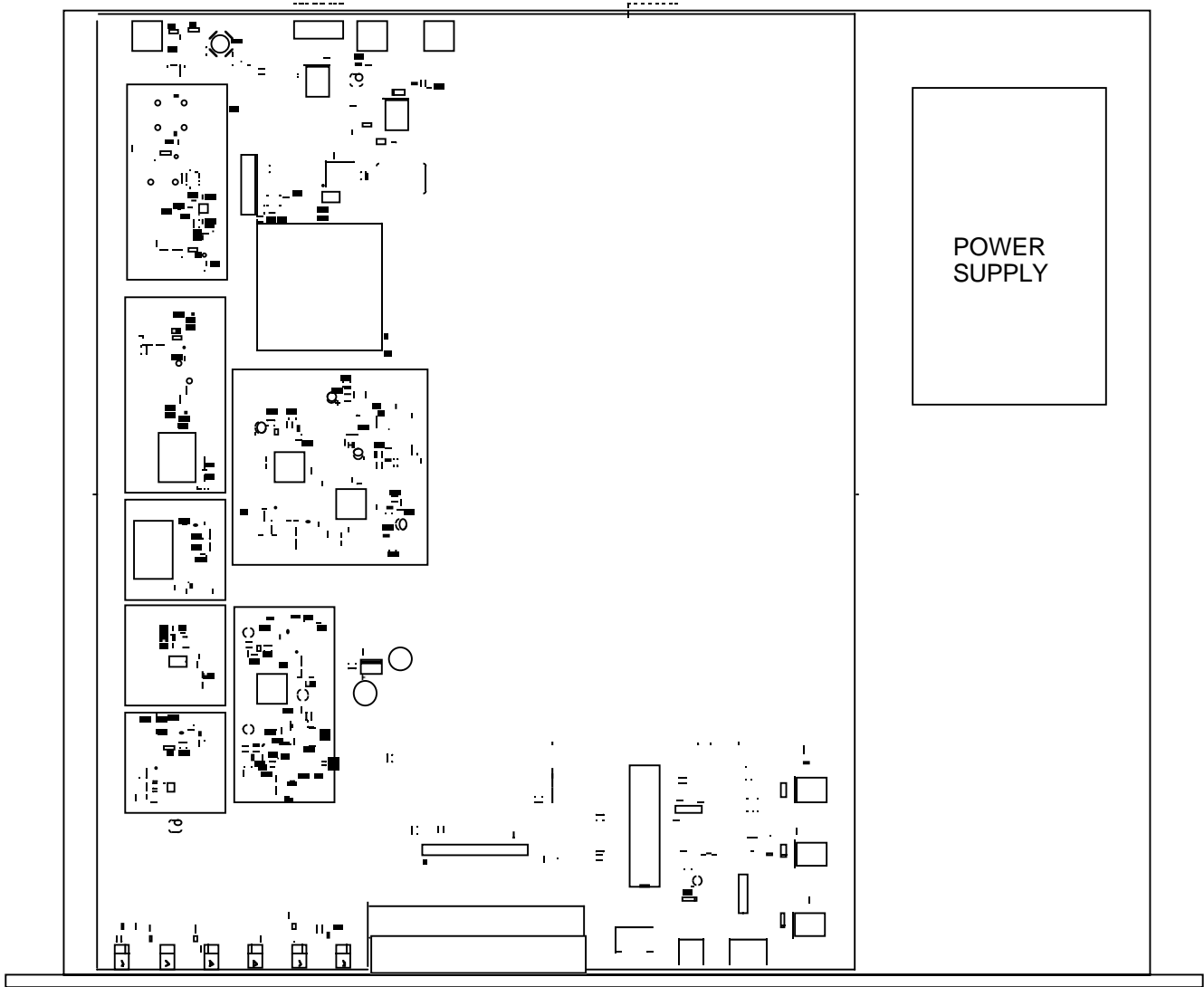


FIGURE 2.0 2015-04-720 Mechanical Assembly

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

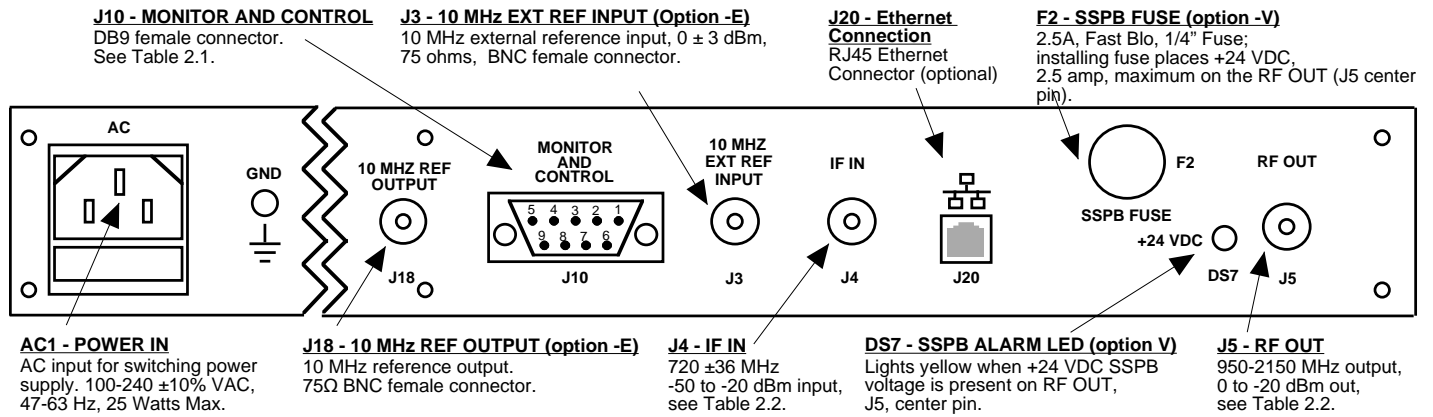


FIGURE 2.1 2015-04-720 Rear Panel I/O's

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

*Remote Serial Interface

Interface: DB-9 Male

Protocol: RS-232C, 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, 50 Ω	BNC, 75 Ω
-B	BNC, 75 Ω	BNC, 75 Ω
-C	BNC, 75 Ω	BNC, 50 Ω
-D	BNC, 50 Ω	BNC, 50 Ω
-N	BNC, 75 Ω	Type N, 50 Ω
-M	BNC, 50 Ω	Type N, 50 Ω

*Contact Cross Technologies for other options.

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

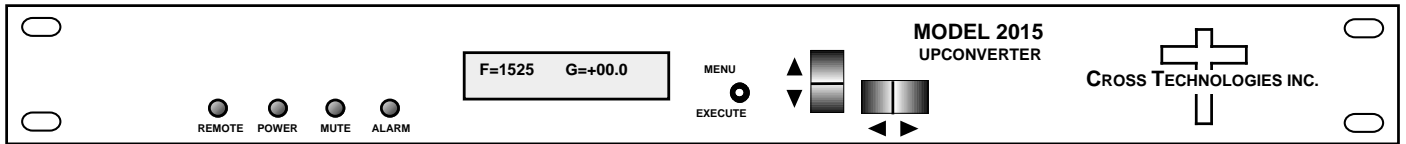


FIGURE 2.2 2015-04-720 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2015-04-720, Upconverter Section

1. Connect a -50 dBm to -20 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 AC1 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 0 to -20 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. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.2).
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 2.3. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

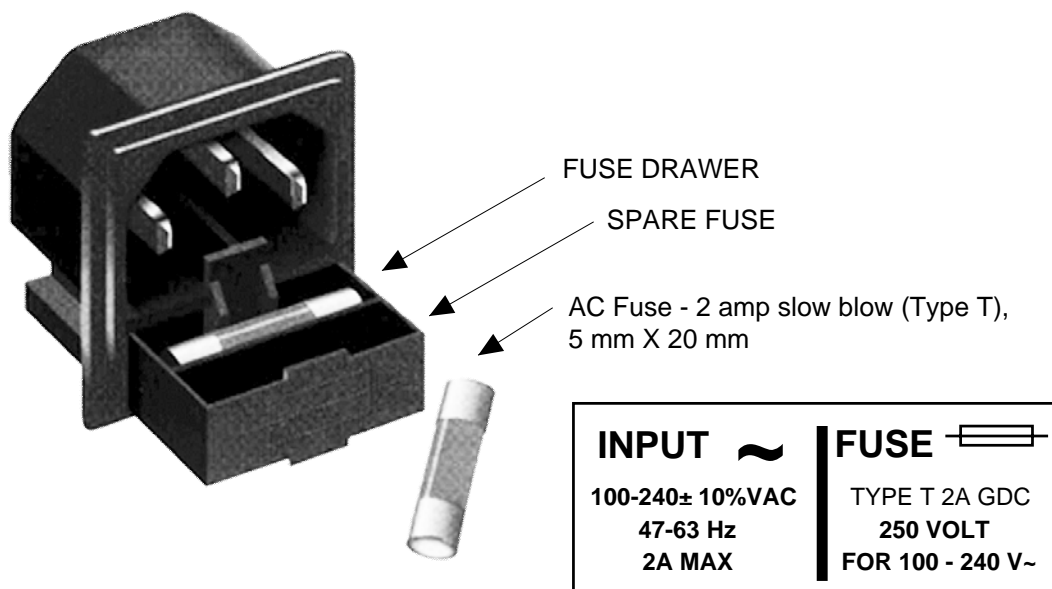


FIGURE 2.3 Fuse Location and Spare Fuse

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

Power Up

Normal Display

Menu 1 Frequency in MHz

Menu 2 Input Level (Set from -50 to -20)

Menu 3 Gain (0 to 40, 1dB steps (0.1dB steps, option -Z))

Menu 4 Up Mute

Menu 5 Set Unit to Remote Operation

Menu 6 Select External 10 MHz Ref (option -E)

Menu 7 Select Reference Out (option -E)

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 “R” is selected from any menu or at 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 its previous settings.

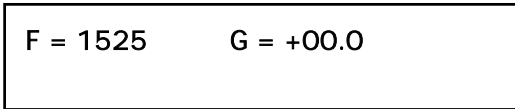
When power is first applied, the LCD display goes through three steps.

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



REV 1.00

3. The present frequency and gain of the upconverter is shown.



F = 1525 G = +00.0

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 2.4 for the sequence of menu options. The following display is for changing the upconverter frequency:

```
FREQ = 1 4 5 0      R
```

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

```
FREQ = 1 3 5 0      R
```

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

```
FREQ = 1 3 5 0      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 0      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 :

```
F = 1525      G = +00.0
```

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.

To change the UP CONVERTER GAIN, first push the Menu/Execute switch until you get to the gain setting:

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 IN LVL = - 2 0 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 A I N = + 2 0 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:

```
G A I N = + 2 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 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? 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 :

```
F = 1525 G = +00.0
```

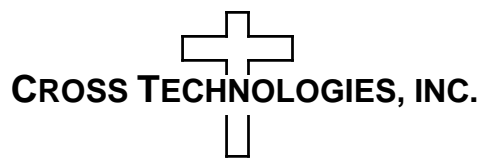
Figure 2.4 gives the menu items and how to make changes

2.5.5 Alarm Indications

An alarm condition 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.

Power Up	ON POWER UP REV 1.00		
Normal Display	NORMAL DISPLAY F = 1525 G = +00.0		PUSH BUTTON
Menu 1 Frequency	PUSHING MENU/EXECUTE SEQUENCE F = 1450 R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 2 Input Level (Set from -50 to -20)	UP INLVL = -20 R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 3 Gain (0 to 40)	G = +10.0 R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 4 Up Mute	UP MUTE OFF R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 5 Set Unit to Remote Operation	REMOTE OFF R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 6 Select External 10 MHz Reference (option -E)	EXT REF OFF R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 7 Select 10MHz Reference Out (option -E)	REF OUT OFF R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 8 Set Remote Mode (option -Q)	RS 485 OFF R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 9 Set RS-485 Address (option -Q)	ADDRESS = 00 R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 10 View PCB temperature (option -T)	TEMP = 35 DEG R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Menu 11 View SSPB current (option -V)	SSB DC = 1.86 A R	SCROLL <> SCROLL ⇄	PUSH BUTTON
Save? When "R" is selected from any above menu or at the end	SAVE SETTINGS? Y N	SCROLL <>	PUSH BUTTON

FIGURE 2.4 Menu Display and Sequences



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