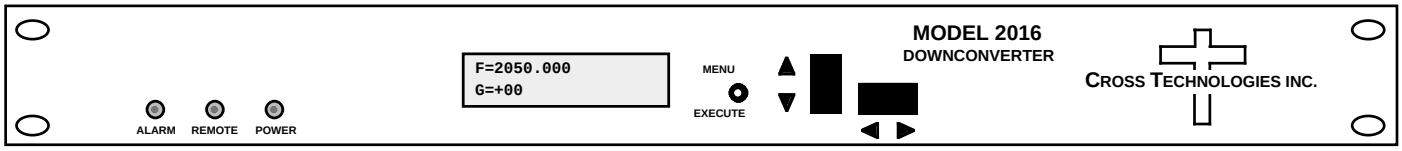
Instruction Manual

Model 2016-225
Downconverter

January 2013, Rev. E



When ordering parts from Cross Technologies, Inc., be sure to include the equipment model number, equipment serial number, and a description of the part.

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INSTRUCTION MANUAL

MODEL 2016-225 Downconverter

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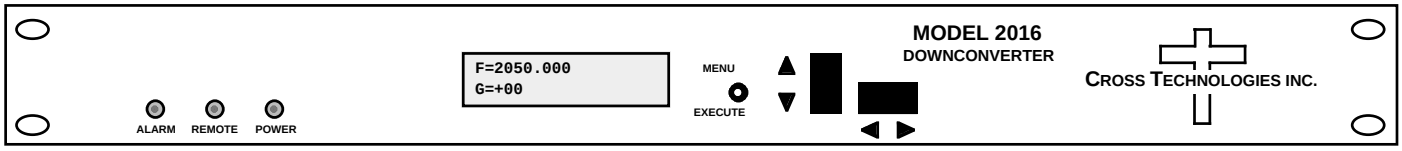
MODEL 2016-225 Downconverter

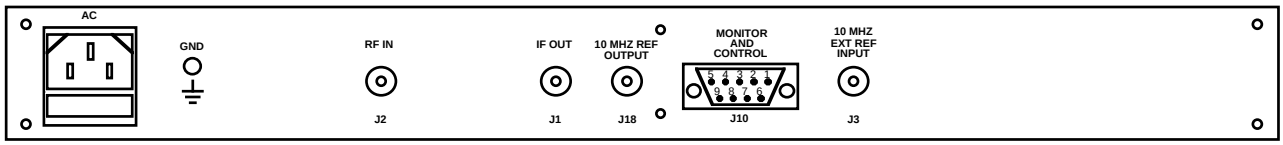
1.0 General

1.1 Equipment Description

The 2016-225 Downconverter converts 2.0 to 2.5 GHz to 70 ± 18 MHz in 1kHz, 10kHz, 100kHz or 125kHz steps (user selectable) with low group delay and flat frequency response. Synthesized local oscillators (LO) provide very low phase noise and ±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), and remote operation (yellow). Variable attenuators provide a gain range of 0 to +50 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 output and the optional external reference input and output (**option E**). The unit is powered by a 100-240 ±10% VAC power supply, and housed in a 1RU X 16" chassis.



FRONT PANEL



REAR PANEL

FIGURE 1.1 Model 2016-225 Front and Rear Panels

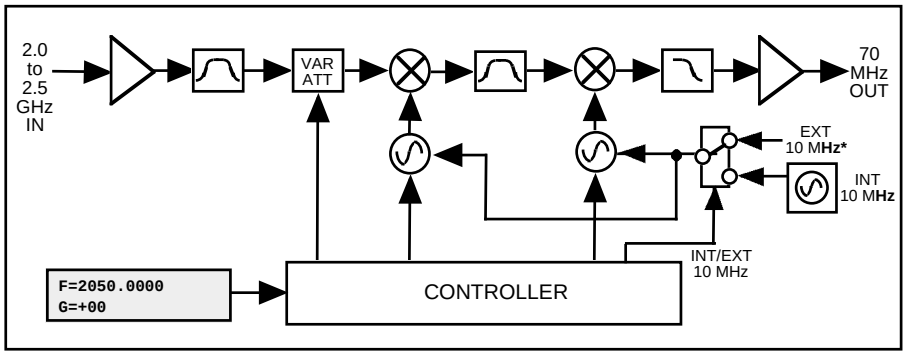


FIGURE 1.2 Model 2016-225 Downconverter Block Diagrams

1.2 Technical Characteristics

TABLE 1.0 2016-225 Downconverter Specifications*

Input Characteristics

Impedance/Return Loss	50Ω / 12 dB
Frequency	2.0 to 2.5 GHz
Level	-70 to -20 dBm
1dB compression	-15 dBm

Output Characteristics

Impedance/Return Loss	50Ω / 18 dB
Frequency	70 ± 18 MHZ
Output level/max linear	-20 dBm / -10 dBm
1dB compression	-5 dBm

Channel Characteristics

Gain range (adjustable)	0 to +50.0 dB
Image Rejection	> 50 dB, min.
Spurious Response	< -50 dBC in band
Frequency Response	±1.5 dB, 2000 - 2500 MHz; ± 0.5 dB, 36 MHz BW
Group Delay, max	0.015 ns/MHz^2 (parabolic), 0.05 ns/MHz (linear); 1 ns ripple
Frequency Sense	Inverting or Non-inverting (selectable)

Synthesizer Characteristics

Frequency Accuracy	± 0.01 ppm max over temp
Frequency Step	1, 10, 100, or 125 kHz (selectable)
10 MHz Level (In/Out)	+3 dBm ± 3 dB (**option E**)

Phase Noise @ Freq	100 Hz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-72	-85	-88	-110	-120

Controls, Indicators

Frequency Selection	direct readout LCD; pushbutton switches
Gain Selection	direct readout LCD; pushbutton switches
Power	Green LED
Alarm	Red LED
Remote	Yellow LED, RS 232C, 9600 baud (RS 422/485, **option Q**)

Other

RF Connector	BNC (female)
IF Connector	BNC (female)
10 MHz Connectors	BNC (female), 50Ω/75Ω (**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

Options

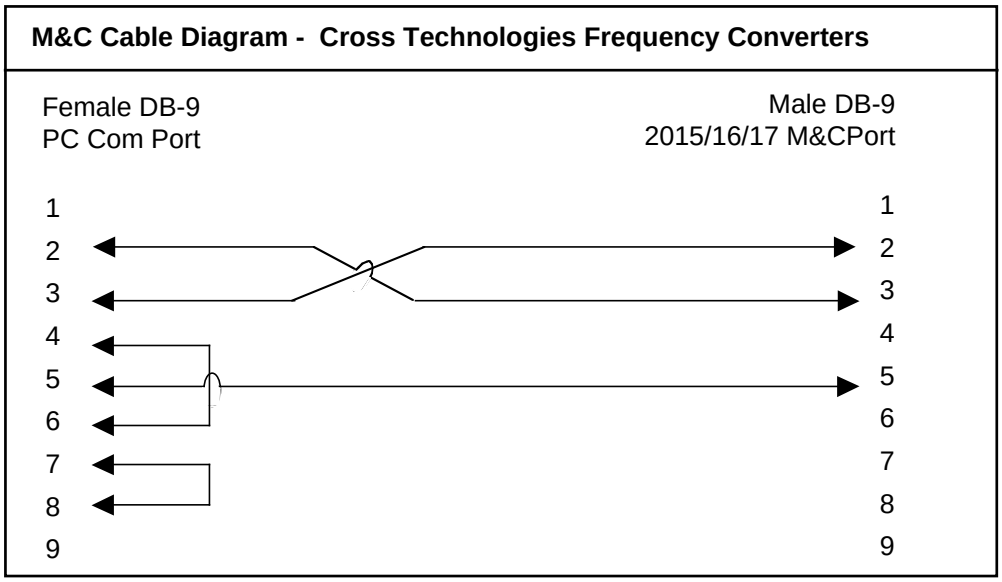
E	Allows ext. 10 MHz ref input
Q	RS-422/485 remote capability
T -	Temperature Sensor
W8	Ethernet with Web Browser
W28	Ethernet with TCP/IP, *Telnet*®
W32	P1dB Compression = +10 dBm, Max. Output Level = 0 dBm
Connector Options	See TABLE 2.2

*+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 female

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 2016-225 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 2016-225 Status Requests

Command	Syntax*	Description
Command Status	{aaS1}	Returns {S1bbbbbbbccIA} where:
		• bbbbbbb = Rx frequency (7 characters)
		• cc = Rx gain
		• I = 0 - non-inverted Receiver; I = 1 - inverted
		• A = Summary Alarm; 1=Alarmed, 0=Normal
10MHz Ref Status	{aaS2}	Returns {S2E} where:
(option E only)		• E = 1 - external 10 MHz switched in

C) Commands

Table 1.2 lists the commands for the 2016-225 and briefly describes them. After a command is sent the 2016-225 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 2016-225 Commands

Command	Syntax*	Description
Set Receiver Frequency	{aaC2xxxxxxx}	where:
		• xxxxxxx = 7 characters
		• Range: 2000000 to 2500000 kHz
Set Receiver Gain	{aaC4xx}	where:
		• xx = 2 characters
		• Range: 00 to 50 (0 dB to +50 dB, in 1 dB steps)
Enable Spectrum Invert	{aaC7x}	where x =:
		• 0 to disable spectrum invert
		• 1 to enable spectrum invert
Enable External 10MHz IN	{aaCEx}	where x =:
(option E only)		• 0 to disable External 10MHz ref signal
		• 1 to enable External 10MHz ref signal
Enable Remote	#	Just # sign
Disable Remote	{aaCR0}	{CR and zero}

2.0 Installation

2.1 Mechanical

The 2016-225 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 2016-225 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2016-225 is assembled.

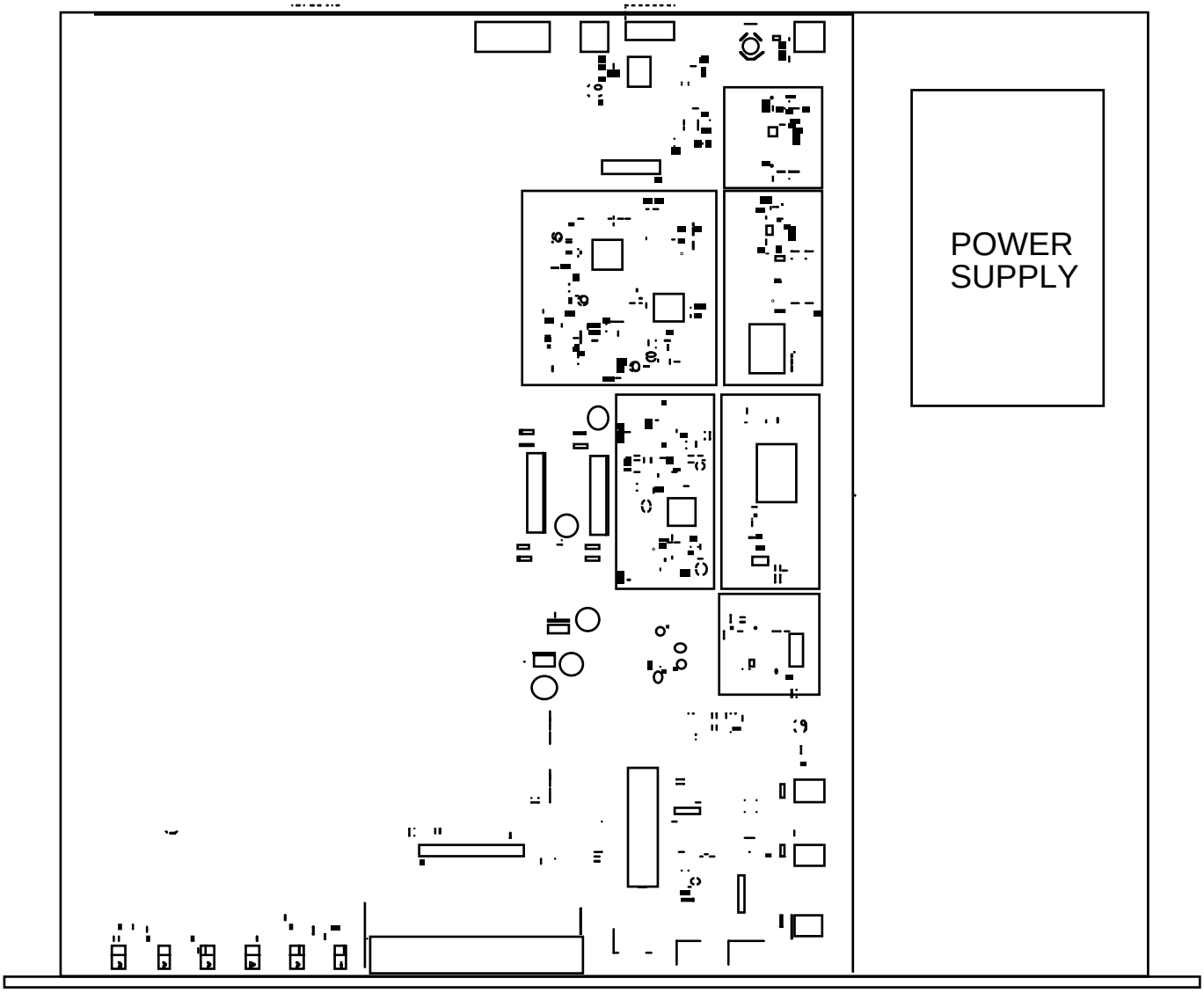


FIGURE 2.1 Model 2016-225 Downconverter Assembly

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

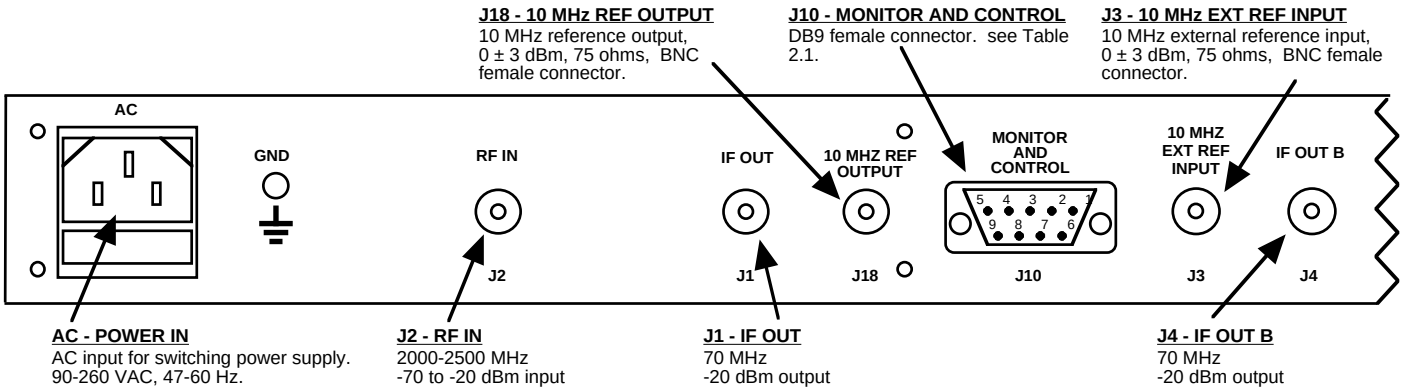


FIGURE 2.2 2016-225 Downconverter Rear Panel Inputs/Outputs

Table 2.1 J10 Pinouts (RS-485/RS-422/RS-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	Output Level Detector, 0 to +5 VDC (option W1 ONLY)
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

TABLE 2.2 IF/RF Connector Options

Option	IF	RF
STD	BNC, 50Ω	BNC, 50Ω
B	BNC, 75Ω	BNC, 75Ω
D	BNC, 50Ω	BNC, 50Ω
N	BNC, 75Ω	Type N, 50Ω
M	BNC, 50Ω	Type N, 50Ω

Option W1 Level Detector - Provides 0 to +5 VDC level indication for -60 to -30 dBm 70 MHz output. The DC voltage comes out on pin 8 of the DB9 connector, J10, with pin 5 being ground. The impedance of the 0 to +5 VDC level indication signal is 1kΩ. The relation between the change in output level and the change in DC voltage is linear.

2.3 Front Panel Controls and Indicators

Figure 2.3 shows the front panel controls and indicators.

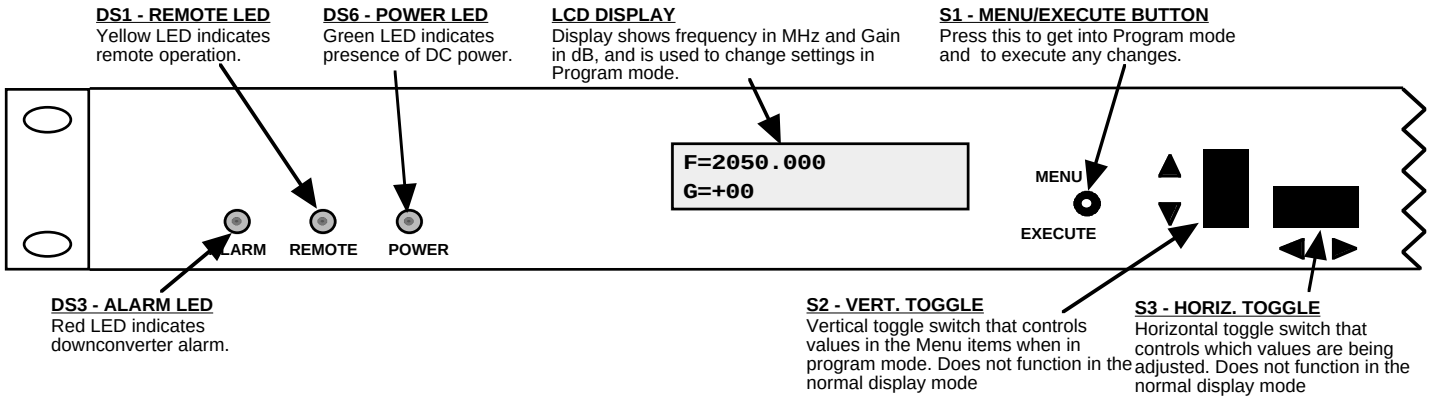


FIGURE 2.3 2016-225 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2016-225, Downconverter Section

1. Connect a -70 dBm to -20 dBm signal to RF In, J2 (Figure 2.2)
2. Connect the IF OUT, J1, to the external equipment
3. Connect 100-240 ±10% VAC, 47 - 63 Hz to AC on the back panel.
4. Set the desired input frequency (See Section 2.5 Menu Settings).
5. Set the gain for 0 to +50 dB. Make sure the output stays within -20 to -30 dBm with the gain selected and the input level provided. (See Section 2.5 Menu Settings).
6. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3).
7. 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.

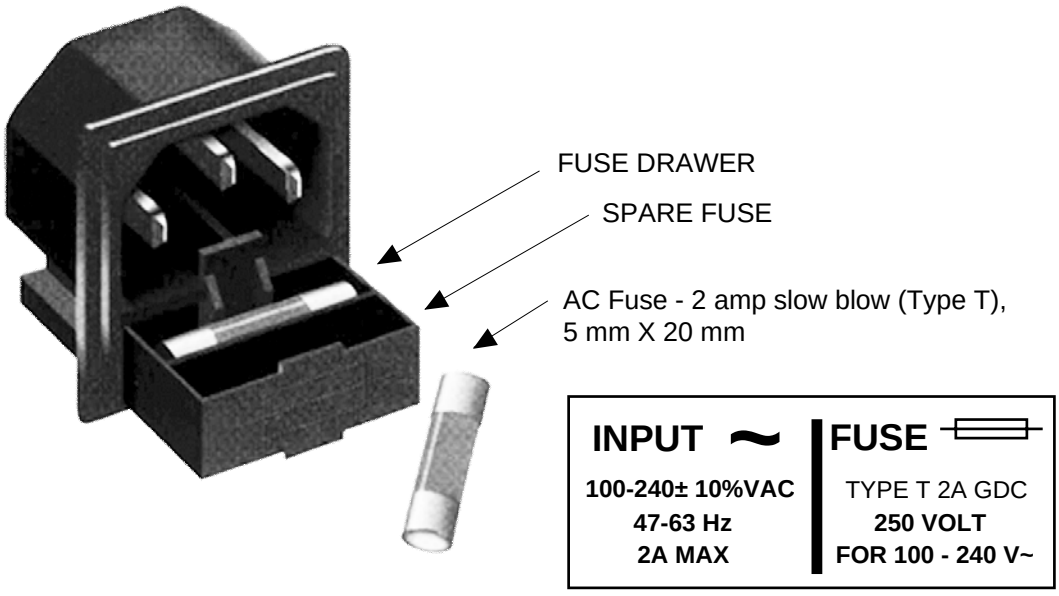


FIGURE 2.4 Fuse and Spare Fuse Locations

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	Gain (0 to +50 dB)
Menu 3	Set Unit to Remote Operation (Note: the local controls still function when in REMOTE)
Menu 4	Select Non-inverting or Inverting Spectrum
Menu 5	Select Frequency Step Size
Menu 6	Select External 10 MHz Ref (**option E**)
Menu 7	Select RS232, RS422, or RS 485 Remote Operation (**option Q**)
Menu 8	Select Remote Address for Unit (RS485 only) (**option Q**)

Save Menu When "R" is selected in any above menu or after the last menu in the sequence

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 30 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 downconverter is shown.

```
F = 2050.000
G = +00
```

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 and gain changes, the vertical movement will raise or lower the selected number in the direction of the arrows.
    B. For other functions, 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 30 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 downconverter 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 = 2150.000          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:

```
G = +00               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 = 2150.000
G = +00
```

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 30 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).

NOTE: CHANGES TAKE PLACE ON 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 = +00                    R
```

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

```
G = +10.0                  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" and 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:

```
F = 2150.000
G = +10.0
```

Figure 2.5 gives the menu items and how to make changes

2.5.5 Alarm Indications

An alarm condition for 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.

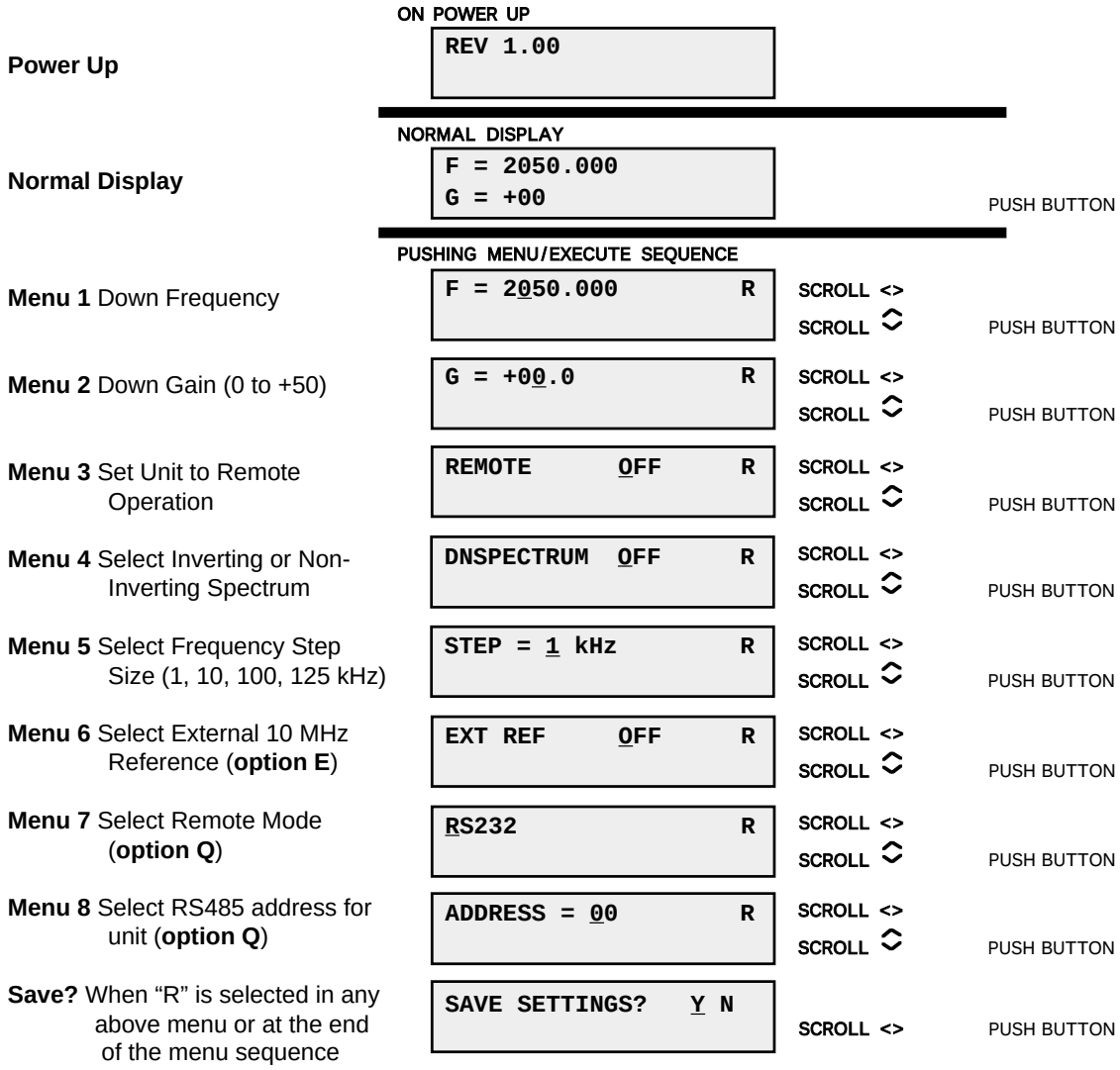


FIGURE 2.5 Menu Display and Sequence

2.6 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.

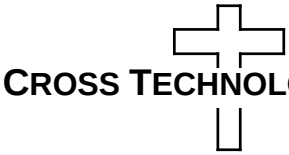
C. **Elevated Operating Ambient Temperature** - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack may be greater than room ambient temperature. Therefore, consideration should be given to Tmra.

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.



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