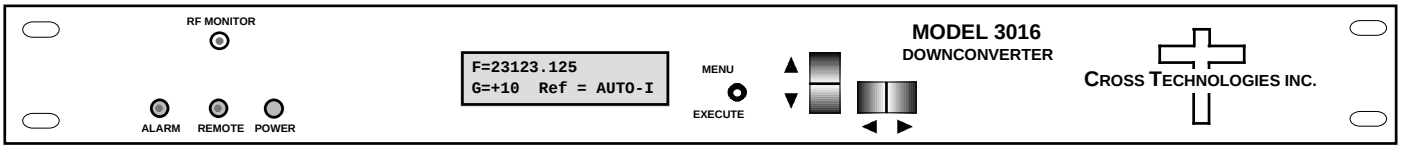
Instruction Manual

Model 3016-2124
Downconverter

August 2012, Rev. 0



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INSTRUCTION MANUAL

MODEL 3016-2124 Downconverter

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MODEL 3016-2124-Downconverter

1.0 General

1.1 Equipment Description

The 3016-2124 Downconverter converts 21 to 24 GHz to 70 ± 18 MHz in 125 kHz steps (1 kHz opt -X1008). This unit combines a multi-band block downconverter with a 3-4 GHz to 70 MHz agile downconverter to obtain the wide tuning range. Synthesized local oscillators (LO) provide frequency selection. Multi-function switches select the input frequency, gain, and other parameters. Front panel LEDs provide indication of DC power, PLL alarm or Remote operation. Gain is adjustable manually (MGC) over a 0 to +30 dB range. The frequency and gain are remotely selectable. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are 2.92 mm female for the RF, and BNC female for the IF and external 10 MHz reference input and output. Other connector options are available. The unit is powered by a 100-240 ±10% VAC power supply, and is contained in a 1 3/4" X 19" X 18" rack mount chassis.

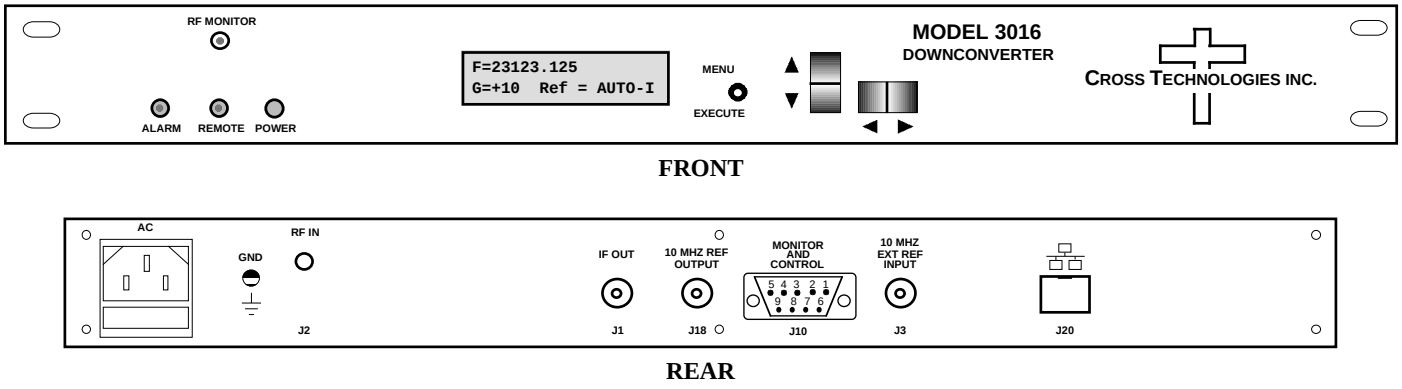


FIGURE 1.1 Model 3016-2124 Front and Rear Panels

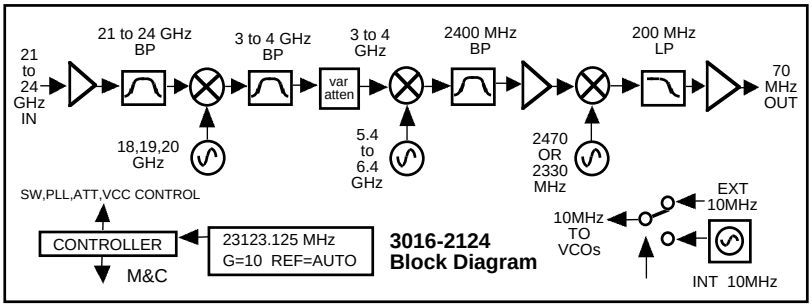


FIGURE 1.2 Model 3016-2124 Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 3016-2124 Downconverter Specifications*

Input Characteristics (RF)	
Impedance / Return Loss	50Ω /18 dB typ., 14 dB min.
Frequency	21 to 24 GHz
Noise Figure, max.	20 dB (max. gain)
Input Level Range	-50 to -30 dBm
Output Characteristics (IF)	
Impedance / Return Loss	50Ω / 18 dB (50Ω, works for 50 or 75 ohms)
Frequency	70 ± 18 MHz
Output Level Range	-20 to 0 dBm
Output 1 dB Compression	+10 dBm
Channel Characteristics	
Gain Max./Range (adjustable)	30 to +30.0 dB Max./ 0.0 to +30.0 dB range , 1 dB ± 1 dB steps
Image Rejection	> 50 dB, min.
Frequency Response	±3.0 dB, 21-24 GHz; ±1.5 dB, any 1 GHz band; ± 1.0 dB, 36 MHz BW
Spurious Response	<-50 dBc, in band
Intermod	< -50 dBC for two carriers each at -5 dBm out
Group Delay, max.	0.02 ns/MHz2 parabolic; 0.05ns/MHz linear; 1 ns ripple, 36 MHz BW
Frequency Sense	Inverting or Non-inverting (user selectable)
Synthesizer Characteristics	
Frequency Accuracy	± 0.01 ppm max. over temp internal ref.; ext. ref. input
Frequency Step	125 kHz minimum, (1 kHz Opt -X1008)
10 MHz In/Out Level	3 dBm ± 3 dB

Phase Noise @ Frequency	100 MHz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	60	70	80	90	100

Controls, Indicators	
Frequency/Gain Selection	Direct readout LCD; manual or remote selection
Power, Alarm, Remote	Green LED; Red LED, Yellow LED
Remote	RS232C, 9600 baud (RS422/485/opt. -Q, Ethernet/opt -W8, -W18, -W28
Other	
RF, IF	2.92 mm (female), BNC, 75Ω (female), (50Ω IF Opt - S29)
10MHz Connectors	BNC (female) 50Ω, works for 50 or 75 ohms
Alarm / Remote Connector	DB9 (female) - NO or NC contact closure on Alarm
Size	19 inch, 1RU Standard Chassis 1.75" high X 18.0" deep
Power	100-24 ±10% VAC, 47-63 Hz, 60 watts max.

Available Options	
- O	RS485 Remote Interface
- W8	Ethernet with Web Browser (WB)
- W16	Test Data
- W18	Ethernet with Web Browser & SNMP
- W28	Ethernet with TCP/IP, Telenet
- W71	IF Mon., -20dB, 50 ohm
- W73	RF Mon., -3 ±3 dB, 50 ohm
- X1008	1 KHz Steps
Connector / Impedance	See Table 2.2 - PG 9

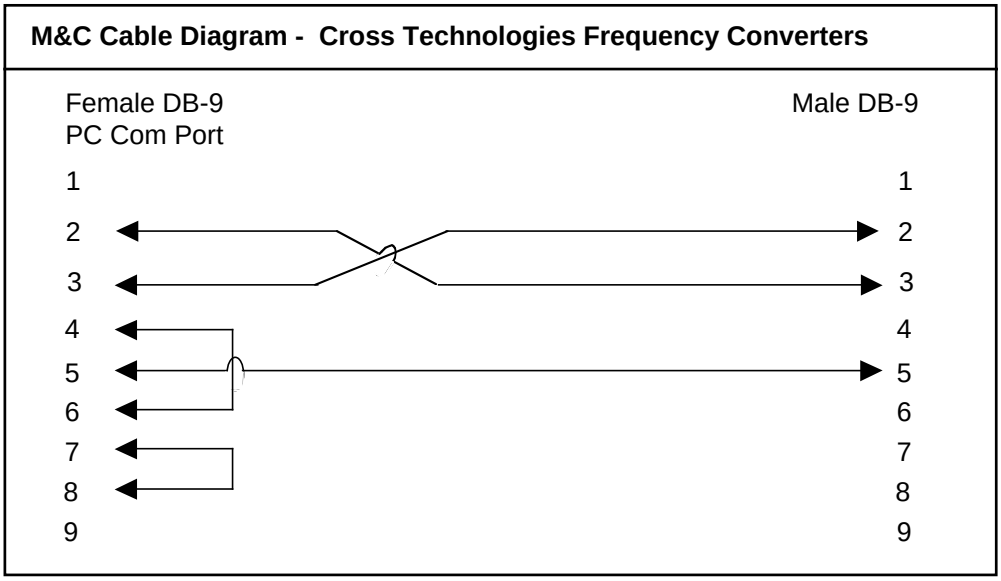
*+0 to +50 degrees C; Specifications subject to change without notice.

Bundled Options
-01
S29
W8
W16
W70
X1008

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 (RS485/RS422)	
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 2016-03 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 3016-2124 Status Requests

Command	Syntax*	Description
Command Status	{aaS1}	Returns {S1bbbbbbbcccIA} where:
		• bbbbbbb = Rx frequency (in kHz)
		• ccc = Rx gain
		• I = Spectrum invert; 1 = inverted, 0=normal
		• A = summary alarm; 1 = alarmed, 0 = normal
10MHz Reference Status	{aaS2}*	Returns {aaS2xy} where:
		• x = 0 if Internal reference mode is selected
		• x = 1 if external reference mode is selected
		• x = 2 if auto reference mode is selected
		• y = 0 if the internal reference is active
		• y = 1 if the external reference is active

C) Commands - Table 1.1 lists the commands for the 3016-2124 and briefly describes them. After a command is sent the 3016-2124 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 3016-2124 Commands

Command	Syntax*	Description
Set Receiver Frequency	{aaC2xxxxx}	where:
		• xxxxxxx = 5 characters
		• Range: 21000 to 24000 kHz, in 125kHz steps
Set Receiver Gain	{aaC4xx}	where:
		• xxx = 3 characters
		• Range: 0 to 30 (0.0 dB to +30 dB, in 1.0 dB steps)
Set Spectrum Invert	{aaC7x}	where x =:
		• 0 to disable spectrum invert
		• 1 to enable spectrum invert
Enable External 10MHz IN	{aaCEx}	where x =:
		• 0 to select Internal Reference Mode
		• 1 to select External Reference Mode
		• 2 to select Auto Reference Mode
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 3016-2124 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 3016-2124 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 3016-2124 is assembled.

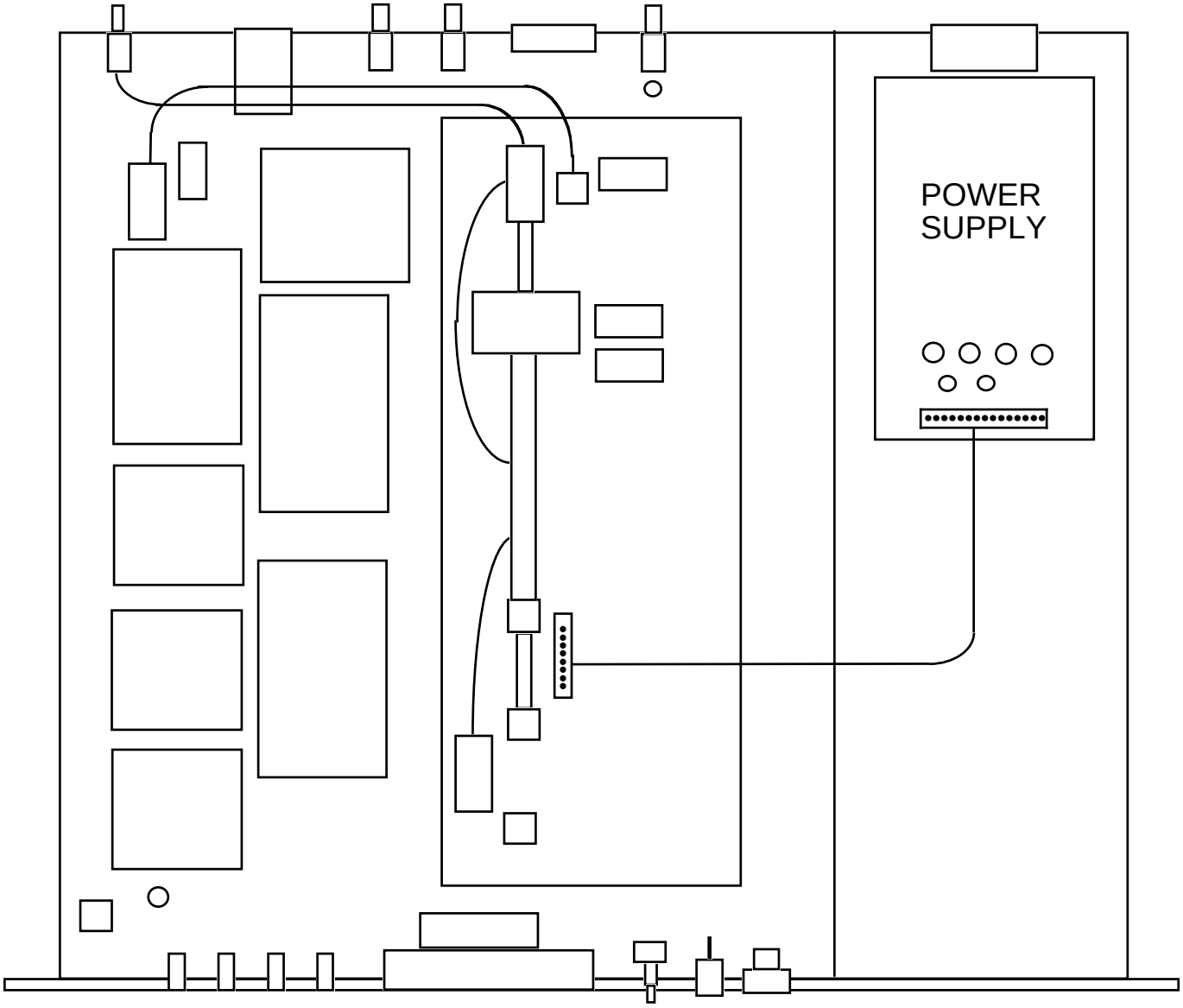


FIGURE 2.1 3016-2124 Mechanical Assembly

2.2 Rear Panel Input/Output Signals

Figure 2.2 shows the input and output connectors on the rear panel.

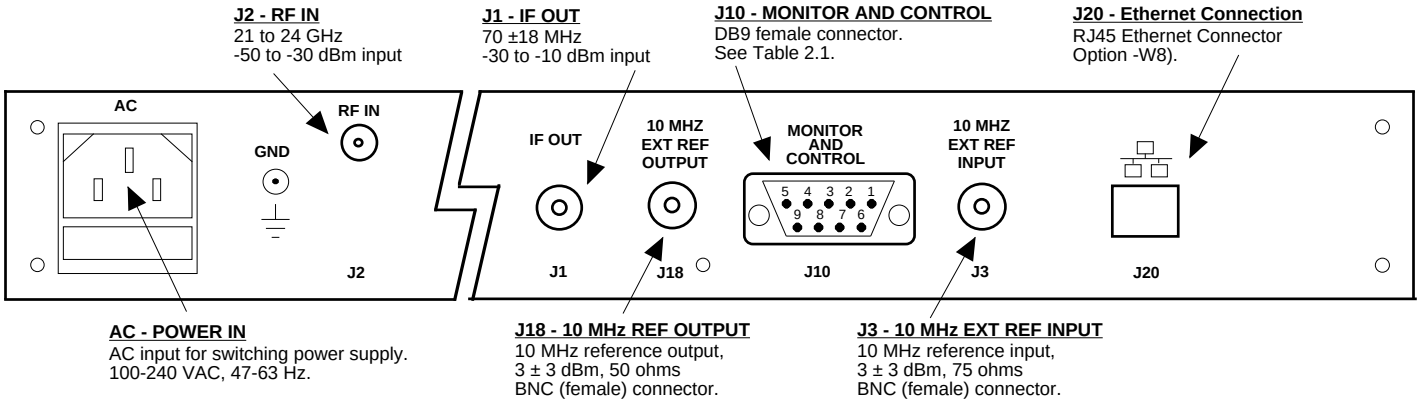


FIGURE 2.2 3016-2124 Rear Panel I/Os

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

TABLE 2.2 Connectors/Impedance

S29	2.92mm (RF), 50 ohm BNC (IF)
SS29	2.92mm (RF), SMA (IF)

***Remote Serial Interface**

Interface: DB-9 Female
Protocol: RS-232C, 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.

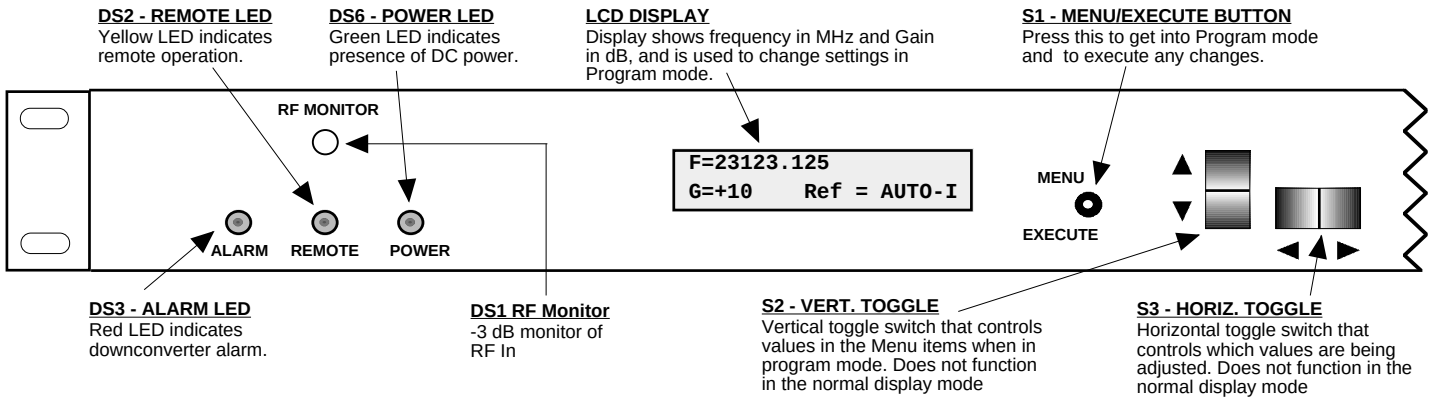


FIGURE 2.3 3016-2124 Front Panel Controls and Indicators

2.4 Operation

2.4.1 Installing and Operating the 3016-2124 Downconverter

1. Connect a -50 dBm to -30 dBm signal to RF IN, J2 (Figure 2.2, page 10).
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 input frequency (See Section 2.5 Menu Settings, page 16).
5. Set the gain for 0.0 to +30.0 dB (See Section 2.5 Menu Settings, page 16).
6. Be sure DS6 (green, DC Power) is on and DS3 (red, Alarm) is off (Figure 2.3, page 10).
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 2.4 below. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

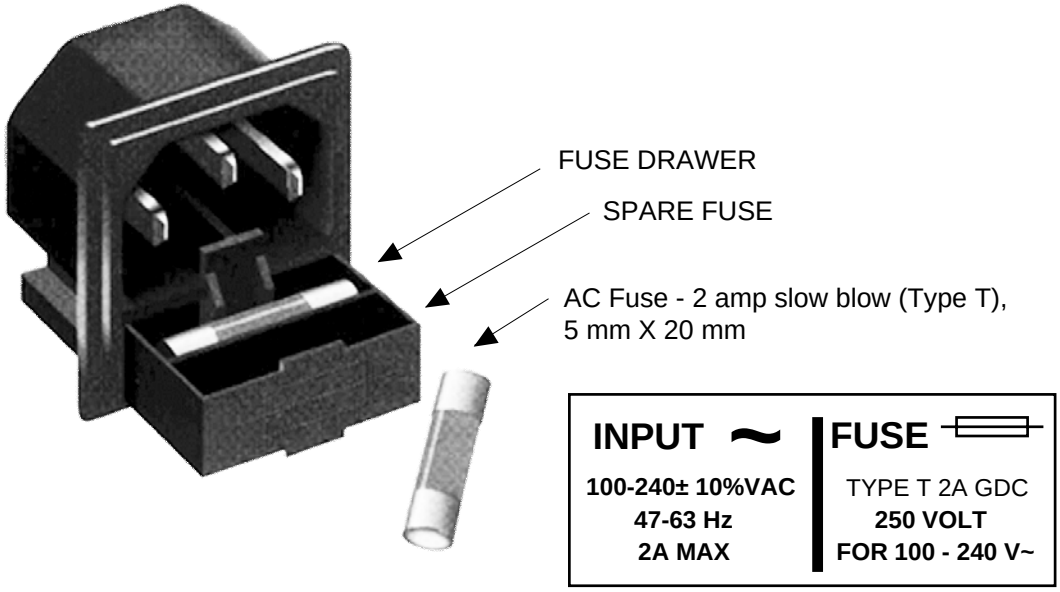


FIGURE 2.4 Fuse Location and Spare Fuse

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 Gain (0.0 to +30.0)
Menu 3 Set Spectrum Invert
Menu 4 Set Unit to Remote Operation
Menu 5 Select Frequency Step Size -1kHz minimum (**option X1008**)
Menu 6 Select External 10 MHz Ref
Menu 7 Set Remote Mode (option Q) (option W8, W18, W28)
Menu 8 Set RS-485 address (option Q)

Save Menu When "R" is selected in any above menu or at the end of the menu options.

Alarm indications appear on the LEDs (see figure 2.3).

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

<u>NOTE</u>: 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 = 23123.125
G=+10        Ref=AUTO=I
```

The unit is now operational and ready for any changes the operator may desire.

2.5.3 Control Switches

1. <u>Menu/Execute</u> - 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. <u>Horizontal Switch</u> - This switch is mounted so its movement is horizontal and moves the cursor left or right.
3. <u>Vertical Switch</u> - 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 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:

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 = 24123.125          R
```

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

```
F = 24123.125          R
```

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

```
F = 24123.125          R
```

NOTE: CHANGES DO NOT TAKE PLACE ON FREQUENCY UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

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

```
G = +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 this:

```
F = 23123.125
G=+10        Ref=AUTO=I
```

Figure 2.5 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 30 seconds, and the system will return to the normal operating mode.

To change the GAIN:

Push the Menu/Execute switch to get to the gain setting (See Figure 2.5 for the sequence of menu options):

```
G = +10              R
```

Pressing the Up/Down switch will change the gain in 1 or 10 dB steps depending on the cursor location:

```
G = +20              R
```

By using the horizontal rocker switch the cursor can be moved left or right. Pressing the Up/Down switch will toggle the display digit selected until you have the desired gain:

```
G = +20              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.

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

```
REMOTE   OFF         R
```

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 this:

```
F = 23123.125
G=+10        Ref=AUTO=I
```

Figure 2.5 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.

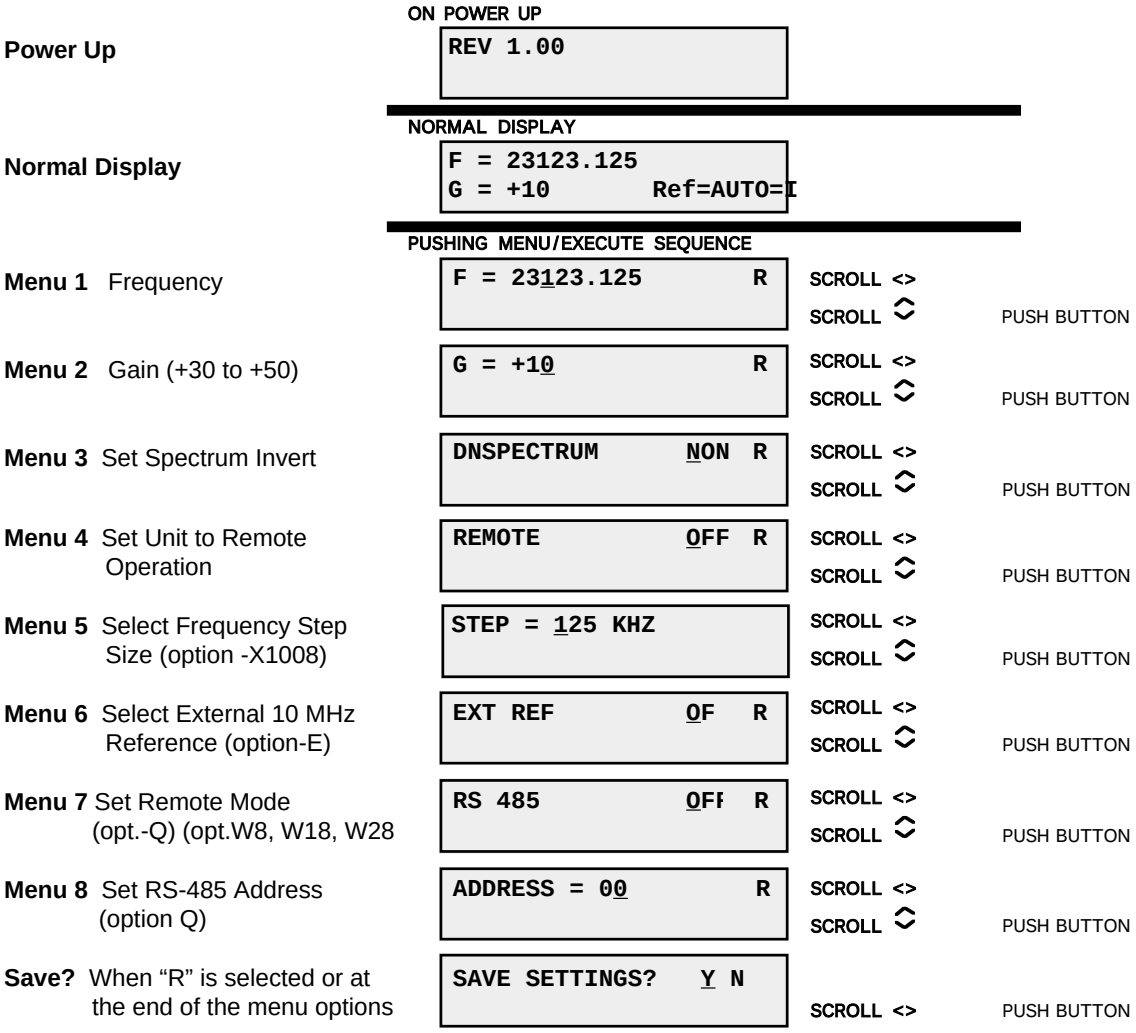
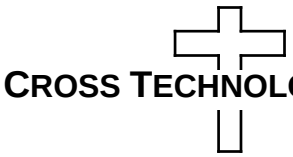


FIGURE 2.5 Menu Display and Sequence



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