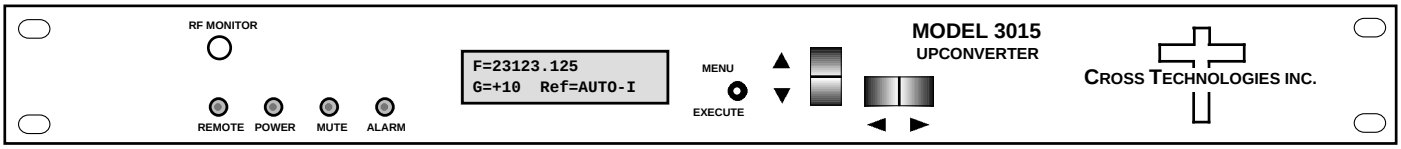
Instruction Manual

Model 3015-2124
Upconverter

August 2012, Rev. 0



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INSTRUCTION MANUAL

MODEL 3015-2124 Upconverter

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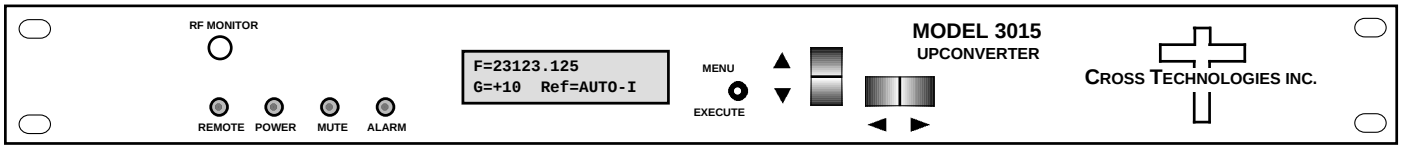
MODEL 3015-2124 Upconverter

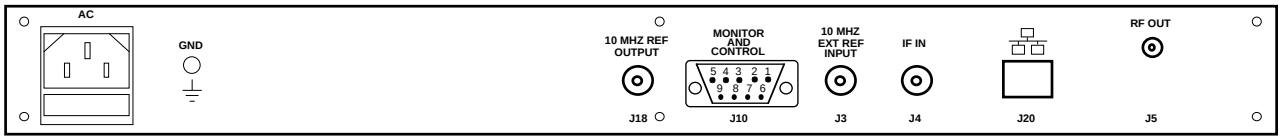
1.0 General

1.1 Equipment Description

The 3015-2124 Upconverter converts 70 ± 18 MHz to 21 to 24 GHz in 125 kHz steps (1 kHz opt - X1008). This unit combines a 70 MHz to 3-4 GHz agile upconverter with a multi-band block upconverter to obtain the wide tuning range. Synthesized local oscillators (LO) provide frequency selection. Multi-function switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow) or the TX carrier is muted (yellow). Variable attenuators for the IF input and output provide a gain range of -10 to +20 dB as adjusted by the front panel multi-function 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 external 10MHz reference input and output, and 2.92 mm (female) for the RF output. The unit is powered by a 100-240 ±10% VAC power supply, and housed in a 1 3/4" X 19" X 18" rack mount chassis.



FRONT



REAR

FIGURE 1.1 Model 3015-2124 Front and Rear Panels

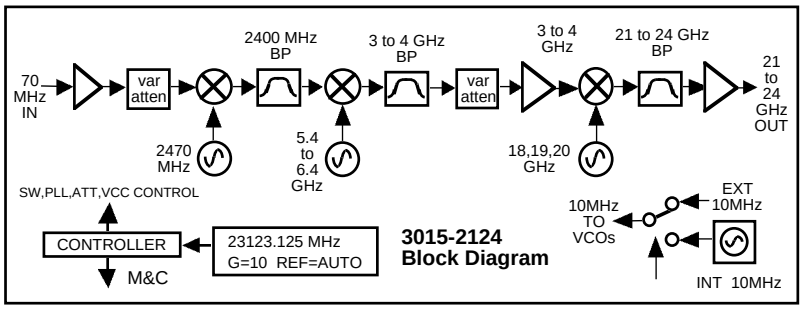


FIGURE 1.2 Model 3015-2124 Upconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 3015-2124 Upconverter Specifications*

Input Characteristics	
Impedance / Return Loss	75Ω / 18 dB
Frequency	70 ±18 MHz
Input Level	-30 to -10 dBm
Output Characteristics	
Impedance / Return Loss	50Ω / 18 dB min., 14 dB typical
Frequency	21 to 24 MHz
Output Level	-15 to 0 dBm
Output 1 dB Compression	+10 dBm
Channel Characteristics	
Gain Max./Range (adjustable)	20 ± 2 dB Max., -10.0 to +20.0 dB, 1 dB ± 1 dB steps
Spurious Inband	<-50 dBC
Spurious, Out of band	<-50 dBm
Intermod	<-50 dBC for two carriers each at -5 dBm out
Frequency Response	±3.0 dB, 21-24 GHz; ±1.5 dB, any 1 GHz band; ± 1.0 dB, 36 MHz BW
Group Delay, max.	0.02 ns/MHz^2 parabolic; 0.05ns/MHz linear; 1 ns ripple, 36 MHz BW
Frequency Sense	Non-inverting
Synthesizer Characteristics	
Frequency Accuracy	± 1.0 ppm max. over temp internal reference; ext. ref. input
Frequency Step	125 kHz minimum
External 10 MHz Level	+3 dBm ± 3 dB, 50Ω

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, Mute	Green LED, Red LED, Yellow LED, Yellow LED
Remote	RS232C, 9600 baud (RS422/485/option -Q, Ethernet/option -W8, -W18, -W28)
Other	
RF, IF Connectors	2.92 mm (female), BNC, 75Ω (female), (50Ω IF opt - S29)
10 MHz 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
- W70	RF Mon., -20dB, 50 ohm
- X1008	1 KHz Steps
Connector / Impedance	See Table 2.2 - PG 9

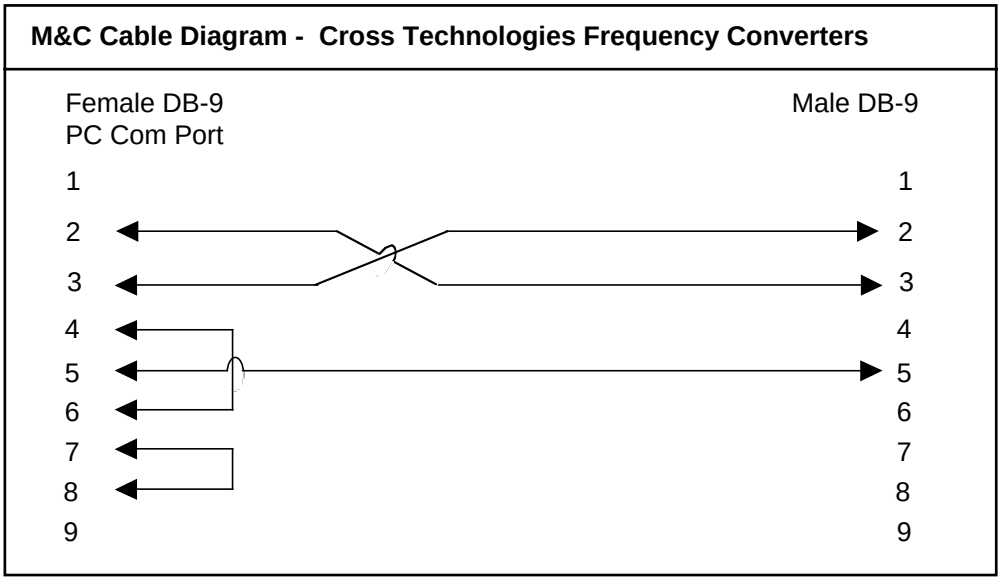
*+0 to +50 degrees C; Specifications subject to change without notice.

Bundled Options
-01
S29
W8
W16
W70
X1008

1.3 Monitor and Control Interface

A) Remote Serial Interface

Protocol - RS-485, RS-422 or RS-232C (selectable), 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.



Connector - Rear panel, DB-9 female

Pinouts (RS-485/422/232C)

Pin - J10	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) Commands - Table 1.2 lists the commands for the 3015-2124 and briefly describes them. After a command is sent the 3015-2124 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**)
C = 1 character, either C (command) or S (status)
N = 1 character command of 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 3015-2124 Commands

Command	Syntax	Description
Set Transmitter Frequency	{aaC1xxxxxxxx}*	where:
		• xxxxxxxx = 8 characters
		• Range: 21000000 to 24000000, 125 kHz steps
		(1 kHz steps if Option X1008)
Set Input Level	{aaClxx}*	where:
		• xx = 2 characters
		• Range: 30 to 10 (-30 dB to -10 dB, in 1 dB steps)
Set Transmit Gain	{aaC3xxx}*	where:
		• xxxx = 2 or 3 characters (use 3 char. for negative gain)
		• Range:-10 to +20 (-10 dB to +20 dB,in 1.0 dB steps)
Enable Tx	{aaCAx}*	where x =:
		• 0 to disable Tx signal
		• 1 to enable Tx signal
10MHz Reference Mode	{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}

C) Status Requests - Table 1.3 lists the status requests for the 3015-2124 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 1.3 3015-2124 Status Requests

Command	Syntax	Description
Command Status	{aaS1}*	Returns {aaS1bbbbbbbbccddAM} where:
		• bbbbbbbb = Tx frequency
		• cc = TX Gain
		• ddd = Input Level
		• A = Alarm Status (0 = NO Alarm, 1 = Alarm)
		• M = Tx RF Status (1 = Normal, 0 = Muted)
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

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 Tmra.

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 unit 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 3015-2124 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 3015-2124 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 3015-2124 is assembled.

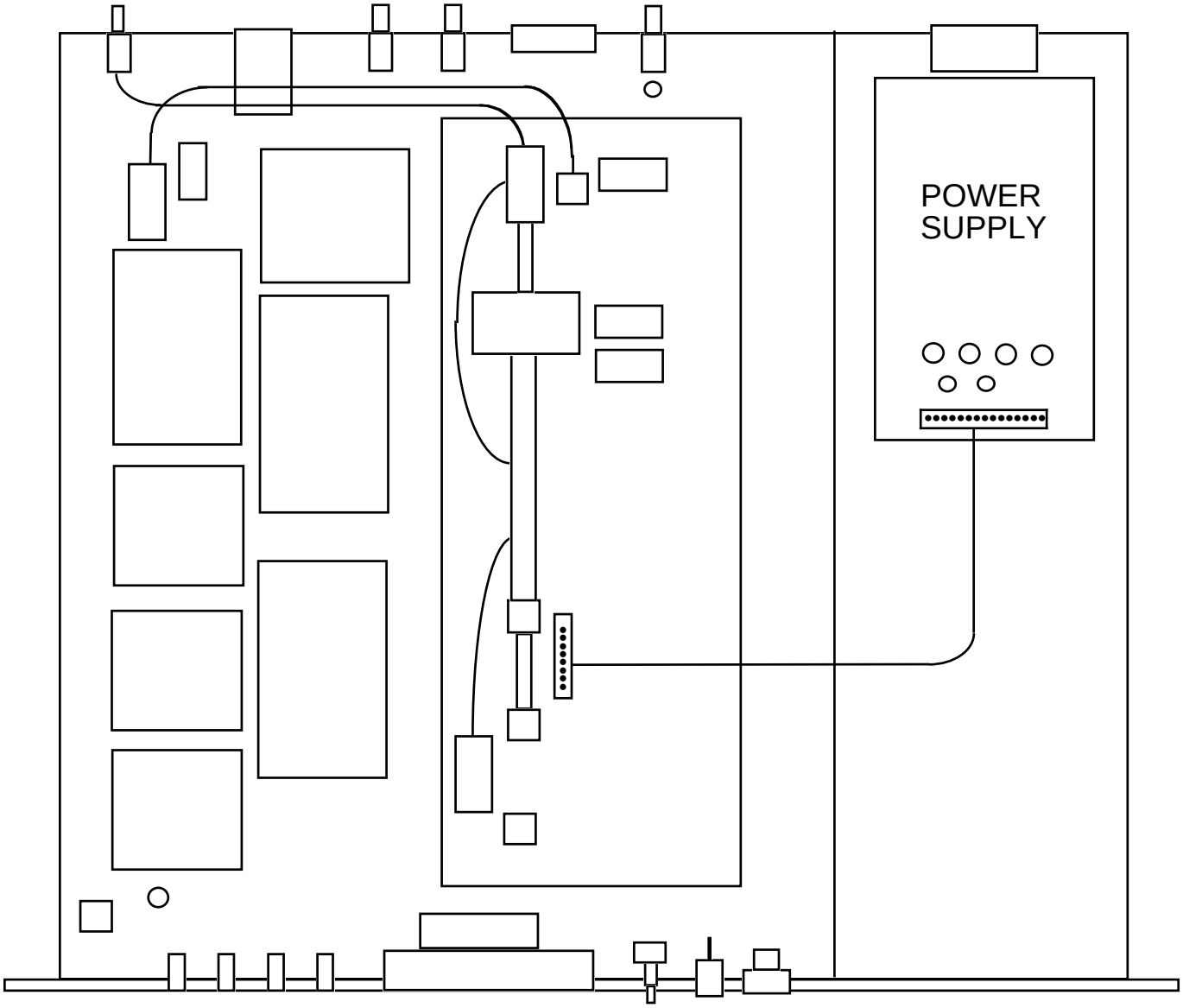


FIGURE 2.1 3015-2124 Mechanical Assembly

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

FIGURE 2.2 3015-2124 Rear Panel Inputs and 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	Not Used
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 Connectors/Impedance	
S29	2.92mm (RF), 50Ω BNC (IF)
SS29	2.92mm (RF), SMA (IF)

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

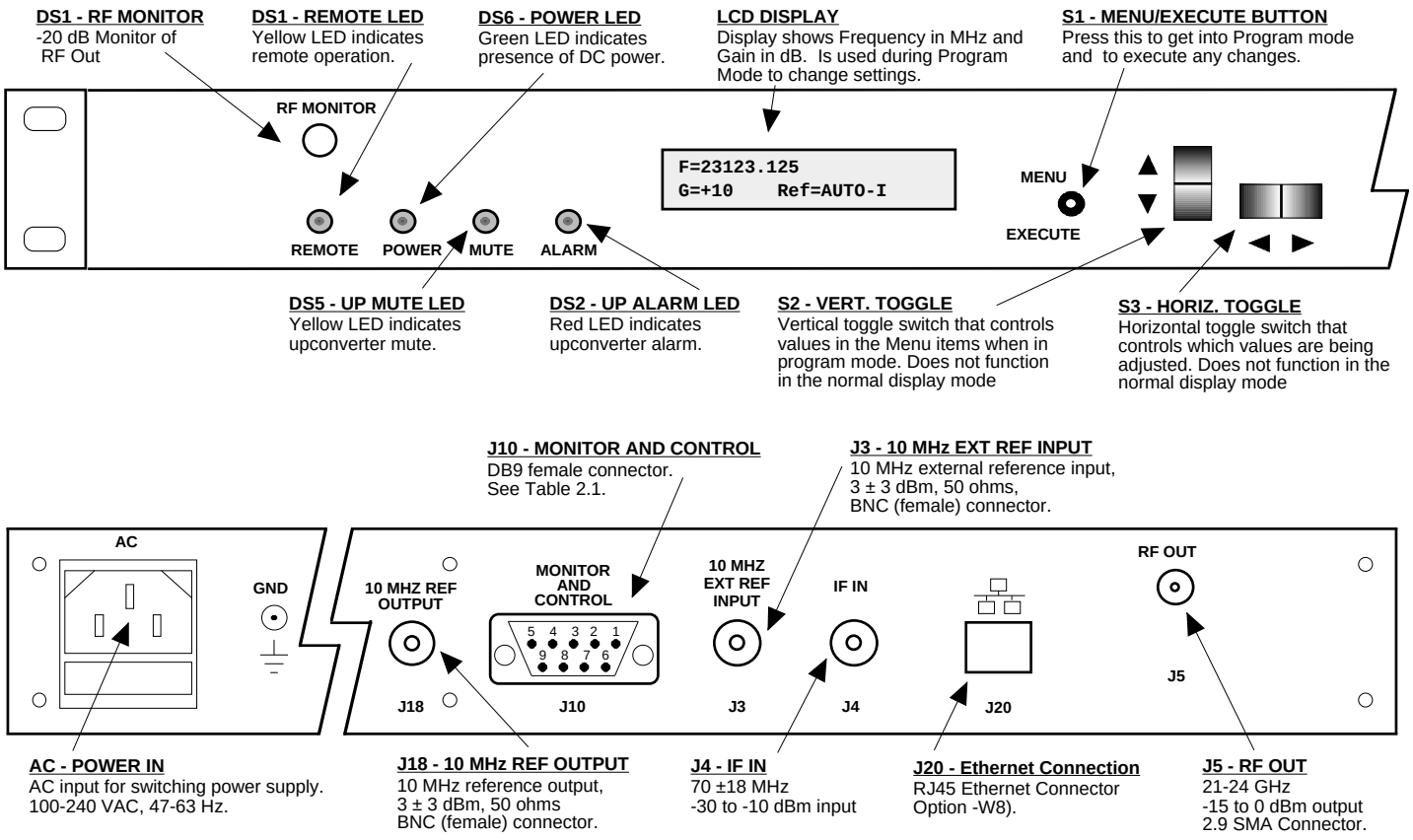


Figure 2.3 Front & Rear Panel Controls & Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3015-2124 Upconverter

1. Connect a -30 dBm to -10 dBm, 70MHz signal to IF IN, J4 (Figure 2.3, page 9)
2. Connect RF OUT, J5, to the external equipment.
3. Connect 100- 240 ±10% VAC, 47 - 63 Hz to AC input on the back panel.
4. Set the desired output frequency (See Section 2.5 Menu Settings, page 13).
5. Set the input level (See Section 2.5 Menu Settings, page 15).
6. Set the gain for -10.0 to +20.0 dB. Make sure the output stays within -15 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, page 15).
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3, page 9).
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, page 10. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

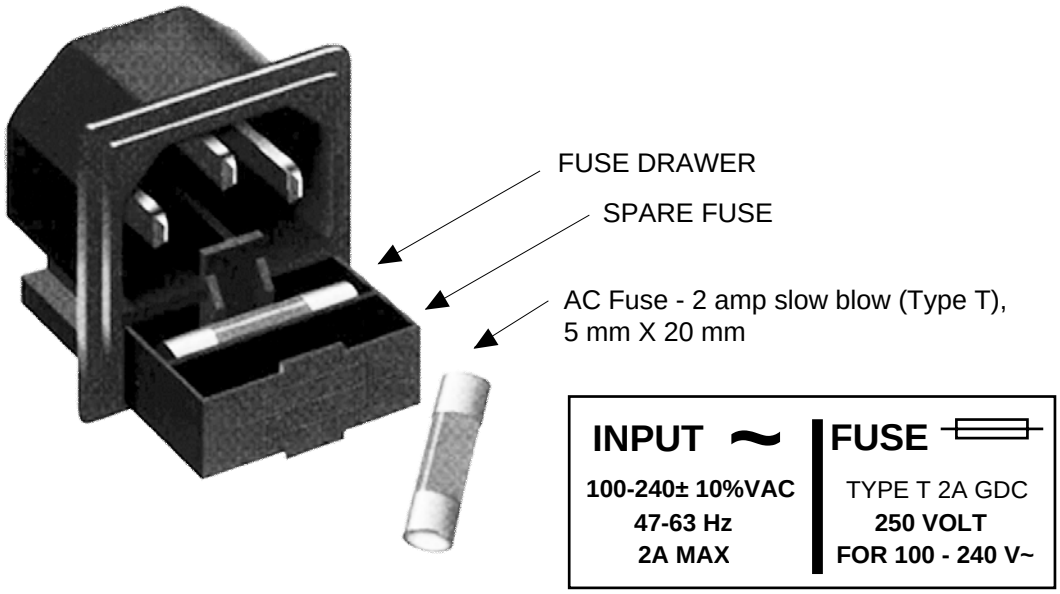


FIGURE 2.4 Fuse Location and Spare Fuse

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, page 15):

Power Up
Normal Display

Menu 1	Frequency in MHz
Menu 2	Input Level in dBm (-30 to-10)
Menu 3	Gain in dB (-10.0 to +20.0)
Menu 4	Mute TX Signal
Menu 5	Set Unit to Remote Operation
Menu 6	Select Frequency Step Size -1kHz minimum (**option X1008**)
Menu 7	Select External 10 MHz Reference
Menu 8	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, page 9).

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 = 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. 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 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 upconverter frequency:

```
F = 23123.125          R
```

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

```
F = 22123.125          R
```

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

```
F = 22123.125          R
```

NOTE: CHANGES DO NOT TAKE PLACE ON FREQUENCY UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES. 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 = -20            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 = 23123.125
G = +10    REF = AUTO-I
```

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 = -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:

```
G = +10.0            R
```

Press the Up/Down switch to change the gain in 0.1, 1 or 10 dB steps:

```
G = +20.0            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:

```
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 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.

2.5.6 10 MHz Reference Mode Operation

Internal Mode: The unit uses its own built-in 10 MHz OCXO. The Internal Reference is present on the Reference Output Connector, J18. REF = INT appears on the front panel display.

External Mode: The unit uses a 10 MHz Reference that is connected to the External Reference Input, J3. REF = EXT appears on the front panel display. The External 10 MHz Reference level must be +3dBm, ±3dB. If the External 10 MHz signal does not meet the unit's specified parameters then the unit will not function properly. The External Reference is present on the Reference Output connector, J18.

Auto Mode: The unit defaults to the External 10 MHz Reference as long as the level meets the +3dBm, ±3dB specification. REF = AUTO - E appears on the front panel display where the -E indicates that the unit is using the External 10 MHz Reference. The External Reference is present on the Reference Output connector, J18.

If the external 10 MHz Reference signal level is less than -1dBm, the unit switches to Internal 10 MHz Reference. REF = AUTO -I appears on the front panel display where -I indicates that the unit is using the Internal 10 MHz Reference. The Internal 10 MHz Reference is present on the reference output connector, J18.

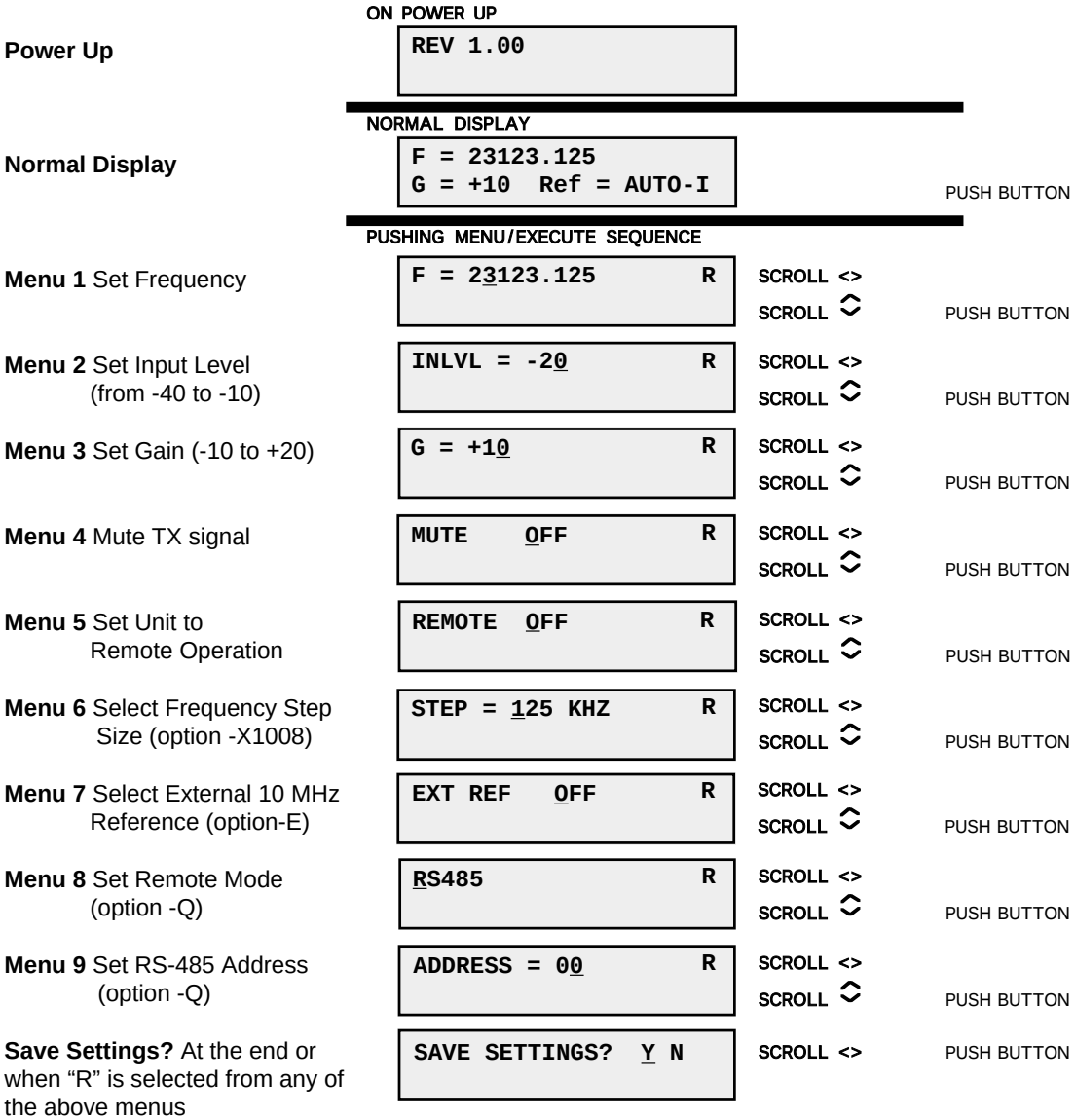
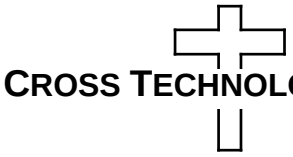


FIGURE 2.5 Menu Display and Sequence



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