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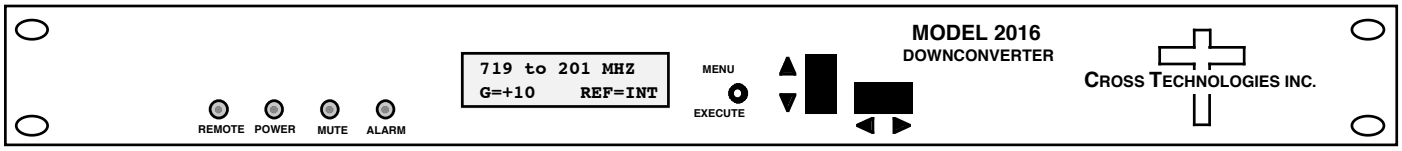
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Instruction Manual

Model 2016-75-213
Downconverter

April 2009 Rev A



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INSTRUCTION MANUAL

MODEL 2016-75-213 Downconverter

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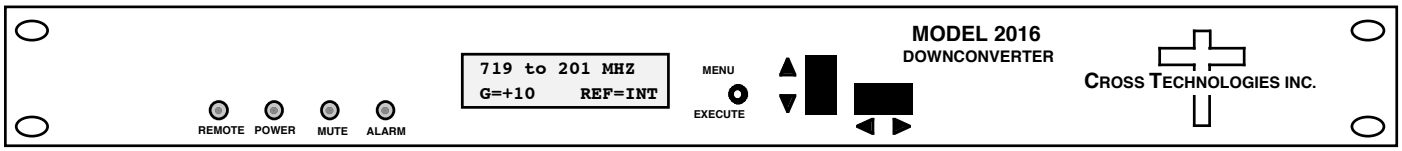
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MODEL 2016-75-213 Downconverter

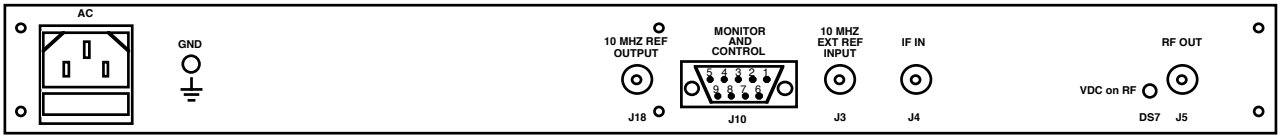
1.0 General

1.1 Equipment Description

The 2016-75-213 Downconverter converts **719** MHz to **201.143 or 213.143 ± 3 MHz** with low group delay and flat frequency response. Synthesized local oscillators (LO) provide output frequency selection. Multi-function push button switches select the output frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), remote operation (yellow), and PLL alarm (red). Variable attenuators for the RF input provide a gain range of 0 to **+40** dB as adjusted by the front panel multi-function pushbutton switches. Remote operation allows selection of output frequency and gain. Parameter selection and frequency translation and gain settings appear on the LCD display. Connectors are Type F female for the RF and BNC female for IF and optional 10 MHz input and output signals (option -E). A high stability (±0.01ppm) (option -H) is also available. 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.

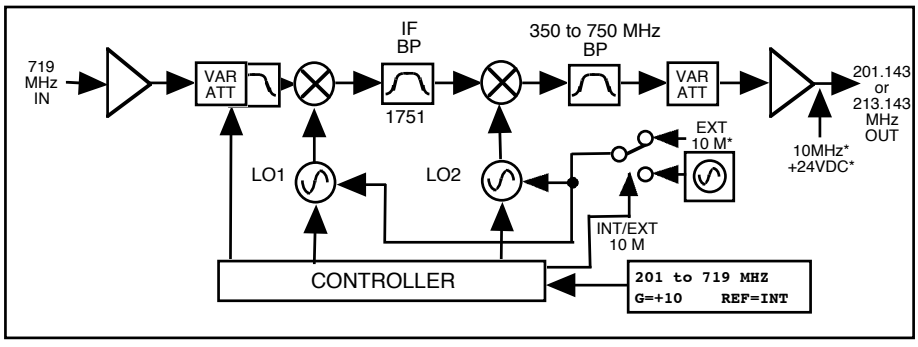


FRONT PANEL



REAR PANEL

FIGURE 1.1 Model 2016-75-213 Front and Rear Panels



Block Diagram

FIGURE 1.2 Model 2016-75-213 Downconverter Block Diagram

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1.2 Technical Characteristics

TABLE 1.0 2016-75-213 Downconverter Specifications*

Input Characteristics

Impedance/Return Loss	75 Ω /12 dB (see TABLE 2.2 for connector options)
Frequency	719 MHz ± 3 MHZ
Input Level	-60 to -20 dBm

Output Characteristics

Impedance/Return Loss	75 Ω/12 dB (see Table 2.2 for connector options)
Frequency	201.143 or 213.143 ± 3 MHz
Level Range	-30 to -20 dBm
Output 1 dB Compression	-15 dBm

Channel Characteristics

Gain range (adjustable)	0.0 to +40 dB
Image Rejection	<50 db, min.
Frquency Reponse	201.143 or 213.143 ± 3 MHz out; ± 0.5 dB
Spurious Response	<-45 dBC, in band
Group Delay, max.	0.01 ns/MHz^2 parabolic; 0.03 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) internal reference
Frequency Step	1.0 MHz minimum
10 MHz In/Out Level	3 dBm, ± 3 dB, 75 (**option -E**)

Phase Noise @ Freq	10Hz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-70	-70	-80	-95	-110

Controls, Indicators

Frequency/Gain Selection	direct readout LCD; manual or remote
Power	Green LED
Alarm	Red LED
Remote	Yellow LED; RS232C (RS485, **option -Q**), 9600 baud

Other

RF, IF Connector	Type F (female) (see TABLE 2.2 for other options)
IF Connector	BNC (female) (see TABLE 2.2 for other options)
Ext 10 MHz Conn. (In/Out)	BNC (female) (**option -E**)
Alarm/Remote Connector	DB9 - 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 Available

E - External 10 MHz ref input & output
H - High Stability Internal Ref (±0.01 ppm)
Q - RS485 Remote Interface
X - 125 kHz Frequency Steps

Connectors/Impedance

B - 75Ω BNC (RF), 75Ω BNC (IF)
C - 50Ω 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)
S - 50Ω SMA (RF), 50Ω BNC (IF)

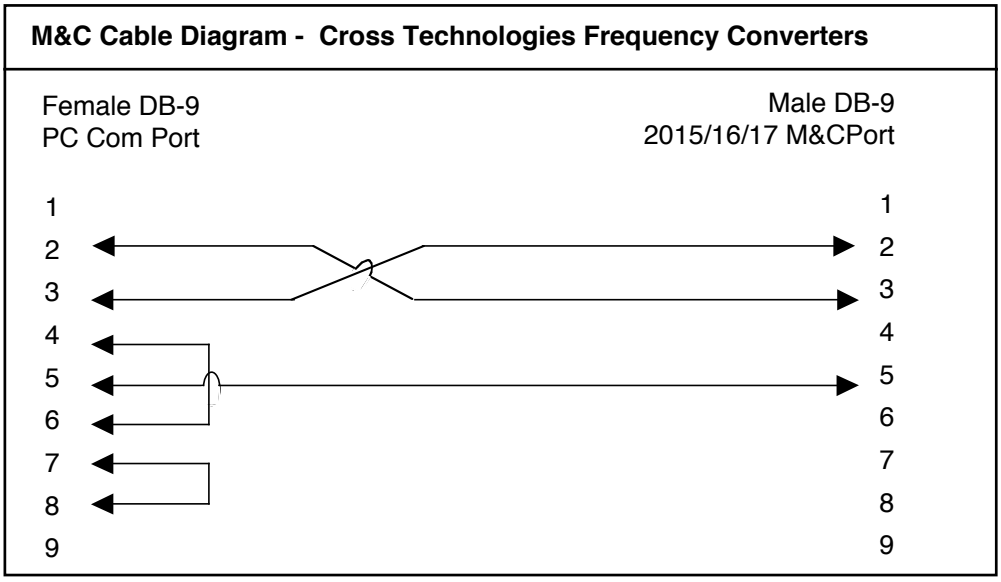
*+10˚C to +40˚C; Specifications subject to change without notice.

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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

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B) Status Requests Table 1.1 lists the status requests for the 2016-75-40 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 2016-75-213	STATUS REPORT	
Command	**Syntax ***	**Description**
Command Status	{aaS1}	Returns {aaS1bccAM} where:
		• b = 0 if input frequency = 201 MHz
		• b = 1 if input frequency = 213 MHz
		• cc = Tx gain
		• A = 0 - summary alarm
Reference Status	{aaS2}	Returns {aaS2E} where:
		• E = Ext 10MHz Status (1 = on, 0 = off)

C) Commands Table 1.2 lists the commands for the 2016-75-213 and briefly describes them. After a command is sent the 2016-75-213 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.**

Talbe 1.2 2016-75-213	COMMANDS	
Command	**Syntax***	**Description**
Set Input Frequency	{aaC1x}	where:
		• x = 1 characters
		• x = 0 for 201 MHz
		• x = 1 for 213 MHz
Set Transmit Gain	{aaC3xx}	• Range: 0 to 40 dB
Set External Reference	{aaCEx}	where x =
		• 0 to disable External 10MHz ref signal
Enable Remote	#	• 1 to enable External 10MHz ref signal
Disable Remote	{aaCR0}	Just # sign
		{CR and zero}

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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 eqipment 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 unit 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 servicable 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 RE-INSTALLED prior to Top Cover screw replacement. FAILURE TO DO this may cause INGRESS and/or EGRESS emission problems.

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2.0 Installation

2.1 Mechanical - The 2016-75-213 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 2016-75-213 can be secured to a rack using the 4 holes on the front panel.
Figure 2.0 shows how the 2016-75-213 is assembled.

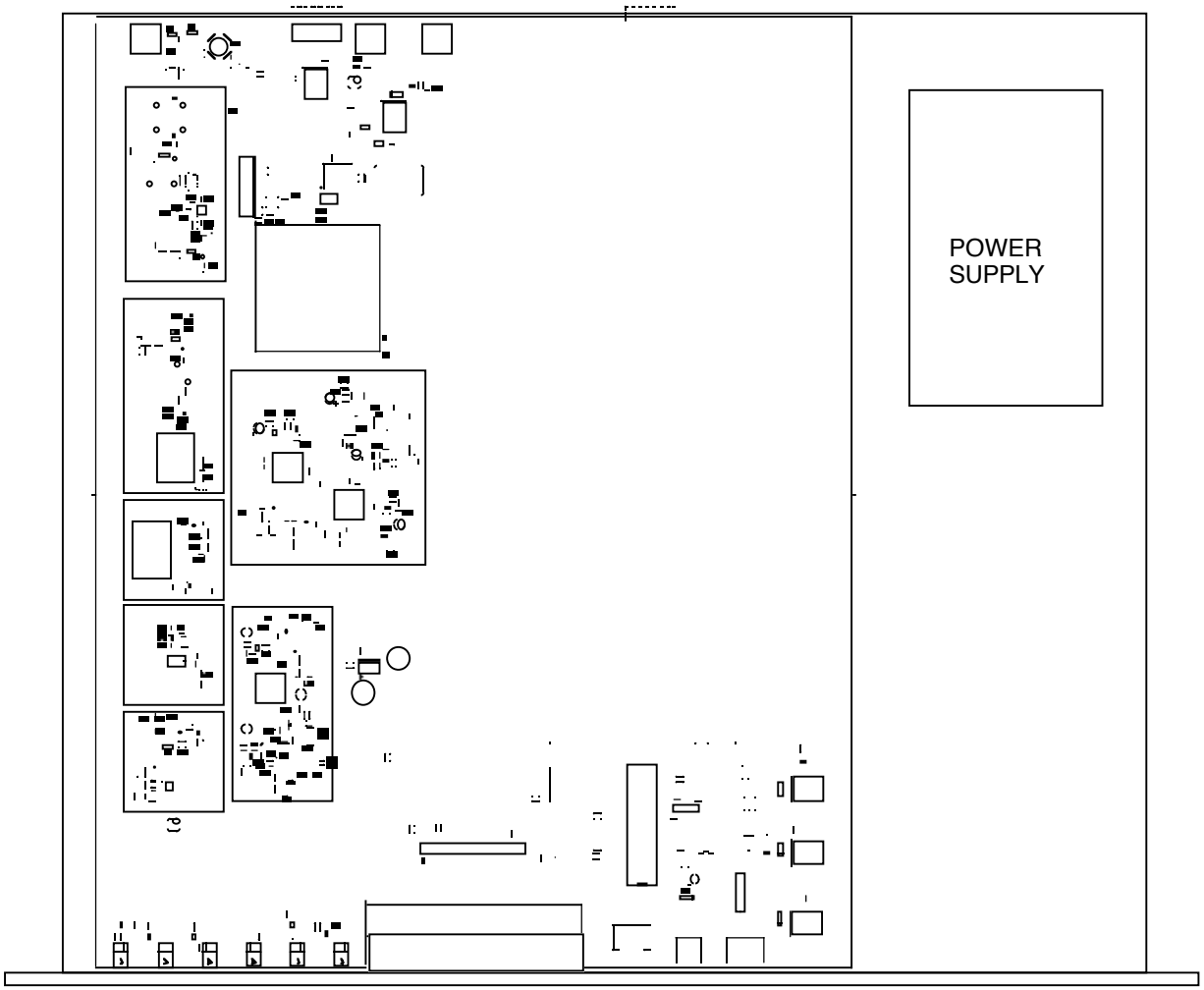


FIGURE 2.0 2016-75-213 Mechanical Assembly

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

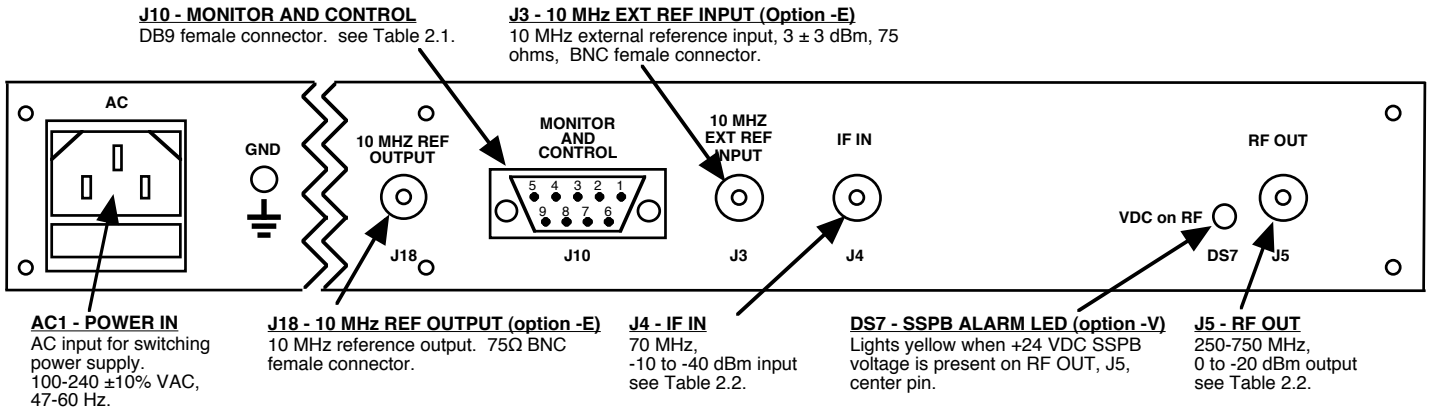


FIGURE 2.1 2016-75-213 Rear Panel I/O's

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/RF Connector Options		
Option	IF	RF
STD	BNC, 75Ω	Type F, 75Ω
-B	BNC, 75Ω	BNC, 75Ω
-C	BNC, 75Ω	BNC, 50Ω
-D	BNC, 50Ω	BNC, 50Ω
-N	BNC, 75Ω	Type N, 50Ω
-M	BNC, 50Ω	Type N, 50Ω
-S	BNC, 50Ω	SMA, 50Ω

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

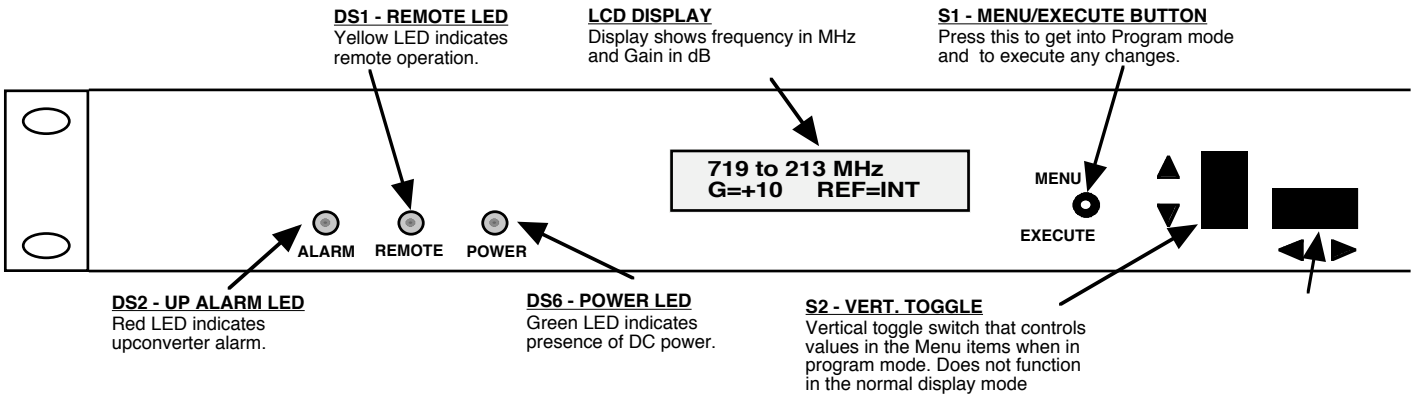


FIGURE 2.2 2016-75-213 Front Panel Controls and Indicators

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2.4 Installation / Operation

2.4.1 Installing and Operating the 2016-75-213, Upconverter Section

1. Connect a -10 dBm to -40 dBm signal to IF In, J4 (Figure 2.1)
2. Connect the RF OUT, J5, to the external equipment
3. Connect 100-240 ± 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 -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).
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.2).
8. Option -V only - To insert SSPB +24 VDC on the RF center pin install 2.5A fast blo fuse in F2 and check that DS7 lights yellow (Figure 2.1)
9. **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.

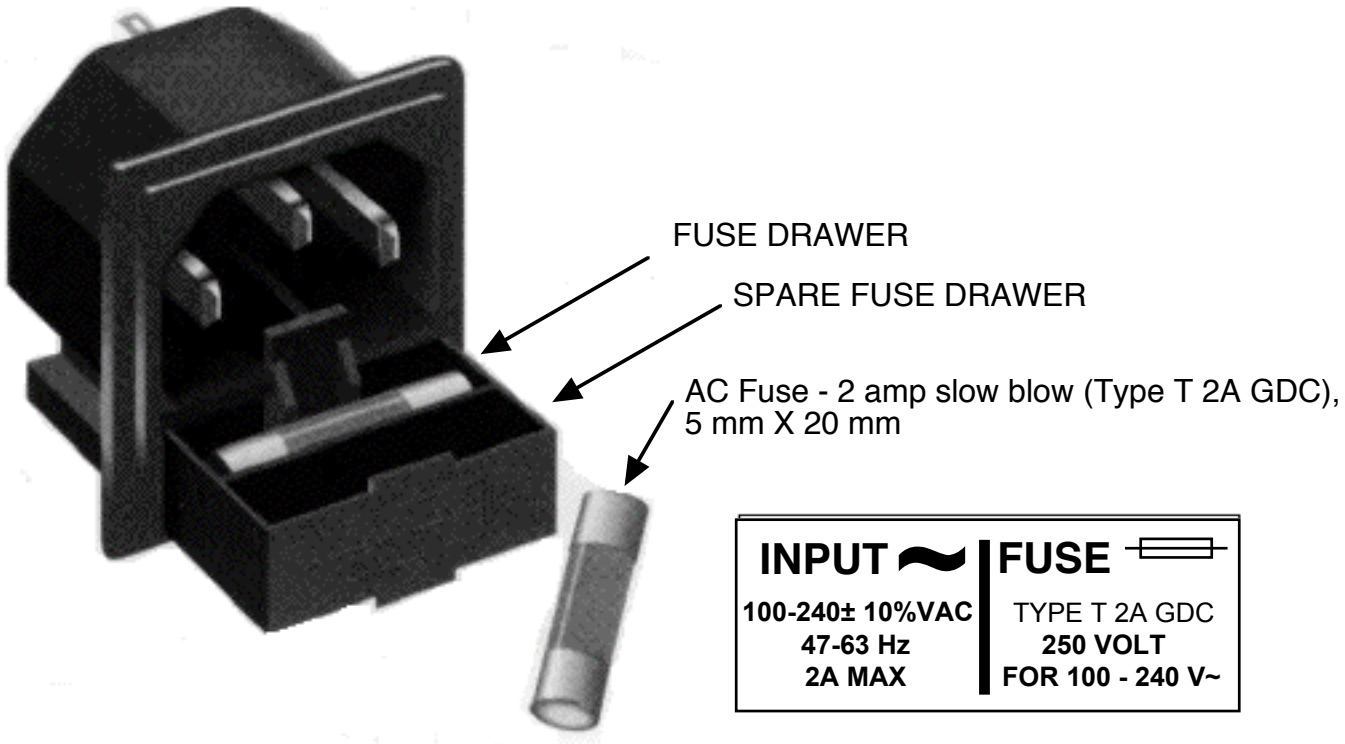


FIGURE 2.3 Fuse Location and Spare Fuse

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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 Gain
Menu 3 Select External 10 MHz
Menu 4 Set Remote
Menu 5 Remote Mode (Option Q)
Menu 6 RS-485 Address (Option Q)
Menu 7 Save Changes

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.

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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.

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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.

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 the next item:

```
719 to 201
G = +10          REF=INT
```

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 :

```
719 to 201
G = +10          REF=INT
```

Figure 2.4 gives the menu items and how to make changes

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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.

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.

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 :

```
719 to 201
G = +10        REF=INT
```

Figure 2.4 gives the menu items and how to make changes

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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.

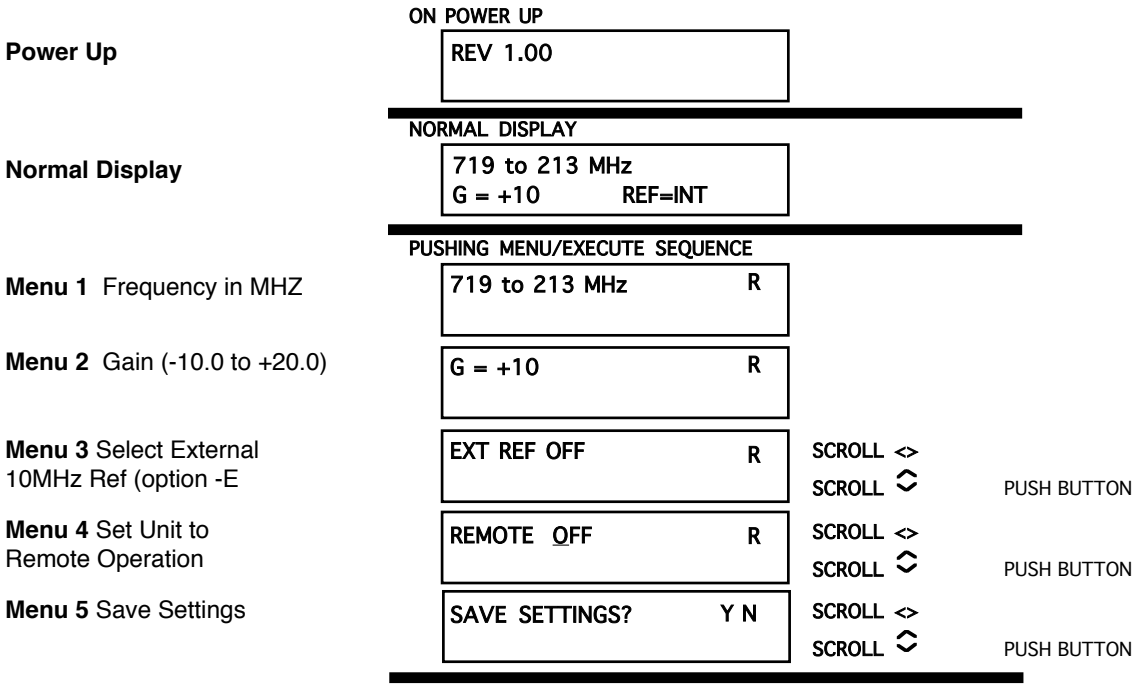
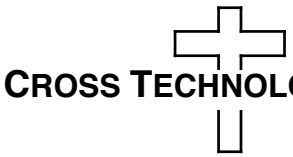


FIGURE 2.4 Menu Display and Sequences

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