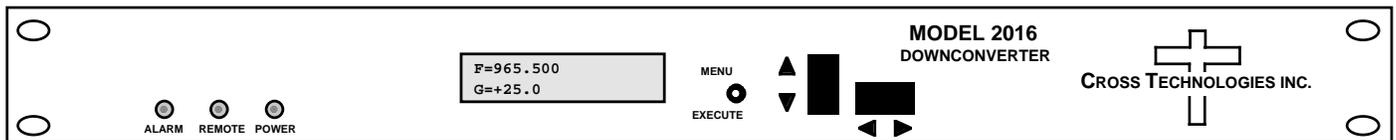


# Instruction Manual

# Model 2016-1096 Downconverter

May 2009 Rev A



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# INSTRUCTION MANUAL

## MODEL 2016-1096 Downconverter

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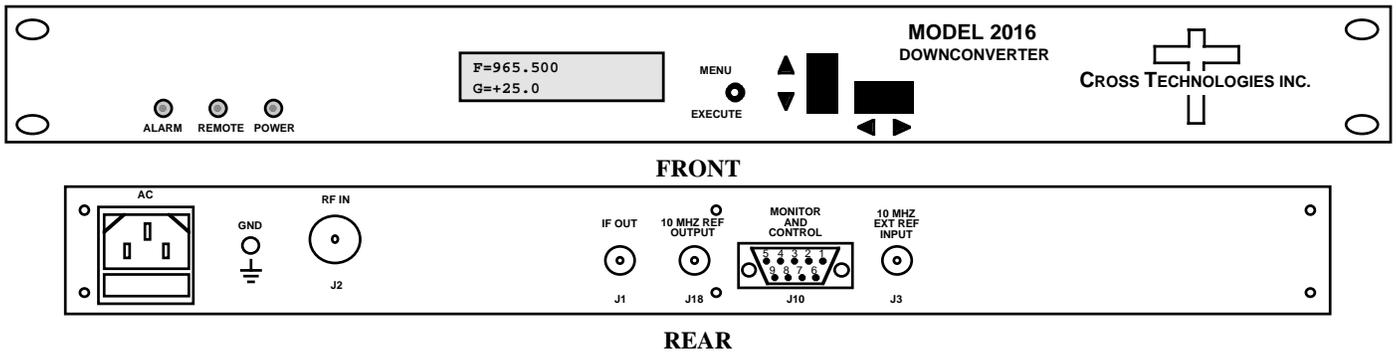
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# MODEL 2016-1096 Downconverter

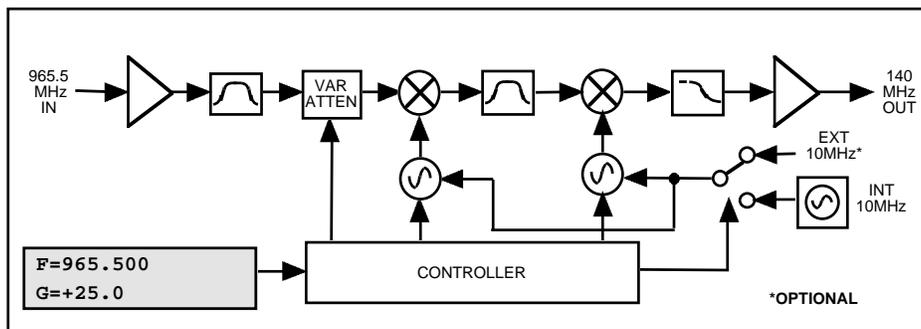
## 1.0 General

### 1.1 Equipment Description

The 2016-1096 UHF-band Downconverter converts 965.5 ( $\pm 36$ ) MHz fixed to 140 ( $\pm 36$ ) MHz with low group delay and flat frequency response. Synthesized local oscillators (LO) provide very low phase noise and  $\pm 0.01$  ppm stability frequency selection. Multi-function push button switches select the gain, and other variable parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow) or the TX carrier is muted (yellow). Gain is adjustable manually over a 0 to +50 dB range as adjusted by the front panel multi-function push-button switches. Remote operation allows selection of gain and other variable parameters. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are Type N (female) for the RF input and BNC (female) for IF output and optional external reference input / output. The External 10 MHz reference Option also includes a 10 MHz output connector, which provides the selected (internal or external) 10 MHz reference signal output. The unit is powered by 100-240  $\pm 10\%$  VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.



**FIGURE 1.1 Front and Rear Panels**



**FIGURE 1.2 Block Diagram**

## 1.2 Technical Characteristics

**TABLE 1.0 2016-1096 Downconverter Specifications\***

### Input Characteristics

Impedance/Return Loss	50Ω / 12 dB (see TABLE 2.2 for connector options)
Frequency	965.5 ±36 MHz, fixed
Noise Figure, Max.	15 dB max gain
Input Level range	-70 to -20 dBm
Input 1 dB compression	-15 dBm

### Output Characteristics

Impedance/Return Loss	75Ω /18 dB (see TABLE 2.2 for connector options)
Frequency	140 ± 36 MHz
Output Level/max linear	-20/-10 dBm
Output 1 dB compression	-5 dBm

### Channel Characteristics

Gain	0 to 50 dB, 1 dB steps (adjustable)
Image Rejection	> 50 dB, min
Frequency Response	±0.5 dB, 72 MHz BW, 965.5 MHz
Spurious Response	<-60 dBC in band typ.; -55 dBC max.
Group Delay, max	0.0035 ns/MHz <sup>2</sup> parabolic; 0.025 ns/MHz linear; 1 ns ripple
Frequency Sense	Non-inverting or Inverting (selectable)

### Synthesizer Characteristics

Frequency Accuracy	±0.01 ppm max over temp internal reference
Frequency Step	NONE; fixed frequency, non-tunable
10 MHz level (In & Out)	3 dBm, ± 3 dB ( <b>option E</b> )

Phase Noise @ Freq	100 Hz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-77	-82	-90	-102	-110

### Controls, Indicators

Gain Selection	direct readout LCD; pushbutton switches or remote selection
Power	Green LED
Alarm	Red LED
Remote	Yellow LED; RS232C (RS485 <b>option Q</b> ), 9600 baud

### Other

RF Connector	Type N (female) (see TABLE 2.2 for other options)
IF Connector	BNC (female) (see TABLE 2.2 for other options)
10 MHz Connectors	BNC (female), 50Ω/75Ω ( <b>option E</b> )
Connector, Alarm, Remote	DB9 - NO or NC contact closure on Alarm
Size	19 inch standard chassis 1.75"high X 16.0" deep
Power	100-240 ±10% VAC, 47 - 63 Hz, 45 watts max.

### Options

E	External 10MHz Reference input and output
Q	RS-422/RS-485 Remote capability
Connector options	see TABLE 2.2

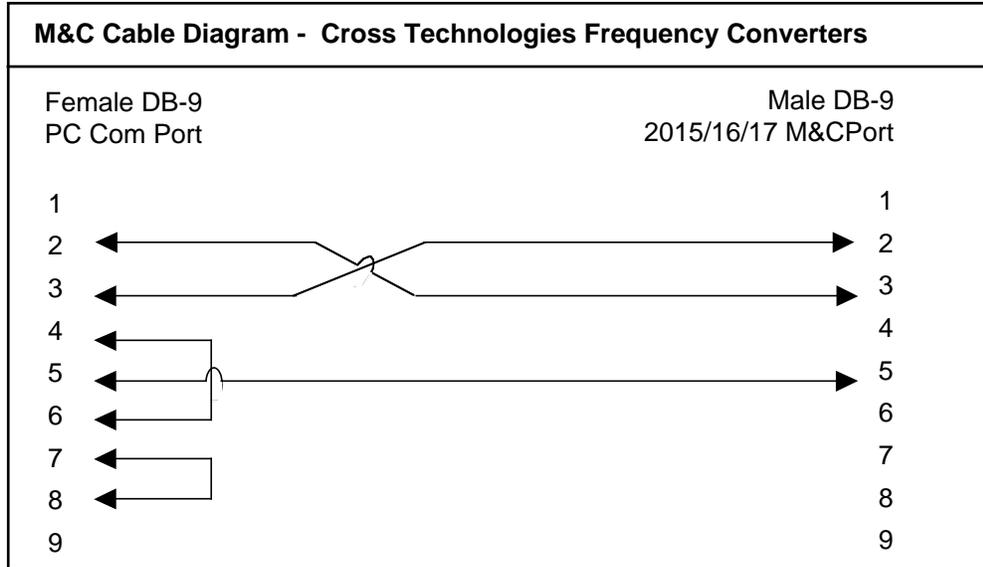
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\*+10°C to +40°C; Specifications subject to change without notice

### 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 2016-1096 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.

<b>TABLE 1.1 2016-1096 Status Requests</b>		
<b>Command</b>	<b>Syntax*</b>	<b>Description</b>
Command Status	{aaS1}	Returns {S1bbbbbbccIEA} where:
		• bbbbbbb = Rx frequency
		• cc = Rx gain
		• I = 1 - spectrum invert enabled
		• E = 1 - external 10 MHz switched in
		• A = summary alarm; 1=alarmed, 0=normal

**C) Commands** - Table 1.2 lists the commands for the 2016-1096 and briefly describes them. After a command is sent the 2016-1096 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 2016-1096 Commands		
Command	Syntax*	Description
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 (option -E only)	{aaCEx}	where x =:
		• 0 to disable External 10MHz ref signal
		• 1 to enable External 10MHz ref signal
Enable Remote	#	Just # sign
Disable Remote	{aaCR0}	{CR and zero}

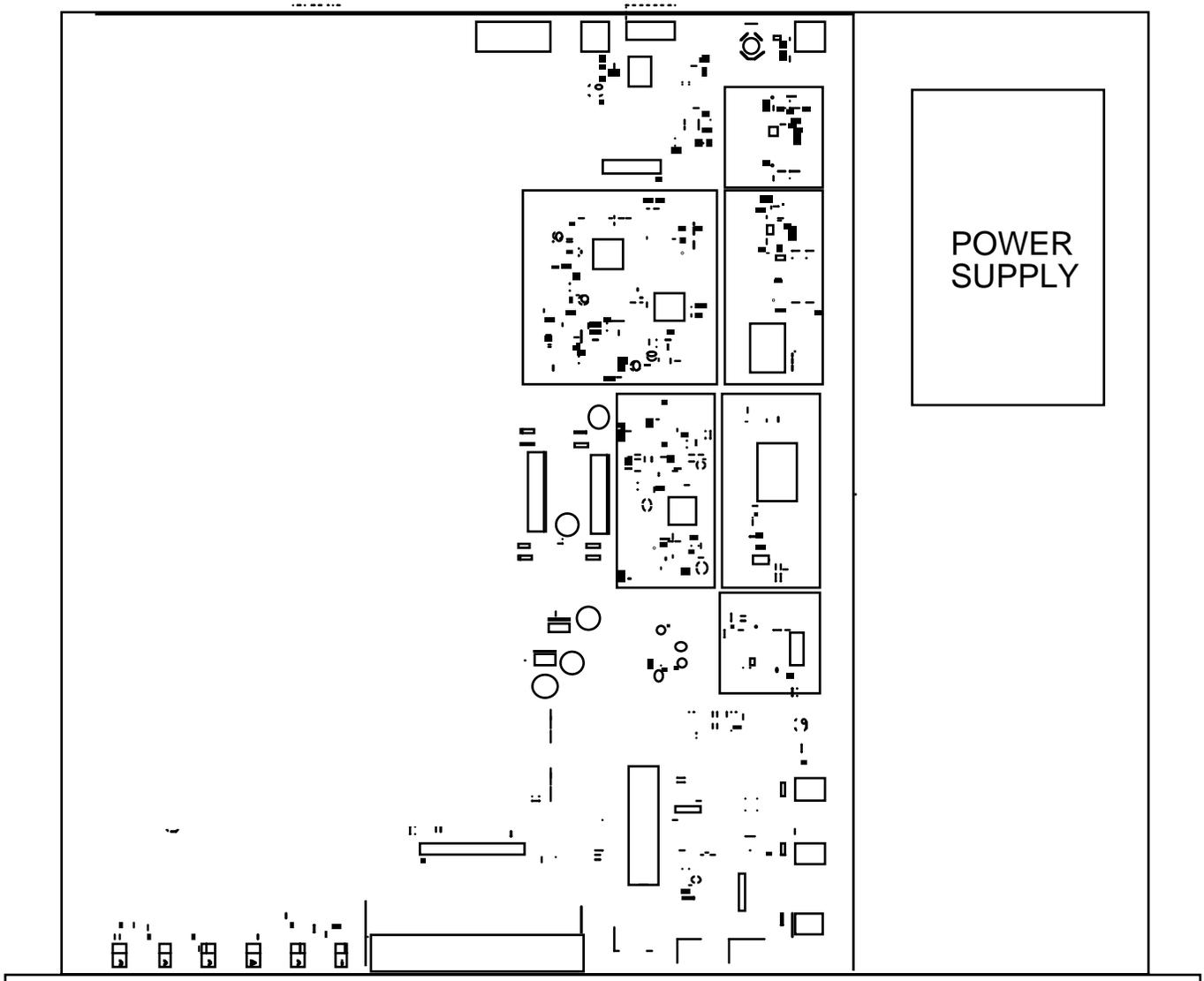
## 1.4 Environmental Use Information

- 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 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 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

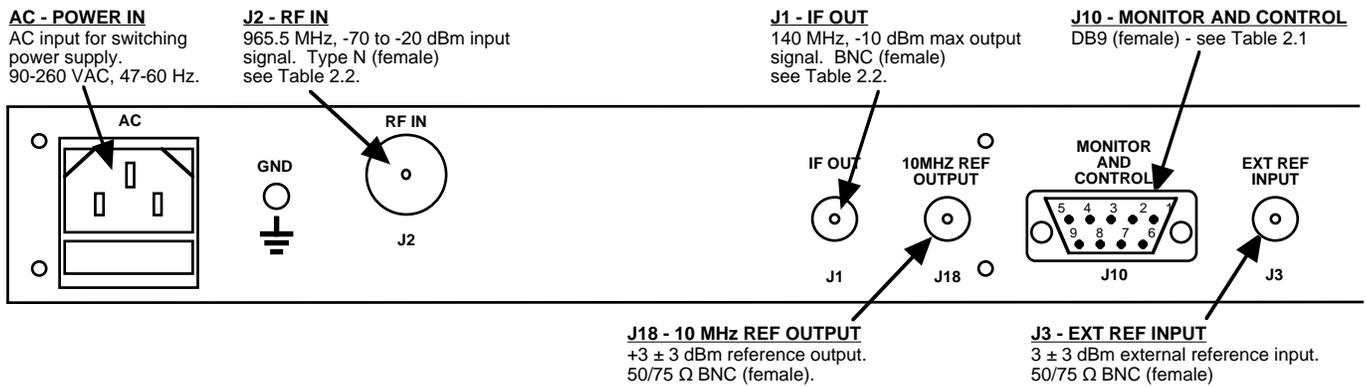
### 2.1 Mechanical

The 2016-1096 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching,  $\pm 12$ , +24, +5 VDC power supply provides power for the assemblies. The 2016-1096 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2016-1096 is assembled.



**FIGURE 2.1 2016-1096 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 Rear Panel I/Os**

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

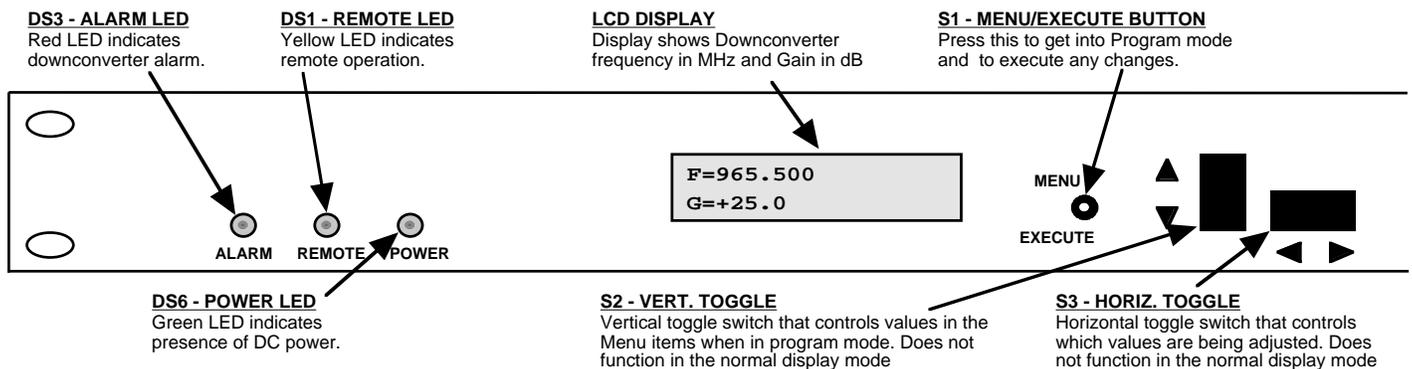
Option	IF	RF
STD	BNC, 75Ω	Type N, 50Ω
-B	BNC, 75Ω	BNC, 75Ω
-C	BNC, 75Ω	BNC, 50Ω
-D	BNC, 50Ω	BNC, 50Ω
-M	BNC, 50Ω	Type N, 50Ω

### \*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

## 2.3 Front Panel Controls and Indicators - Figure 2.3 shows the controls and indicators on the front panel.

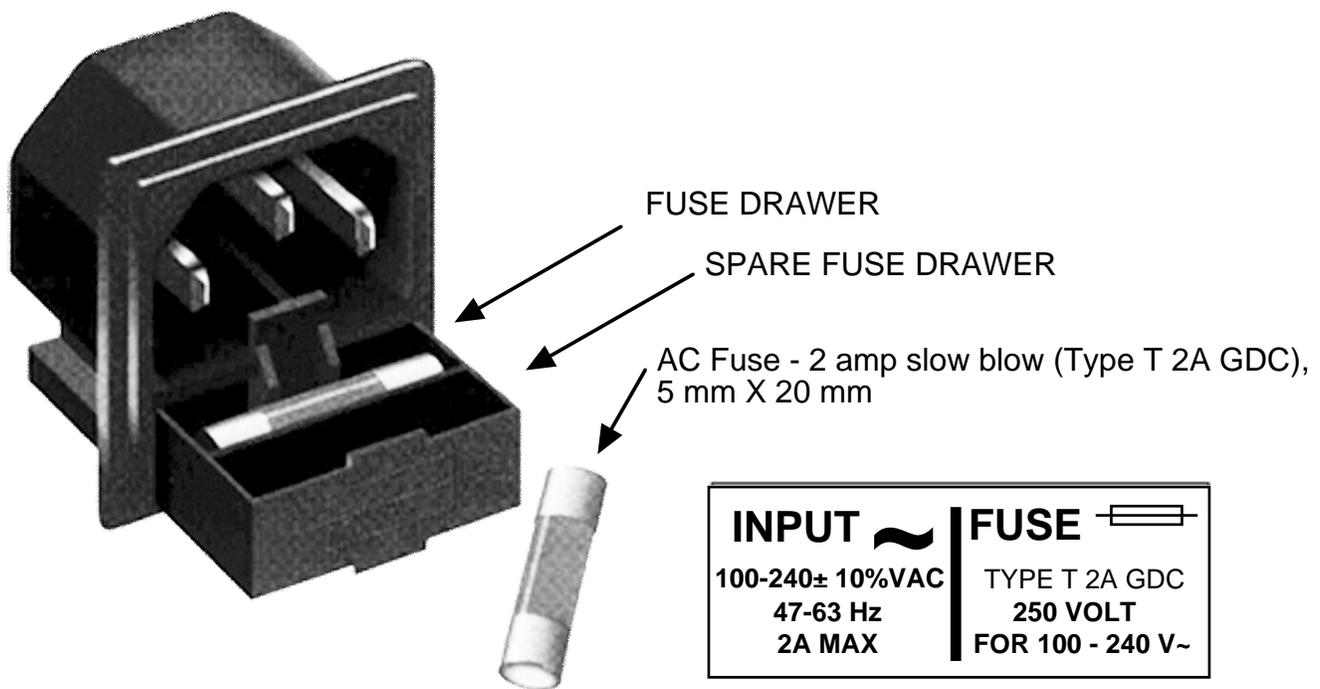


**FIGURE 2.3 Front Panel Controls and Indicators**

## 2.4 Operation

### 2.4.1 Installing and Operating the 2016-1096 Downconverter

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  $\pm$ 10% VAC, 47 - 63 Hz to AC on the back panel.
4. Set the gain for +00.0 to +50.0 dB (See Section 2.5 Menu Settings).
5. Be sure DS6 (green, DC Power) is on and DS3 (red, Alarm) is off (Figure 2.3).
6. **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. 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** Gain (0 to +50, 1dB steps)

**Menu 2** Set Unit to Remote Operation

**Menu 3** Select Inverting or Non-inverting Spectrum

**Menu 4** Select External 10 MHz Ref (option E)

**Menu 5** Set Remote mode (option Q)

**Menu 6** Set RS-485 address (option Q)

**Save Menu** When get to end of menu cycle or when “R” is selected

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 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.**

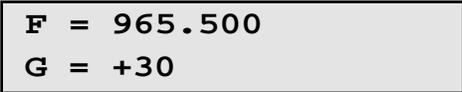
When power is first applied, the LCD display goes through three steps.

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 and gain of the downconverter is shown.



F = 965.500  
G = +30

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 gain changes, the vertical movement will raise or lower the number in the direction of the arrows.
  - b. For other functions such as Remote on/off, the vertical switch will alternately turn the function on or off regardless of the direction operated.

## 2.5.4 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 DOWNCONVERTER GAIN:

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

<b>G = +<u>3</u>0</b>	<b>R</b>
-----------------------	----------

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

<b>G = +<u>4</u>0</b>	<b>R</b>
-----------------------	----------

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.

<b>G = +4<u>0</u></b>	<b>R</b>
-----------------------	----------

**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:

<b>REMOTE</b>	<b><u>O</u>FF</b>	<b>R</b>
---------------	-------------------	----------

OR you can scroll to “**R**” and push the Menu/Execute switch to get to:

<b>SAVE SETTINGS?</b>	<b><u>Y</u> N</b>
-----------------------	-------------------

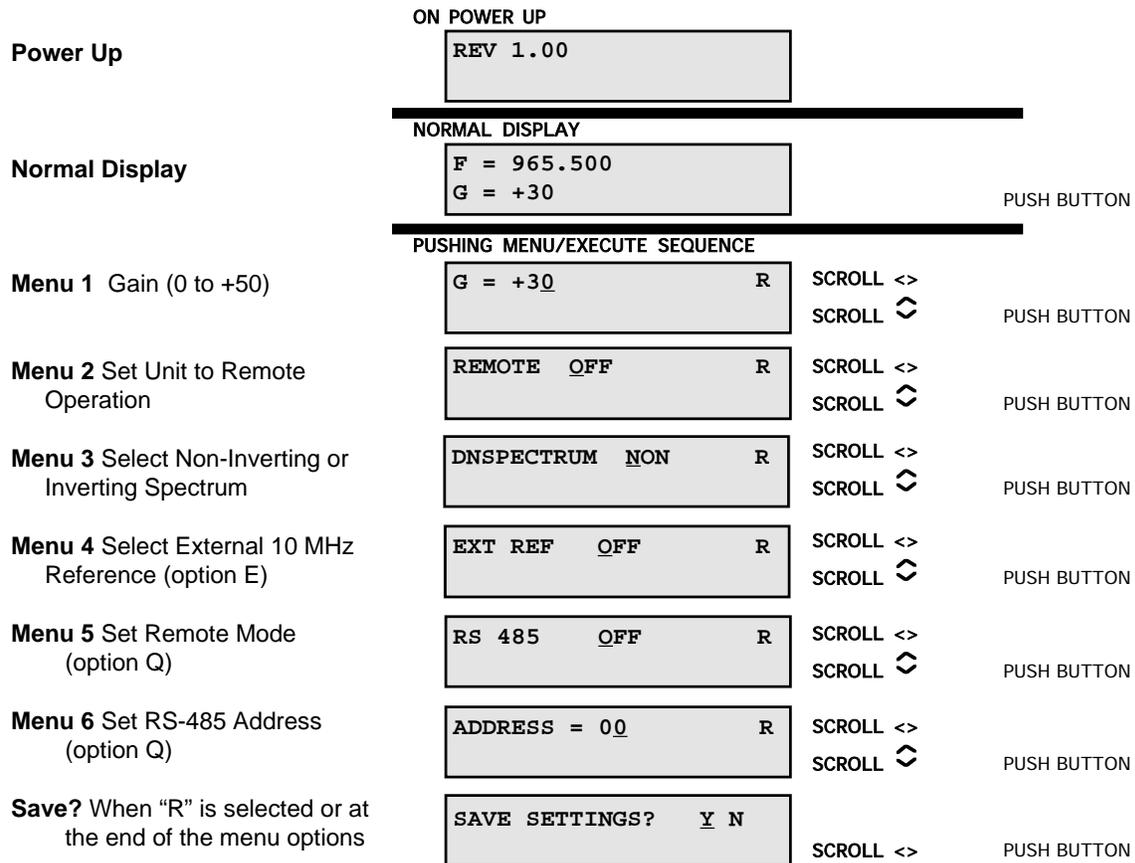
Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings. Pushing the Menu/Execute switch then takes you to this:

<b>F = 965.500</b>
<b>G = +40</b>

Figure 2.5 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.



**FIGURE 2.5 Menu Display and Sequence**



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