Instruction Manual

Model 2016-0510
Downconverter

July 2013,   Rev. 0

```
┌─────────────────────────────────────────────────────────────────────────────┐
│  ◯                                              MODEL 2016                 ◯   │
│         ┌──────────────┐                      DOWNCONVERTER                    │
│         │ F=1000  G=+25.0│      MENU    ▲                 CROSS TECHNOLOGIES INC.│
│     ◉  ◉  ◉             └──────────────┘        ◯   ▼                           │
│  ◯ ALARM REMOTE POWER               EXECUTE       ◀ ▶                      ◯   │
└─────────────────────────────────────────────────────────────────────────────┘
```
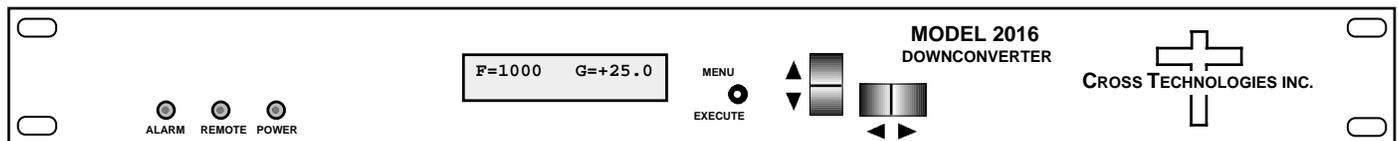
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INSTRUCTION MANUAL

MODEL 2016-0510 Downconverter

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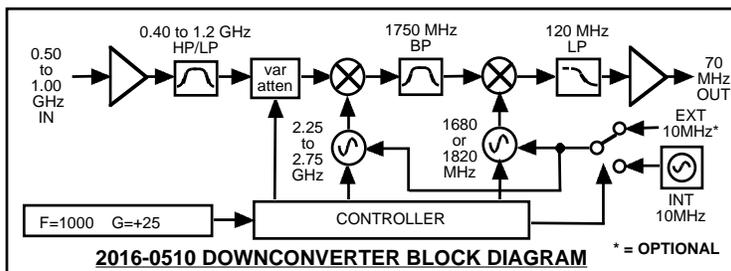
MODEL 2016-0510 Downconverter

1.0 General

1.1 Equipment Description

The 2016-0510 Downconverter converts 500 to 1000 MHz to 70 ± 18 MHz in 1 MHz steps (125 kHz to 1 kHz step options available). Synthesized local oscillators (LO) provide frequency selection. Push button switches select the input frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), and Remote operation (yellow). Gain is adjustable manually (MGC) over a 0 to 50 dB range. 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 the optional external reference input and output, and Type F female for the RF input. The external 10 MHz option E includes a 10 MHz output connector which contains either the internal or external 10 MHz reference signal. A high stability Option H (± 0.01 ppm) is also available. The unit is powered by a $100\text{-}240 \pm 10\%$ VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.
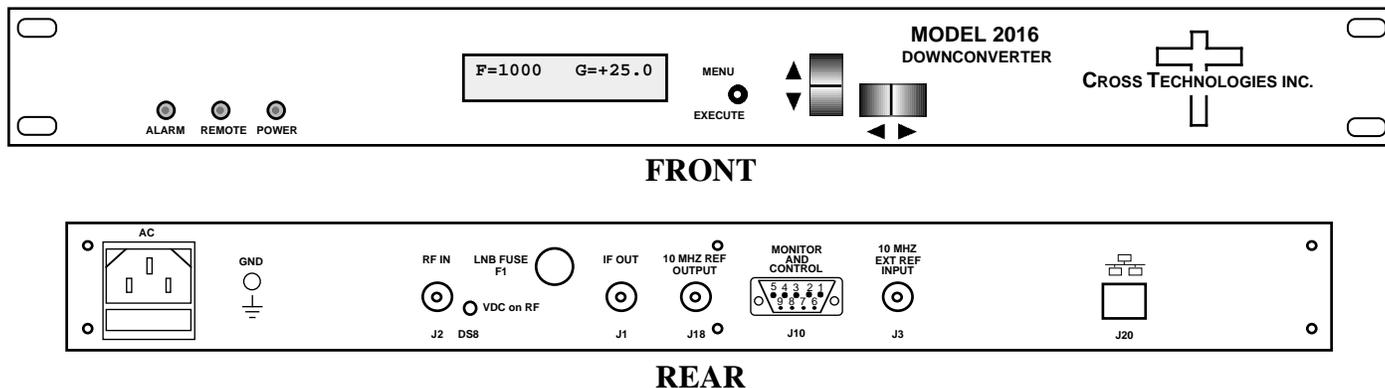
FIGURE 1.1   Model 2016-0510 Front and Rear Panels

FIGURE 1.2   Model 2016-0510 Downconverter Block Diagram
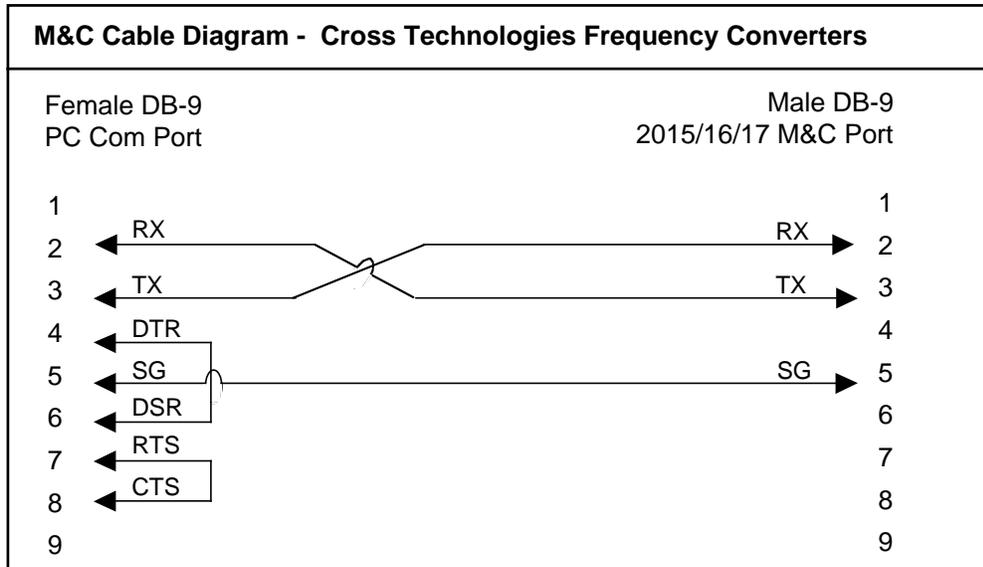
1.2 Technical Characteristics

TABLE 1.1   2016-0510 Downconverter Specifications*

Input Characteristics (IF)	
Impedance / Return Loss	75Ω / 10 dB
Frequency	500-1000 MHz
Input Level	-70 to -20 dBm

Output Characteristics (RF)	
Impedance / Return Loss	75Ω / 18 dB
Frequency	70 ±18 MHz
Output Level	-20 to -10 dBm
Output 1 dB Compression	-5 dBm at maximum gain

Channel Characteristics	
Gain Range (adjustable)	0.0 to +50.0 dB
Image Rejection	> 50 dB, minimum
Frequency Response	±1.5 dB, 500-1000 MHz; ±0.5 dB, 36 MHz BW; ±1.0 dB, 40 MHz BW
Spurious Response	< -50 dBC, in band
Group Delay, max.	0.015 ns/MHz^2 parabolic; 0.05ns/MHz linear; 1 ns ripple
Frequency Sense	Inverting or Non-inverting, Selectable

Synthesizer Characteristics						
Frequency Accuracy	± 1.0 ppm maximum over temperature (±0.01 ppm, **Option H**)					
Frequency Step	1.0 MHz (125 kHz to 1 kHz step options available)					
10 MHz Level (In or Out)	3 dBm, ± 3 dB, 75 ohms (**Option E**)					
Phase Noise @ F (Hz) >	10	100	1K	10K	100K	1M
Standard 1MHz steps: dBC/Hz	-55	-70	-70	-80	-90	-110
X1001-1kHz steps: dBC/Hz	-60	-75	-85	-90	-105	-120

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 (RS485, Ethernet Optional)

Other	
RF, IF Connectors	Type F (female), BNC (female)
IF, 10 MHz Connectors	BNC (female), 75Ω, works with 50 or 75 ohms (**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, 25 watts max. (24, 48 VDC Optional)

Available Options	
E	External 10 MHz reference input & output, RF Insertion
H	High Stability (± 0.01 ppm) internal reference
X or X1	125 kHz or 100 kHz step size
X 1001	1 kHz step, includes Option H

Communication Interface/Standard RS232	
Q	RS485 Remote Interface
W8	Ethernet, with Web Browser
W18	Ethernet, with Web Browser and SNMP
W28	Ethernet, with TCP/IP, Telnet®

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

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)

Contact Cross Technologies for other available options.

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**)

M&C Cable Diagram - Cross Technologies Frequency Converters

Female DB-9
PC Com Port

Male DB-9
2015/16/17 M&C Port

Female DB-9			Male DB-9
1			1
2	RX	RX	2
3	TX	TX	3
4	DTR		4
5	SG	SG	5
6	DSR		6
7	RTS		7
8	CTS		8
9			9

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

B) Status Requests -

Table 1.2 lists the status requests for the 2016-0510 and briefly describes them.

* PLEASE NOTE: The two character {aa}(OO-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

TABLE 1.2 2016-0510 Status Requests		
Command	Syntax*	Description
Command Status	{aaS1}	Returns {S1bbbbccclA} where:
		• bbbb = Rx frequency
		• cc = Rx gain
		• I = 1 - spectrum invert enabled
		• A = summary alarm; 1=alarmed, O=normal
1OMHz Ref Status	{aaS2}	Returns {S2E} where:
(option -E only)		• E = 1 - external 10 MHz switched in

C) Commands - Table 1.1 lists the commands for the 2016-0510 and briefly describes them. After a command is sent the 2016-0510 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 1.1 2016-0510 Commands		
Command	Syntax*	Description
Set Receiver Frequency	{aaC2xxxx}	where:
		• xxxx = 4 characters
		• Range: 500 to 1000 MHz, in 1 MHz steps
Set Receiver Gain	{aaC4xx}	where:
		• xxx = 3 characters
		• Range: 000 to 500 (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 2016-0510 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. 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. The 2016-0510 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2016-0510 is assembled.

POWER SUPPLY
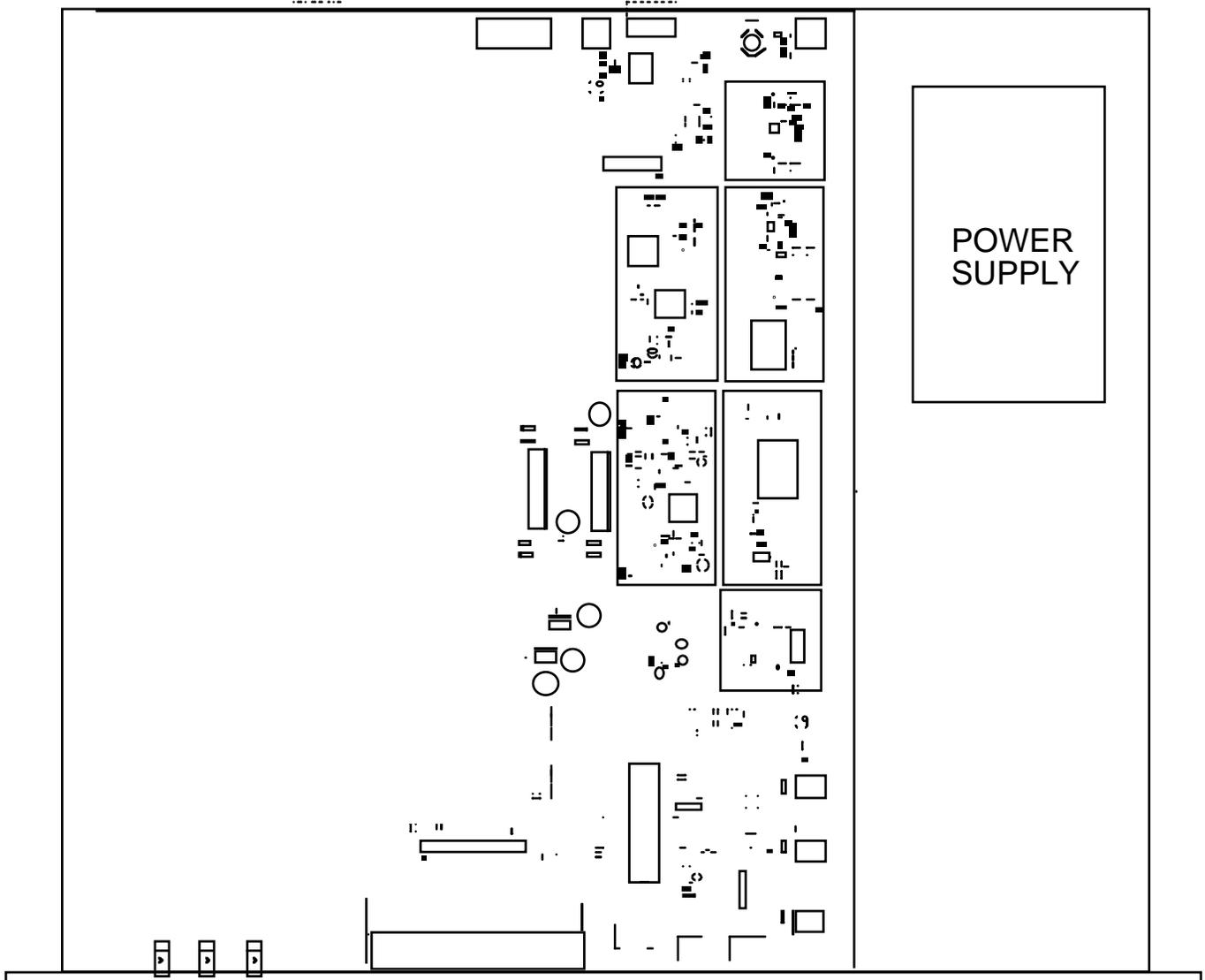
FIGURE 2.1   2016-0510 Mechanical Assembly

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

AC1 - POWER IN
AC input for switching power supply. 100-240 ±10% VAC, 47-60 Hz.

J2 - RF IN
500-1000 MHz input -70 to -20 dBm see Table 2.2.

F1 - LNB FUSE (option -L)
0.5A, Fast Blo, 1/4" Fuse; installing fuse places +24 VDC, 0.4 Amps, max on the RF IN (J2 center pin).

J1 - IF OUT
70 MHz output -20 to -10 dBm see Table 2.2.

J10 - MONITOR AND CONTROL
DB9 female connector see Table 2.1

J20 - Ethernet Connection
RJ45 Ethernet Connector

DS8 - LNB ALARM LED (option -L)
Lights yellow when +24 VDC LNB voltage is present on RF IN, J2, center pin.

J18 - 10 MHz REF OUTPUT (option -E)
10 MHz external reference input 3 ± 3 dBm, 75Ω, BNC female connector.

J3 - 10 MHz EXT REF INPUT (Option -E)
10 MHz external reference input 3 ± 3 dBm, 75Ω, BNC female connector.

FIGURE 2.2   2016-0510 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

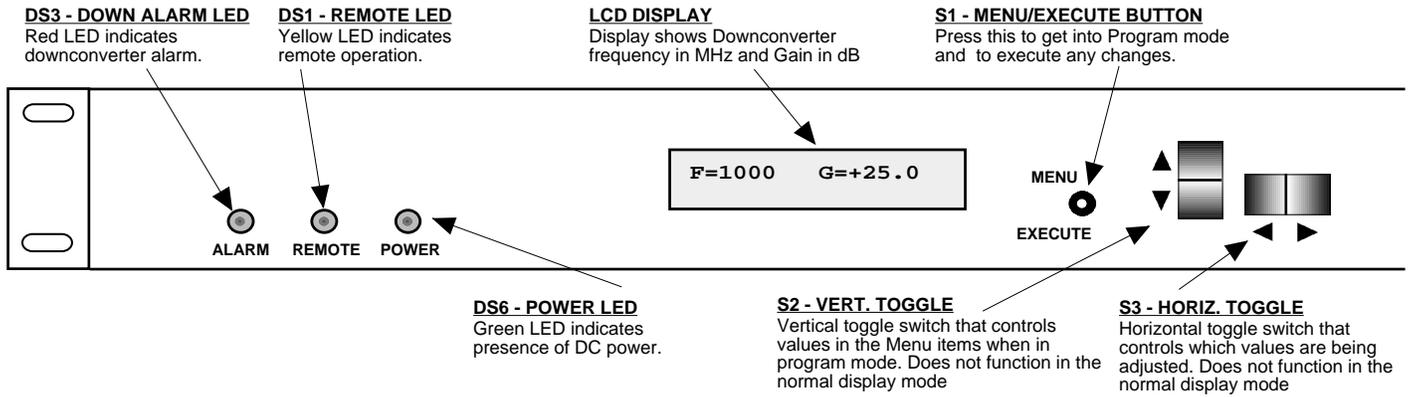***Remote Serial Interface**
Interface: DB-9 Male
Protocol: RS-232C, 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit

TABLE 2.2 IF/RF Connector Options		
Option	IF	RF
STD	BNC, 75Ω	F-Type, 75Ω
-B	BNC, 75Ω	BNC, 75Ω
-C	BNC, 75Ω	BNC, 50Ω
-D	BNC, 50Ω	BNC, 50Ω
-M	BNC, 50Ω	Type N, 50Ω
-N	BNC, 75Ω	Type N, 50Ω

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

DS3 - DOWN ALARM LED
Red LED indicates
downconverter alarm.

DS1 - REMOTE LED
Yellow LED indicates
remote operation.

LCD DISPLAY
Display shows Downconverter
frequency in MHz and Gain in dB

S1 - MENU/EXECUTE BUTTON
Press this to get into Program mode
and to execute any changes.

```
F=1000   G=+25.0
```

MENU

EXECUTE

ALARM   REMOTE   POWER

DS6 - POWER LED
Green LED indicates
presence of DC power.

S2 - VERT. TOGGLE
Vertical toggle switch that controls
values in the Menu items when in
program mode. Does not function in the
normal display mode

S3 - HORIZ. TOGGLE
Horizontal toggle switch that
controls which values are being
adjusted. Does not function in the
normal display mode

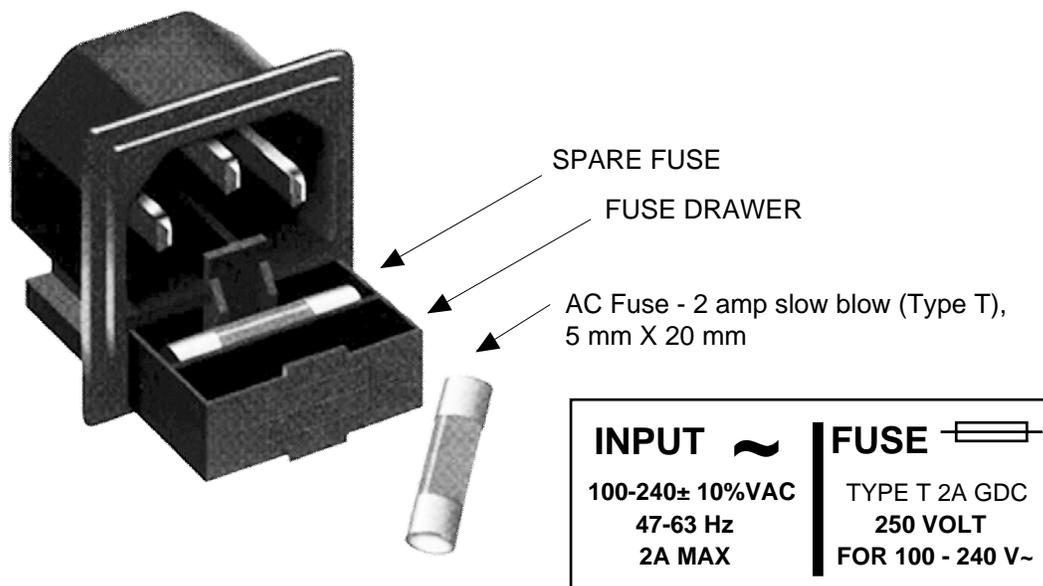# FIGURE 2.3   2016-0510 Front Panel Controls and Indicators

2.4 Operation

2.4.1 Installing and Operating the 2016-0510 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 ±10% VAC, 47 - 63 Hz, 25 watts max. to AC on the back panel.
4. Set the input frequency (See Section 2.5 Menu Settings).
5. Set the gain for 0.0 to +50.0 dB (See Section 2.5 Menu Settings).
6. Be sure DS6 (green, DC Power) is on and DS3 (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 2.4. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

SPARE FUSE

FUSE DRAWER

AC Fuse - 2 amp slow blow (Type T), 5 mm X 20 mm

INPUT ~	FUSE ▭
100-240± 10%VAC	TYPE T 2A GDC
47-63 Hz	250 VOLT
2A MAX	FOR 100 - 240 V~

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 to +50, 1 dB steps)

Menu 3 Set Unit to Remote Operation

Menu 4 Select External 10 MHz Reference (Option -E)

Menu 5 Set Remote mode (Option -Q)

Menu 6 Set RS-485 address (Option -Q)

Save Menu When go to end

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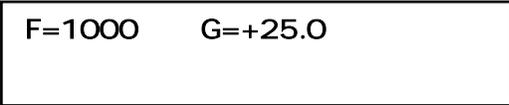
When power is first applied, the LCD display goes through three steps.

      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=1000    G=+25.0

```

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 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.

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 = 1000                    R
```

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

```
F = 975                     R
```

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

```
F = 975                     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 get to the next item:

```
G = +25.0                   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=1000      G=+25.0
```

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 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):

```
G = +25.0              R
```

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

```
G = +35.0              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 = +35.0              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.

```
SAVE SETTINGS?    Y N
```

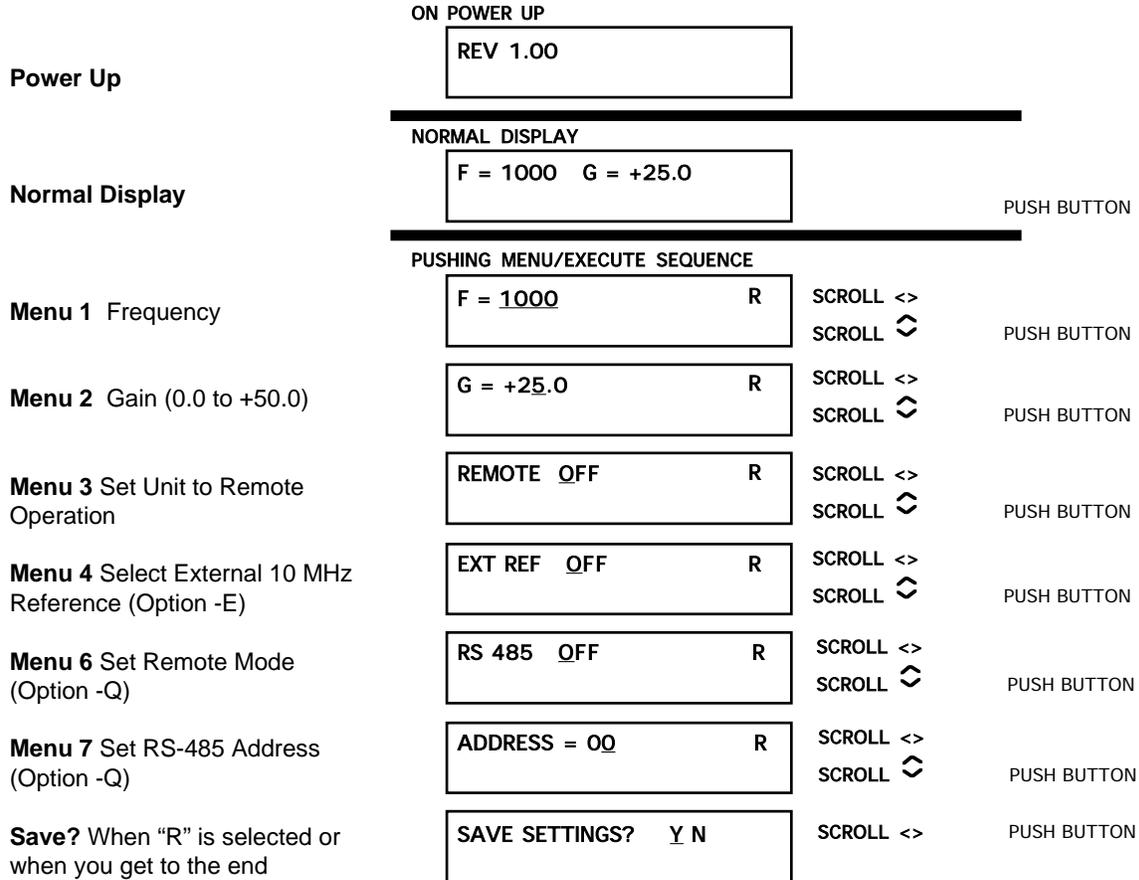Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.
Pushing the Menu/Execute switch then takes you to this:

```
F=1000      G=+25.0
```

Figure 2.5 gives the menu items and how to make changes.

2.5.5 Alarm Indications

An alarm condition for will occur if 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.

Power Up

ON POWER UP

REV 1.00

Normal Display

NORMAL DISPLAY

F = 1000   G = +25.0

PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Frequency

F = 1000   R

SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 2 Gain (0.0 to +50.0)

G = +25.0   R

SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 3 Set Unit to Remote Operation

REMOTE OFF   R

SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 4 Select External 10 MHz Reference (Option -E)

EXT REF   OFF   R

SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 6 Set Remote Mode (Option -Q)

RS 485   OFF   R

SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 7 Set RS-485 Address (Option -Q)

ADDRESS = 00   R

SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Save? When "R" is selected or when you get to the end

SAVE SETTINGS?   Y N

SCROLL <>   PUSH BUTTON

FIGURE 2.5   Menu Display and Sequence

3.0 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 <u>Top Cover should not be removed</u>. 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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