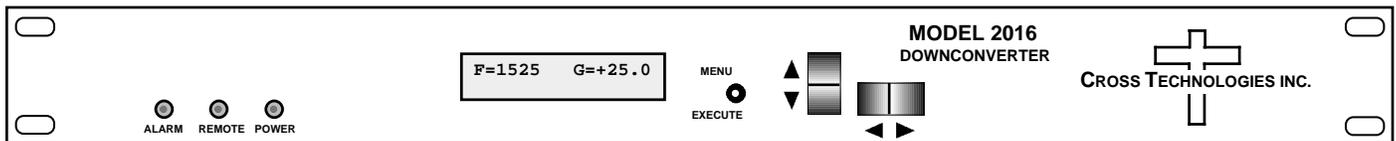


# Instruction Manual

# Model 2016-02 Downconverter

October 2015, Rev. P



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# INSTRUCTION MANUAL

## Model 2016-02 Downconverter

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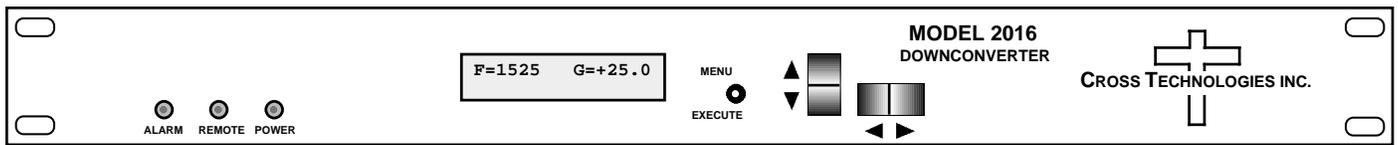
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# Model 2016-02 Downconverter, 0.95 - 2.15 GHz to 70 MHz

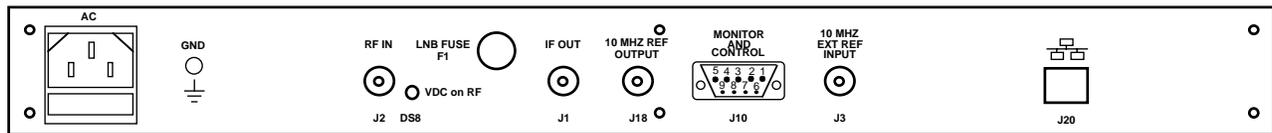
## 1.0 General

### 1.1 Equipment Description

The 2016-02 Downconverter converts 950 to 2150 MHz to  $70 \pm 18$  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. LNB +24, +18, or +12 VDC and 10 MHz reference can be inserted on the RF line as added options. 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 ( $\pm 0.01$ ppm) is also available. The unit is powered by a  $100-240 \pm 10\%$  VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.

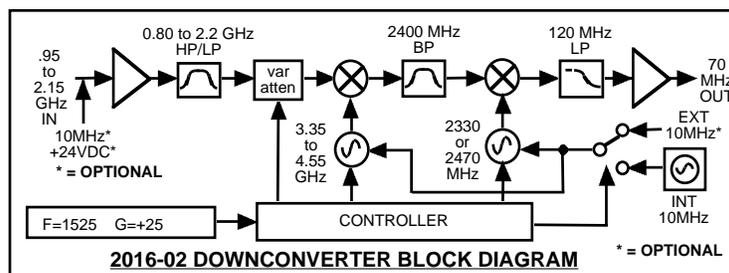


FRONT PANEL



REAR PANEL (Optional Ethernet and LNB Insertion Shown)

**FIGURE 1.1 Model 2016-02 Front and Rear Panels**



**FIGURE 1.2 Model 2016-02 Downconverter Block Diagram**

## 1.2 Technical Characteristics

**TABLE 1.0 2016-02 Downconverter Specifications\***

### Input Characteristics (IF)

Impedance/Return Loss	75 $\Omega$ /10 dB
Frequency	950 to 2150 MHz
Input Level	-70 to -20 dBm

### Output Characteristics (RF)

Impedance/Return Loss	75 $\Omega$ /18 dB (see TABLE 2.2 for connector options)
Frequency	70 $\pm$ 18 MHz
Output Level/max. linear	-20 to -10 dBm
Output 1 dB compression	-5 dBm at maximum gain

### Channel Characteristics

Gain Range (adjustable)	0.0 to +50.0 dB range, 1 $\pm$ 1 dB steps (manually adjustable)
Image Rejection	> 50 dB, minimum
Spurious Response	<-50 dBC, in band
Frequency Response	$\pm$ 1.5 dB, 950 - 2150 MHz; $\pm$ 0.5 dB, 36 MHz BW; $\pm$ 1.0 dB, 40 MHz BW
Group Delay, maximum	0.015 ns/MHz <sup>2</sup> parabolic; 0.05 ns/MHz linear; 1 ns ripple
Frequency Sense	Inverting or Non-inverting (selectable)

### Synthesizer Characteristics

Frequency Accuracy	$\pm$ 1.0 ppm maximum over temp ( $\pm$ 0.01 ppm option H)
Frequency Step	1.0 MHz (125 kHz to 1 kHz step options available)
10 MHz level (In & Out)	3 dBm, $\pm$ 3 dB, 75 ohms (option E)

Phase Noise @ F (Hz) >	10	100	1K	10K	100K	1M
Standard dBC/(Hz)	-55	-70	-70	-80	-90	-110

### Controls, Indicators

Frequency Selection	Direct readout LCD; pushbutton switches or remote selection
Gain Selection	Direct readout LCD; pushbutton switches or remote selection
Power; Alarm; Remote	Green LED, Red LED, Yellow LED
Remote	RS232C, 9600 baud (RS485, Ethernet Optional)

### Other

RF Connector	Type F (female) (see TABLE 2.2 for other options)
IF Connector	BNC (female) (see TABLE 2.2 for other options)
10 MHz Connectors	BNC (female), 75 $\Omega$ , works with 50 or 75 ohms (option E)
Alarm, Remote Connector	DB9 (female), - NO or NC contact closure on Alarm
Size	19 inch standard chassis 1.75" high X 16.0" deep
Power	100-240 $\pm$ 10% VAC, 47-63 Hz, 25 W max.; 24, 48 VDC Optional

### Options

E -	External 10 MHz reference in & out; RF Ins.
H -	High Stability ( $\pm$ 0.01ppm) Internal Reference
L -	LNB Voltage, +24 VDC, 0.4 amps
L18 -	LNB Voltage, +18 VDC, 0.4 A
L12 -	LNB Voltage, +12 VDC, 0.5 A
SW1 -	Switch-system specific option
X or X1-	125 kHz or 100 kHz step size
X1002 -	1 kHz step, includes Option H
Z5 -	Attenuator 0.5 dB steps

### Comm. Interface/Standard RS232

Q -	RS485 Remote Interface
W8 -	Ethernet; with Web Browser
W18 -	Ethernet; with Web Browser & SNMP
W28 -	Ethernet; with TCP/IP, Telnet

### Connector Options

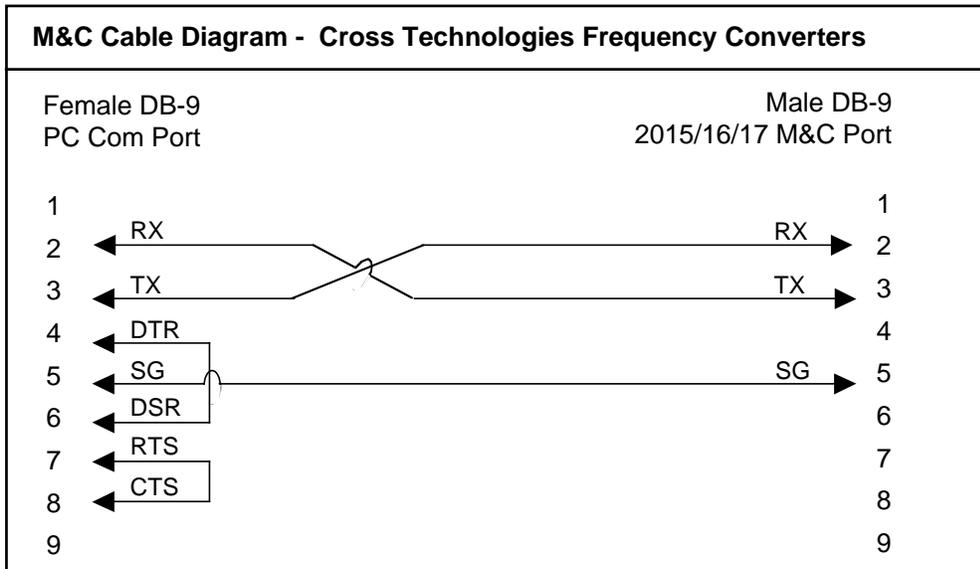
See TABLE 2.2

+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 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 1.1 lists the status requests for the 2016-02 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 2016-02 Status Requests</b>		
<b>Command</b>	<b>Syntax*</b>	<b>Description</b>
Command Status	{aaS1}	Returns {S1bbbbccIA} where:
		• bbbb = Rx frequency
		4 characters - standard (7 characters - Option-X)
		• cc = Rx gain
		• I = 1 - spectrum invert enabled
		• A = summary alarm; 1=alarmed, 0=normal
10MHz Ref Status	{aaS2}	Returns {S2ER} where:
<b>(option -E only)</b>		• E = 1 - external 10 MHz switched in
		• R = 1 - 10 MHz ref inserted on RF input connector
LNB Current	{aaS3}	Returns {S3eee} where:
<b>(option -L only)</b>		• eee = LNB current (000 to 500 = 0 to .500 A)

## C) Commands

Table 1.2 lists the commands for the 2016-02 and briefly describes them. After a command is sent the 2016-02 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 2016-02 Commands		
Command	Syntax*	Description
Set Receiver Frequency	{aaC2xxxx}	where: <ul style="list-style-type: none"> <li>• xxxx = 4 characters standard (7 characters -Option-X)</li> <li>• Range: 0950 to 2150 MHz, in 1 MHz steps</li> </ul>
Set Receiver Gain	{aaC4xx}	where: <ul style="list-style-type: none"> <li>• xx = 2 characters</li> <li>• Range: 00 to 50 (0 dB to +50 dB, in 1 dB steps)</li> </ul>
Enable 10MHz Ref Insertion <b>(option -E only)</b>	{aaC6x}	where x =: <ul style="list-style-type: none"> <li>• 0 to disable 10MHz insertion on RF input connector</li> <li>• 1 to enable 10MHz insertion on RF input connector</li> </ul>
Enable Spectrum Invert	{aaC7x}	where x =: <ul style="list-style-type: none"> <li>• 0 to disable spectrum invert</li> <li>• 1 to enable spectrum invert</li> </ul>
Enable External 10MHz IN <b>(option -E only)</b>	{aaCEx}	where x =: <ul style="list-style-type: none"> <li>• 0 to disable External 10MHz ref signal</li> <li>• 1 to enable External 10MHz ref signal</li> </ul>
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}	{CR and zero}

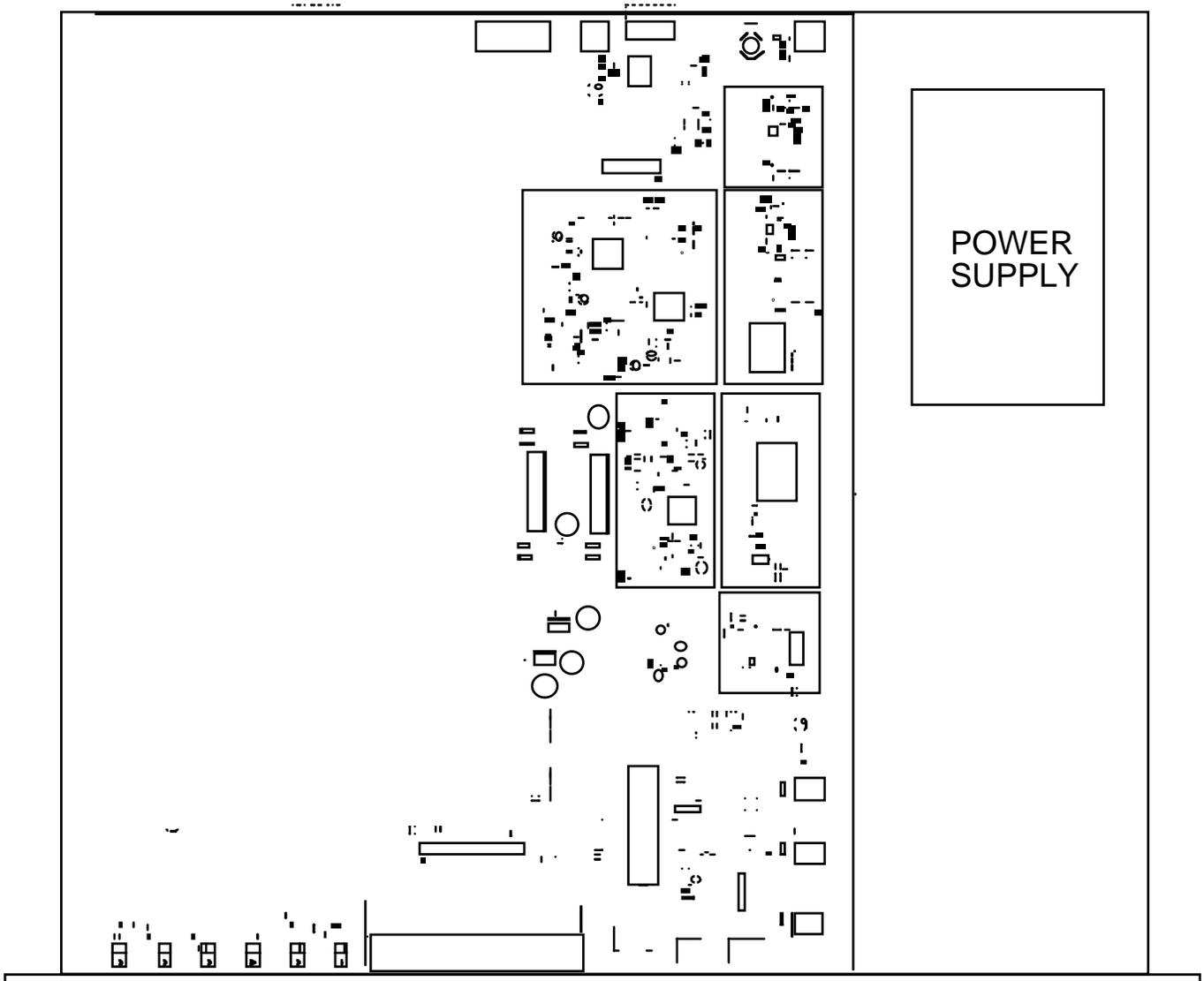
## 1.4 Use Information

- 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  $T_{mra}$ .
- 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

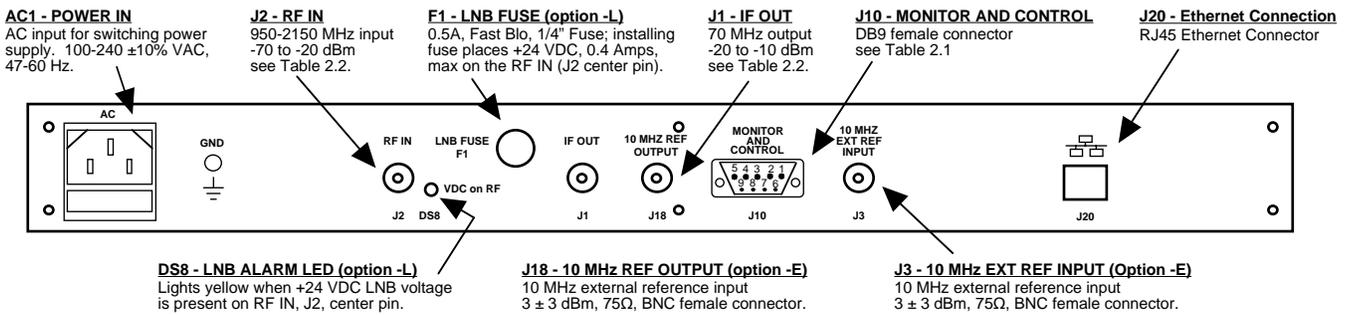
The 2016-02 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching,  $\pm 12$ , +24, +5 VDC power supply provides power for the assemblies. The 2016-02 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2016-02 is assembled.



**FIGURE 2.1 2016-02 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 2016-02 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

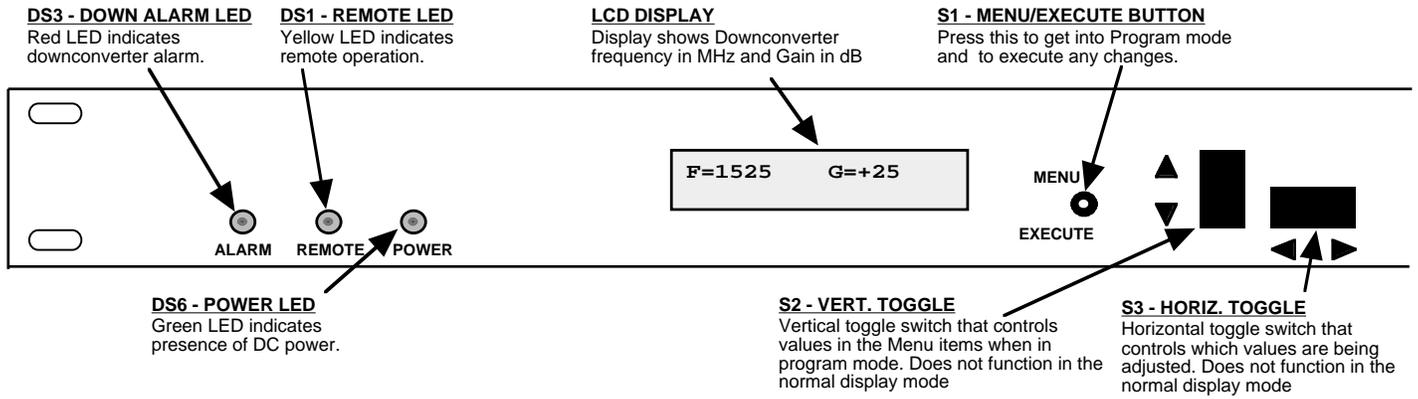
### \*Remote Serial Interface

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	Type F, 75Ω
B	BNC, 75Ω	BNC, 75Ω
C	BNC, 75Ω	BNC, 50Ω
D	BNC, 50Ω	BNC, 50Ω
F	Type F, 75 Ω	Type F, 75 Ω
FN	Type F, 75 Ω	Type N, 50 Ω
J	BNC, 50Ω	Type F, 75 Ω
K	BNC, 50Ω	BNC, 75 Ω
M	BNC, 50Ω	Type N, 50Ω
N	BNC, 75Ω	Type N, 50Ω
S	BNC, 50Ω	SMA, 50Ω

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

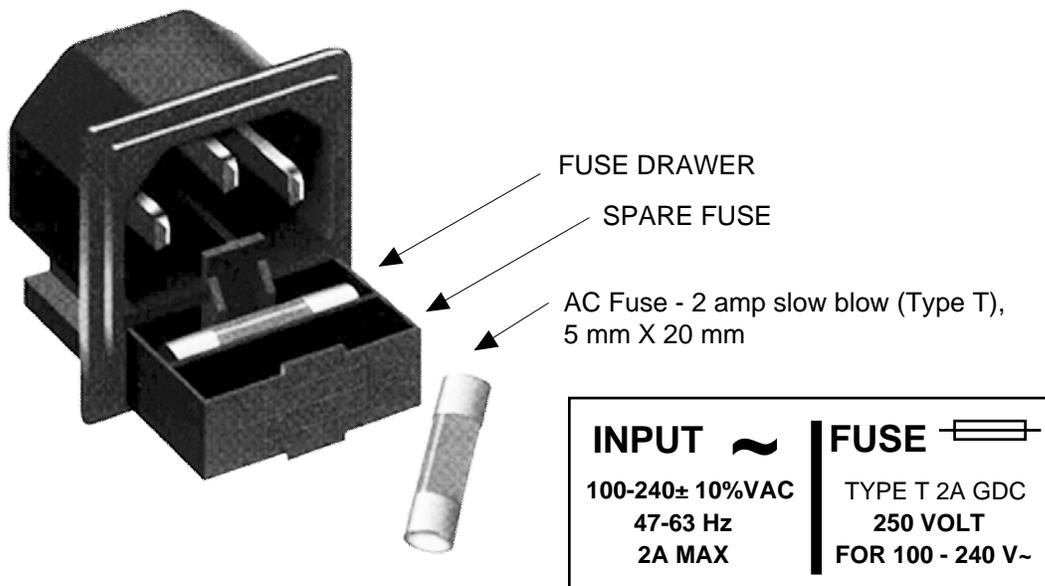


**FIGURE 2.3 2016-02 Front Panel Controls and Indicators**

## 2.4 Operation

### 2.4.1 Installing and Operating the 2016-02 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 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. Option -L only - To insert LNB +24 VDC on the RF center pin install 0.5A fast blo fuse in F1 and check that DS8 lights yellow (Figure 2.1).
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. 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 to +50)
- Menu 3** Set Unit to Remote Operation
- Menu 4** Select Non-inverting or Inverting Spectrum
- Menu 5** Select External 10 MHz Ref (option -E)
- Menu 6** Select Reference Out (option -E)
- Menu 7** Set Remote mode (option -Q)
- Menu 8** Set RS-485 address (option -Q)
- Menu 9** View LNB Current (option -L)

**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 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

**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.**

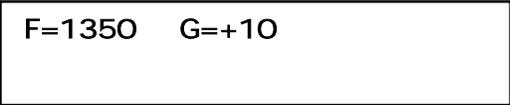
When power is first applied, the LCD display goes through three steps.

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=1350 G=+10

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.

## 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 = 1 <u>3</u> 50	R
-------------------	---

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

F = 1 <u>4</u> 50	R
-------------------	---

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

F = 14 <u>5</u> 0	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 = + <u>1</u> 0	R
------------------	---

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

SAVE SETTINGS? <u>Y</u> 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=1450    G=+10
-----------------

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 DOWNCONVERTER GAIN:

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

G = + <u>1</u> 0	R
------------------	---

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

G = + <u>2</u> 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 = +2 <u>0</u>	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:

OTHER? <u>Y</u> N	R
-------------------	---

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

SAVE SETTINGS? <u>Y</u> 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=1450    G=+20
-----------------

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.

<b>Power Up</b>	ON POWER UP REV 1.00		
<b>Normal Display</b>	NORMAL DISPLAY F = 1450 G = +10		PUSH BUTTON
<b>Menu 1</b> Frequency	PUSHING MENU/EXECUTE SEQUENCE F = 1450 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 2</b> Gain (00 to +50)	G = +10 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 3</b> Set Unit to Remote Operation	REMOTE OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 4</b> Select Non-inverting or Inverting Spectrum	DNSPECTRUM NON R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 5</b> Select External 10 MHz Reference (option -E)	EXT REF OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 6</b> Select 10MHz Reference Out (option -E)	REF OUT OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 7</b> Set Remote Mode (option -Q)	RS 485 OFF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 8</b> Set RS-485 Address (option -Q)	ADDRESS = 00 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
<b>Menu 9</b> View LNB current (option -L)	LNB DC = 0.250A R	SCROLL <>	PUSH BUTTON
<b>Save?</b> When "R" is selected or at the end of the menu options	SAVE SETTINGS? Y N	SCROLL <>	PUSH BUTTON

**FIGURE 2.5 Menu Display and Sequence**

### 3.0 Ethernet Interface Installation and Operation

The 2016-02 frequency converter is equipped with a 10/100 Base-T compatible Ethernet interface for control and monitoring of its operating parameters. An HTML script interface allows the user to monitor and control the converter using a standard web browser. SNMP (Simple Network Management Protocol) is also supported. Contact Cross Technologies for the SNMP MIB file.

### 3.1 Connection

#### 3.1.1 Direct Connection to a PC

For control from a local PC, attach the 2016-02 Ethernet port to the Ethernet network connector on the PC using a crossover RJ-45 cable.

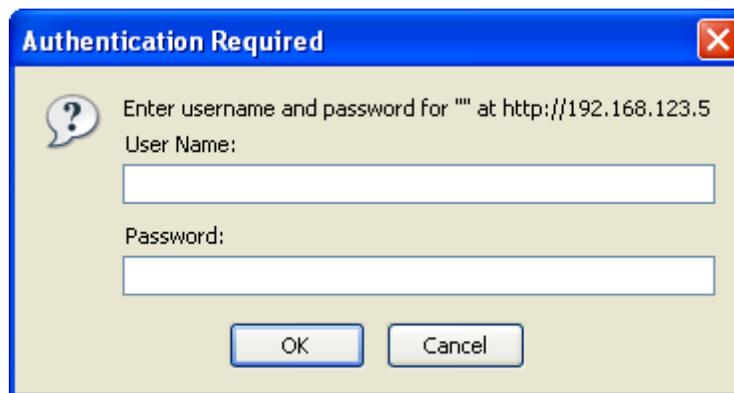
#### 3.1.2 LAN Connection

For LAN connections, attach the 2016-02 Ethernet port to the LAN using a normal RJ-45 cable. Use any PC on the LAN to connect to the 2016-02.

### 3.2 Ethernet Configuration

Each 2016-02 must be configured with an appropriate IP address, Netmask, and Gateway assigned by your network manager. The 2016-02 is set at the factory with a static address that is written on a tag attached to the unit. The device server in the 2016-02 has a built in HTTP based configuration manager that is used to configure network settings. To access the configuration manager open a web browser and enter the IP address of the 2016-02 in the browser's address field. The window shown in Figure 1 will appear. As delivered, there is no password set. Choose your user name and password here or leave those fields blank and click OK to proceed to the configuration manager webpage.

**Figure 2.5: Password Screen**





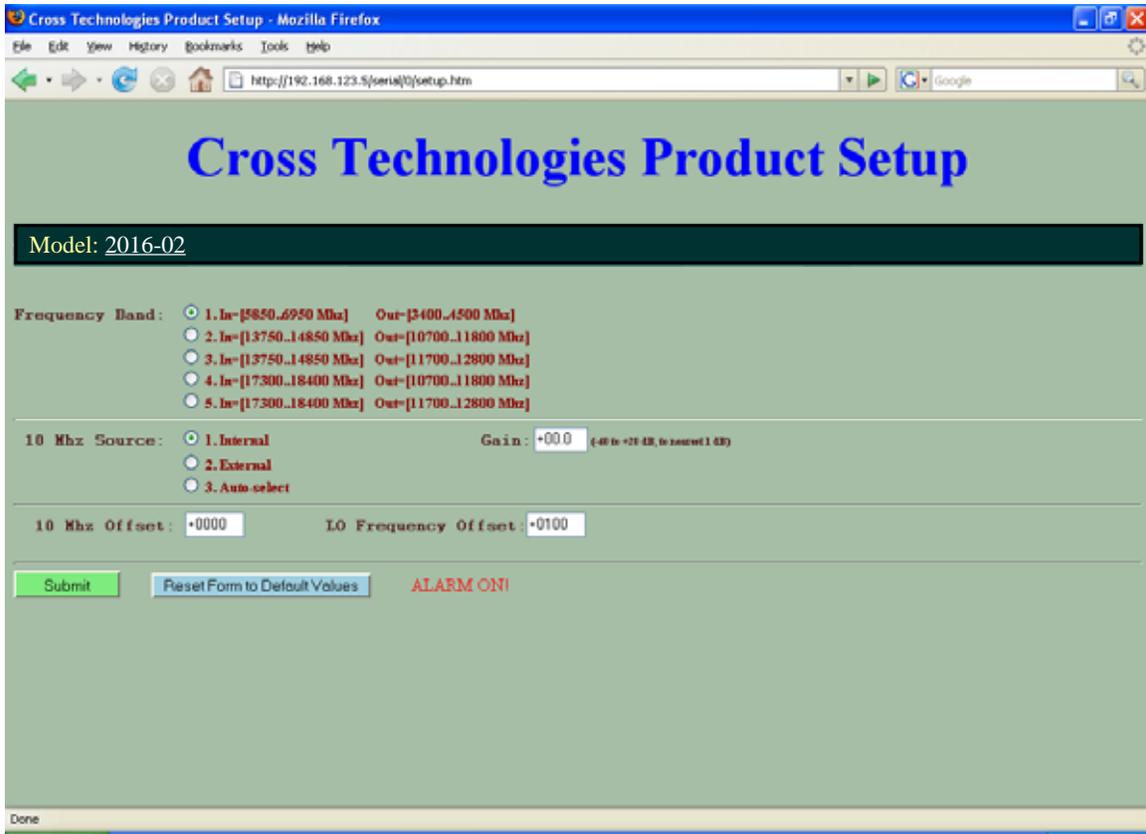
**Figure 2.6: Configuration Manager Screen**

In the left frame of the configuration manager click on Network to display the Network Settings screen. Enter the IP address, Subnet mask, and Gateway address with delimiter dots (example: 192.168.192.47). Click to apply settings in the left frame to apply the new settings in the network device.

### 3.3 Webpage M & C

Enter the following address in a web browser to access the M & C webpage:

<http://<ip address of 2016-02>/serial/0/setup.htm> where <ip address> is the IP address of the unit. Figure 2.7 shows the webpage from a model 2016-02 frequency converter.



**Figure 2.7: Model 2016 Webpage**

### 3.4 SNMP Configuration

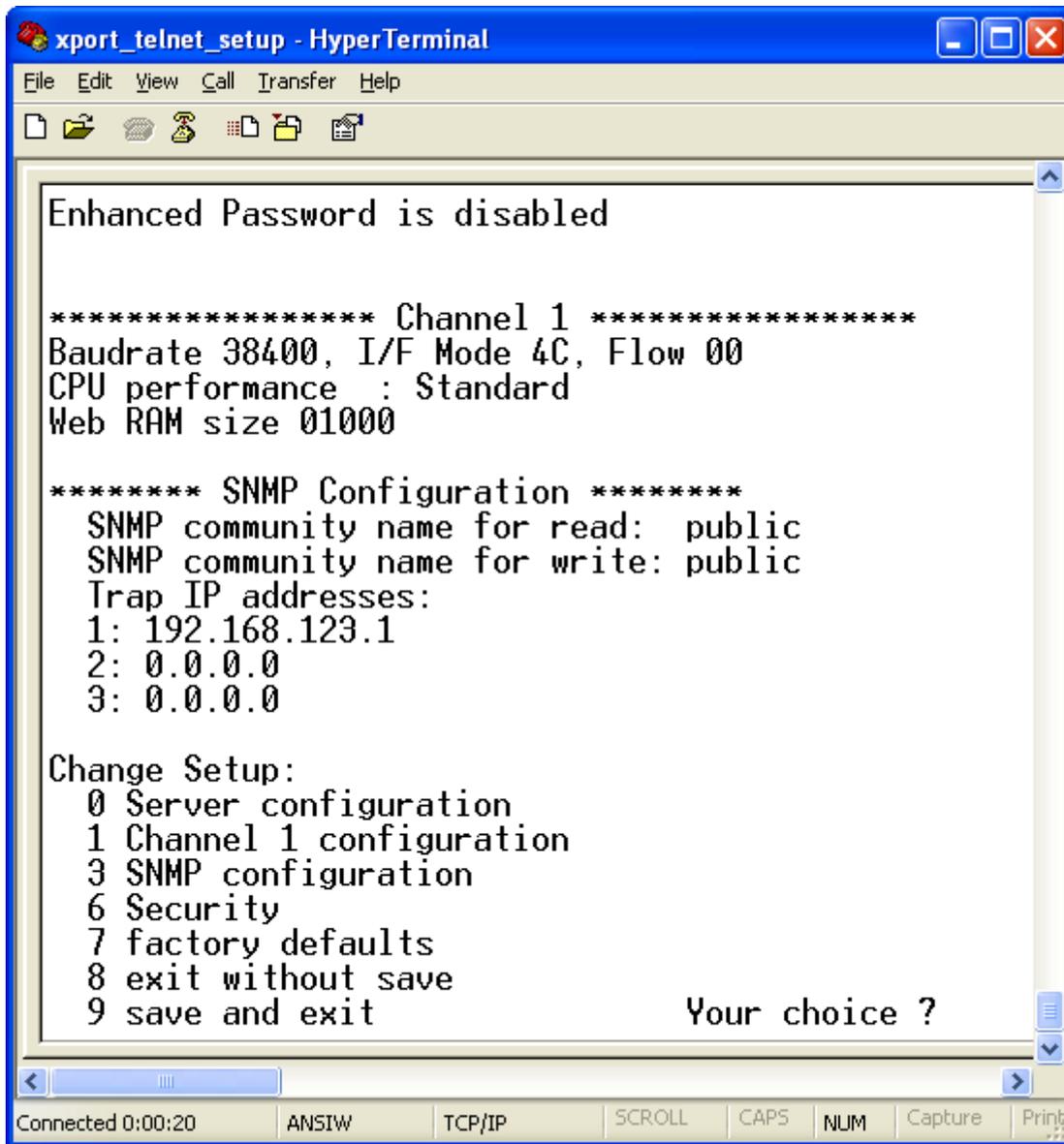
Setting of SNMP parameters such as Community Write and Community Read strings requires a Telnet connection to port 9999. The following instructions explain how to establish such a Telnet connection using Windows XP's utility Hyper Terminal.

Start the Hyper Terminal application and select "New Connection" from the "File" drop down menu. The next screen is a "Connect To" dialog box. Select TCP/IP (Winsock) from the "Connect using:" drop down menu. Enter the IP address of the 2016-02 in the "Host address:" field and 9999 in the "Port number:" field. Figure 2.8 shows an example of the Hyper Terminal settings required to access the SNMP configuration menu.



**Figure 2.8: Telnet Settings in Hyper Terminal**

Once the Telnet connection is established you will be prompted to “Press Enter for Setup Mode”. Press enter and a menu of device server configuration options will appear. Select menu item 3, “SNMP configuration”. You will be prompted to enter SNMP community read and write strings. After setting your desired community strings you will be prompted to “Enter IP addresses for SNMP traps:”. You must enter at least one and up to four IP addresses of SNMP managers that will access the unit. This is required even though SNMP traps are not implemented. The unit will not process SNMP SET and GET requests from an SNMP manager unless the IP address associated with that manager is entered in the device server.



**Figure 2.9: Device Server Configuration Menu**



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