Instruction Manual

Model 2016-1522#
Downconverter

June 2017, Rev A

```
                              MODEL 2016
                              DOWNCONVERTER
  F=1544  G=25        MENU                    CROSS TECHNOLOGIES INC.
  ATTEN=10 REF=AUTO-I  ○
                      EXECUTE
  ○    ○    ○
ALARM REMOTE POWER
```
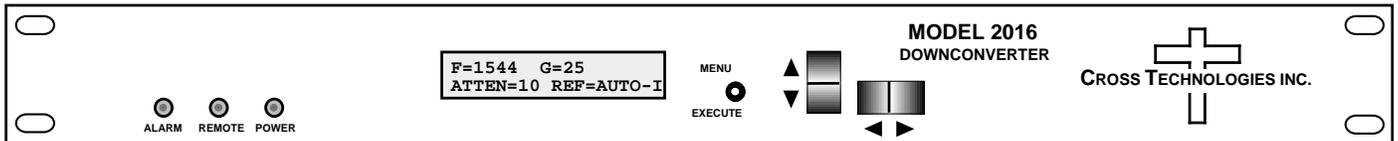
Data, drawings, and other material contained herein are proprietary to Cross Technologies, Inc.,

but may be reproduced or duplicated without the prior permission of Cross Technologies, Inc.

for purposes of operating the equipment.

When ordering parts from Cross Technologies, Inc., be sure to include the equipment model number,
equipment serial number, and a description of the part.

CROSS TECHNOLOGIES, INC.

6170 Shiloh Road
Alpharetta, Georgia 30005

(770) 886-8005
FAX (770) 886-7964
Toll Free 888-900-5588

WEB www.crosstechnologies.com
E-MAIL info@crosstechnologies.com

INSTRUCTION MANUAL

Model 2016-1522# Downconverter

CROSS TECHNOLOGIES, INC.

6170 Shiloh Road
Alpharetta, Georgia 30005

WEB www.crosstechnologies.com
E-MAIL info@crosstechnologies.com

Model 2016-1522# Downconverter, 1.544 or 2.226 GHz to 70 ± 5 MHz

1.0 General

1.1 Equipment Description

The 2016-1522# Downconverter converts 1.544 or 2.226 GHz to 70 MHz. The gain is 0 to +50 dB, adjustable in 1±1 dB steps. 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 Type N female for the IF out and RF in and BNC female for the external 10 MHz reference input (Option E) which includes a 10 MHz output connector which contains either the internal or external 10 MHz reference signal. 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.
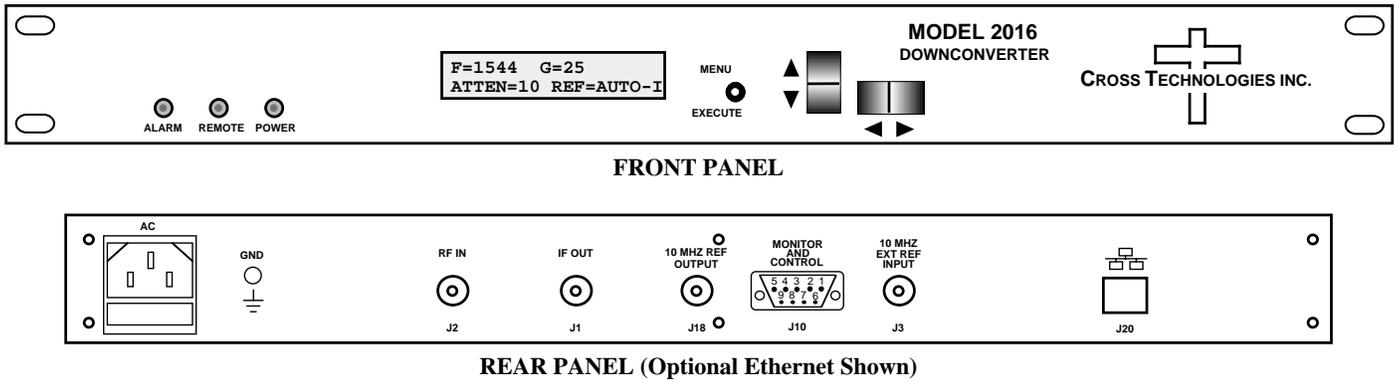

FRONT PANEL

REAR PANEL (Optional Ethernet Shown)

FIGURE 1.1   Model 2016-1522# Front and Rear Panels

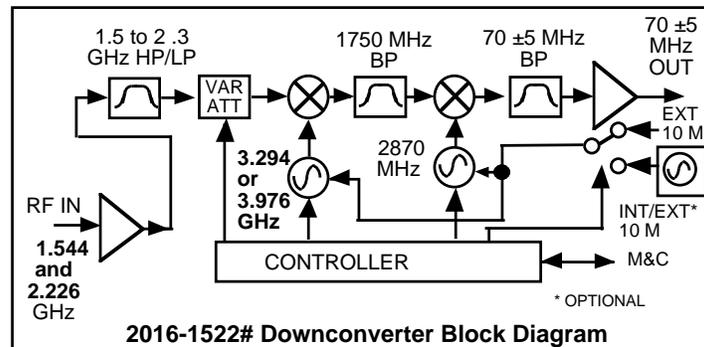2016-1522# Downconverter Block Diagram

FIGURE 1.2   Model 2016-1522# Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.0 2016-1522# Downconverter Specifications*

Input Characteristics

Impedance/Return Loss	50 Ω /12 dB
Frequency	1.544 and 2.226 GHz
Noise Figure, Max.	15 dB at maximum gain
Input Level Range	-50 to -20 dBm

Output Characteristics

Impedance/Return Loss	50 Ω /18 dB
Frequency	70 ± 5 MHz
Output Level/max. linear	-20 to 0 dBm
Output 1 dB compression	+10 dBm maximum gain

Channel Characteristics

Gain at Fc	+50 ±3dB maxium, (+50 to 0 dB variable in 1 ±1 dB steps)
Image Rejection	> 50 dB, minimum
Frequency Response	1544 or 2226, 10 MHz BW, ± 0.75 dB
Spurious Response	<-50 dBc, in band, 70 ± 5 MHz
Group Delay, maximum	0.015 ns/MHz2 parabolic; 0.05 ns/MHz linear; 1 ns ripple
Frequency Sense	Non-inverting

Lo Characteristics

LO Step Size	NONE, Fixed tuned to 1544 or 2226 MHz In
Frequency Accuracy	±0.01 ppm maximum over temperature internal reference

Phase Noise @ F (Hz) >	100Hz	1kHz	10kHz	100kHz	1MHz
Standard dBC/(Hz)	-75	-80	-90	-100	-110

Controls, Indicators

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

Other

RF, IF Connectors	N (female), N (female)
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 standard chassis 1.75" high X 16.0" deep
Power	100-240 ±10% VAC, 47-63 Hz, 25 watts maximum

*Custom Specifications and/or Standard Options (shown below) included with Model 2016-1522#

Option H -	±0.01 10MHz Internal Reference
Option NN -	Connector N-Type (RF), N-Type (IF)

Available Options

E -	External 10 MHz Reference

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®

Connectors / Impedance

STD - 50Ω Type N (RF), 50Ω Type N (IF)
SS - 50Ω SMA (RF), 50Ω SMA (IF)

+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**)

M&C Cable Diagram - Cross Technologies Frequency Converters

Female DB-9
PC Com Port

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

PC Com Port		M&C Port
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
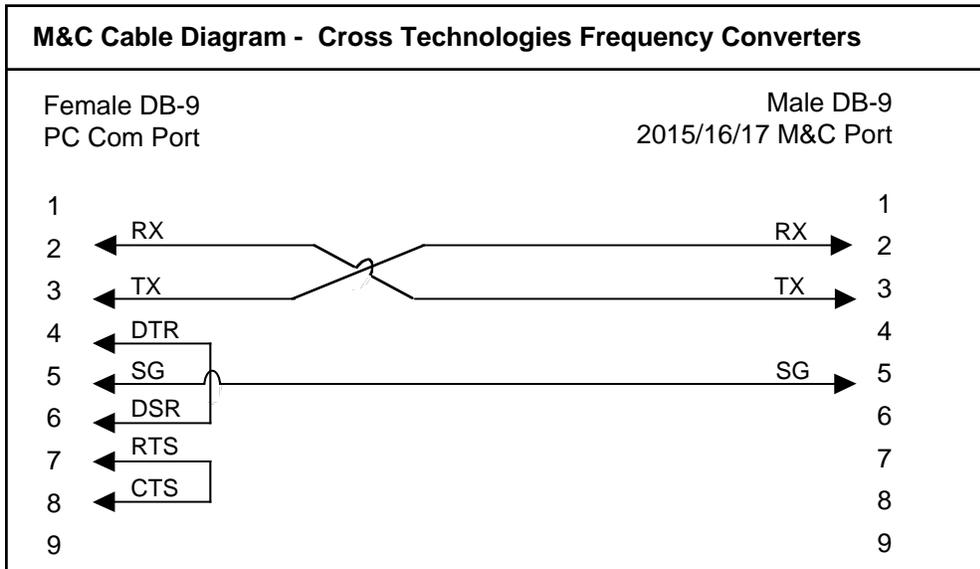
Connector: Rear panel, DB-9 male

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 1.1 lists the status requests for the 2016-1522# 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 2016-1522# Status Requests		
Command	**Syntax***	**Description**
Get Frequency	{aaSF}	returns {aaSFxxxx}
		where: xxxx = frequency in MHz (either 1544 or 2226)
Get Gain	{aaSGxx}	returns {aaSGxx}
		where: xx = gain in dB (00 to 50)
Get reference status	{aaSE}	returns {aaSExy}
(option E only)		where: x = setting:1 for internal 10 MHz; 2 for external 10MHz; 3 for auto detect
		y = currently selected in hardware: 1 for internal 10 MHz; 2 for external 10 MHz
Get Reference Insertion Status	{aaSL}	returns {aaSLx}
(option E only)		where: x = 0 for non-insertion; 1 for insertion
Get Output Attenuation	{aaSN}	returns {aaSNxx}
(option Z20 only)		where: xx = output attenuation in dB (00 to 20)
		xxx = LNB current in amps to 2 decimal places (e.g., 065 = 0.65 amps)
Get IP address	{aaSi}	returns {aaSixxx.xxx.xxx.xxx}
(ethernet options only)		where xxx.xxx.xxx.xxx = IP address
Get subnet mask	{aaSs}	returns {aaSsxxx.xxx.xxx.xxx}
(ethernnet options only)		where xxx.xxx.xxx.xxx = subnet mask
Get alarm status	{aaSA}	returns {aaSAa}
		where a = alarm state (0 for alarm off; 1 for alarm on)
Get product/model info	{aaSV}	returns {aaSV2016-1522#xxxxver5.00}
		where 2016-1522# = product model
		xxx = list of options, if any
		"ver" = separates model & options from firmware version
		5.00 = firmware version

C) Commands

Table 1.2 lists the commands for the 2016-1522# and briefly describes them. After a command is sent the 2016-1522# 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 2016-1522# Commands

Command	Syntax*	Description
Set Frequency	{aaCFx}	where: x = 0 for 1544 MHz: x = 1 for 2226 MHz
Set Gain	{aaCGxx}	where: xx = gain (Range: 00 to 50) in 1 dB steps
10 MHz reference mode (option E only)	{aaCEx}	where: x = 0 for internal 10 MHz;1 for external 10 MHz; 2 for auto detect
Reference insertion on output (option E only)	{aaCLx}	where: x = 0 for non-insertion; 1 for insertion
Set Output Attenuation (option Z20 only)	{aaCNxx}	where: xx = attenuation (Range 00 to 20) in 1 dB steps

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 Tmra (Maximum Recommended Ambient Temperature).

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 2016-1522# 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 2016-1522# can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2016-1522# is assembled.
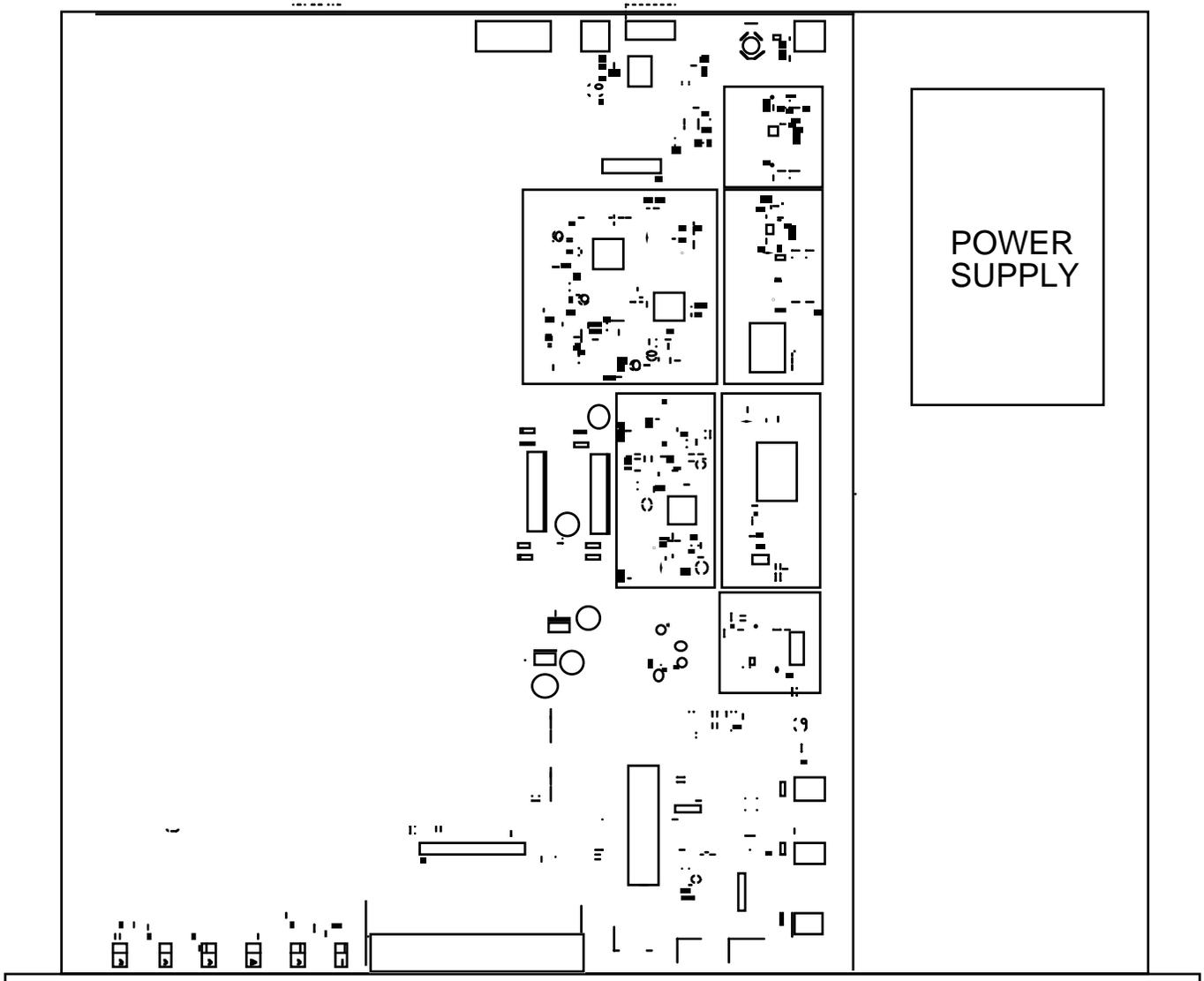

POWER
SUPPLY

FIGURE 2.1 2016-1522# 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
-50 to -20 dBm input
1.544 & 2.226 GHz
see Table 2.2.

J10 - MONITOR AND CONTROL
DB9 female connector
see Table 2.1

J20 - Ethernet Connection
RJ45 Ethernet Connector

J1 - IF OUT
-20 to 0 MHz output
70 ±5 MHz dBm
see Table 2.2.

J18 - 10 MHz REF OUTPUT (option -E)
10 MHz external reference output
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   2016-1522# 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.

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=1544   G=25
ATTEN=10 REF=AUTO-I
```

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
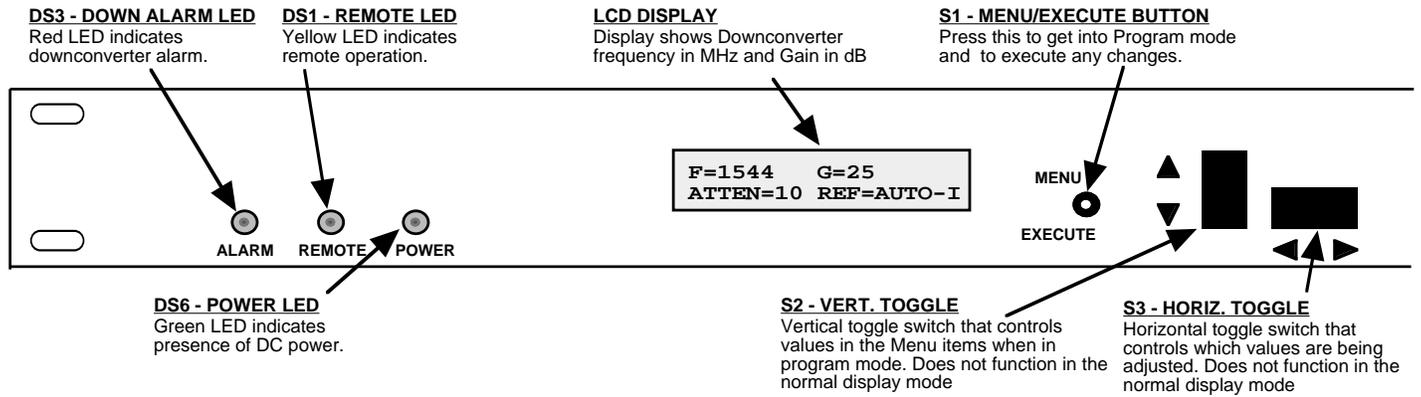normal display mode

FIGURE 2.3   2016-1522# Front Panel Controls and Indicators

2.4 Operation

2.4.1 Installing and Operating the 2016-1522# Downconverter

1. Connect a -50 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 to AC on the back panel.
4. Set the input frequency (See Section 2.5 Menu Settings).
5. Set the gain for +50 to +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.
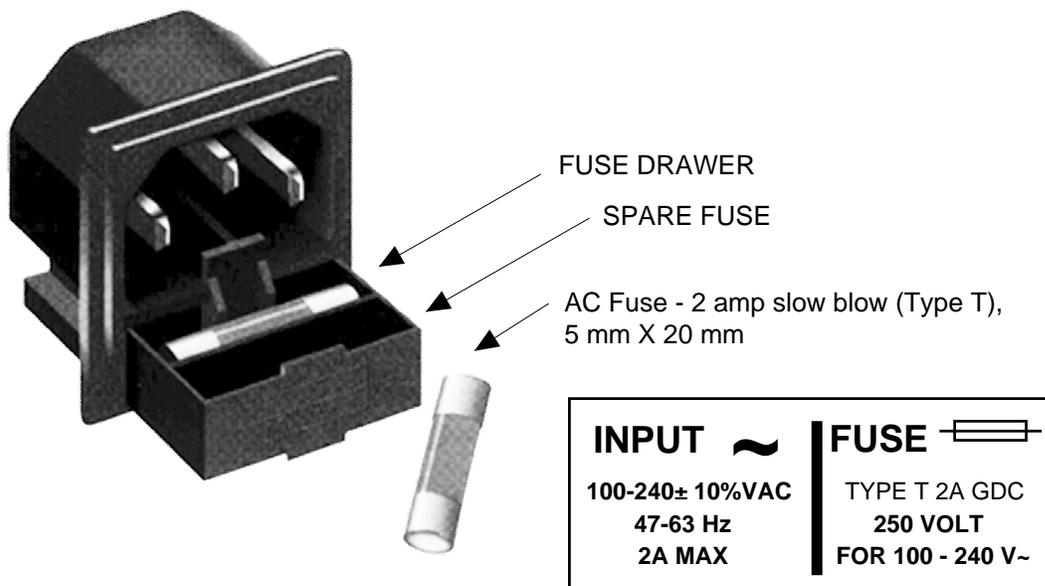
FUSE DRAWER

SPARE FUSE

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 (+50 to 0)
Menu 2a.	Output Attenuator (option Z20)
Menu 3	Set Unit to Remote Operation
Menu 4	Select External 10 MHz Ref (option -E)
Menu 5	Select Reference Out (option -E)
Menu 6	Set Remote mode (option -Q)
Menu 7	Set RS-485 address (option -Q)
Menu 8	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

<u>NOTE</u>: 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 = 1544      G=+25.0
ATTN=10       REF=AUTO-I
```

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 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 = 1554                    R


```

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

```
 F = 2226                    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 = +10                     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 = 1544      G=+10          R


```

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 = +10                    R

```

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

```
 G = +20                    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 = +20                    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?  YN                 R

```

OR you can scroll to "R" and 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 this:

```
 F = 1544      G=+20        R

```

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.

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

Power Up

ON POWER UP
```
REV 1.00
```

Normal Display

NORMAL DISPLAY
```
F = 1544    G = +25.0
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Frequency
```
F = 1500              R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 2 Gain (+50 to 0)
```
G = +50               R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 2a Output Attenuation
Option Z20
```
OUTPUT ATTENUATION=R R
15
```
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 5 Select 10MHz Reference
Out (option -E)
```
REF OUT    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

Menu 8 View LNB current
(option -L)
```
LNB DC = 0.250A       R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Save? When "R" is selected or at
the end of the menu options
```
SAVE SETTINGS?    Y N
```
SCROLL <>   PUSH BUTTON

CROSS TECHNOLOGIES, INC.

6170 Shiloh Road

Alpharetta, Georgia 30005

(770) 886-8005
FAX (770) 886-7964
Toll Free 888-900-5588

WEB www.crosstechnologies.com
E-MAIL info@crosstechnologies.com

Printed in USA