Instruction Manual

Model 3116-7786-2150

Block Downconverter

November 2020,   Rev. 0

```
MODEL 3116
DOWNCONVERTER

CROSS TECHNOLOGIES INC.

FC = 8200.000
G=+10.0 REF AUTO-I

MENU
EXECUTE
REMOTE  ALARM  POWER
```
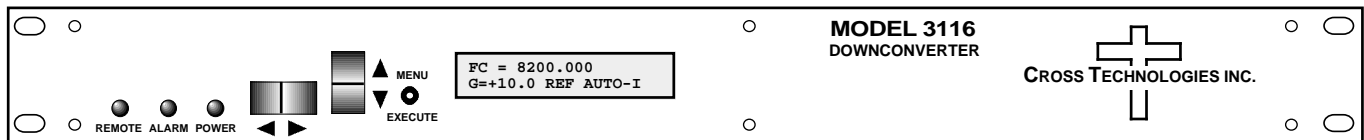
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CROSS TECHNOLOGIES, INC.

INSTRUCTION MANUAL

MODEL 3116-7786-2150 Block Downconverter

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MODEL 3116-7786-2150 Downconverter

1.0 General

1.1 Equipment Description - The 3116-7786-2150 Downconverter converts 7.75 - 8.65 GHz (Fc = 7.9 - 8.5 GHz) to 2150 ± 150 MHz (non-inverted) in 1 MHz steps (100 kHz, 125 kHz steps optional) with a 5.75 - 6.35 GHz local oscillator. The gain is +35 dB maximum with a 30 dB adjustment in 0.5 ±0.5 dB steps. Front panel LEDs provide indication of Remote operation, PLL Alarm and DC Power. Frequency and internal/external/Auto reference mode selection are controlled by front panel switches or remote selection (via RS-232C/485, standard; Ethernet Optional) and are viewable on the LCD Display. Connectors are Type N female for the RF and BNC female for the L-Band and external reference input and reference output. In AUTO, the 10 MHz reference stays in external if the external level is +3 dBm, ±3 dB. The 3116 is powered by a 100-240 ± 10% VAC power supply, and housed in a 1 3/4" X 19" X 14" rack mount chassis.
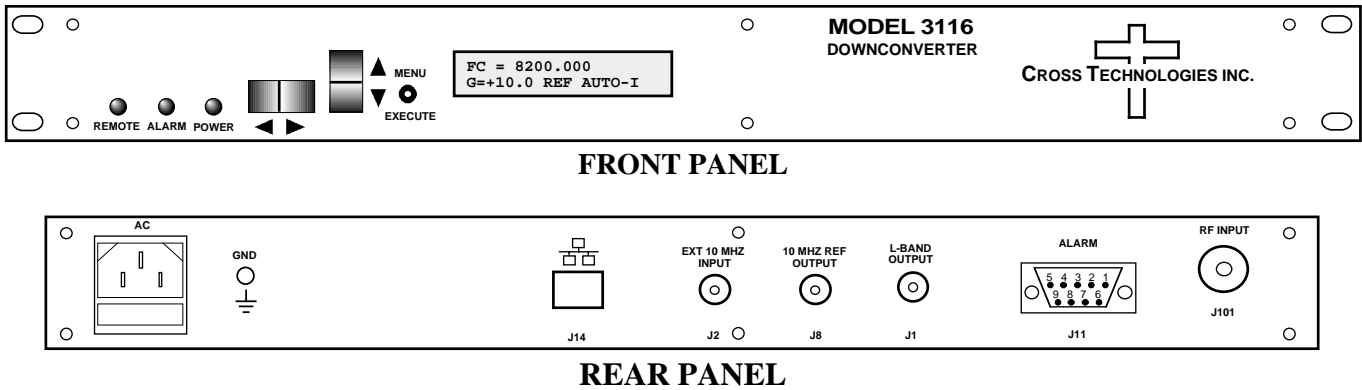

FRONT PANEL

REAR PANEL

**FIGURE 1.1   Model 3116-7786-2150 Front and Rear Panels
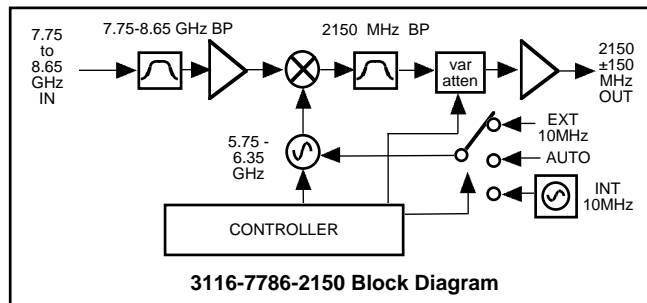(Shown with optional Ethernet)**

FIGURE 1.2   Model 3116-7786-2150 Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.0	3116-7786-2150 Block Downconverter Specifications**
Input Characteristics	
Impedance/Return Loss	50Ω/14 dB
Frequency	7.75 to 8.65 GHz (Fc = 7.9 - 8.5 GHz
Noise Figure, Maximum	12 dB maximum gain, Gmax.
Input Level Range	-55 to -35 dBm
Input 1 dB Compression	-25 dBm
Output Characteristics (L-Band)	
Impedance/Return Loss	50Ω / 14 dB
Frequency	2150 ± 150 MHz
Output Level Range	-20 to 0 dBm
Output 1 dB Compression	+10 dBm at maximum gain
Channel Characteristics	
Gain, at Fc, Max.; adj.	+35 dB ±2 dB, max. gain; 30 dB adjustment in 0.5± 0.5 dB Steps (Fc = 7.9 - 8.5 GHz
Image Rejection	> 60 dB, minimum
Spurious, In Band	Signal Related <-45 dBC in band, 0 dBm out; SIGNAL INDEPENDENT,<-55 dBm (2150 ±150 MHz Out), Gmax.
Spurious, Out of Band	<-50 dBm (0.3-1.99 and 2.31-2.5 GHz Out)
Intermodulation	<-50 dBC for two carriers at 4 MHz spacing, each at -10 dBm out, at Gmax.
Frequency Response	±2.0 dB over the band, ± 1.0 dB 2150 ± 150 MHz out;
Frequency Sense	Non-inverting
LO Characteristics	
LO Frequency	5.75 - 6.35 GHz, 1 MHz steps; 100 kHz, 125 kHz steps opt.
Frequency Accuracy	±0.01 ppm maximum over temp. internal reference; external reference input
10 MHz Level (In / Out)	3 dBm, ±3 dB, with Auto-detect

Phase Noise @ F (Hz) >	10	100	1K	10K	100K	1M
Standard dBC/Hz	-55	-75	-80	-80	-100	-120

Controls, Indicators	
Freq.; External Ref. Selection	Direct readout LCD; pushbutton switches or remote
Power, Alarm, Remote, Mute	Green LED; Red LED, Yellow LED; Yellow LED
Remote	RS232C/RS485/422, 9600 Baud; (Ethernet Optional)
Other	
RF Connector	N-Type (female), 50Ω
L-Band Connector	BNC (female), 50Ω
10 MHz Connectors	BNC (female), 75Ω, works with 50 or 75 ohms
Alarm/Remote Connector	DB9 - NO or NC contact closure on Alarm
Size	19 inch, 1RU standard chassis, 1.75" high x 14.0" deep
Power	100-240 ±10% VAC, 47- 63 Hz, 30 watts maximum

1.2 Technical Characteristics *(continued from page 4.)*

Available Options (3116-7786-2150)	
X -	125 kHz frequency step
X1 -	100 kHz frequency step
Remote M&C Ethernet Options	
W8 -	Ethernet with web browser Interface
W18 -	Ethernet with SNMP (and MIB) Interface
W28 -	Ethernet with direct TCP/IP Interface
W828 -	W8 + W18 + W28
Connector Options	
N -	50Ω N-Type (RF), 75Ω BNC (L-Band)
NS -	50Ω N-type (RF), 50Ω SMA (L-BAND)
S7 -	50Ω SMA (RF), 75Ω BNC (L-Band)
SS -	50Ω SMA (RF), 50Ω SMA (L-Band)
Contact Cross Technologies for other options.	
**+10˚C to +40˚C; Specifications subject to change without notice.	© Cross Technologies, Inc.

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)

M&C Cable Diagram - Cross Technologies Frequency Converters and Frequency Sources

Female DB-9
PC Com Port

Male DB-9
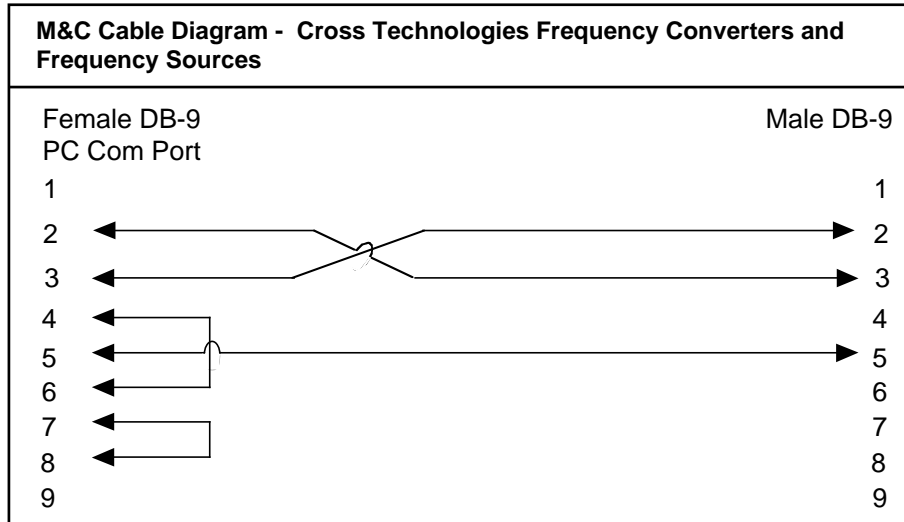
Figure 1.3   M&C Cable Diagram

Connector Pinouts: Rear Panel, DB9 male.

Table 1.1 J11 Pinouts (RS-232C/422/485)	
1	RS422/RS485 Rx Data In-
2	RS422/RS485 Rx Data In+, RS232 Data In
3	RS422/RS485 Tx Data Out+, RS232 Data Out
4	RS422/RS485 Tx Data Out-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

B) M&C Commands -

Table 1.1 lists the status requests for the 3116-7786-2150 and briefly describes them. After a command is sent the 3116-7786-2150 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**)
C = 1 character, either C (command) or S (status)
N = 1 character command or status byte
D = 1 character or more of data (depends on command)
} = stop byte
* 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 1.1 3116-7786-2150 Status Requests		
Command	**Syntax ***	**Description**
Get Frequency	{aaSF}	returns: {aaSFxxxx}
		where:
		• xxxx = 4 characters standard, 7 characters options x, x1
		• xxxx = Frequency in MHz, xxxxxxx = Frequency in kHz
Get Gain	{aaSG}	returns {aaSGxxx} where:
		• xxx = Converter gain in 0.5 dB steps.
Get Internal 10 MHz Reference Offset	{aaSO}	Returns {aaSOxxxxx} where:
		• xxxxxx = Internal 10 MHz reference frequency offset.
Get 10 MHz Reference Mode	{aaSE}	Returns {aaSEx} where:
		• x = 0 if the converter's 10 MHz reference mode is set to Internal
		• x = 1 if the converter's 10 MHz reference mode is set to External
		• x = 2 if the converter's 10 MHz reference mode is set to Auto
Get Mute	{aaSM}	Returns {aaSMx} where:
		• x = 0 if the converter's RF output is NOT muted (RF output is ON)
		• x = 1 if the converter's RF output is muted (RF output is OFF)
Get 10 MHz Reference Status	{aaSB}	Returns {aaSBx} where:
		• x = 0 if the currently selected 10 MHz reference is Internal
		• x = 1 if the currently selected 10 MHz reference is External
Get IP Address	{Si}	Returns {Sixxx.xxx.xxx.xxx} where:
(Options W8, W18, W28 only)		• xxx.xxx.xxx.xxx = IP address
Get Subnet Mask	{Ss}	Returns {Ssxxx.xxx.xxx.xxx} where:
(Options W8, W18, W28 only)		• xxx.xxx.xxx.xxx = subnet mask
Get Product/Model info	{SV}	Returns {Sv3116-xxy..yverZZZZ} where:
		• 3116-xx is the product model number
		• y..y = list of options, if any
		• '"ver" = separates model & options from firmware version
		• ZZZZ = firmware version (e.g., 4.00)
Get Alarm Status	{aaSA}	Returns {aaSAx}where:
		• x = 0 if alarm is off
		• x = 1 if alarm is on
Get Output Path	{aaSD}	Returns {aaSDx}where:
(option W116)		• x = 0 if selected output path is A.

B) Status Requests

TABLE 1.2 3116-7786-2150 Commands		
Command	Syntax *	Description
Set Frequency	{aaCFxxxx}	where:
		• aa = unit address, range = 00 to 31,
		only used if interface is RS485, otherwise omit.
		• F = command code
		• xxxx=frequency in MHz, range = 7900-8500,
		xxxxxxx = frequency in kHz if option - X, X1
		(7900 to 8500 MHz, 1 MHz steps)
		• example: {CF8250}
		Will set the unit's frequency to 8250 MHz
		The unit will reply with the '>' character if the
		command is successfully processed.
Set Gain	{aaCGxxx}	where:
		• xxx = Converter gain in 0.5 dB steps
		Range: 050 to 350 where 300 = 30.0 dB
		Example: {CG255} sets the converter's gain to +25.5 dB
Set Internal 10 MHz Reference Offset	{aaCOxxxxx}	where:
		• xxxxxx = Internal 10 MHz reference frequency offset.
		Range: -2000 to +2000
Set 10 MHz Reference Mode	{aaCEx}	where:
		• x = 0 if the converter's 10 MHz reference mode is set to Internal
		• x = 1 if the converter's 10 MHz reference mode is set to External
		• x = 2 if the converter's 10 MHz reference mode is set to Auto
Set Mute	{aaCMx}	where:
		• x = 0 if the converter's RF output is NOT muted (RF output is ON)
		• x = 1 if the converter's RF output is muted (RF output is OFF)
Set Output Path	{aaCDx}	Returns {aaSDx}where:
(option W116)		• x = 0 if selected output path is A.

2.0 Installation

2.1 Mechanical - The 3116-7786-2150 consists of one RF PCB housed in a 1 RU (1 3/4 inch high) by 14 inch deep chassis. A switching, ± 12, +24, +5 VDC power supply provides power for the assemblies. The 3116-7786-2150 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 3116-7786-2150 is assembled.

J101 - Panel Mount
Type N Connector

BP FILTER/
ISOLATOR

A4

J6

POWER
SUPPLY

J10

1

PS IN
PIN 1, +12 VDC
PIN 2, +5 VDC
PIN 3, +5 VDC
PIN 4, GROUND
PIN 5, GROUND
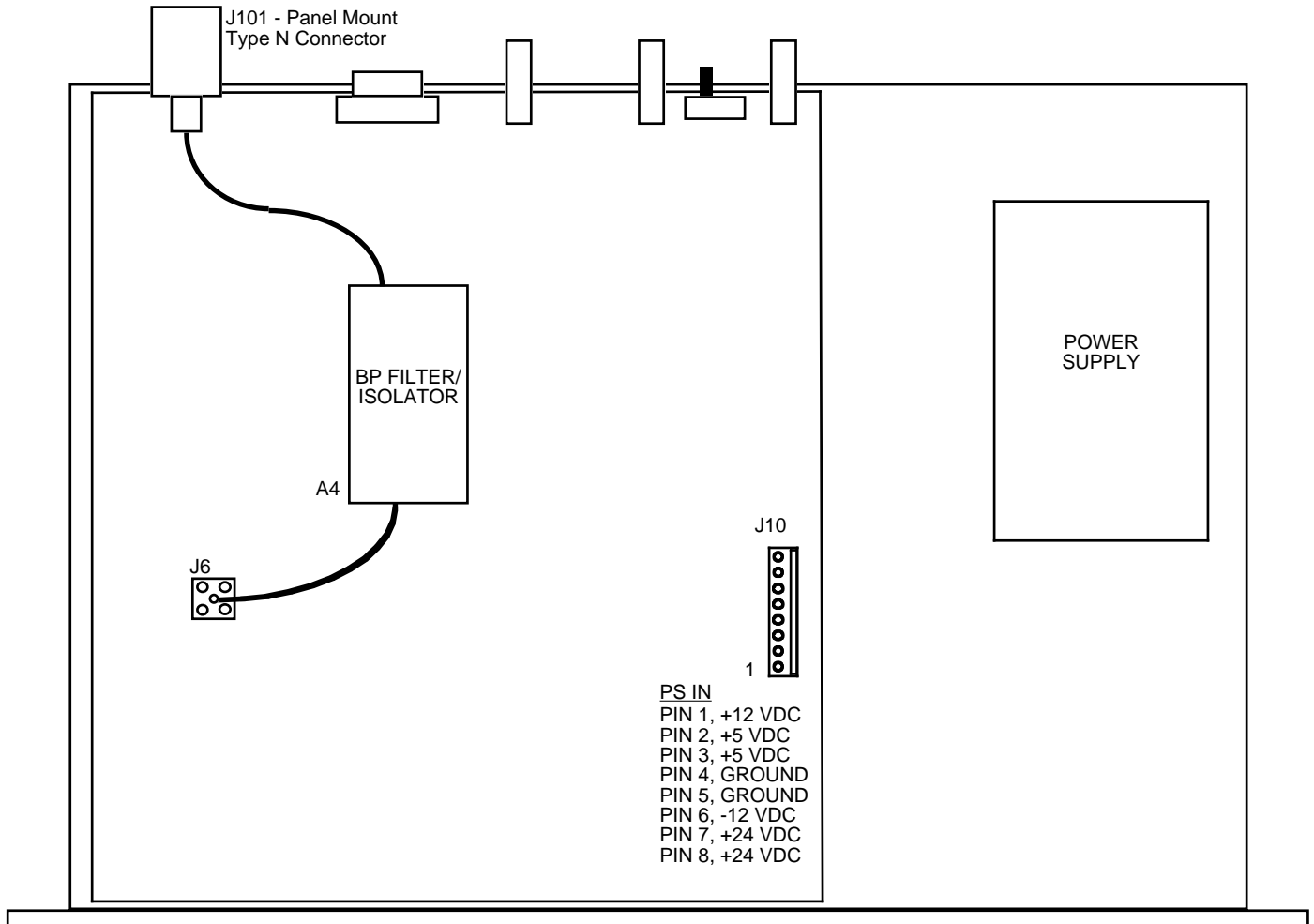PIN 6, -12 VDC
PIN 7, +24 VDC
PIN 8, +24 VDC

FIGURE 2.0   3116-7786-2150 Mechanical Assembly

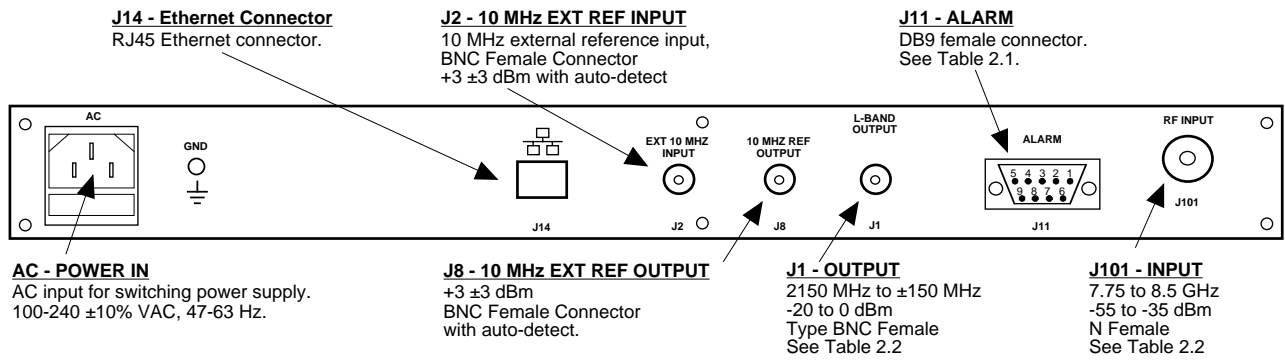## 2.2 Rear Panel Input/Output Signals - Figure 2.1 shows the input and output connectors on the rear panel.

J14 - Ethernet Connector
RJ45 Ethernet connector.

J2 - 10 MHz EXT REF INPUT
10 MHz external reference input,
BNC Female Connector
+3 ±3 dBm with auto-detect

J11 - ALARM
DB9 female connector.
See Table 2.1.

AC - POWER IN
AC input for switching power supply.
100-240 ±10% VAC, 47-63 Hz.

J8 - 10 MHz EXT REF OUTPUT
+3 ±3 dBm
BNC Female Connector
with auto-detect.

J1 - OUTPUT
2150 MHz to ±150 MHz
-20 to 0 dBm
Type BNC Female
See Table 2.2

J101 - INPUT
7.75 to 8.5 GHz
-55 to -35 dBm
N Female
See Table 2.2

FIGURE 2.1   3116-7786-2150 Rear Panel I/O's

TABLE 2.1 Connector Options		
Option	RF	L-Band
-N	50Ω Type N	75Ω BNC
-NS	50Ω Type N	50Ω SMA
-S7	50Ω SMA	75Ω BNC
-SS	50Ω SMA	50Ω SMA

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

ALARM LED
Red LED indicates
downconverter alarm.

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

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

LCD DISPLAY
Display shows frequency in
MHz and Gain in dB, and is
used to change settings in
Program mode.

MODEL 3116
DOWNCONVERTER

CROSS TECHNOLOGIES INC.

```
FC = 8200.000
G  = +10.0 REF AUTO-1
```

REMOTE LED
Yellow LED
indicates remote
operation.

POWER LED
Green LED indicates
presence of DC
power.

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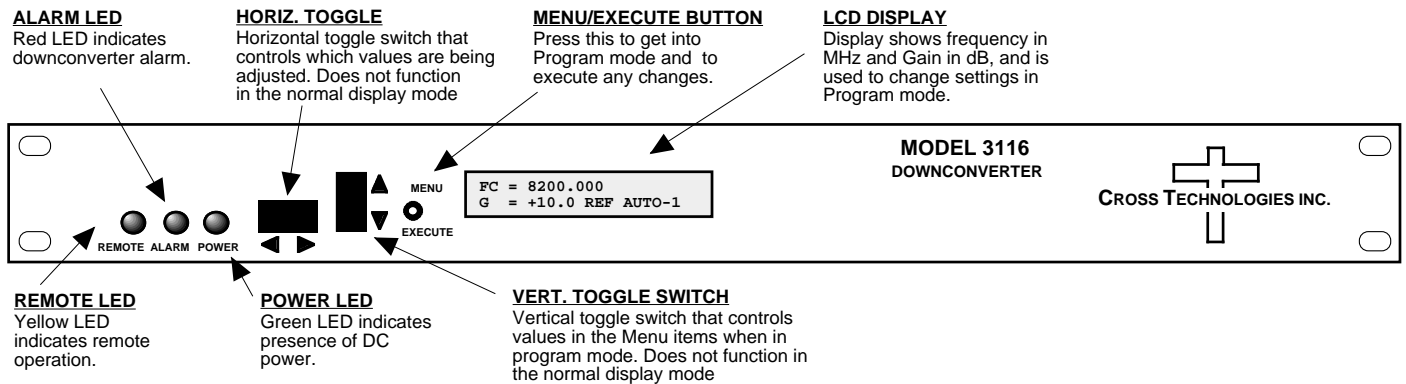the normal display mode

FIGURE 2.2   3116-7786-2150 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3116-7786-2150 Downconverter

    1.) Connect a -55 dBm to -35 dBm signal to RF INPUT, J101 (Figure 2.1).

    2.) Connect the L-BAND OUTPUT, J1, to the external equipment.

    3.) Connect 100-240 ±10% VAC, 47 - 63 Hz to AC connector on the back panel.

    4.) Set the gain (+35 dB maximum with a 30 dB adjustment in 0.5 ±0.5 dB steps.)
Make sure the output stays within -20 to 0 dBm with the gain
selected and the input level provided. (See Section 2.5 Menu Settings).

    5.) Be sure the green DC Power is on and the red Alarm is off (Figure 2.2).

    6.) <u>AC Fuse</u> **-** 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.

FUSE DRAWER

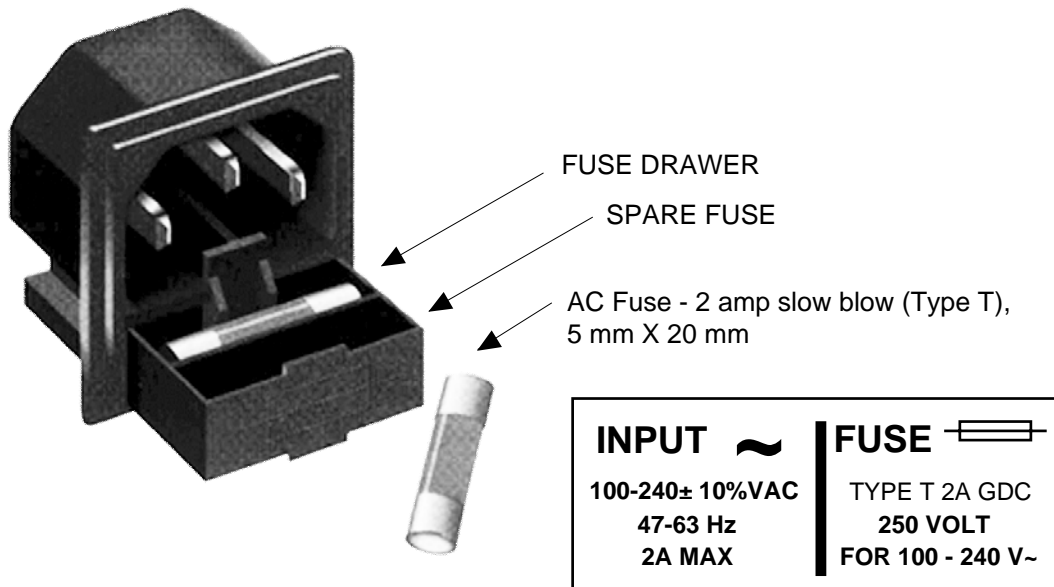SPARE FUSE

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 2.3   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 2.4):

Power Up
Normal Display

Menu 1   Set Frequency
Menu 2   Set Gain
Menu 3   Set Mute
Menu 4   Set Reference Mode
Menu 5   Set Reference Offset
Menu 6   Set Remote
Menu 7   Set Remote Interface
Menu 8   Set RS-485 Address

Save Menu When "R" is selected from any above menu or at the end.

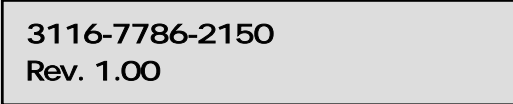Alarm indications appear on the LEDs (see Figure 2.2).

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 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 OPERATING PARAMETERS OF A UNIT ARE RETAINED EVEN WHEN POWER IS REMOVED. WHEN POWER IS RESTORED, THE UNIT WILL RETURN TO IT'S PREVIOUS SETTINGS.
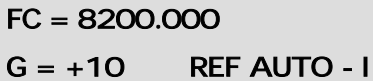
When power is first applied, the LCD display goes through three steps.

    1. The LCD goes black to show all segments are functioning.

    2. The Model and Software version will be displayed.

```
3116-7786-2150
Rev. 1.00
```

    3. The present frequency and gain of the upconverter is shown.

```
FC = 8200.000
G = +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 display cursor left or right.

    3. <u>Vertical Switch</u> - 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 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 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.

> **NOTE: THE GAIN WILL CHANGE AS YOU ADJUST THE NUMBERS. HOWEVER, THE VALUE WILL NOT BE STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW. DO NOT SET A GAIN THAT WOULD EXCEED 0 dBm OR HAVE LESS THAN -20 dBm OUTPUT LEVEL.**

Press the Up/Down switch to change the gain in 0.5 ±0.5 dB steps and then push the Menu/Execute switch to get to the Save Settings Menu:

```
 GAIN   =          +30.0             R

```

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?            Y N

```

Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.

Figure 2.4 (page 17) gives the menu items and how to make changes.

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 = 8100.000            R
```

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

```
F = 8200.000            R
```

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

```
F = 8200.000            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 = +30.0               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:

```
FC = 8200.000
G =+ 10.0 REF AUTO-1
```

Figure 2.4 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 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, J8. 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, J2.
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, J8.

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, J8.

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, J8.

2.5.8 Alarm Indications

An alarm condition will occur if any local oscillator phase lock loop (PLL) comes out of lock.
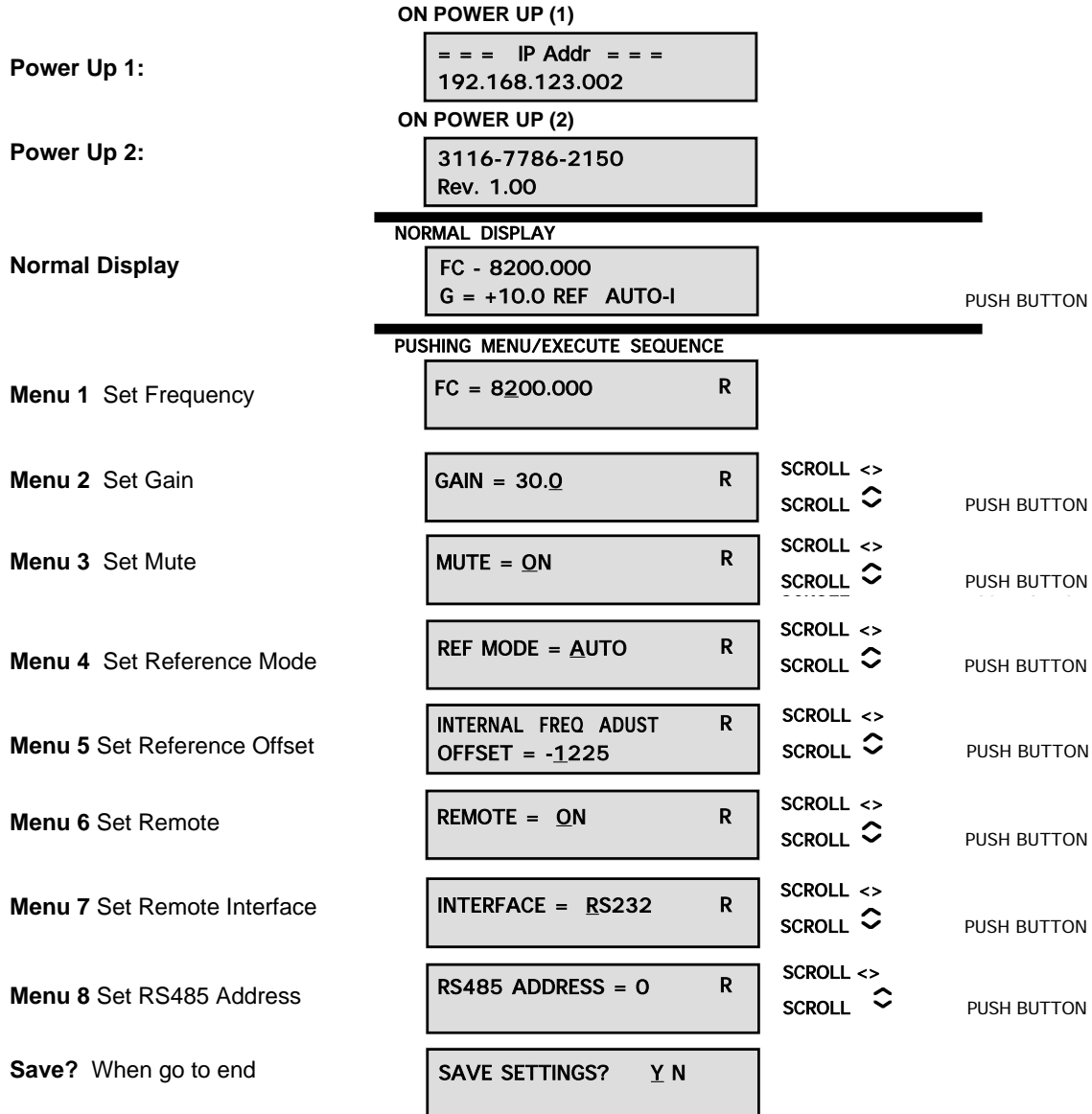The Mute LED will light if you select Mute and the Remote LED will light when you select the Remote mode.

Power Up 1:

ON POWER UP (1)

```
= = =  IP Addr  = = =
192.168.123.002
```

Power Up 2:

ON POWER UP (2)

```
3116-7786-2150
Rev. 1.00
```

NORMAL DISPLAY

Normal Display

```
FC - 8200.000
G = +10.0 REF  AUTO-I
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Set Frequency

```
FC = 8200.000          R
```

Menu 2 Set Gain

```
GAIN = 30.0            R
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Menu 3 Set Mute

```
MUTE = ON             R
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Menu 4 Set Reference Mode

```
REF MODE = AUTO       R
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Menu 5 Set Reference Offset

```
INTERNAL  FREQ  ADUST    R
OFFSET = -1225
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Menu 6 Set Remote

```
REMOTE =  ON          R
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Menu 7 Set Remote Interface

```
INTERFACE =  RS232     R
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Menu 8 Set RS485 Address

```
RS485 ADDRESS = 0      R
```
SCROLL <>
SCROLL ⌃⌄   PUSH BUTTON

Save? When go to end

```
SAVE SETTINGS?     Y N
```

FIGURE 2.4   Menu Display and Sequences

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 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.

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