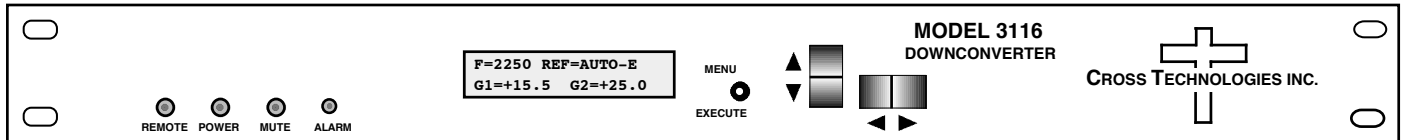


Instruction Manual

Model 3116-22-2223# Two Channel Downconverter

December 2023, Rev. 0



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INSTRUCTION MANUAL

MODEL 3116-22-2223# Two Channel Downconverter

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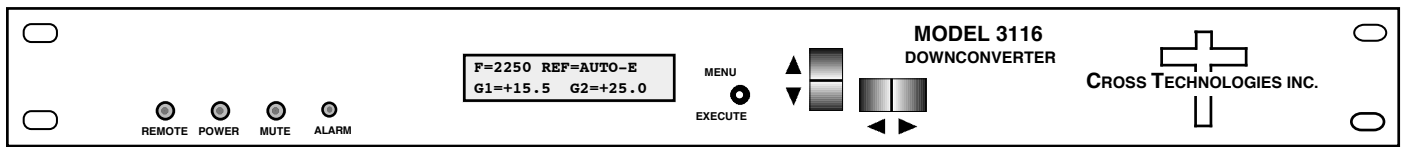
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MODEL 3116-22-2223# Two Channel Downconverter

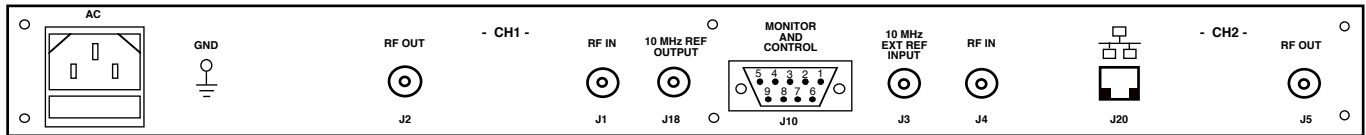
1.0 General

1.1 Equipment Description

The **3116-22-2223#** Two Channel Downconverter converts **2200 to 2300 MHz** to **1200 ±12.5 MHz** (non-inverted) with a **1.00 to 1.10 GHz (common)** local oscillator. The gain is +30 dB maximum and is adjustable in **0.5 ± 0.5 dB** steps. Front panel LEDs provide indication of Remote operation, PLL Alarm and DC Power. Gain and internal/external/Auto reference frequency 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 BNC female for the RF In and RF Out 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**. It is powered by a 100-240 ± 10% VAC power supply, and is in a 1 3/4" X 19" X 17" rack mount chassis.



FRONT PANEL - 3116-22-2223#



REAR PANEL - 3116-22-2223# (Shown with optional RJ45 Ethernet Connector)

FIGURE 1.1 3116-22-2223# Front and Rear Panels

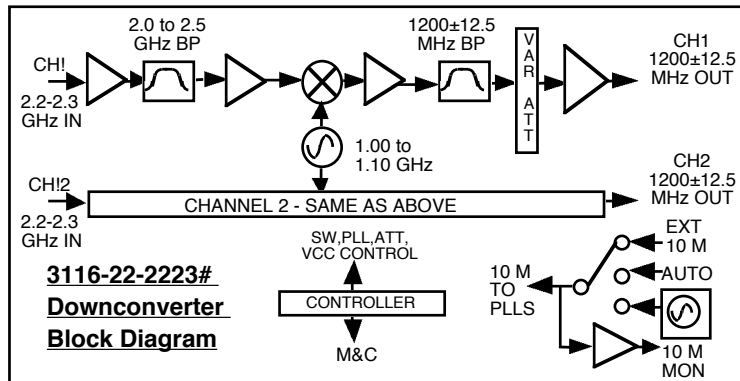


FIGURE 1.2 3116-22-2223# Block Diagram

1.2 Technical Characteristics

TABLE 1.0 3116-22-2223# Two Channel Downconverter Specifications*

Input Characteristics					
Impedance / Return Loss	50Ω / 14 dB				
Frequency	2200 to 2300 MHz				
Noise Figure, Maximum	15 dB maximum gain				
Input Level Range	-40 to -20 dBm				
Input 1 dB Compression	-10 dBm				
Output Characteristics					
Impedance / Return Loss	50Ω / 14 dB				
Frequency	1200 ± 12.5 MHz				
Output Level Range	-20 to 0 dBm				
Output 1 dB Compression	+10 dBm				
Channel Characteristics					
Gain, Max. @ Fc	+30 dB ±2 dB				
Gain, adjustment	+10 to +30 dB in 0.5 ±0.5 dB Steps				
Image Rejection	> 60 dB, minimum				
Spurious, In Band	> 50 dBC, 0 dBm out; (1200 ± 12.5 MHz Out)				
Spurious, Out of Band	<-50 dBm (0.5 - 1.18 and 1.22 - 2.0 GHz Out)				
Channel-Channel Isolation	> 50 dBC, > 55 dBC typical, Gain = +30 dB				
Intermodulation	< -50 dBC for two carriers at 4 MHz spacing, each at -10 dBm out				
Frequency Response	±1.0 dB, 1200 ± 12.5 MHz out				
Frequency Sense	Non-Inverting				
LO Characteristics					
LO Frequency	1.00 to 1.10 GHz, 1 MHz steps (Common LO to both channels)				
Frequency Accuracy	±0.01 ppm maximum over temperature internal reference; external reference input				
10 MHz In/Out Level	3 dBm, ± 3 dB				
Phase Noise @ F (Hz) >					
Standard dBC/(Hz)	100 Hz	1kHz	10kHz	100kHz	1MHz
	-70	-80	-85	-100	-120
Controls, Indicators					
Gain; Ext. Reference Selection	Direct Readout LCD; pushbutton switches or remote				
Power; Alarm; Remote	Green LED, Red LED, Yellow LED				
Remote	RS232C/RS485/422, 9600 baud (Ethernet Optional)				
Other					
RF In, RF Out Connector	BNC (female), 50Ω (Other Options available)				
10 MHz Connectors	BNC (female). 75Ω works with 50 or 75 ohms				
Alarm Connector	DB9 - NO or NC Contact Closure on Alarm				
Size	19 inch, Standard Chassis, 1.75" high X 17.0" deep				
Power	100-240 ±10% VAC, 47-63 Hz, 25 watts maximum				

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

Continued on page 5...

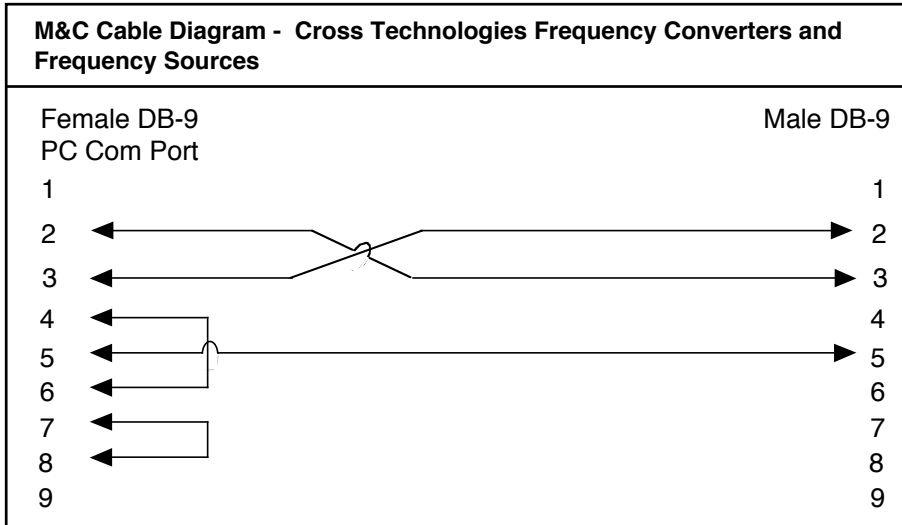
Technical Characteristics continued from page 4...

Available Options		Remote M&C Ethernet Options	
W31 -	0 to +50 degrees C Operation	- W8	Ethernet with Web Browser Interface
Connector Options		- W18	Ethernet with SNMP (and MIB) Interface
SS - 50Ω SMA (RF In), 50Ω SMA (RF Out)		- W28	Ethernet with Direct TCP/IP Interface
Additional Connector Options, See Table 2.2, PG 10			

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 - Ethernet optional)



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 3116-22-2223# 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 3116-22-2223# Two Channel Downconverter Status Requests		
Command	Syntax *	Description
Get Frequency	{aaSF}	returns {aaSFxxxx} where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • F = command code • xxxx = Frequency in MHz. The unit will append the '>' character if the command is successfully processed.
Get Channel 1 Gain	{aaSG}	returns {aaSGxxx} where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • G = command code • xxx = Channel 1's Gain in 0.5 dB. The unit will append the '>' character if the command is successfully processed.
Get Channel 2 Gain	{aaSH}	Returns {aaSHxxx} where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • H = command code • xxx = Channel 2's Gain in 0.5 dB. The unit will append the '>' character if the command is successfully processed.
Get Mute	{aaSE}	Returns {aaSEx} where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • E = command code • x = 0 for Internal, 1 for External, and 2 for Auto. The unit will append the '>' character if the command is successfully processed.
Get Reference Mode	{aaSM}	Returns {aaSMx} where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • E = command code • x = 0 for Mute Off, 1 for Mute On. The unit will append the '>' character if the command is successfully processed.
Get Alarm Status	{aaSA}	Returns {aaSAX} where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • A = command code • X = 0 if no alarm; 1 if alarm. The unit will append the '>' character if the command is successfully processed.

C) Commands

Table 1.2 lists the commands for the 3116-22-2223# and briefly describes them.

After a command is sent the 3116 sends a return “>” indicating the command has been received and executed.

General Command Format - The general command format is {CND...}, where:

{ = start byte

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 is selected.

TABLE 1.2 3116-22-2223# Two Channel Downconverter Commands		
Command	Syntax *	Description
Set Frequency	aaCFxxx	where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit • F = command code • xxx = frequency in MHz:
		Range 2200 to 2300 in 1 MHz steps.
		example: {CG155}
		Will set Channel 1's gain to 15.5 dB.
		The unit will reply with the '>' character if the command is successfully processed.
Set Channel 1 Gain	aaCGxxx	where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit • G = command code • xxx = desired gain in 0.5 dB steps, omit the decimal point:
		Range 50 to 350 (5.0 to 35.0 in 0.5 dB steps).
		example: {CG155}
		Will set Channel 1's gain to 15.5 dB.
		The unit will reply with the '>' character if the command is successfully processed.
Set Channel 2 Gain	aaCHxxx	where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit • H = command code • xxx = desired gain in 0.5 dB steps, omit the decimal point:
		Range 50 to 350 (5.0 to 35.0 in 0.5 dB steps).
		example: {CG155}
		Will set Channel 2's gain to 15.5 dB.
		The unit will reply with the '>' character if the command is successfully processed.

TABLE 1.2 3116-22-2223# Two Channel Downconverter Commands

Command	Syntax *	Description
Set Reference Mode	{aaCEx}	where: <ul style="list-style-type: none">• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit• E = command code• x = 0 for Internal, 1 for External, and 2 for Auto.• example: {CE1} Will set unit's 10 MHz reference mode to External. The unit will reply with the '>' character if the command is successfully processed.
Set Mute	{aaCMx}	where: <ul style="list-style-type: none">• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit• M = command code• x = 0 to Unmute the output, x = 1 to Mute the output.• example: {CM1} Will mute CH1 and CH2 outputs. The unit will reply with the '>' character if the command is successfully processed.

2.0 Installation

2.1 Mechanical

The 3116-22-2223# is powered by a 100-240 \pm 10% VAC power supply, and housed in a 1 3/4" X 19" X 14" rack mount chassis. The 3116-22-2223# can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 3116-22-2223# is assembled.

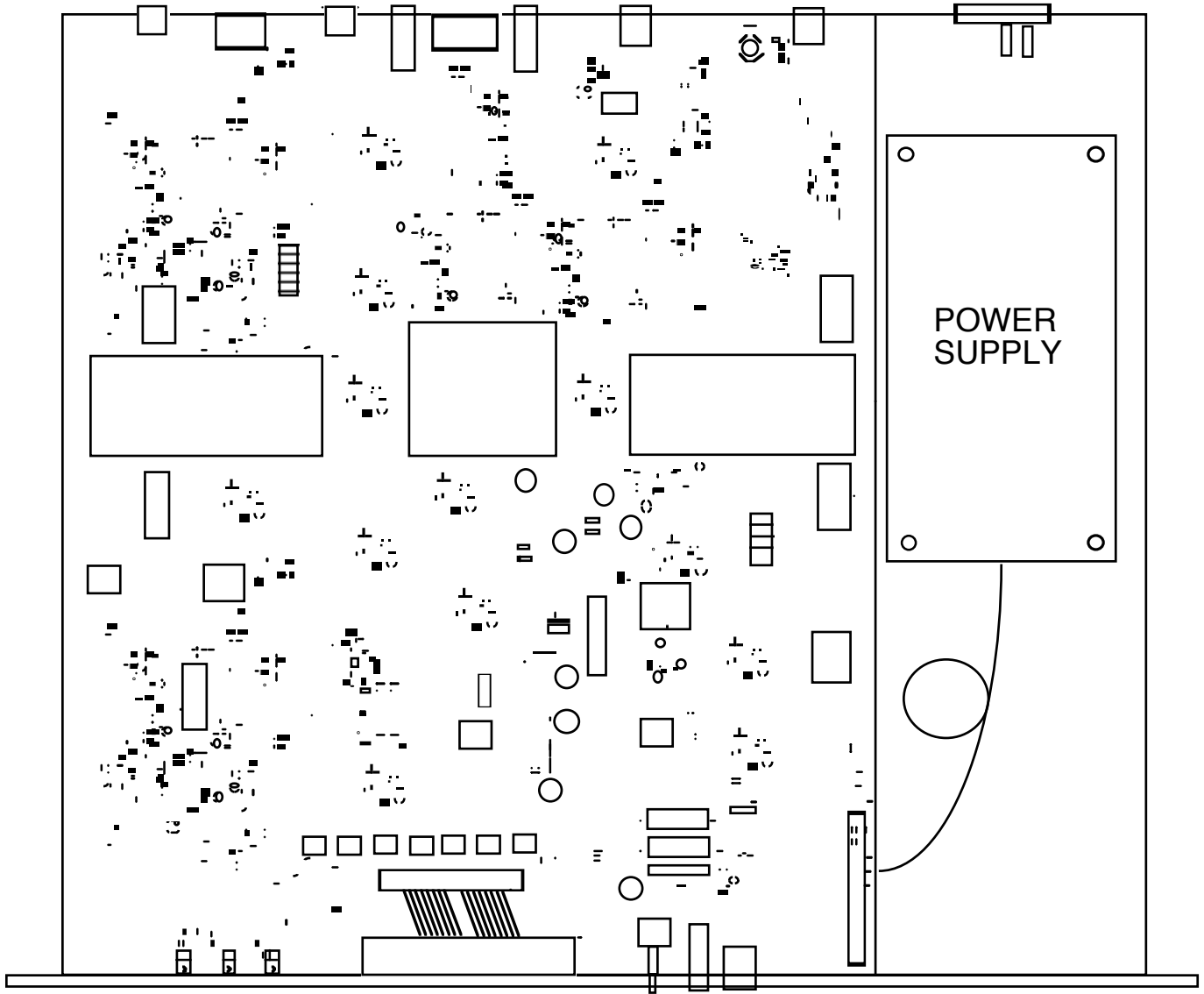


FIGURE 2.0 3116-22-2223# Mechanical Assembly

2.2 Rear Panel Input/Output Signals

Figure 2.1 shows the input and output connectors on the rear panel.

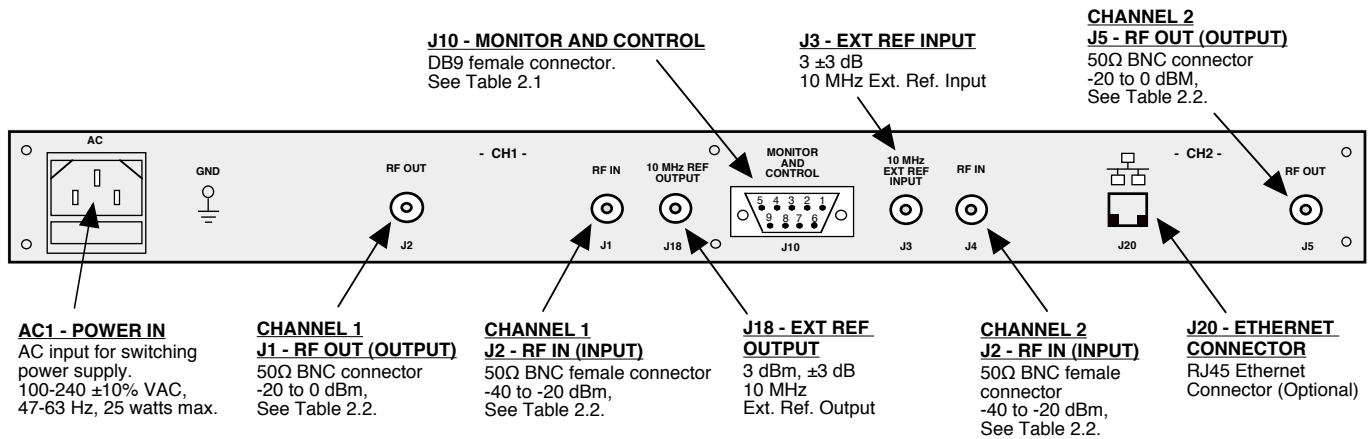


FIGURE 2.1 3116-22-2223# Rear Panel I/O's

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

Option	RF	L-Band
-N	50Ω Type N	75Ω BNC
-NF	50Ω Type N	75Ω Type N
-NN	50Ω Type N	50Ω Type N
-S7	50Ω SMA	75Ω BNC
-SF	50Ω SMA	75Ω Type N
-SN	50Ω SMA	50Ω Type N
-SS	50Ω SMA	50Ω SMA

*Remote Serial Interface

Interface: DB-9 Male Protocol: RS-232C (RS-232C/422/485),
9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.

2.3 Front Panel Controls and Indicators

Figure 2.2 shows the front panel controls and indicators.

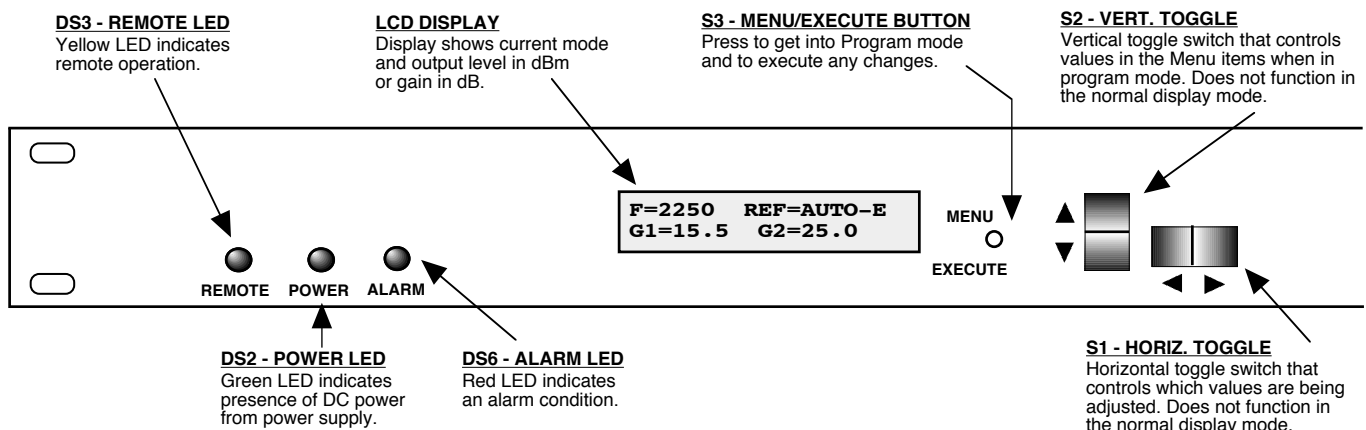


FIGURE 2.2 3116-22-2223# Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3116-22-2223#

1. Connect a -40 dBm to -20 dBm signal to RF IN CH1, J1 (Figure 2.1).
2. Connect a -40 dBm to -20 dBm signal to RF IN CH2, J4 (Figure 2.1).
3. Connect the RF OUT CH1, J2, to the external equipment.
4. Connect the RF OUT CH2, J5, to the external equipment.
5. Connect 100-240 $\pm 10\%$ VAC, 47 - 63 Hz to AC connector on the back panel.
6. Set the CH1 and CH2 gain (+30 dB maximum, in 0.5 ± 0.5 dB steps) for the desired output levels. Make sure the output stays within -20 to 0 dBm with the gain selected and the input levels provided. (See Section 2.5 Menu Settings).
7. Be sure DS2 (green, DC Power) is on and DS6 (red, Alarm) is off (Figure 2.2).
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 2.3. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

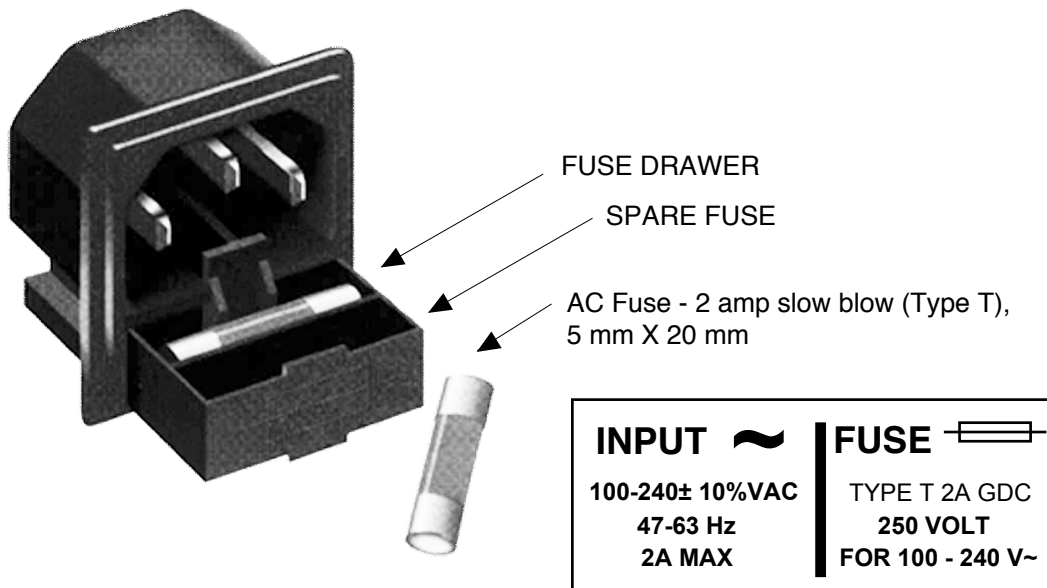


FIGURE 2.3 Fuse Location and Spare Fuse

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 CH1 Gain
Menu 3	Set CH2 Gain
Menu 4	Set Mute
Menu 5	Set Reference Mode
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.

3116-22-2223#W828 Rev. 5.20
--

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

F=2250	REF=AUTO-E
G1=15.5	G2=25.0

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 display cursor left or right.
3. Vertical Switch - This switch is mounted so its movement is vertical and has two functions:
 - a. During gain changes, the vertical movement will raise or lower the number in the direction of the arrows.
 - b. For other functions such 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, 1, or 10 dB steps and then push the Menu/Execute switch to get to the Save Settings Menu:

GAIN = +17.5	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?	<u>Y</u> N
-----------------------	-------------------

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

Figure 2.4 (page 15) 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, 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, ± 3 dB. 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, ± 3 dB 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.

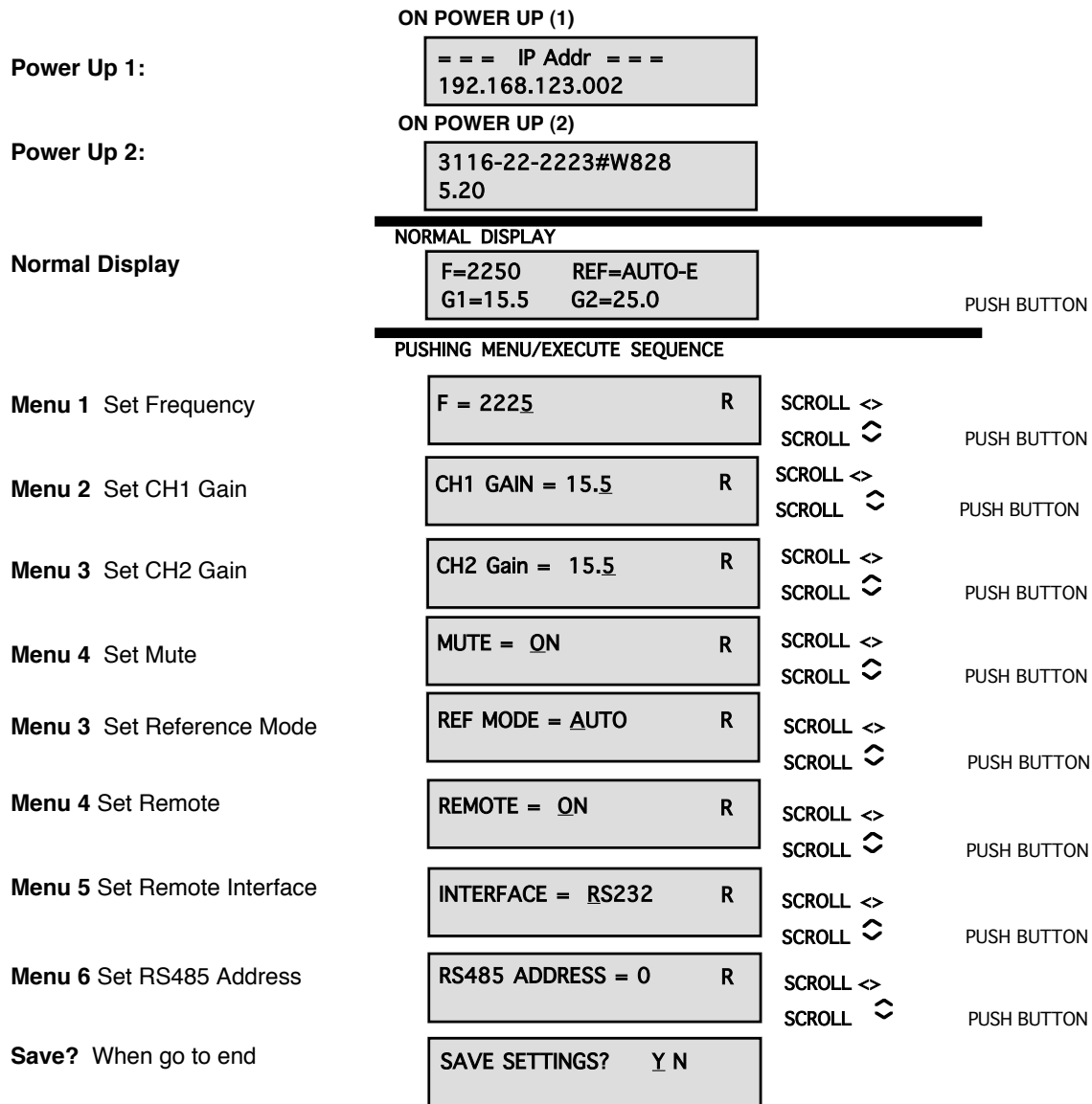


FIGURE 2.4 Menu Display and Sequences

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. (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 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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