Instruction Manual

Model 3115-7984-720-400#
Upconverter

November 6,   Rev. A

```
  ○  ○                                                          ○      MODEL 3115
                          ▲ MENU    FC = 8175.000                    UPCONVERTER
                          ▼ ◉       G=+10.0  REF AUTO-I                           CROSS ✝ TECHNOLOGIES INC.     ○  ○
  ○  ○  REMOTE ALARM POWER  ◄ ►  EXECUTE                       ○                                               ○  ○
```

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✝

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INSTRUCTION MANUAL

MODEL 3115-7984-720-400# Upconverter

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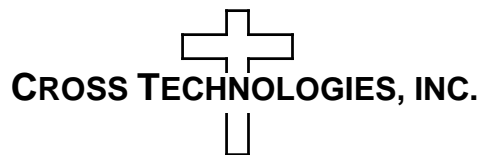
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MODEL 3115-7984-720-400# Downconverter

1.0 General

1.1 Equipment Description

The 3115-7984-720-400# Upconverter converts 720 ± 200 MHz to 7.9 to 8.4 GHz (non-inverted) in 125 kHz steps, Fc = 8.05-8.355 GHz (8.40 GHz max RF out). The gain is 0 to +20 dB, adjustable in 0.5 ± 0.5 dB steps. Front panel LEDs provide indication of Remote operation, PLL Alarm and DC Power. Gain, Fc frequency (8.05-8.355 GHz, 8.40 max output frequency) 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 Type N female for the RF and BNC female for the RF Input 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 in a 1 3/4" X 19" X 14" rack mount chassis.
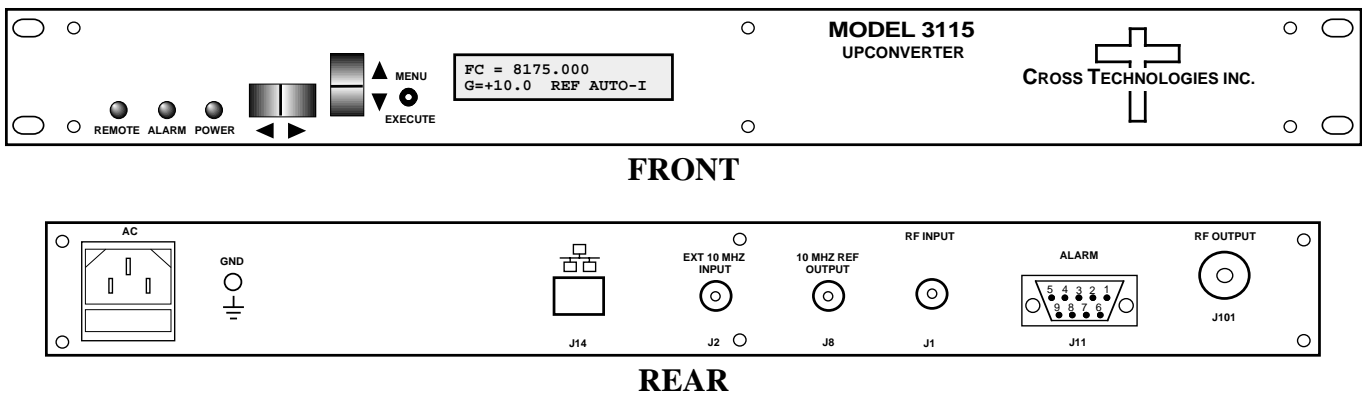
FIGURE 1.1   Model 3115-7984-720-400# Front and Rear Panels
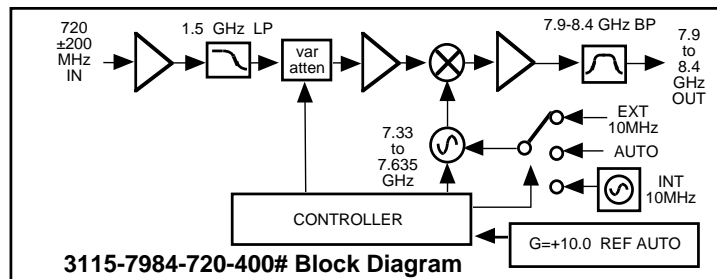
FIGURE 1.2   Model 3115-7984-720-400# Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 3115-7984-720-400# Downconverter Specifications*

Input Characteristics (RF Input)	
Impedance / Return Loss	75Ω / 14 dB
Frequency	720 ±200 MHz
Input Level	-30 to -10 dBm
Output Characteristics (RF Output)	
Impedance / Return Loss	50Ω / 14 dB minimum
Frequency	7.9 to 8.4 GHz, Fc = 8.05-8.355 GHz
Output Level	-25 to -5 dBm
Output 1 dB Compression	+5 dBm at maximum gain
Channel Characteristics	
Gain, (maximum adjustment)	+20 ± 1 dB, max gain at Fc; +0 to +20 dB adjustment in 0.5 ± 0.5 dB steps
Spurious Response	<-50 dBC carrier and non-carrier related, Inband; ≤ -55dBm out of band (Fc ±1 GHz)
Intermodulation	<-50 dBC for two carriers each at -8 dBm out
Frequency Response	± 1.5 dB, 400 MHz BW, (Fc = 8.05-8.355 GHz, 8.40 max output frequency**)**
Group Delay, Maximum	10 ns total (parabolic + linear + ripple)
Frequency Sense	Non-inverting
Synthesizer Characteristics	
Frequency Accuracy	± 0.01 ppm internal reference; External reference input
LO Frequency	7.33 - 7.635 GHz (Fc = 8.05-8.355 GHz, 8.40 GHz max out)
Frequency Step	125 kHz minimum, Fc= 8.05-8.355 GHz; (1 kHz steps, option X1006)
10 MHz In/Out Level	3 dBm, ± 3 dB, with Auto-detect

Phase Noise @ F (Hz) >	100 MHz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-70	-80	-85	-100	-120

Controls, Indicators	
Freq/Gain/Ext Ref Select	Direct Readout LCD, Pushbutton Swiches or Remote Selection
Power; Alarm; Remote; Mute	Green LED, Red LED, Yellow LED, Yellow LED
Remote	RS232C, 9600 baud; RS485/422 or Ethernet optional
Other	
RF Out, RF In Connectors	RF Out - Type N (female)**, 50Ω**, RF In - BNC (female)**,** 75Ω
10 MHz Connectors	BNC (female)**,** 75Ω, works with 50 or 75 ohms
Alarm/Remote Connectors	DB9 - NO or NC Contact Closure on Alarm
Size	19 inch, 1 RU Standard Chassis 1.75" high X 14.0" deep
Power / Temp Range	100-24 ±10% VAC, 47-63 Hz, 45 watts maximum

1.2 Technical Characteristics Continued...

Available Options	
- W31	External Temperature 0C to +50C
- X1006	1 kHz frequency step
Remote M&C Interfaces:	
- W8	Ethernet; with Web Browser
- W18	Ethernet; with Web Browser & SNMP
- W28	Ethernet; with TCP/IP. Telnet®
Connectors / Impedance	
- STD	N-type (RF Out), 75Ω BNC (RF In)
- M	N-type (RF Out), 50Ω BNC (RF In)
- NN	N-type (RF Out), 50Ω N-type (RF In)
- S	SMA (RF Out), 50Ω BNC (RF In)
- S7	SMA (RF Out), 75Ω BNC (RF In)
- SN	SMA (RF Out), 50Ω N-type (RF In)
- SS	SMA (RF Out), 50Ω SMA (RF In)
Contact Cross Technologies for other options.	
*10˚C to 40˚C; Specifications subject to change without notice.	© 2016 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** - **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
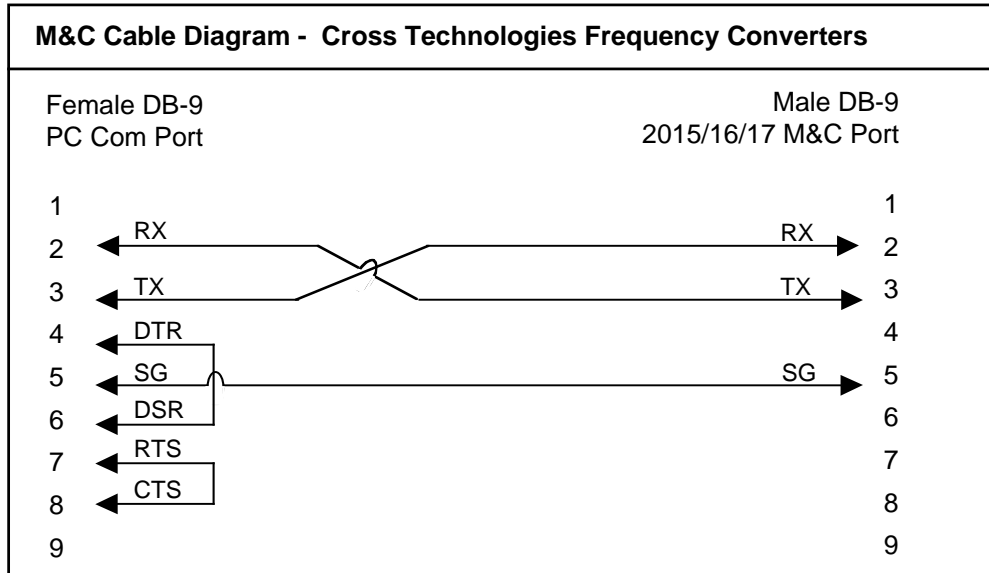
Connector - Rear panel, DB-9 female

Pinouts (RS-485/422/232C)

J11 Pinouts	Description
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	Ground
6	Alarm Relay - Common
7	Alarm Relay - Normally Open
8	Not Used
9	Alarm Relay - Normally Closed

B) M&C Commands -

Table 1.2 lists the status requests for the 3115-7984-720-400# and briefly describes them. After a command is sent the 3115-7984-720-400# 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 3115-7984-720-400# Status Requests		
Command	Syntax *	Description
Get Frequency	{aaSF}	returns: {aaSFxxxxxxx}
		where:
		• xxxxxxx = converter frequency in kHz
Get Gain	{aaSG}	returns {aaSGxxx} where:
		• xxx = Converter gain in 0.5 dB steps.
Get Internal 10 MHz Reference Offse	{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 {Sv3115-xxy..yverZZZZ} where:
		• 3115-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

TABLE 1.2 3115-7984-720-400# Commands

| Command	Syntax *	Description
Set Frequency	{aaCFxxxxxxx}	where:
		• aa = unit address, range = 00 to 31,
		only used if interface is RS485, otherwise omit.
		• F = command code
		• xxxxxxx=frequency in kHz, range=8050000-8355000
		(8050.000 to 8355.000 MHz, 0.125 MHz steps)
		• example: {CF8175125}
		Will set the unit's frequency to 8175.125 MHz
		The unit will reply with the '>' character if the
		command is sucessfully processed.
Set Gain	{aaCGxxx}	where:
		• xxx = Converter gain in 0.5 dB steps.
		Range: 000 to 200 where 200 = 20.0 dB
		Example: {CG155} sets the converter's gain to +15.5dB
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)

1.4 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.

2.0 Installation

2.1 Mechanical

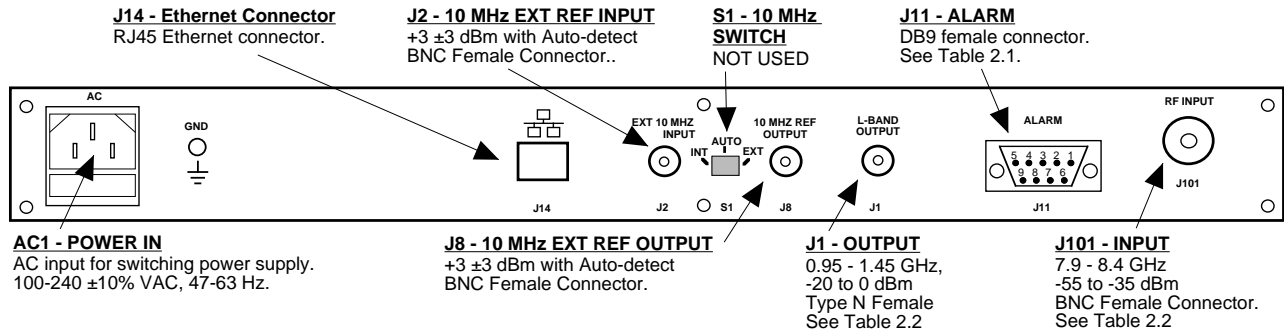The 3115-7984-720-400# consists of one RF/Controller PCB which is housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching, ± 12, +24, +5 VDC power supply provides power for the assembly.

The 3115-7984-720-400# can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 3115-7984-720-400# is assembled.
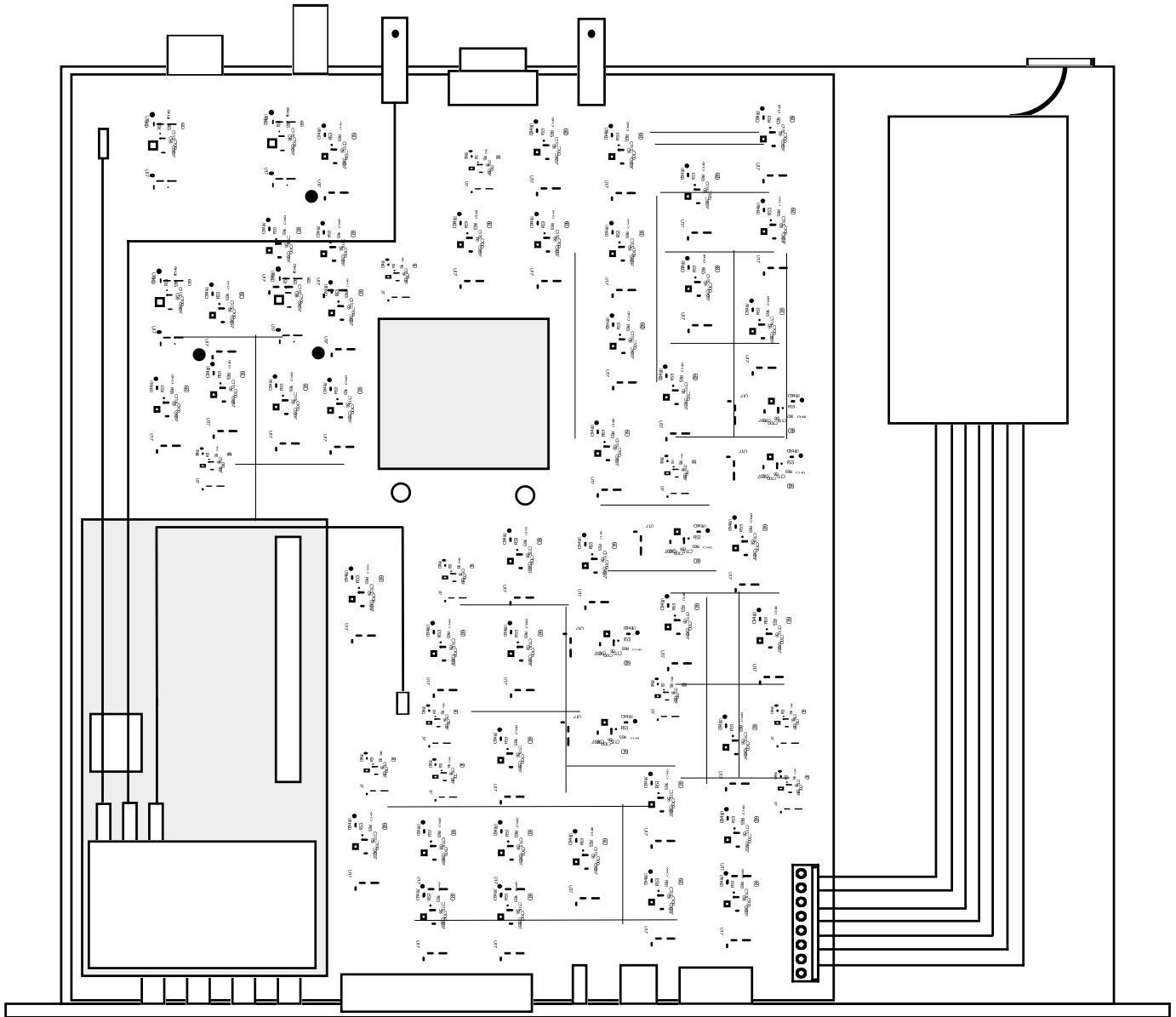
FIGURE 2.1   3115-7984-720-400# Mechanical Assembly

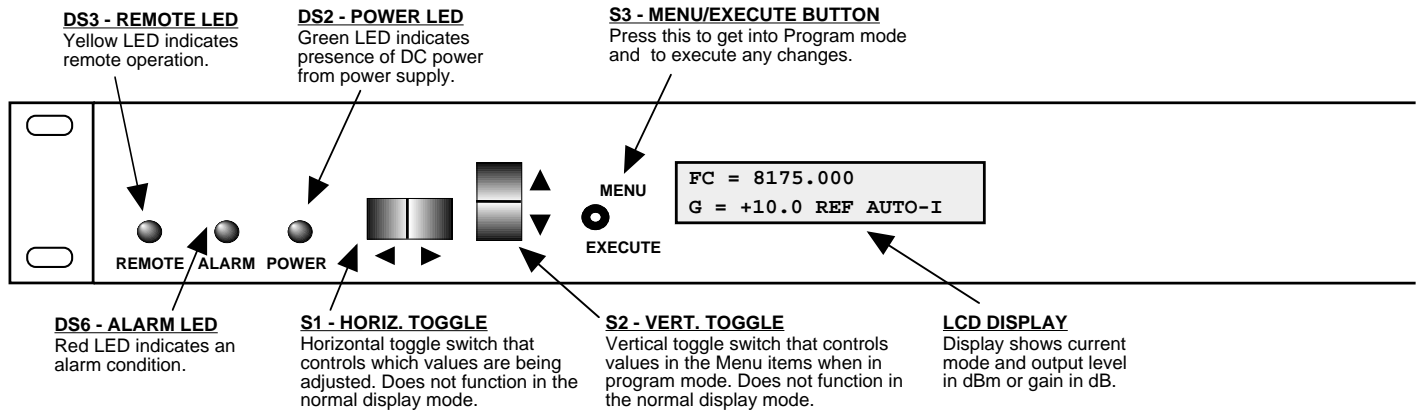**2.2 Rear Panel Input / Output Signals -** Figure 2.2 shows the input and output connectors on the rear panel.

J14 - Ethernet Connector
RJ45 Ethernet connector.

J2 - 10 MHz EXT REF INPUT
+3 ±3 dBm with Auto-detect
BNC Female Connector..

S1 - 10 MHz SWITCH
NOT USED

J11 - ALARM
DB9 female connector.
See Table 2.1.

AC1 - POWER IN
AC input for switching power supply.
100-240 ±10% VAC, 47-63 Hz.

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

J1 - OUTPUT
0.95 - 1.45 GHz,
-20 to 0 dBm
Type N Female
See Table 2.2

J101 - INPUT
7.9 - 8.4 GHz
-55 to -35 dBm
BNC Female Connector.
See Table 2.2

FIGURE 2.2   3115-7984-720-400# Rear Panel Inputs and Outputs

TABLE 2.1 J11 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

TABLE 2.2 RF Connector Options		
Option	**RF**	**RF**
STD	N-type (RF Out)	75Ω BNC (RF In)
M	N-type (RF Out)	50Ω BNC (RF In)
NN	N-type (RF Out)	50Ω N-type (RF In)
S	SMA (RF Out)	50Ω BNC (RF In)
S7	SMA (RF Out)	75Ω BNC (RF In)
SN	SMA (RF Out)	50Ω N-type (RF In)
SS	SMA (RF Out)	50Ω SMA (RF In)

Protocol: RS485, RS422, or RS232C (selectable), 9600
baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit

2.3 Front Panel Controls and Indicators - Figure 2.3 shows the front panel controls and indicators.

DS3 - REMOTE LED
Yellow LED indicates remote operation.

DS2 - POWER LED
Green LED indicates presence of DC power from power supply.

S3 - MENU/EXECUTE BUTTON
Press this to get into Program mode and to execute any changes.

```
FC = 8175.000
G = +10.0 REF AUTO-I
```

MENU

EXECUTE

REMOTE ALARM POWER

DS6 - ALARM LED
Red LED indicates an alarm condition.

S1 - HORIZ. TOGGLE
Horizontal toggle switch that controls which values are being adjusted. Does not function in the normal display mode.

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.

LCD DISPLAY
Display shows current mode and output level in dBm or gain in dB.
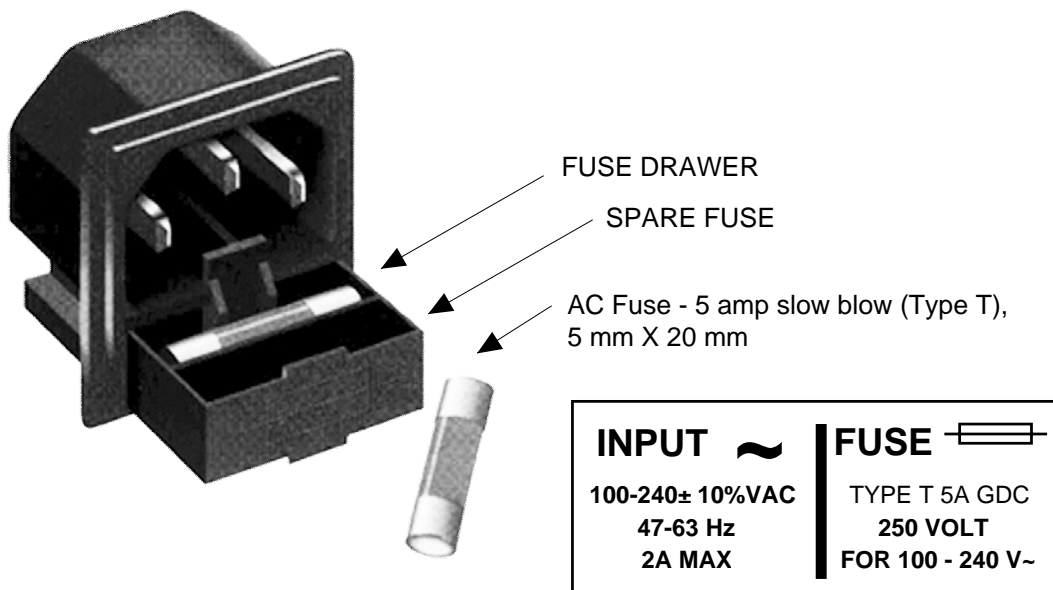
FIGURE 2.3   3115-7984-720-400# Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3115-7984-720-400# Upconverter

1. Connect a -30 dBm to -10 dBm, 70MHz signal to RF IN, J1 (Figure 2.2)
2. Connect RF OUT, J101, to the external equipment.
3. Connect 100- 240 ± 10% VAC, 47 - 63 Hz to AC input on the back panel.
4. Set the desired output frequency (See Section 2.5 Menu Settings).
5. Set the gain for +0 to +20 dB. *Make sure the output stays within -30 to -10 dBm with the gain selected and the input level provided. The firmware will prevent setting gain and input level outside this range. (See Section 2.5 Menu Settings).*
6. Be sure DS2 (green, DC Power) is on and DS6 (red, Alarm) is off (Figure 2.3).
7. <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 2.4. 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 - 5 amp slow blow (Type T),
5 mm X 20 mm

INPUT ~	FUSE ▭
100-240± 10%VAC	TYPE T 5A GDC
47-63 Hz	250 VOLT
2A MAX	FOR 100 - 240 V~

FIGURE 2.4   <u>Fuse Location and Spare Fuse</u>

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

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

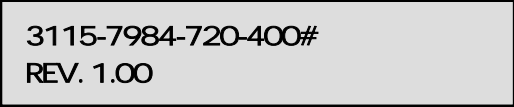Alarm indications appear on the LEDs (see Figure 2.2).

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.

```
3115-7984-720-400#
REV. 1.00
```

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

```
FC = 8175.000
G = +10.0  REF AUTO  -  1
```

       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 Frequency Changes

2.5.5 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   =        +1 7.5              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?             Y 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.
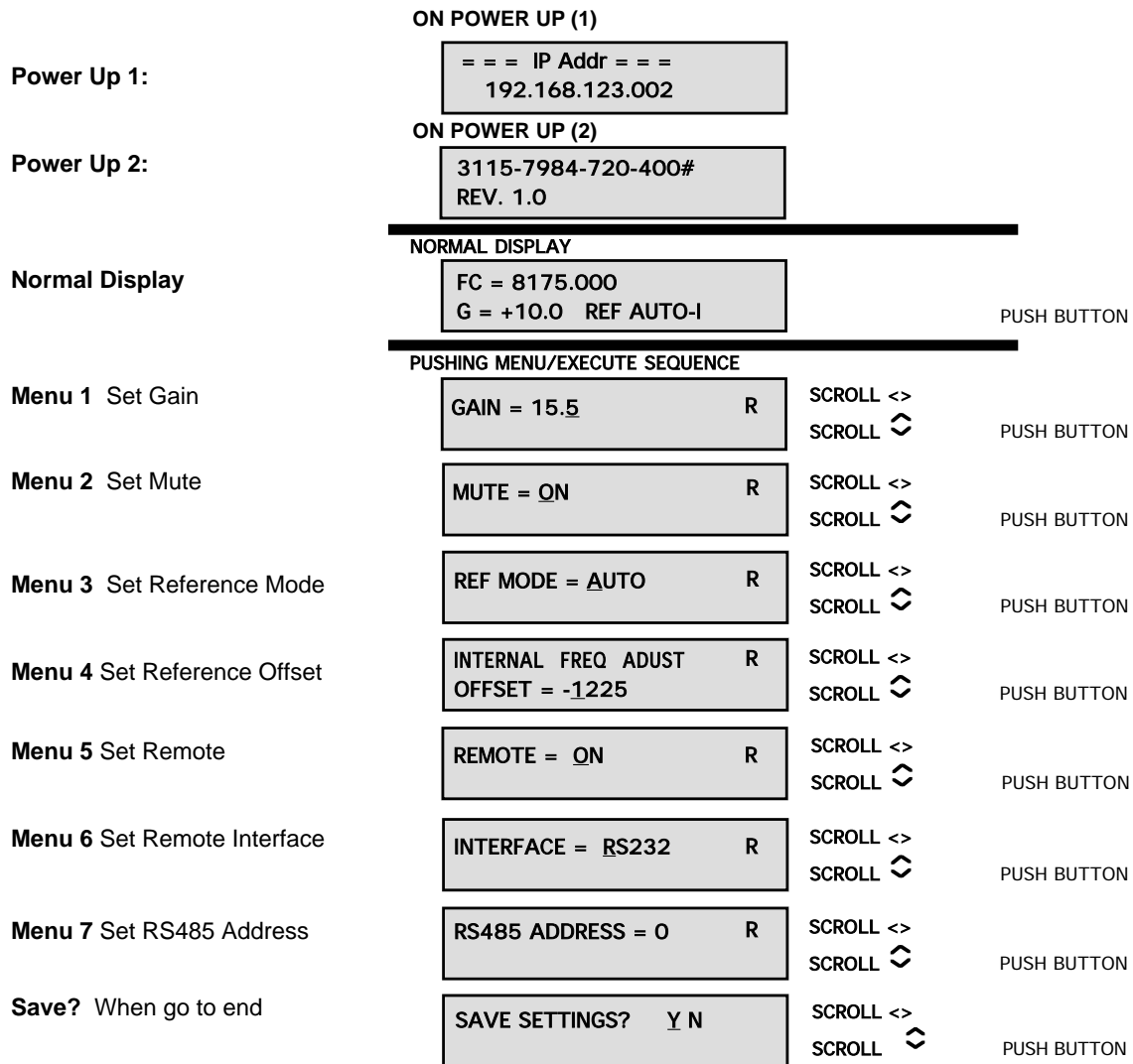The Remote LED will light when you select the Remote mode.

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
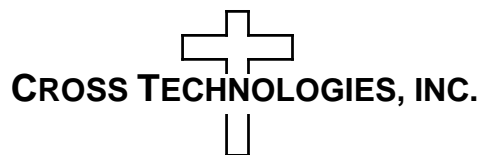Reference Output Connector, J8. REF = INT appears on the front panel display.

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.

Power Up 1:

ON POWER UP (1)

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

Power Up 2:

ON POWER UP (2)

```
3115-7984-720-400#
REV. 1.0
```

Normal Display

NORMAL DISPLAY

```
FC = 8175.000
G = +10.0   REF AUTO-I
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Set Gain

```
GAIN = 15.5                R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 2 Set Mute

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

Menu 3 Set Reference Mode

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

Menu 4 Set Reference Offset

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

Menu 5 Set Remote

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

Menu 6 Set Remote Interface

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

Menu 7 Set RS485 Address

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

Save? When go to end

```
SAVE SETTINGS?    Y N
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

FIGURE 2.5   Menu Display and Sequence

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