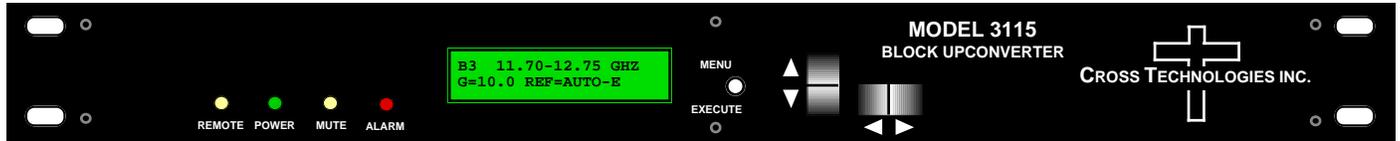# Instruction Manual

Model 3115-31-128

Block Upconverter, Tri-Band

April 2015, Rev. A

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CROSS TECHNOLOGIES, INC.

INSTRUCTION MANUAL

MODEL 3115-31-128 Block Upconverter, Tri-Band

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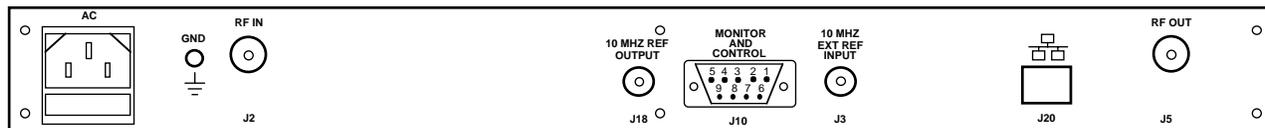
MODEL 3115-31-128 Block Upconverter, Tri-Band

1.0 General

1.1 Equipment Description

The 3115-31-128 Block Upconverter converts 0.95-1.75 to 3.4-4.2 GHz or 0.95-2.05 to 10.70-11.80 GHz or 0.95-2.0 to 11.70-12.75 GHz. The gain range is 0 to +30 dB, adjustable in 0.5 dB steps. Front panel LEDs indicate Remote Operation, DC Power, Mute and PLL Alarm. Band select, gain and internal/external/Auto reference selection are controlled by front panel switches or remotely via RS 232C or RS485/422 (Ethernet Optional) and are viewable on the LCD Display. Connectors are SMA 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 in the +2 to +8 dBm range. The 3115 is powered by a 100-240 ±10% VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.
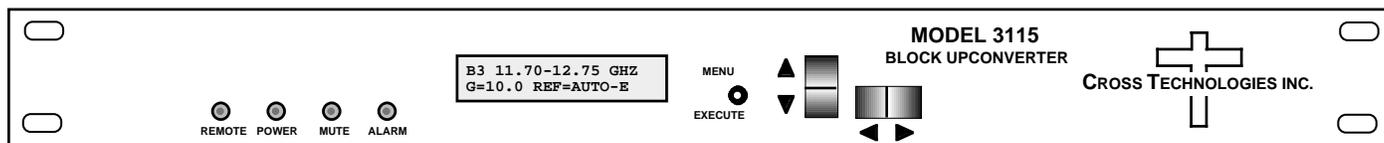
FRONT PANEL - 3115-31-128

REAR PANEL - 3115-31-128

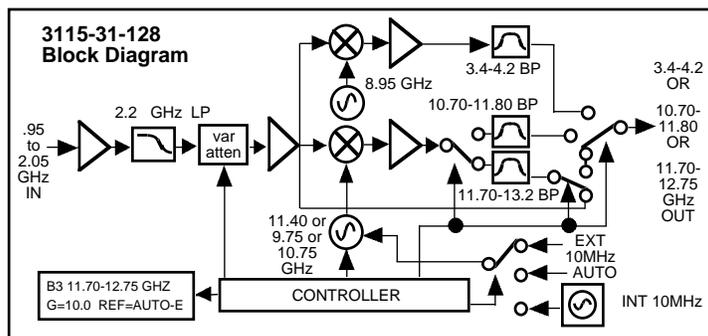## FIGURE 1.1   3115-31-128   Front and Rear Panels

FIGURE 1.2   3115-31-128 Block Diagram

1.2 Technical Characteristics

TABLE 1.0 3115-31-128 Block Upconverter Specifications*	
Input Characteristics	
Impedance / Return Loss	50Ω / 14 dB
Frequency Band 1; 2; 3	0.95 - 1.75; 0.95 - 2.05; 0.95 - 2.0 GHz
Noise Figure, Maximum	20 dB maximum gain
Input Level Range	-40 to -20 dBm
Output Characteristics (L-Band)	
Impedance / Return Loss	50Ω / 14 dB, Mute and Unmute
Frequency Band 1; 2; 3	3.4 - 4.2; 10.70 - 11.80; 11.70 -12.75 GHz
Output Level Range	-20 to -5 dBm
Output 1 dB Compression	+5 dBm at maximum gain
Mute	> 60 dB @ 0 dBm out
Channel Characteristics	
Gain, Max. (adjustment)	+30 dB ±2 dB, max. gain; 30 dB adjustment in 0.5 ±0.5 dB Steps
Image Rejection	> 60 dB, minimum
Spurious, Inband	SIGNAL RELATED <-60 dBC in band, 0 dBm out; SIGNAL INDEPENDENT, <-60 dBm
Spurious, Out of Band	-50 dBm, Band 1, 2, 3; 2.5 - 3.3 and 4.3 - 6 GHz; 9.7 - 10.7 and 11.9 - 15.5 GHz; 10.7 - 11.6 and 12.8 - 15.5 GHz
Intermodulation	-55 dBC for two carriers at 4 MHz spacing, each at -10 dBm out, Gain = +30 dB
Frequency Response	±1.5 dB, 3.4-4.2 GHz, 10.70-11.80 GHz & 11.70-12.75 GHz out; ±0.5 dB, 40 MHz BW
Frequency Sense	Non-inverting
LO Characteristics	
LO Frequency Band 1; 2; 3	11.40/8.95 GHz; 9.75 GHz; 10.75 GHz
Frequency Accuracy	±0.01 ppm maximum over temperature internal reference; external reference input
10 MHz Level In/Out	+ 2 to +8 dBm in, with Auto-detect; Monitor Output = +3 ±3 dBm

Phase Noise @ F (Hz) >	100	1K	10K	100K	1M
Standard dBC/(Hz)	-55	-75	-85	-95	-110

Controls, Indicators	
Gain; Ext. 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)

(Technical Characteristics continued on page 5...)

Other	
RF Connector	SMA (female), 50Ω
L-Band Connector	BNC (female), 50Ω
10 MHz Connectors	BNC (female), 50Ω/75Ω
Alarm / Remote Connector	DB9 - NO or NC Contact Closure on Alarm
Size	19 inch, Standard Chassis, 1.75" high X 16.0" deep
Power	100-24 ±10% VAC, 47-63 Hz, 45 watts maximum
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
Available Connector Options	See Table 2.2 - PG10

*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 and Frequency Sources

Female DB-9   Male DB-9
PC Com Port

Female DB-9 PC Com Port	Male DB-9
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
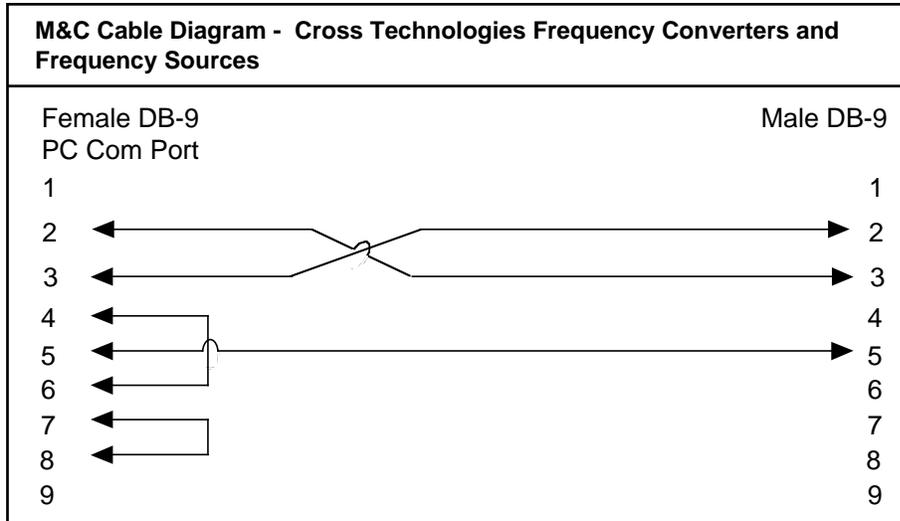
Connector: Rear panel, DB-9 male

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 3115-31-128 and briefly describes them.

> * 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 3115-31-128 Status Requests		
Command	**Syntax ***	**Description**
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 = 1 if the converter's 10 MHz reference mode is set to Internal
		• x = 2 if the converter's 10 MHz reference mode is set to External
		• x = 3 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 {Sv3115-31-128y..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

C) **Commands**

Table 1.2 lists the commands for the 3115-31-128 and briefly describes them.

After a command is sent the 3115 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

TABLE 1.2 3115-31-128 Commands		
Command	Syntax *	Description
Set Gain	{aaCGxxx}	where:
		• xxx = Converter gain in 0.5 dB steps.
		Range: 000 to 300 where 000 = 0.0 dB and 300 = 30.0 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)
Set Band	{aaCBx}	where:
		• x = 1 to select Band 1: 0.95 - 1.75 to 3.4 - 4.2 GHz
		• x = 2 to select Band 2: 0.95 - 2.05 to 10.70 to 11.80 GHz
		• x = 3 to select Band 3: 0.95 - 2.00 to 11.70 to 12.75 GHz

2.0 Installation

2.1 Mechanical

The 3115 is powered by a 100-240 ± 10% VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.   The 3115-31-128 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 3115-31-128 is assembled.
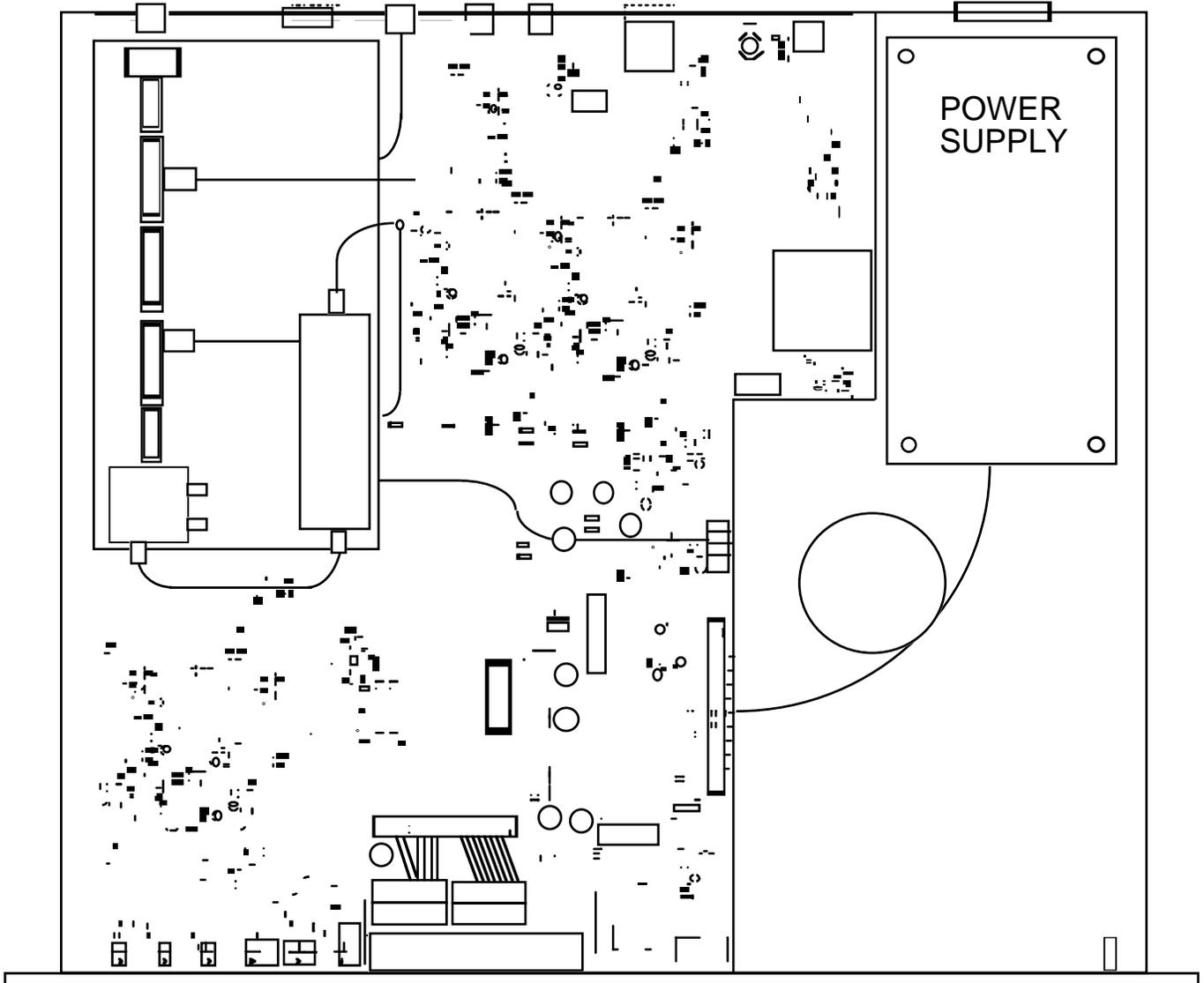
FIGURE 2.0   3115-31-128 Mechanical Assembly

2.2 Rear Panel Input/Output Signals

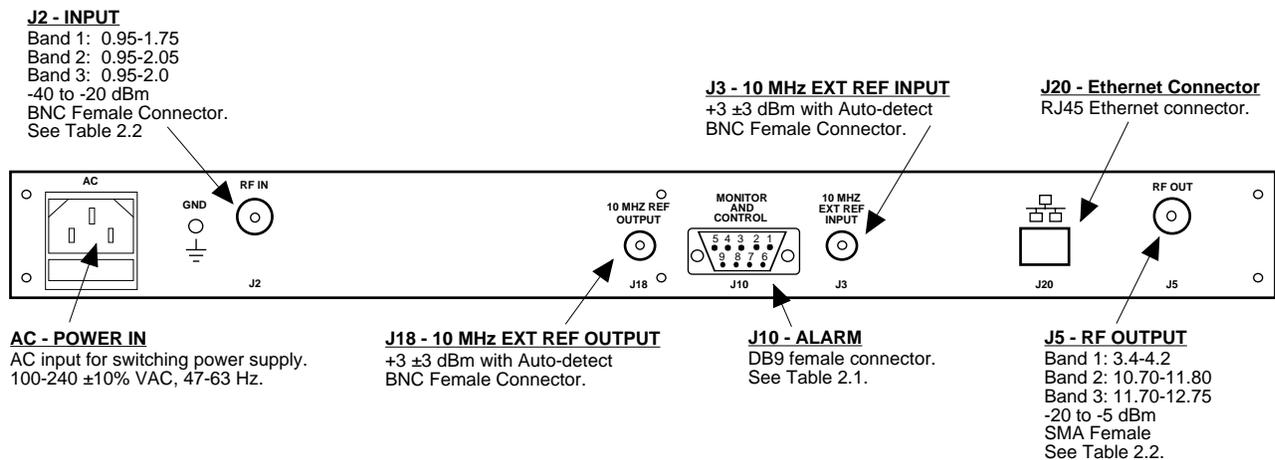Figure 2.1 shows the input and output connectors on the rear panel.

J2 - INPUT
Band 1: 0.95-1.75
Band 2: 0.95-2.05
Band 3: 0.95-2.0
-40 to -20 dBm
BNC Female Connector.
See Table 2.2

J3 - 10 MHz EXT REF INPUT
+3 ±3 dBm with Auto-detect
BNC Female Connector.

J20 - Ethernet Connector
RJ45 Ethernet connector.

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

J18 - 10 MHz EXT REF OUTPUT
+3 ±3 dBm with Auto-detect
BNC Female Connector.

J10 - ALARM
DB9 female connector.
See Table 2.1.

J5 - RF OUTPUT
Band 1: 3.4-4.2
Band 2: 10.70-11.80
Band 3: 11.70-12.75
-20 to -5 dBm
SMA Female
See Table 2.2.

FIGURE 2.1   3115-31-128 Rear Panel I/O's

TABLE 2.1 J10 Pinouts*

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

TABLE 2.2   Connector Options

Option	RF	L-Band
-N	50Ω Type N	75Ω BNC
-NF	50Ω Type N	75Ω Type F
-NN	50Ω Type N	50Ω Type N
-S7	50Ω SMA	75Ω BNC
-SF	50Ω SMA	75Ω Type F
-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, **Option Q**),
9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.

2.3 Front Panel Controls and Indicators
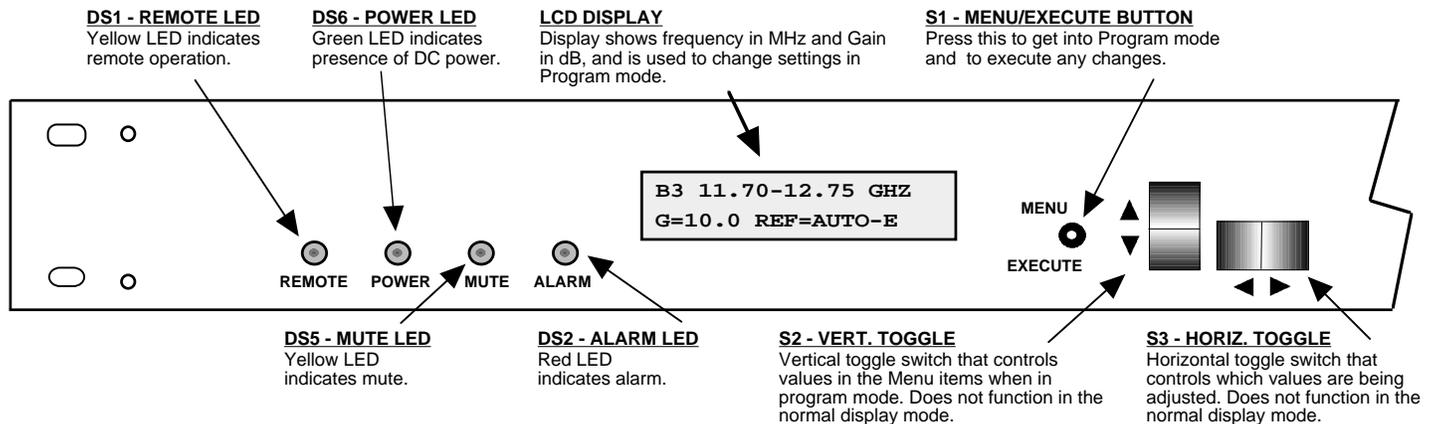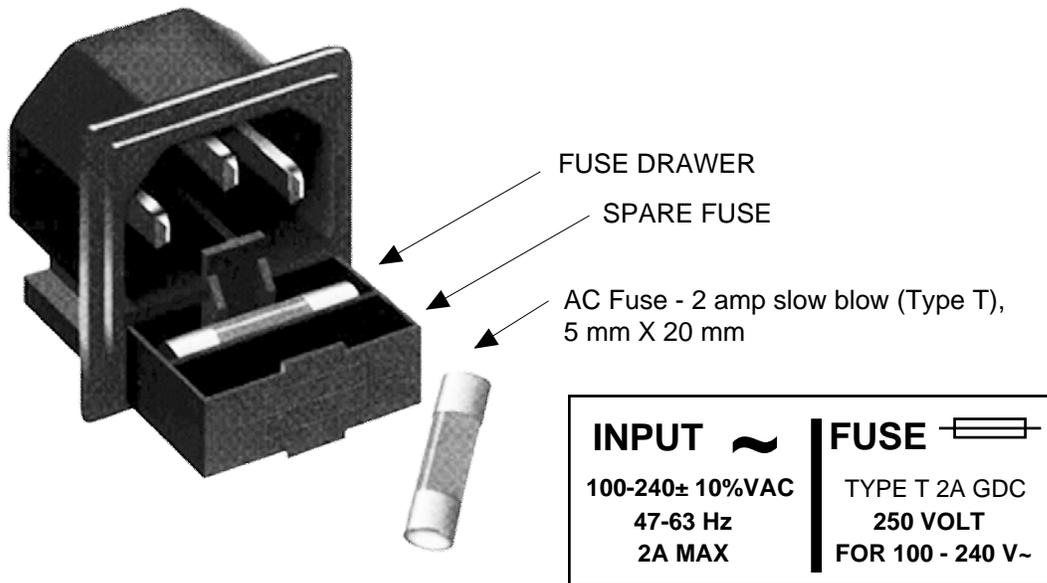Figure 2.2 shows the front panel controls and indicators.

DS1 - REMOTE LED
Yellow LED indicates
remote operation.

DS6 - POWER LED
Green LED indicates
presence of DC power.

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

S1 - MENU/EXECUTE BUTTON
Press this to get into Program mode
and to execute any changes.

```
B3 11.70-12.75 GHZ
G=10.0 REF=AUTO-E
```

REMOTE   POWER   MUTE   ALARM

MENU

EXECUTE

DS5 - MUTE LED
Yellow LED
indicates mute.

DS2 - ALARM LED
Red LED
indicates alarm.

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 2.2   3115-31-128 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3115-31-128

1. Connect a -40 dBm to -20 dBm signal to RF IN, J2 (Figure 2.1).
2. Connect the RF OUT, J5, to the external equipment.
3. Connect 100-240 ±10% VAC, 47 - 63 Hz to AC connector on the back panel.
4. Set the gain (0 to +30 dB, adjustable in 0.5 dB steps) for the desired output level. Make sure the output stays within -20 to -5 dBm with the gain. selected and the input level provided. (See Section 2.5 Menu Settings).
5. Be sure DS2 (green, DC Power) is on and DS6 (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 Band
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
Menu 9   PCB Temperature

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

<u>NOTE</u>: **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.

```
3115-31-128W18
Rev. 4.00
```

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

```
B3 11.70-12.75 GHZ
G=10.0   REF=AUTO-E
```

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, 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 +2 to +8dBm. 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 +2 to +8dBm 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.

ON POWER UP (1)

Power Up 1:

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

ON POWER UP (2)

Power Up 2:

```
3115-31-128W18
4.0
```

NORMAL DISPLAY

Normal Display

```
B3  11.70 -12.75
GHZ
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Set Band

```
BAND = 3              R
11.70 -12.75 GHZ
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 2 Set Gain

```
GAIN = 15.5           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 ADJUST  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

Menu 9 Temperature

```
TEMPERATURE =         R
+032
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Save? When go to end

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

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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