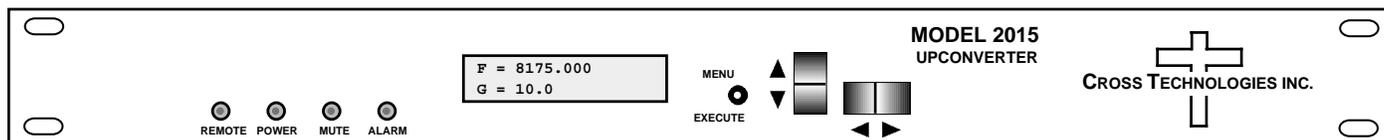


Instruction Manual

Model 2015-7984-720-400 Upconverter

April 2016, Rev A



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INSTRUCTION MANUAL

MODEL 2015-7984-720-400 Upconverter

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MODEL 2015-7984-720-400 Downconverter

1.0 General

1.1 Equipment Description

The 2015-7984-720-400 Upconverter converts 720 ± 200 MHz to 7.9 to 8.4 GHz in 125 kHz steps, $F_c = 8.1$ -8.25 GHz (1 kHz steps, option X1006) with low group delay and flat frequency response. Synthesized local oscillators (LO) provide low phase noise and ± 0.01 ppm stability frequency selection. Push button switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), remote operation (yellow), PLL alarm (red), or the TX carrier is muted (yellow). Variable attenuators for the RF input and RF output provide a gain range of 0 to +20 dB as adjusted by the front panel pushbutton switches. Remote operation allows selection of frequency and gain. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are BNC female for RF input and 10MHz reference input and output, and Type N female for the RF output (other connector options available). The 2015-7984-720-400 is powered by a 100 - $240 \pm 10\%$ VAC power supply; and in a 1.75"X 19"X 16" rack mount chassis.

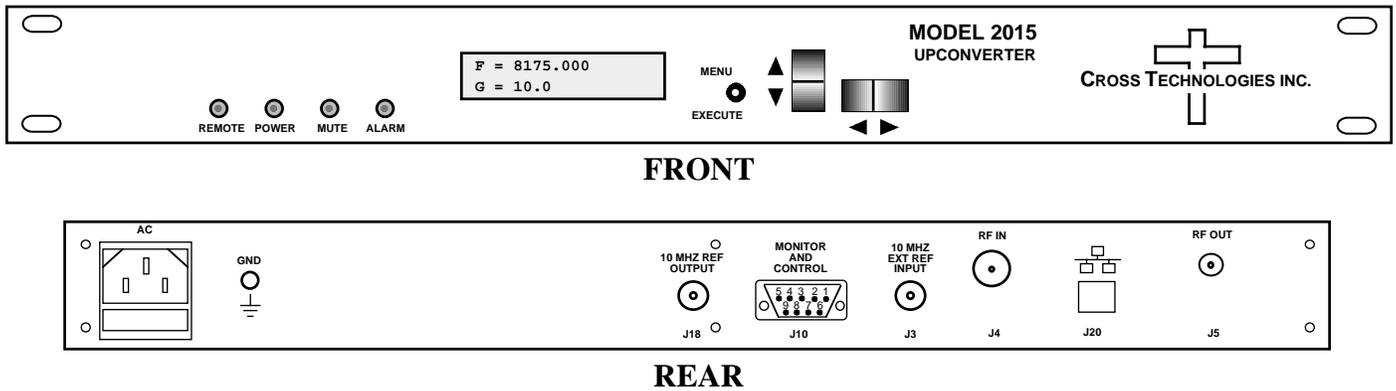


FIGURE 1.1 Model 2015-7984-720-400 Front and Rear Panels

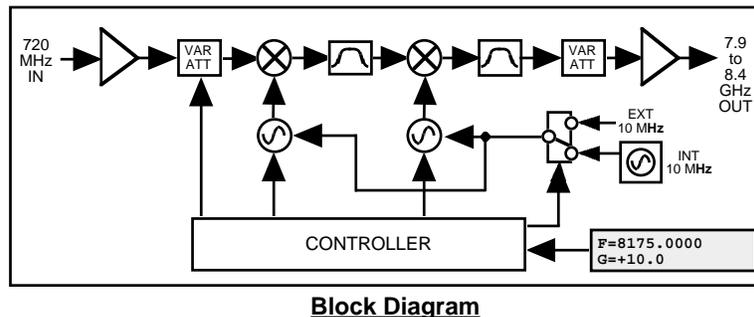


FIGURE 1.2 Model 2015-7984-720-400 Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 2115-7984-720-400 Downconverter Specifications*

Input Characteristics					
Impedance / Return Loss	75Ω / 14 dB				
Frequency	720 ±200 MHz				
Input Level	-30 to -10 dBm				
Output Characteristics					
Impedance / Return Loss	50Ω / 14 dB minimum				
Frequency	7.9 to 8.4 GHz, Fc = 8.1-8.25 GHz				
Output Level	-25 to -5 dBm				
1 dB Compression	+5 dBm				
Channel Characteristics					
Gain Range (adjustable)	+0 to +20 dB, 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 -8.1 dBm out				
Frequency Response	± 1.5 dB, 400 MHz BW, (Fc = 8.1-8.25 GHz)				
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				
Frequency Step	125 kHz min, Fc= 8.1-8.25 GHz; (1 kHz steps, option X1006)				
10 MHz In/Out Level	Input = +1 to +8 dBm In; Output = 3 ± 3 dBm				
Phase Noise @ F (Hz) >	100 MHz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-70	-70	-80	-95	-105
Controls, Indicators					
Frequency/Gain Selection	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/IF Connectors	RF - Type N (female), 50Ω / IF - 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 16.0" deep				
Power / Temp Range	100-24 ±10% VAC, 47-63 Hz, 45 watts maximum				

Continued on page 5...

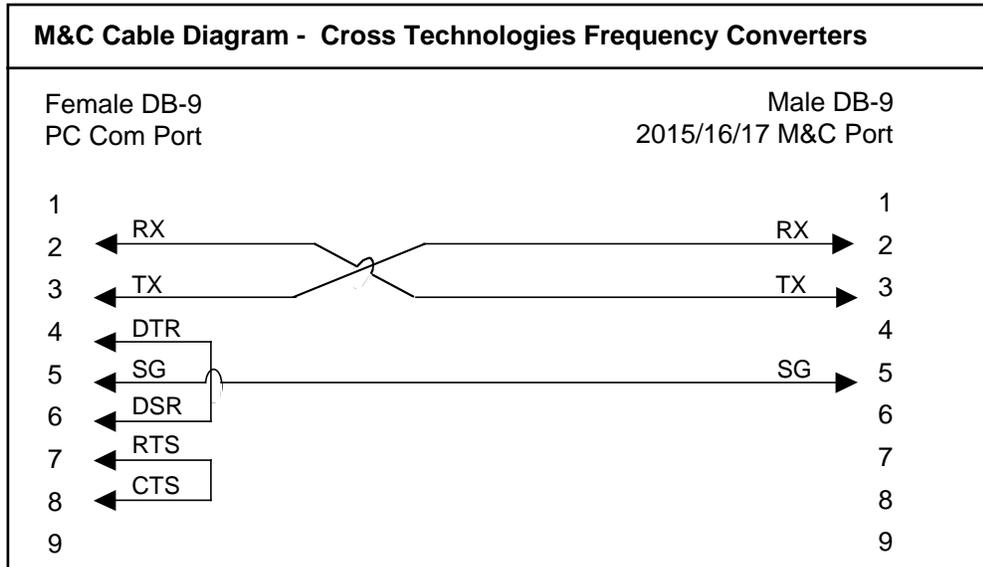
1.2 Technical Characteristics Continued...

Available Options	
- W31	External Temperature 0C to +50C
- X1006	1 kHz frequency step
Remote M&C Interfaces:	
- Q	RS485 Remote Interface
- W8	Ethernet; with Web Browser
- W18	Ethernet; with Web Browser & SNMP
- W28	Ethernet; with TCP/IP. Telnet®
- W828	Ethernet, W18 + W28
Connectors / Impedance	
- STD	50Ω Type N (RF), 75Ω BNC (IF)
- M	50Ω Type N (RF), 50Ω BNC (IF)
- S	50Ω SMA (RF), 50Ω BNC (IF)
- S7	50Ω SMA (RF), 75Ω BNC (IF)
Contact Cross Technologies for other options.	
*10°C to 40°C; Specifications subject to change without notice.	
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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**)



Connector - Rear panel, DB-9 female

Pinouts (RS-485/422/232C)

Pin	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 2015-7984-720-400 and briefly describes them. After a command is sent the 2015-7984-720-400 sends a return ">" indicating the command has been received and executed.

* 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 1.3 2015-7984-720-400 M&C Commands		
Command Function	Syntax	Command Description
Set Frequency	{aaCFxxxxxx}	where:
		• aa = unit address, range = 00 to 31,
		only used if interface is RS485, otherwise omit.
		• F = command code
		• xxxxxx=frequency in kHz, range=8100000-8200000
		(8100.000 to 8200.000 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 successfully processed.
Set Gain	{aaCGxxx}	where:
		• aa = unit address, range = 00 to 31,
		only used if interface is RS485, otherwise omit.
		• G = command code
		• xxx = gain in dB, range = 0 to 20.0 in 0.5 dB steps,
		example: {CG155}
		Will set the unit's gain to 15.5 dB
		The unit will reply with the '>' character if
		the command is successfully processed.

M&C Commands continued on page 8...

M&C Commands continued from page 7...

Table 1.3 2015-7984-720-400 M&C Commands (continued)		
Command Function	Syntax	Command Description
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 = 1 to mute the output, x = 0 to unmute the output example: {CM1} Will mute the output carrier. The unit will reply with the '>' character if the command is successfully processed.
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 to set to internal reference, • x = 1 to set to external reference example: {CE1} Will set the reference mode to External. The unit will reply with the '>' character if the command is successfully processed.
Set Remote Off	{aaCRO}	where: <ul style="list-style-type: none"> • aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit. • R = command code • O, ascii number zero. example: {CRO} Will disable the unit's serial M&C port. The unit will reply with the '>' character if the command is successfully processed. (Note: this command only affects the serial M&C port, the ethernet port is always on and will not be affected).
Set Remote On	#	<ul style="list-style-type: none"> • Just the ascii pound sign, (0x23) Will enable the unit's serial M&C port. The unit will reply with the '>' character if the command is successfully processed. (Note: this command only affects the serial M&C port, the ethernet port is always on and will not be affected).

C) Status Request -

Table 1.2 lists the status requests for the 2015-7984-720-400 and briefly describes them.

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-digit command or status number, 1 through 9
- 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 2015-7984-720-400 Status Request/Inquiries		
Command	Syntax	Description
Frequency Inquiry	{aaSF}	returns: {aaSFxxxxxx}
		where:
		• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit.
		• F = command code
		• xxxxxx = frequency in kHz
		The unit will append the '>' character if the command is successfully processed.
Gain Inquiry	{aaSG}	returns: {aaSGxxx}
		where:
		• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit.
		• G = command code
		• xxx = unit's gain setting in 0.5 dB, decimal point omitted.
		The unit will append the '>' character if the command is successfully processed.
Mute Inquiry	{aaSM}	returns: {aaSMx}
		where:
		• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit.
		• M = command code
		• x = 1 if the output is muted, x = 0 if the output is unmuted
		The unit will append the '>' character if the command is successfully processed.

Status Request continued on page 10...

Status Request/Inquiries continued from page 9

Table 1.2 2015-7984-720-400 Status Request/Inquiries		
Command	Syntax	Description
Reference Mode Inquiry	{aaSE}	returns: {aaSEx}
		where:
		• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit.
		• E = command code
		• x = 0 if reference mode is internal, x = 1 if external
		The unit will append the '>' character if the command is successfully processed.
Alarm Inquiry	{aaSA}	returns: {aaSAx}
		where:
		• aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit.
		• A = command code
		• x = 0 if alarm is off, x = 1 if alarm is on.
		The unit will append the '>' character if the command is successfully processed.

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 2015-7984-720-400 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 2015-7984-720-400 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 2015-7984-720-400 is assembled.

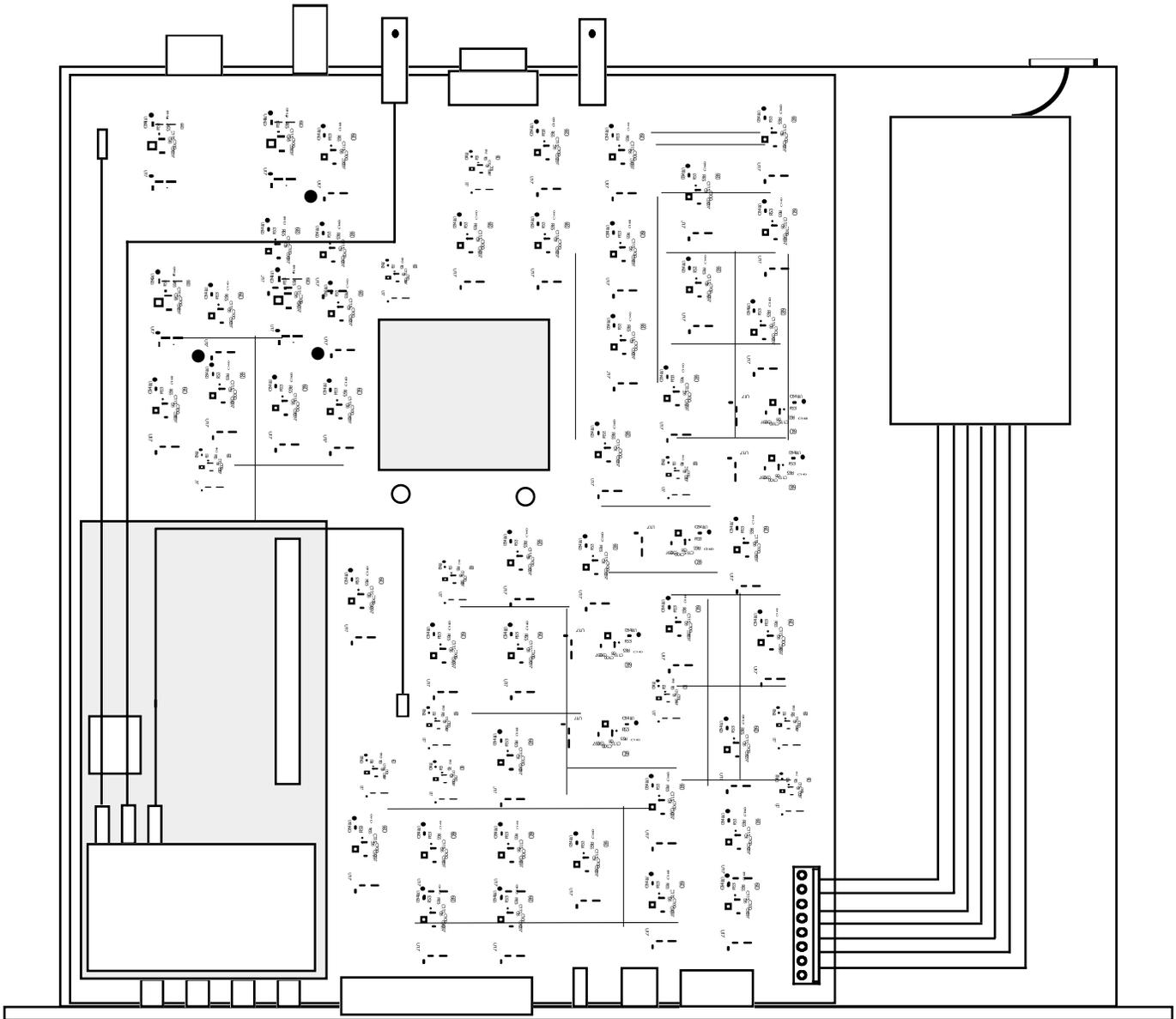


FIGURE 2.1 **2015-7984-720-400 Mechanical Assembly**

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

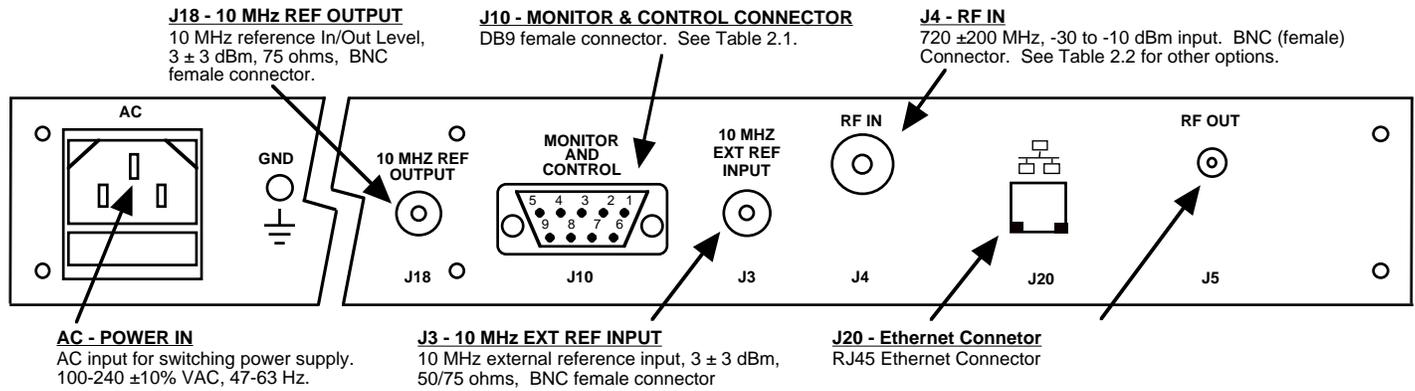


FIGURE 2.2 2015-7981-720-400 Rear Panel Inputs and Outputs

TABLE 2.1 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

TABLE 2.2 IF/RF Connector Options		
Option	IF	RF
STD	BNC, 75 Ω	SMA, 50 Ω
-S	BNC, 50 Ω	SMA, 50 Ω
-N	BNC, 75 Ω	N-Type, 50 Ω
-M	BNC, 50 Ω	N-Type, 50 Ω

***Interface:** DB-9 Female

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.

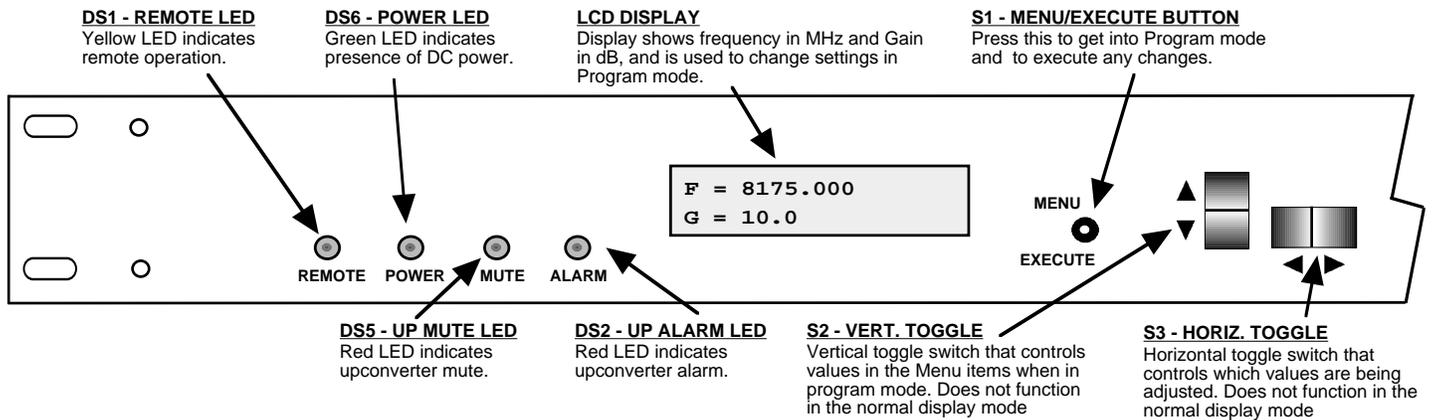


FIGURE 2.3 2015-7984-720-400 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2015-7984-720-400 Upconverter

1. Connect a -30 dBm to -10 dBm, 70MHz signal to IF IN, J4 (Figure 2.2)
2. Connect RF OUT, J5, to the external equipment.
3. Connect 100- 240 \pm 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 input level (See Section 2.5 Menu Settings).
6. 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).***
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3).
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.

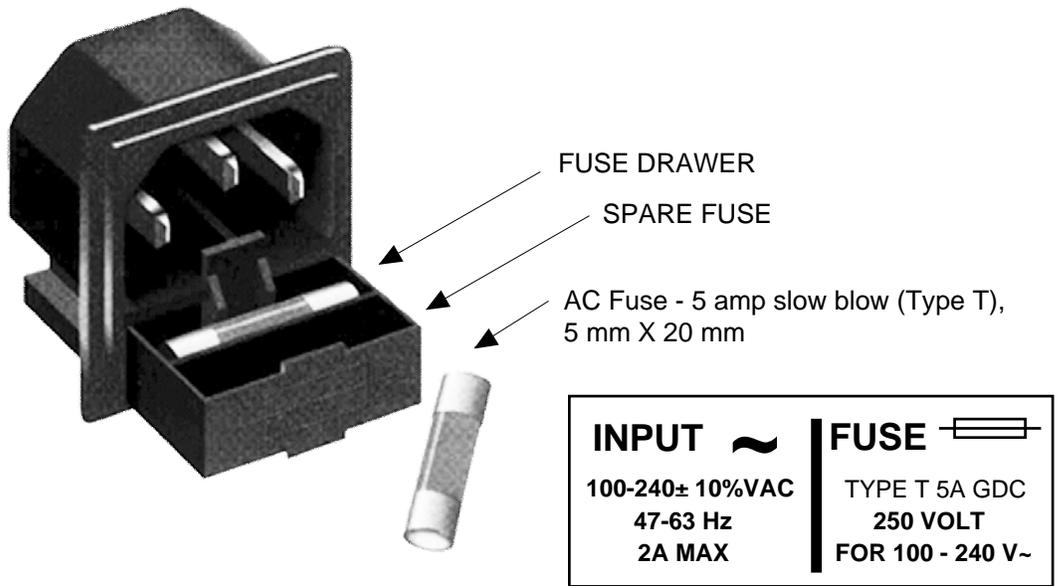


FIGURE 2.4 Fuse Location and Spare Fuse

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 in dB (+0 to +20)
- Menu 3** Mute TX Signal
- Menu 4** Set Unit to Remote Operation
- Menu 5** Select External 10 MHz Reference
- Menu 6** Select RS232, RS422, or RS485 Remote Operation (**option Q**)
- Menu 7** Select RS485 Remote Address for Unit (**option Q**)

Save Menu When “R” is selected in any of the above menus or when operator reaches 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 12 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 status of a unit is retained even when power is removed. When power is restored, the unit will return to its previous settings.

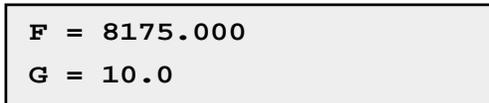
When power is first applied, the LCD display goes through three steps.

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, gain, and selected RF output of the upconverter is shown.



F = 8175.000
G = 10.0

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 cursor left or right.
3. Vertical Switch - 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 as 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 12 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 upconverter 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. THE CARRIER IS MUTED WHEN FREQUENCY IS CHANGED.

When the display indicates the value desired you can push the Menu/Execute switch to the next item:

```
G = +10.0      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 the default display:

```
F = 8175.000
G = 10.0
```

Figure 2.5 shows all 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 GAIN, first push the Menu/Execute switch to get to the gain setting:

NOTE: CHANGES TAKE PLACE TO GAIN IMMEDIATELY BUT DO NOT GET SAVED UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

Press the Up/Down switch to change the gain in 10, 1, or 0.5 dB steps.



G = +10.0 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. DO NOT SET A GAIN THAT WOULD EXCEED -5 dBm OR HAVE LESS THAN -25 dBm OUTPUT LEVEL.

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.

Pushing the Menu/Execute switch then takes you to:



F = 8175.000
G = 10.0

Figure 2.5 gives the menu items and how to make changes.

2.5.5 Alarm Indications

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

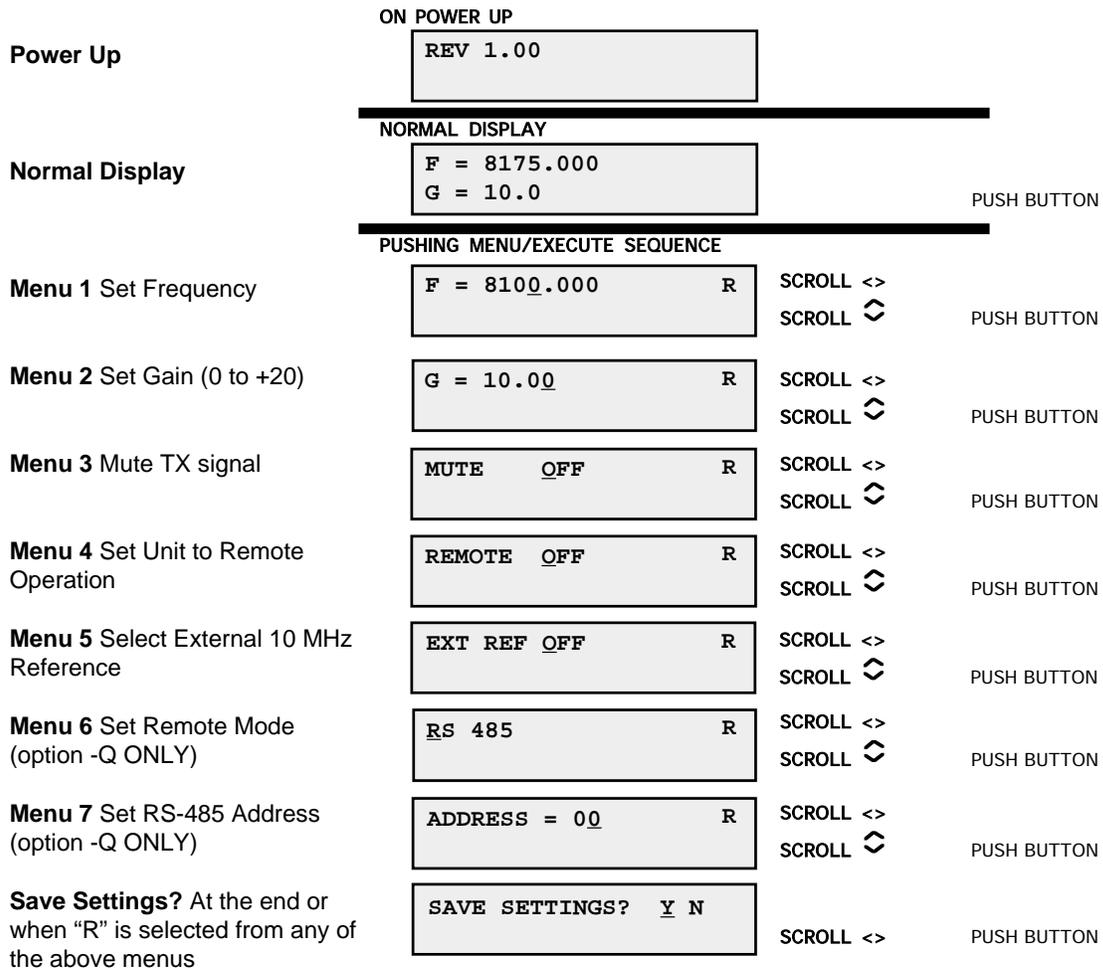


FIGURE 2.5 Menu Display and Sequence



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