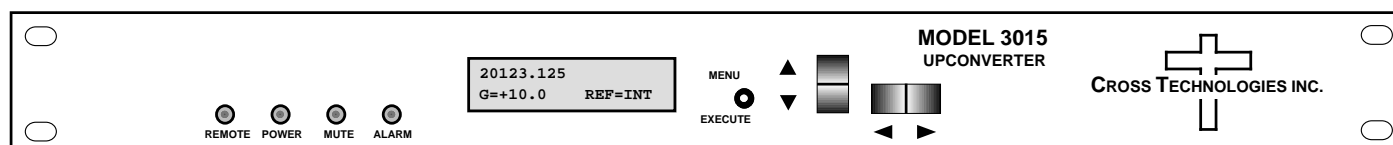


Instruction Manual

Model 3015-1820 Upconverter

March 2018, Rev. 0



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6170 Shiloh Road
Alpharetta, Georgia 30005

(770) 886-8005
FAX (770) 886-7964
Toll Free 888-900-5588

WEB www.crosstechnologies.com
E-MAIL info@crosstechnologies.com

INSTRUCTION MANUAL

MODEL 3015-1820 Upconverter

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FAX (770) 886-7964
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MODEL 3015-1820 Upconverter

1.0 General

1.1 Equipment Description

The 3015-1820 Upconverter converts 70 ± 18 MHz to 18.2 to 20.2 GHz in 125 kHz steps (1 kHz opt- X1008). This unit combines a 70 MHz to 3.45 GHz upconverter with an agile block upconverter to obtain the wide tuning range. Synthesized local oscillators (LO) provide frequency selection. Multi-function switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm (red), remote operation (yellow) or the TX carrier is muted (yellow). Variable attenuators for the IF input and output provide a gain range of -5 to +20 dB as adjusted by the front panel multi-function 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 IF and external 10MHz reference input and output, and 2.92 mm (female) for the RF output. The unit is powered by a $100-240 \pm 10\%$ VAC power supply, and housed in a 1 3/4" X 19" X 18" rack mount chassis.

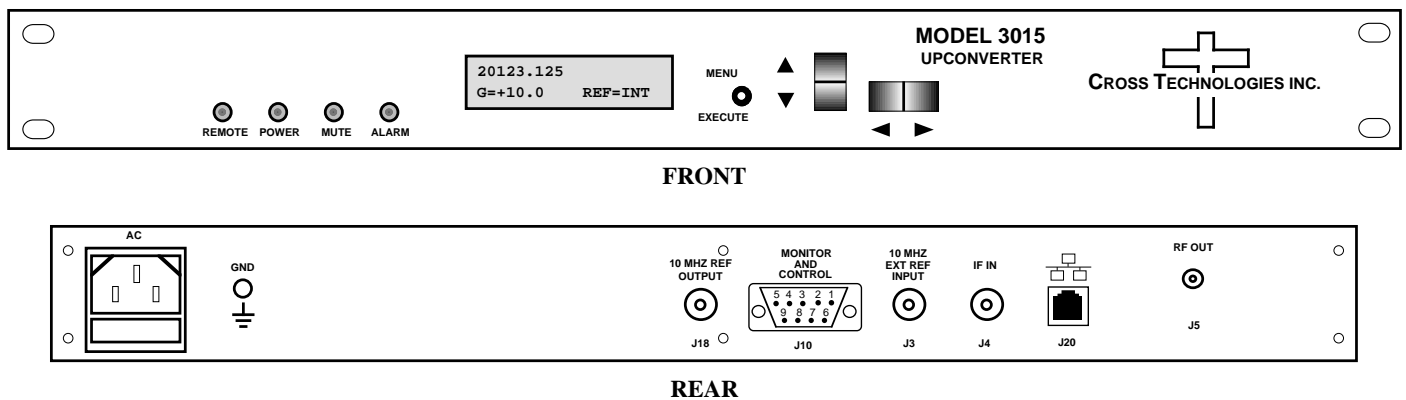


FIGURE 1.1 Model 3015-1820 - Front & Rear Panels

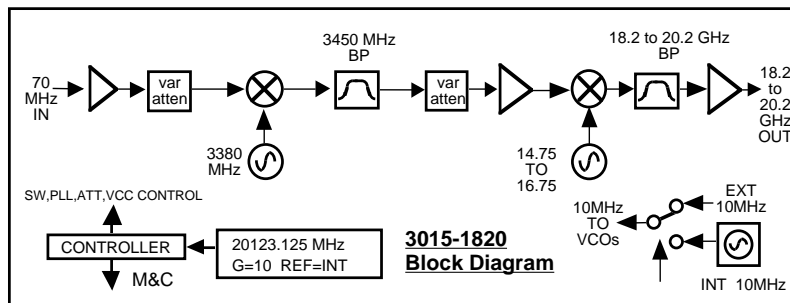


FIGURE 1.2 Model 3015-1820 Upconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 3015-1820 Upconverter Specifications*

Input Characteristics					
Impedance / Return Loss	75Ω / 18 dB				
Frequency	70 ±18 MHz				
Input Level	-30 to -10 dBm				
Output Characteristics					
Impedance / Return Loss	50Ω / 18 dB typical, 14 dB min.				
Frequency	18.2 to 20.2 GHz				
Output Level	-15 to 0 dBm				
Output 1 dB Compression	+10 dBm				
Channel Characteristics					
Gain Max./Range (adjustable)	20 ± 2 dB Maximum/ -5.0 to +20.0 dB, 0.5 dB ± 0.5 dB steps				
Spurious Inband	<-50 dBC at maximum gain				
Spurious, Out of band	<-50 dBm at maximum gain				
Intermod	<-50 dBC for two carriers each at -5 dBm out, at maximum gain				
Frequency Response	±3.0 dB, 18.2-20.2 GHz; ±1.5 dB, any 1 GHz band; ±1.0 dB, 36 MHz BW				
Group Delay, max.	0.02 ns/MHz ² parabolic; 0.05ns/MHz linear; 1 ns ripple, 36 MHz BW				
Frequency Sense	Non-inverting				
Synthesizer Characteristics					
Frequency Accuracy	± 1.01 ppm max. over temp internal reference; external reference input				
Frequency Step	125 kHz minimum (1 kHz option - X1008)				
External 10 MHz Level	+3 dBm ± 3 dB, 50Ω				
Phase Noise @ Frequency	100 Hz	1 kHz	10kHz	100kHz	1MHz
dBC/Hz	-60	-70	-80	-90	-100
Controls, Indicators					
Frequency / Gain Selection	Direct readout LCD; manual or remote selection				
Power, Alarm, Remote, Mute	Green LED, Red LED, Yellow LED, Yellow LED				
Remote	RS232C, 9600 baud (RS422/485/option -Q, Ethernet/option -W8, -W18, -W28)				
Other					
RF, IF Connectors	2.92 mm (female), BNC, 75Ω (female), (50Ω IF opt - S29)				
10 MHz Connectors	BNC (female) 50Ω works for 50 or 75 ohms				
Alarm/Remote Connector	DB9 (female) - NO or NC contact closure on Alarm				
Size	19 inch, 1RU Standard Chassis 1.75" high X 18.0" deep				
Power	100-24 ±10% VAC, 47-63 Hz, 60 watts maximum				

See next page for available options...

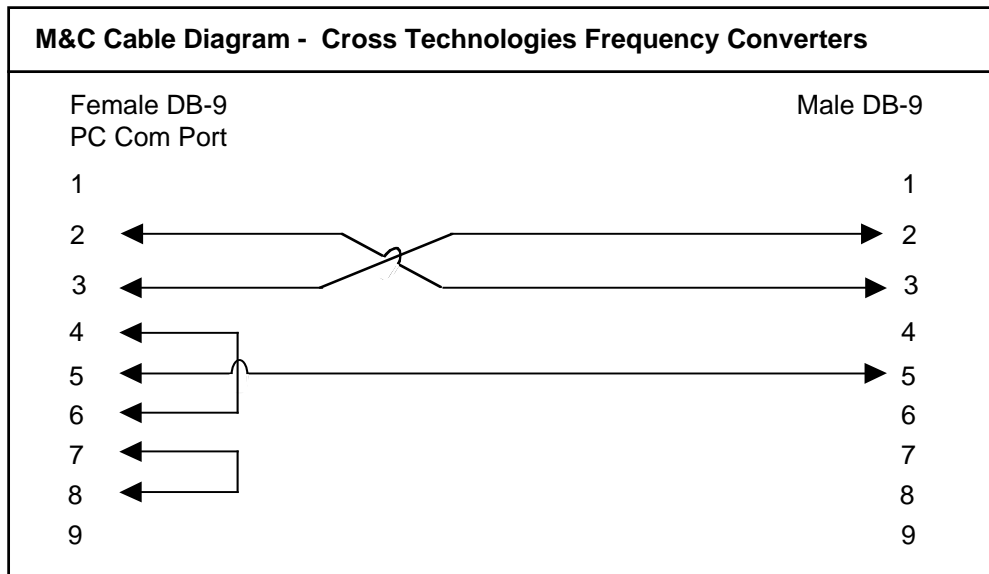
1.2 Technical Characteristics (continued from page 4)

Available Options (contact Cross for other options)		Bundled Options
- W16	Test Data	-01
- W71	IF Mon., -20 dB, 50 ohm	S29
- W70	RF Mon., -20 dB, 50 ohm	W8
- X1008	1 Khz steps	W16
Remote M&C Interfaces		W70
- Q	RS485 Remote Interface	X1008
- W8	Ethernet with Web Browser (WB)	
- W18	Ethernet with Web Browser & SNMP	
- W28	Ethernet with TCP/IP, Telnet®	
Connectors / Impedance		
S29	2.92mm (RF), 50Ω BNC (IF)	
SS29	2.92mm (RF), SMA (IF)	
*+0 to +50 degrees C; Specifications subject to change without notice.		

1.3 Monitor and Control Interface

A) Remote Serial Interface

Protocol - RS-485, RS-422 or RS-232C (selectable), 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.



Connector - Rear panel, DB-9 female

Pinouts (RS-485/422/232C)

Pin - J10	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) Commands - Table 1.2 lists the commands for the 3015-1820 and briefly describes them. After a command is sent the 3015-1820 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 of 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, (OPTION-Q), is selected.

Table 1.2 3015-1820 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 = 18200000 to 20200000 (18200.000 to 20200.000 MHz, 1 kHz steps) example: {CF19250425} Will set the unit's frequency to 19250.425 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, range: -50 to+200 (-5.0 to +20.0) in 0.5dB 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.
Set Input Level	{aaCIxxx}	where: aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit I = command code xxx = input level, range: -30 to -10 in 1 dB steps example: {CI-15} Will set the unit's input level to -15 dB. <i>Note: The negative sign is assumed if not included, i.e. {CI15} is parsed the same as {CI-15}.</i> The unit will reply with the '>' character if the command is successfully processed.

Table 1.2 3015-1820 Commands Continued...

Command	Syntax	Description
Set Mute	{aaCMx}	where: 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: 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, x = 2 to set to auto reference example: {CE2} Will set the reference mode to Auto. The unit will reply with the '>' character if the command is successfully processed.
Set Remote Off	{aaCRO}	where: aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit R = command code 0, 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	#	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 Requests - Table 1.3 lists the status requests for the 3015-1820 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 1.3 3015-1820 Status Requests/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
		xxxxxxx = frequency in kHz
		The unit will append the '>' character if the command is sucessfully processed.
Gain Inquiry	{aaSG}	returns: {aaSGxxxx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		G = command code
		xxxx = gain in dB
		The unit will append the '>' character if the command is sucessfully processed.
Input Level Inquiry	{aaSI}	returns: {aaSIxxx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
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 sucessfully processed.

Table 1.3 3015-1820 Status Requests/Inquiries Continued...

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, x = 2 if auto
		The unit will append the '>' character if the command is successfully processed.
Reference Status Inquiry	{aaSB}	returns: {aaSBx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		B = command code
		x = 1 if the unit is using the external reference, x = 0 if the unit is using the internal reference
		note: this inquiry is useful if the reference mode is auto and the user wants to know if the unit has switched to the internal reference.
		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.
Product/Model Info Inquiry	{aaSV}	returns {aaSV3015-1820-xxxver5.00}
		where 3015-1820 = product model
		xxx = list of options, if any
		"ver" = separates model & options from firmware version
		5.00 = firmware version

1.4 Environmental Use Information

- A. 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 T_{mra} .
- B. 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 unit may be required.
- C. Mechanical loading** - Mounting of equipment in a rack should be such that a hazardous condition does not exist due to uneven weight distribution.
- D. 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.
- E. 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).
- F. 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 3015-1820 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 3015-1820 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 3015-1820 is assembled.

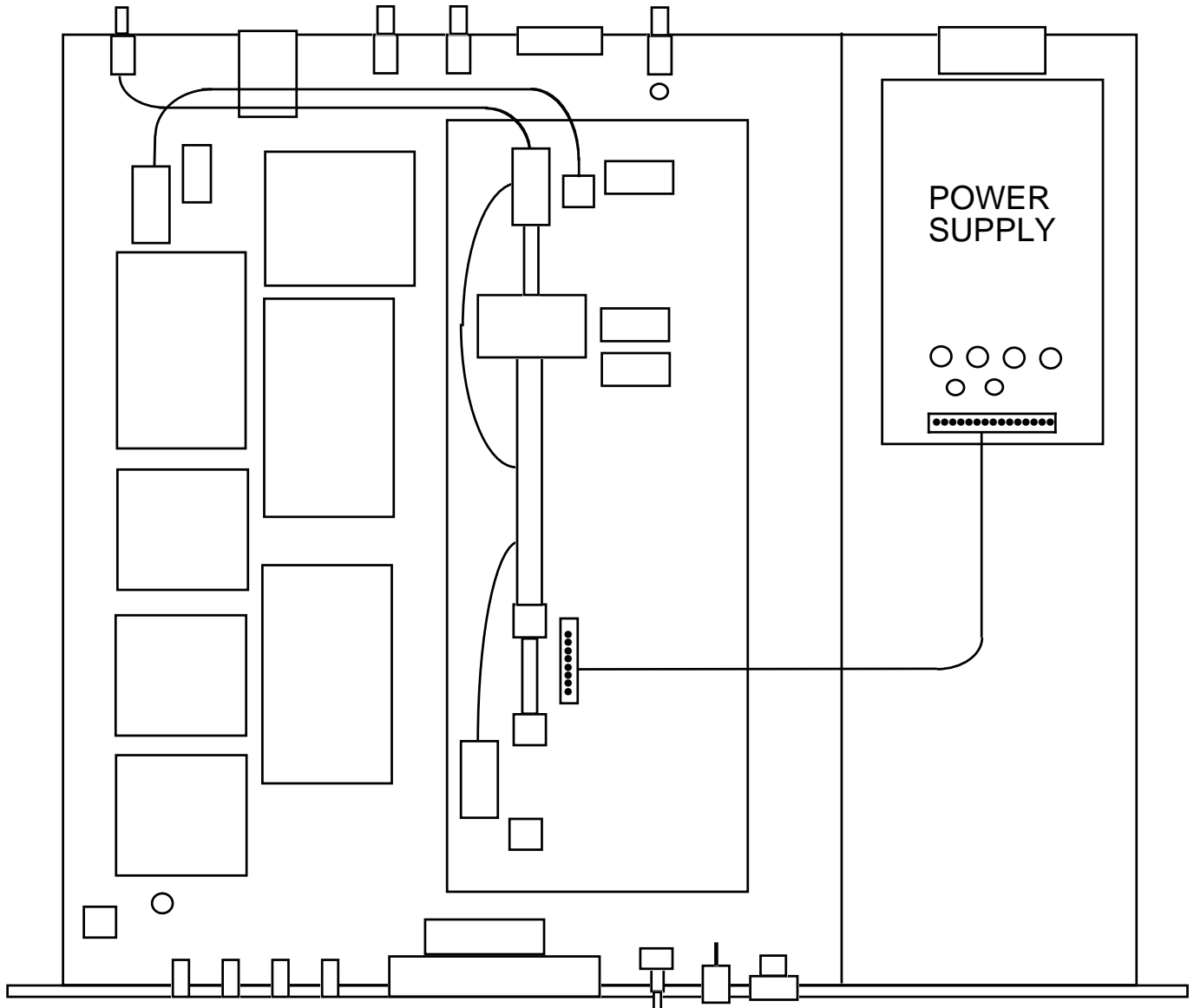


FIGURE 2.1 3015-1820 Mechanical Assembly

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

FIGURE 2.2 3015-1820 Rear Panel Inputs and Outputs

Table 2.1 J10 Pinouts (RS-485/RS-422/RS-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

*Interface: DB-9 Female; Protocol: RS-485, RS-422, or RS-232C (selectable), 9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit

Table 2.2 Connectors/Impedance	
S29	2.92mm (RF), 50Ω BNC (IF)
SS29	2.92mm (RF), SMA (IF)

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

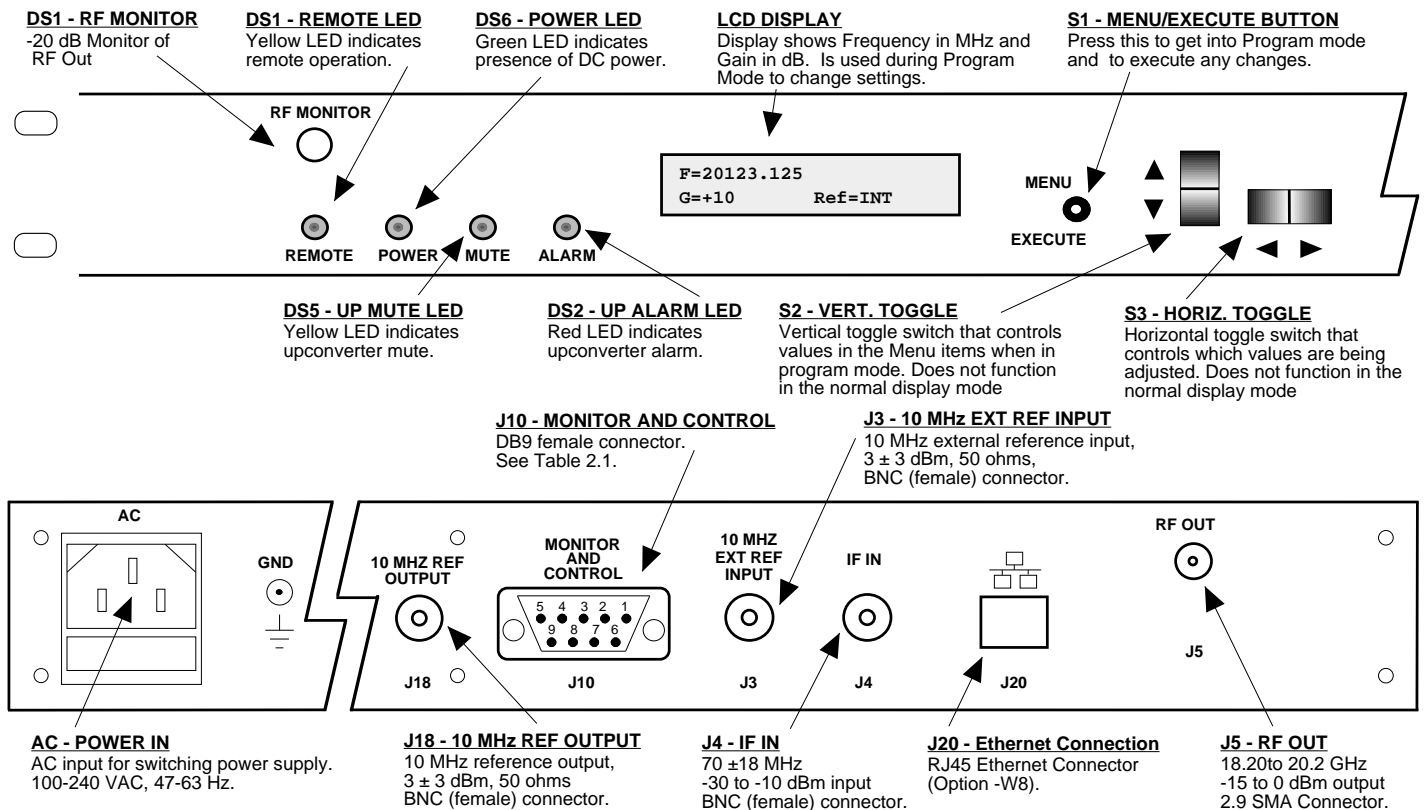


Figure 2.3 Front & Rear Panel Controls & Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3015-1820 Upconverter

1. Connect a -30 dBm to -10 dBm, 70MHz signal to IF IN, J4 (Figure 2.3, page 9)
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, page 13).
5. Set the input level (See Section 2.5 Menu Settings, page 15).
6. Set the gain for -5.0 to +20.0 dB. Make sure the output stays within -15 to 0 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, page 15).
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Alarm) is off (Figure 2.3, page 9).
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, page 10. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.

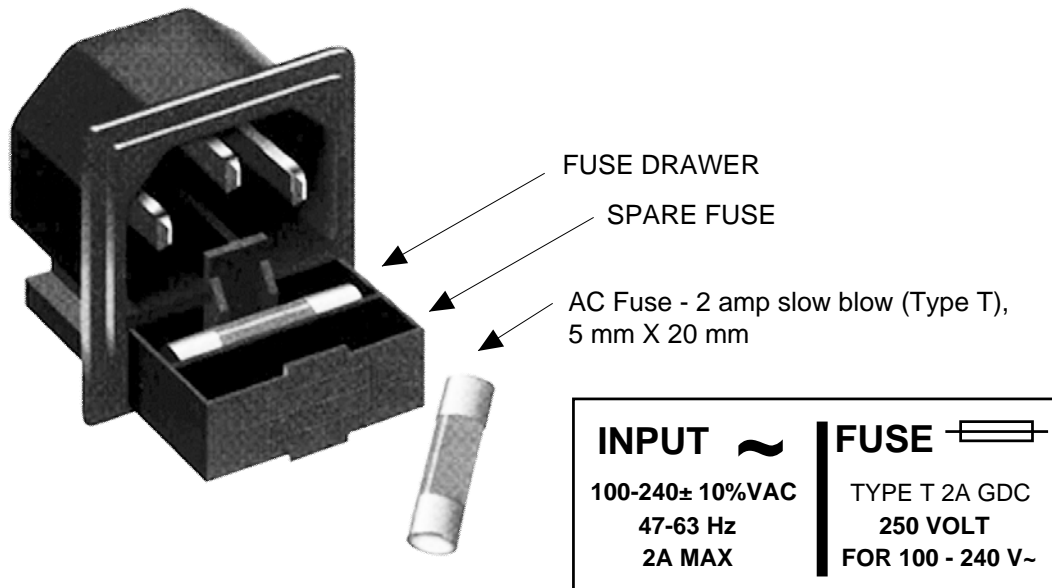


FIGURE 2.4 Fuse Location and Spare Fuse

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, page 15):

Power Up

Normal Display

Menu 1	Frequency in MHz
Menu 2	Input Level in dBm (-30 to -10) / Gain in dB (-5.0 to +20.0)
Menu 3	Mute TX Signal
Menu 4	Set Unit to Remote Operation
Menu 5	Select Frequency Step Size -1 kHz minimum (option X1008)
Menu 6	Select External 10 MHz Reference
Menu 7	Select RS232, RS422, or RS485 Remote Operation (option Q)
Menu 8	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, page 9).

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.

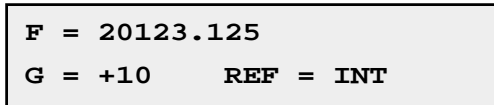
When power is first applied, the LCD display goes through three steps.

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 = 20123.125
G = +10 REF = INT

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 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:

1. 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 = 20123.125      R
```

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

```
F = 20123.125      R
```

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

```
F = 20123.125      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:

```
UP IN LEVEL =   -20      R  
UP GAIN =       +20.0
```

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 = 20123.125  
G = +10      REF = INT
```

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 12 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:

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 input level. This is an important setting to optimize spurious and should be made as accurately as possible:

```
UP IN LEVEL =  -20   R
UP GAIN =      +20.0
```

NOTE: CHANGES TAKE PLACE ON LEVEL AND 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 level in 1 dB steps and then push the Menu/Execute switch to get to the Gain setting:

```
G = +10.0   R
```

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

```
G = +20.0   R
```

By using the horizontal rocker switch the cursor can be moved left or right. Pressing the Up/Down switch down will toggle the display digit selected until you have the desired gain.

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 0 dBm OR HAVE LESS THAN -20 dBm OUTPUT LEVEL. THE FIRMWARE PREVENTS YOU FROM THIS.

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 = 20123.125
G = +10   REF = INT
```

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 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.

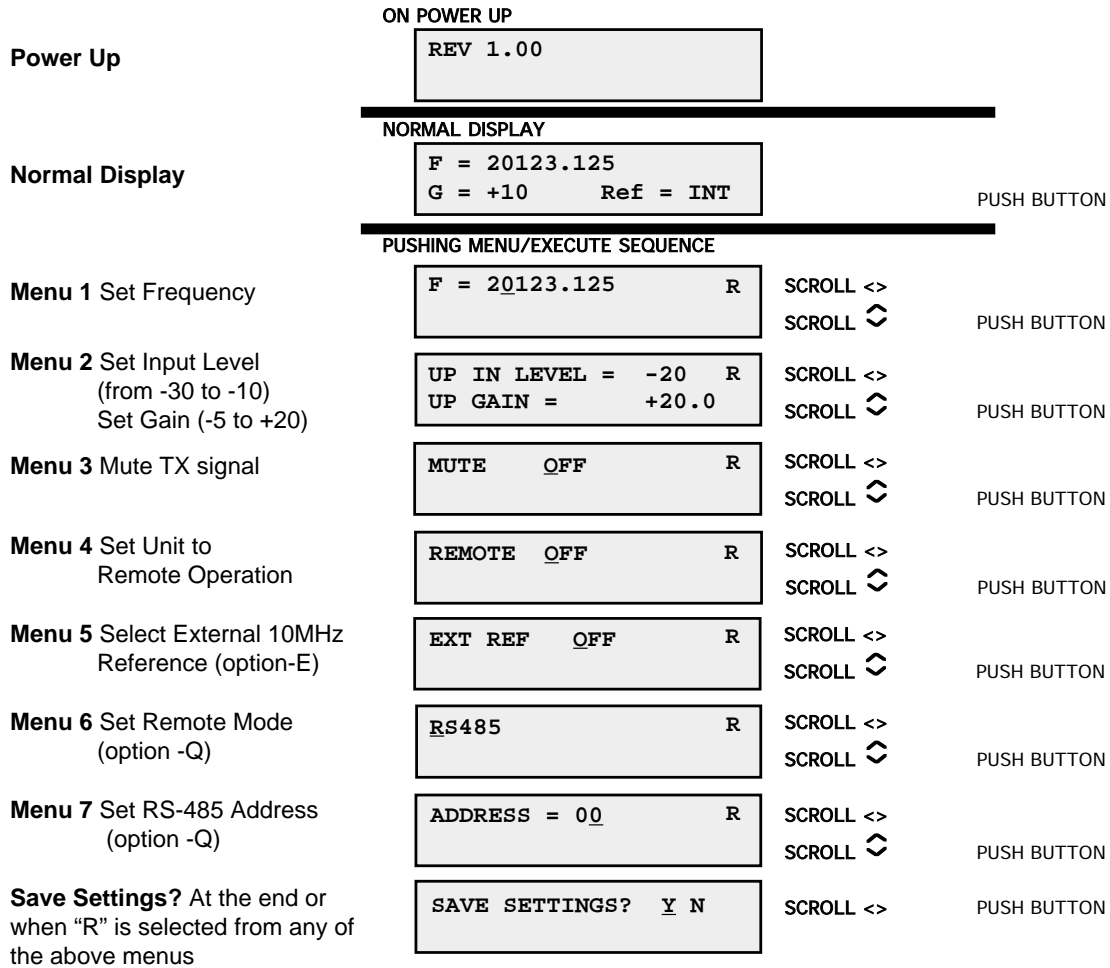


FIGURE 2.5 Menu Display and Sequence



6170 Shiloh Road
Alpharetta, Georgia 30005

(770) 886-8005
FAX (770) 886-7964
Toll Free 888-900-5588

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