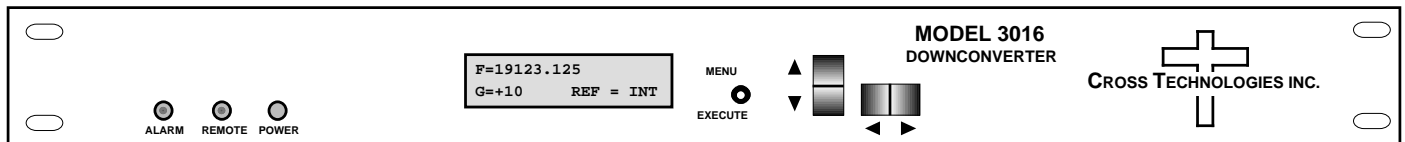


Instruction Manual

Model 3016-1520-1200 Downconverter

December 2019, Rev. B



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INSTRUCTION MANUAL

MODEL 3016-1520-1200 Downconverter

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MODEL 3016-1520-1200 Downconverter

1.0 General

1.1 Equipment Description

The 3016-1520-1200 Downconverter converts 15 to 20 GHz to 1200 ± 50 MHz in 125 kHz steps (1 kHz opt-X1008). The 15 to 20 GHz is first converted to 7.0 GHz with an agile, high side LO and then to 1200 MHz to obtain the wide tuning range. Synthesized local oscillators (LO) provide frequency selection. Multi-function switches select the input frequency, gain, and other parameters. Front panel LEDs provide indication of DC power, PLL alarm or Remote operation. Gain is adjustable manually (MGC) over a +10 to +30 dB range. The frequency and gain are remotely selectable. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are SMA female for the RF, and BNC female for the IF and external 10 MHz reference input and output. Other connector options are available. It is powered by a 100-240 ±10% VAC power supply, and is in a 1 3/4" X 19" X 18" rack mount chassis.

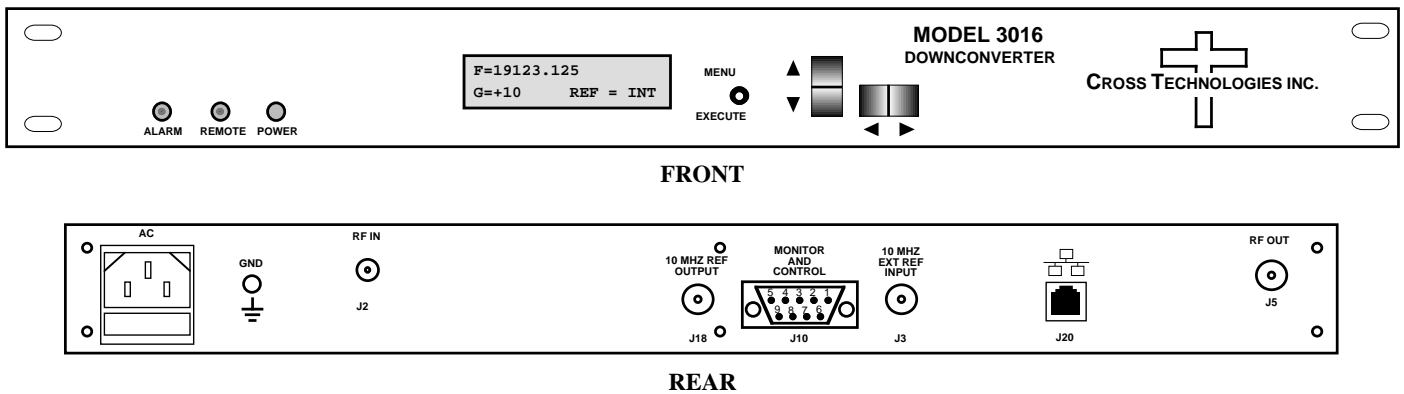


FIGURE 1.1 Model 3016-1520-1200 Front and Rear Panels

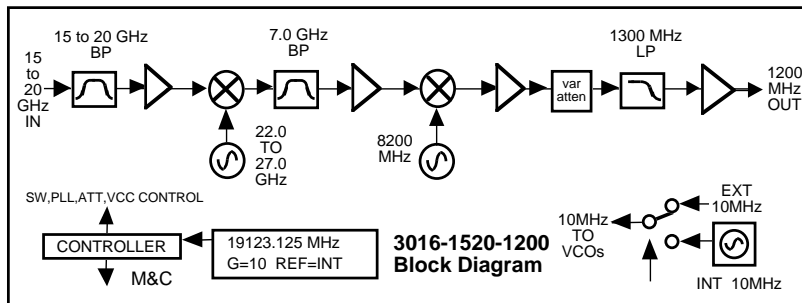


FIGURE 1.2 Model 3016-1520-1200 Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.1 3016-1520-1200 Downconverter Specifications*

Input Characteristics					
Impedance / Return Loss	50Ω / 18 dB typ., 14dB minimum				
Frequency	15 to 20 GHz				
Noise Figure, max.	20 dB (max gain)				
Input Level Range	-50 to -30 dBm				
Output Characteristics (IF)					
Impedance / Return Loss	750Ω / 14 dB				
Frequency	1200 ± 50 MHz				
Output Level Range	-20 to 0 dBm				
Output 1 dB Compression	+10 dBm				
Channel Characteristics					
Gain Max./Range (adjustable)	30 ± 3 dB Max./ +10.0 to +30.0 dB range, 0.5 dB ± 0.5 dB steps				
Image Rejection	> 50 dB, minimum				
Frequency Response	±3.0 dB, 15.0-20.0 GHz; ±1.5 dB, any 1 GHz band; ± 1.0 dB, 100 MHz BW				
Spurious Response	< -50 dBc, in band, 15 to 20 GHz input; 1200 ±50 MHz, 0dBm, output				
Intermod	< -50 dBc for two carriers each at -5 dBm out				
Group Delay, max.	2 ns parabolic; 2 ns linear; 1 ns ripple, 100 MHz BW				
Frequency Sense	Non-inverting				
Synthesizer Characteristics					
Frequency Accuracy	± 0.01 ppm maximum over temp internal reference; external reference input				
Frequency Step	125 kHz minimum				
External 10 MHz Level	+3 dBm ± 3 dB				
Phase Noise @ Frequency	100 MHz	1kHz	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 or -828				
Other					
RF, IF Connectors	Super SMA, (Female). BNC, 75Ω (female), (Others Optional)				
10 MHz Connectors	BNC (female) 75Ω 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 max.				

Continued on next page...

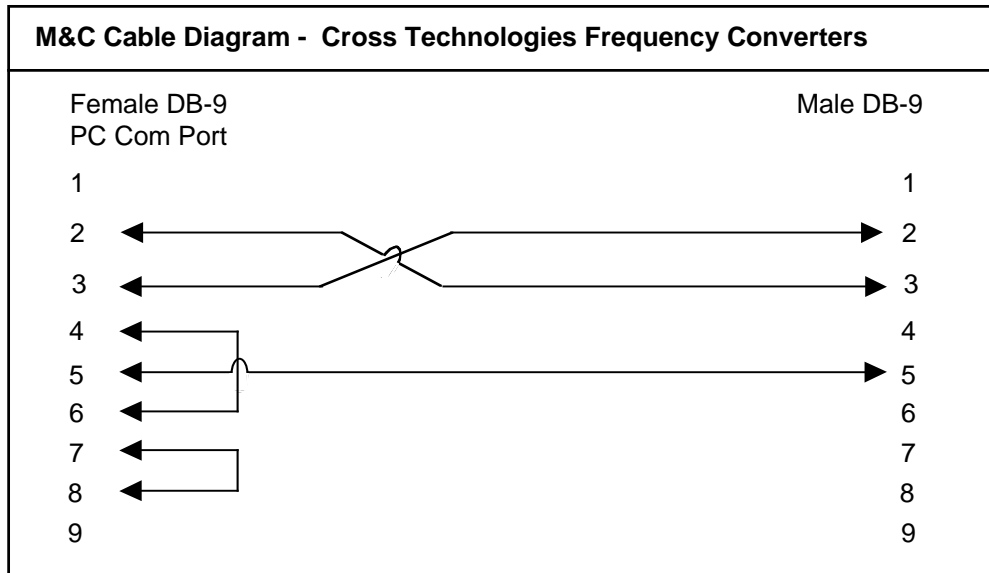
Continued from page 4.

Available Options	
- Q	RS485/422
- W8	Ethernet with Web Browser (WB)
- W18	Ethernet with Web Browser & SNMP
- W28	Ethernet with TCP/IP, Telenet
- W828	W8 +W18 +W28
Connector / Impedance	
- S	50Ω SMA (RF), 50Ω BNC (IF)
- SS	50Ω SMA (RF), 50Ω SMA (IF)
Super SMA for >18 GHz	
Contact Cross for other options	
*10°C to 40°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.



B) Commands - Table 1.2 lists the commands for the 3016-1520-1200 and briefly describes them.

After a command is sent the 3016-1520-1200 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 1.2 3016-1520-1200 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 = Converter center frequency in MHz. Range: 15000.000 to 20000.000 in 125 kHz steps. example: {CF16250.250} Will set the converter output frequency to 16250.250 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 = Desired gain in 0.5 dB steps, omit the decimal point. Range: -50 to 200 (-5.0 to 20.0 in 0.5 dB steps). example: {CG155} Will set the gain to 15.5 dB. 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 for Internal, 1 for External. 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: aa = unit address, range = 00 to 31, only used if interface is RS M = command code x = 0 for mute off and 1 for mute on. example: {CM1} Will mute the converter's RF output. The unit will reply with the '>' character if the command is successfully processed.

C) Status Requests - Table 1.2 lists the status requests for the 3016-1520-1200 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 1.2 3016-1520-1200 Status Requests/Inquiries		
Command	Syntax	Description
Get Frequency	{aaSF}	returns: {aaSFxxxxxxx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		F = command code
		xxxxxxx = the converter's RF center frequency in kHz.
		The unit will reply with the '>' character if the command is successfully processed.
Get Gain	{aaSG}	returns: {aaSGxxx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		G = command code
		xxx = Gain in 0.5 dB.
		The unit will append the '>' character if the command is successfully processed.
Get Reference Mode	{aaSE}	returns: {aaSEx}
		where:
		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.
		The unit will append the '>' character if the command is successfully processed.
Get Mute	{aaSM}	returns: {aaSMx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		A = command code
		x = 0 for alarm off, 1 for alarm on.
		The unit will append the '>' character if the command is successfully processed.
Get alarm status	{SA}	returns {aaSAx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		A = command code
		x = 0 for alarm off, 1 for alarm on.
		The unit will append the '>' character if the command is successfully processed.

C) Status Requests - Continued...

* 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 3016-1520-1200 Status Requests/Inquiries		
Command	Syntax	Description
Get product/model info	{aaSV}	returns {aaSV3016-1520-1200rev.5xx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		V = command code
		3016-1520-1200 = product model and rev. 5.xx
		is the firmware revision.
		The unit will append the '>' character if the command is successfully processed.
Get IP address (ethernet option)	{aaSi}	returns {aaSixxx.xxx.xxx.xxx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		i = command code
		xxx.xxx.xxx.xxx = IP address
Get subnet mask (ethernet option)	{aaSs}	returns {Ssxxx.xxx.xxx.xxx}
		where xxx.xxx.xxx.xxx = subnet mask

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 3016-1520-1200 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 3016-1520-1200 can be secured to a rack using the 4 holes on the front panel. Figure 2.1 shows how the 3016-1520-1200 is assembled.

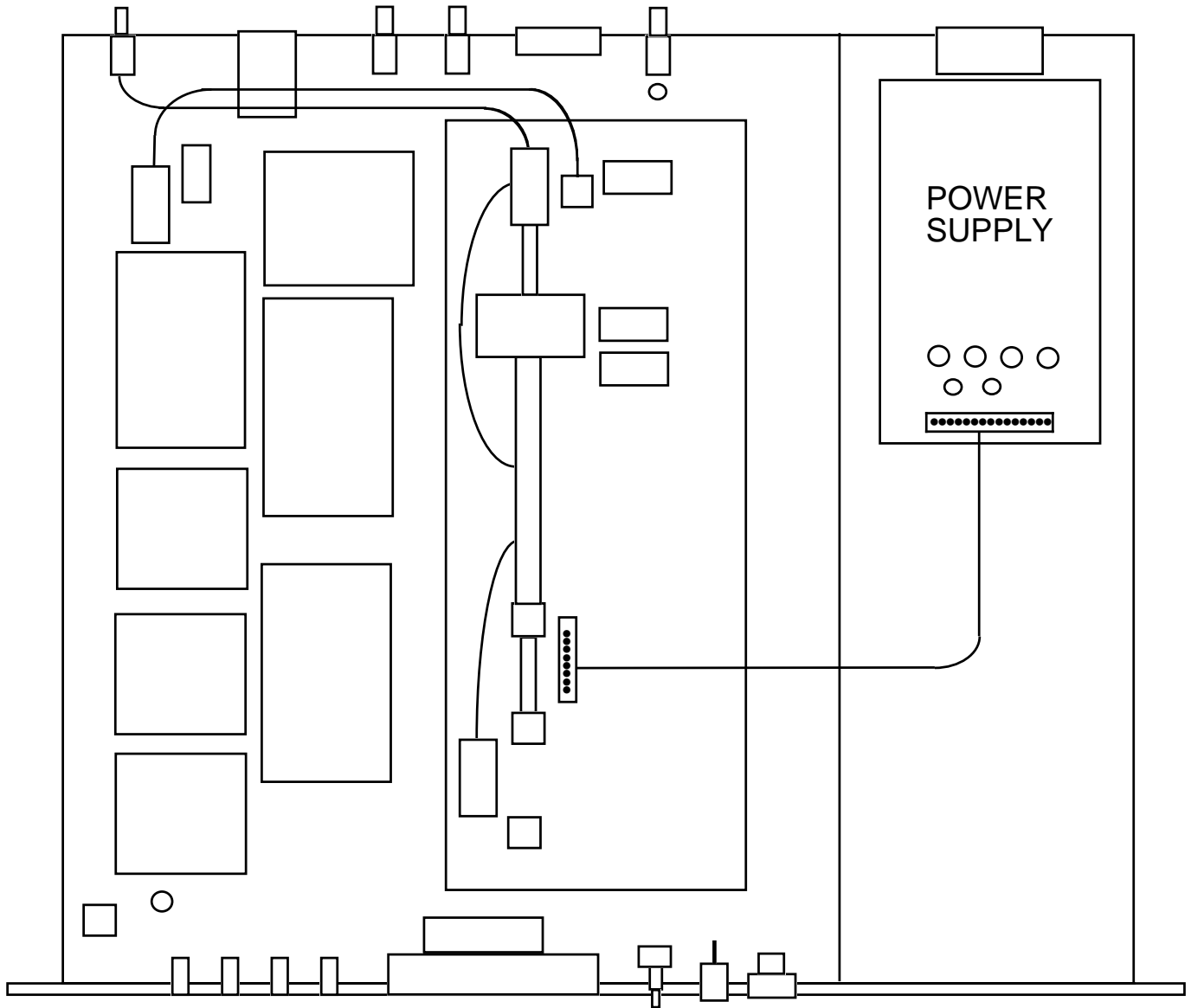


FIGURE 2.1 3016-1520-1200 Mechanical Assembly

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

FIGURE 2.2 3016-1520-1200 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	
S	SMA (RF), 50Ω BNC (IF)
SS	SMA (RF), SMA (IF)
	Super SMA for > 18GHz

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

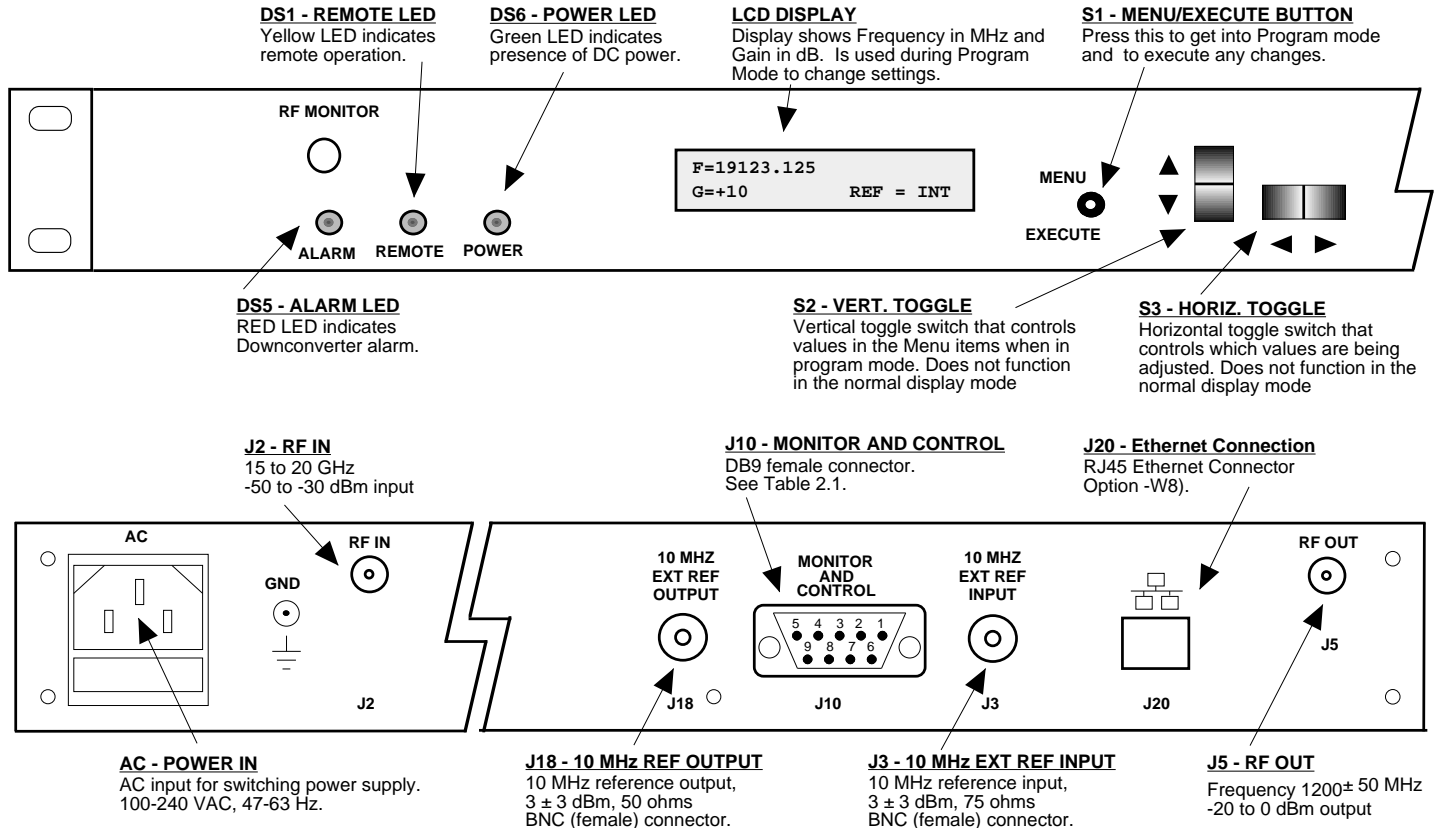


Figure 2.3 Front & Rear Panel Controls & Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 3016-1520-1200 Downconverter

1. Connect a -50 dBm to -30 dBm signal, to RF IN, J2 (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 -10.0 to +30.0 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.

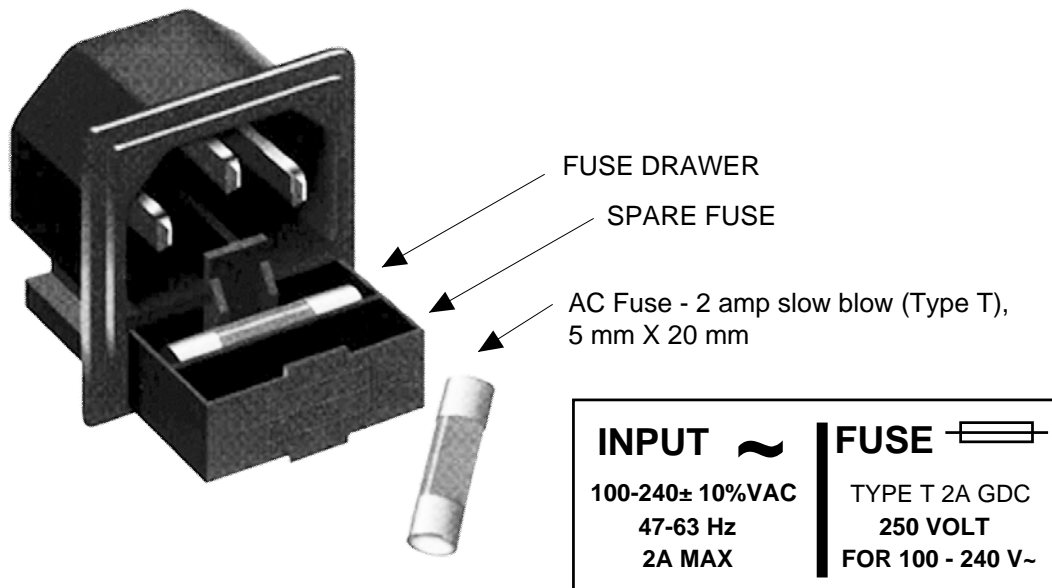


FIGURE 2.4 Fuse Location and Spare Fuse

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 (-50 to-30)
Menu 3	Gain in dB (+10 to +30.0)
Menu 4	Mute Signal
Menu 5	Set Unit to Remote Operation
Menu 6	Select Frequency Step Size -1kHz minimum (option X1008)
Menu 7	Select External 10 MHz Reference
Menu 8	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.

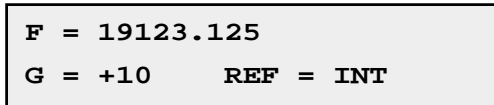
When power is first applied, the LCD display goes through three steps.

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 Downconverter is shown.



F = 19123.125
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 Downconverter frequency:

```
F = 19123.125      R
```

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

```
F = 19123.125      R
```

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

```
F = 19123.125      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:

```
INLVL = -20      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 = 19123.125
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 Downconverter input level. This is an important setting to optimize spurious and should be made as accurately as possible:

```
INLVL = -20          R
```

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 0.1, 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 = 19123.125
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.

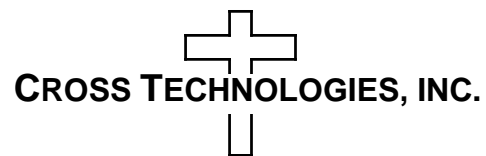
External Mode: The unit uses a 10 MHz Reference that is connected to the External Reference Input, J3. REF = EXT appears on the front panel display. The External 10 MHz Reference level must be +3dBm, ± 3 dB. If the External 10 MHz signal does not meet the unit's specified parameters then the unit will not function properly. The External Reference is present on the Reference Output connector, J18.

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.

ON POWER UP			
Power Up	REV 1.00		
NORMAL DISPLAY			
Normal Display	F = 19123.125 G = +10 Ref = INT		PUSH BUTTON
PUSHING MENU/EXECUTE SEQUENCE			
Menu 1 Set Frequency	F = 19 <u>1</u> 23.125 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 2 Set Input Level (from -40 to -10)	INLVL = -2 <u>0</u> R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 3 Set Gain (-10 to +20)	G = + <u>1</u> 0 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 4 Mute TX signal	MUTE <u>O</u> FF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 5 Set Unit to Remote Operation	REMOTE <u>O</u> FF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 6 Select Frequency Step Size (option -X1008)	STEP = <u>1</u> 25 KHZ	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 7 Select External 10 MHz Reference (option-E)	EXT REF <u>O</u> FF R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 8 Set Remote Mode (option -Q)	<u>R</u> S485 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Menu 9 Set RS-485 Address (option -Q)	ADDRESS = <u>0</u> 0 R	SCROLL <> SCROLL ⏪	PUSH BUTTON
Save Settings? At the end or when "R" is selected from any of the above menus	SAVE SETTINGS? <u>Y</u> N	SCROLL <>	PUSH BUTTON

FIGURE 2.5 Menu Display and Sequence



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