Instruction Manual

Model 2017-64
Up/Downconverter

June 2009   Rev. C

```
DOWNCONVERTER          UPCONVERTER        U  F=1525   G=+00       MENU        ▲  ▮           MODEL 2017
                                          D  F=1525   G=+25                                  UP/DOWNCONVERTER
  ○     ○    ○      ○     ○                            ○                                    CROSS TECHNOLOGIES INC.
ALARM  REMOTE POWER  MUTE  ALARM                      EXECUTE    ▼  ▮
                                                                    ◄ ►
```
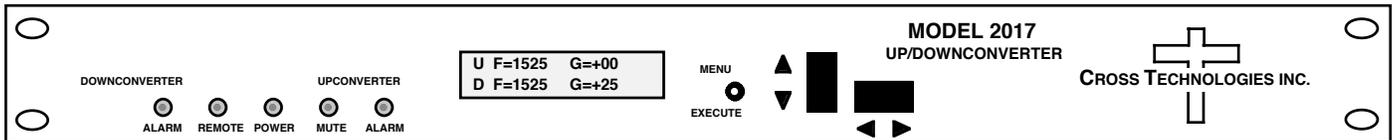
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MODEL 2017-64 Up/Downconverter

1.0 General

1.1 Equipment Description

The 2017-64 C-band Up/Downconverter converts 70 GHz to 5.85-6.425 GHz (Up) and 3.625-4.2 MHz to 70 MHz (Down) in 0.125 MHz steps with low group delay and flat frequency response. A common synthesized local oscillator (LO) provides frequency selection for the Up and Down converter simultaneously. Multi-function push button switches select the RF frequency, gain, and other parameters. Front panel LEDs provide indication of DC power (green), PLL alarm for up and downconverters (red), remote operation (yellow), and Upconverter mute (yellow). Gain can be manually controlled over a 0 to +30 dB range for the upconverter and over a +30 to +50 dB range for the downconverter as adjusted by the front panel multi-function push-button 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 the optional external reference input and output, and N female for RF. A high stability (±0.01ppm) option is also available. It is powered by a 100-240 ±10% VAC power supply and housed in a 1.75" X 19" X 16" 1RU chassis.

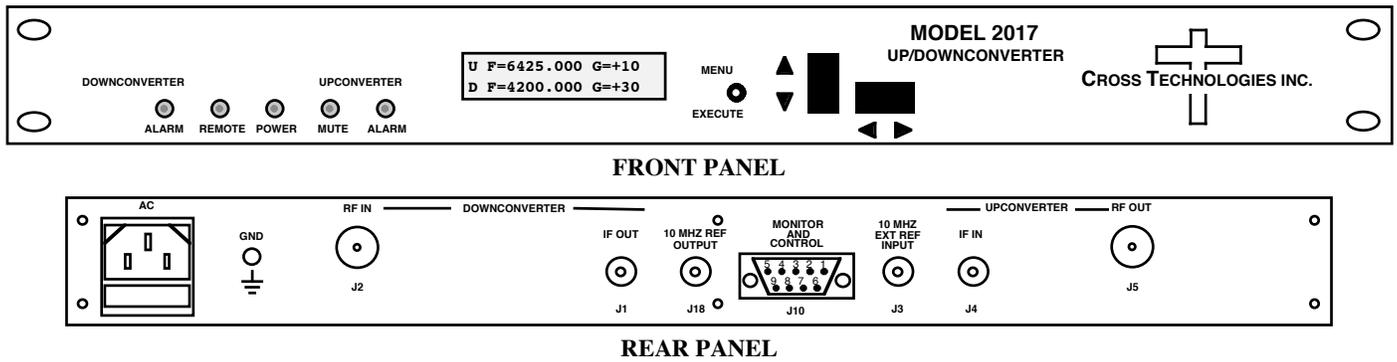**FRONT PANEL**

REAR PANEL

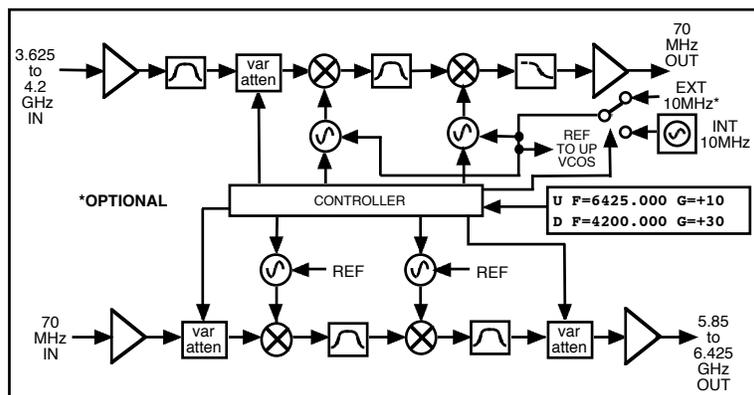**Figure 1.1 Front and Rear Panels**

Figure 1.2 Block Diagram

1.2 Technical Characteristics

TABLE 1.0 Equipment Specifications*

--------UPCONVERTER--------

Input Characteristics (IF)

Impedance/Return Loss	75 Ω /18 dB
Frequency	70 ± 18 MHZ
Input Level	-40 to -10 dBm

Output Characteristics (RF)

Impedance/Return Loss	50 Ω/14 dB
Frequency	5.85 to 6.425 GHz
Output level	-20 to 0 dBm
Output 1 dB compression	+10 dBm

Channel Characteristics

Gain range (adjustable)	0 dB to +30 dB
Frequency Sense	Non-inverting

--------DOWNCONVERTER--------

Input Characteristics (RF)

Impedance/Return Loss	50 Ω /14 dB
Frequency	3.625 to 4.2 GHz
Noise Figure (max)	15 dB @ max gain
Input Level	-60 to -30 dBm
Input 1 dB compression	-10 dBm @ min gain

Output Characteristics (IF)

Impedance/Return Loss	75 Ω/18 dB
Frequency	70 ± 18 MHz
Output level range	-15 to +5 dBm
Output 1 dB compression	+15 dBm

Channel Characteristics

Gain range (adjustable)	+30 dB to +50 dB
Image rejection	> 50 dB
Freq Sense (selectable)	Non-inverting

--------UP AND DOWNCONVERTER--------

Channel Characteristics

Frequency Response	±1.5 dB, in band; ± 0.5 dB, 36 MHz BW
Spurious Response	<-50 dBC in band
Group Delay (max)	0.015 ns/MHz^2 parabolic; 0.05 ns/MHz linear; 1 ns ripple

Synthesizer Characteristics

Frequency Accuracy	± 0.01 ppm max over temp internal reference
Frequency Step	1 MHz (125 kHz, **option X**)
10 MHz Level (In/Out)	+3 dBm ± 3 dB (**option -E**)

Phase Noise @ Freq	100 Hz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-60	-70	-80	-90	-100

Controls, Indicators

Frequency Selection	direct readout LCD; manual or remote selection
Gain Selection	direct readout LCD; manual or remote selection
Power	Green LED
Down/Up Alarm	Red LEDs
Up Mute	Yellow LED
Remote	Yellow LED; RS232C, 9600 baud (RS485, **option -Q**)

Other

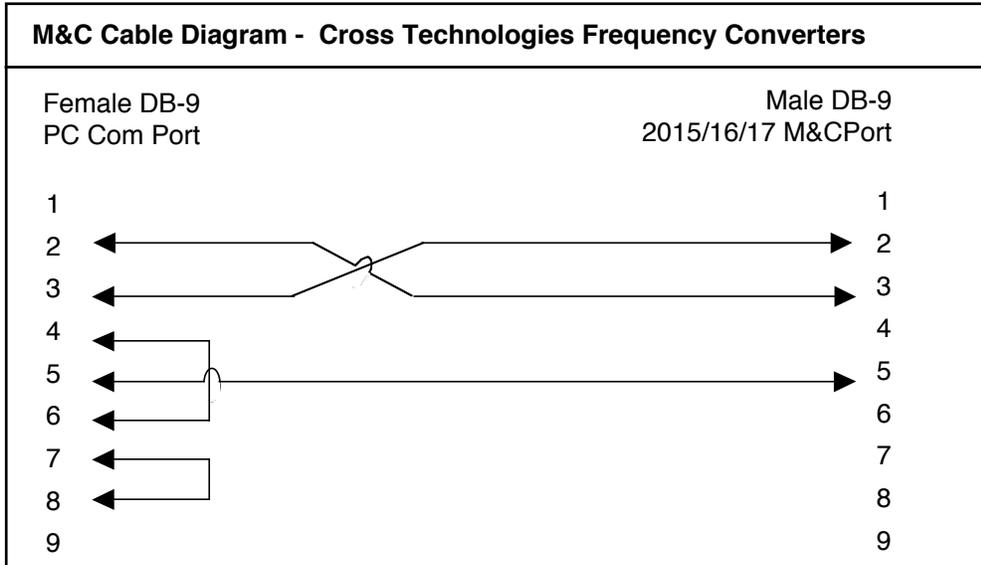|	
RF Connectors	Type N (female) (see Table 2.2 for connector options)
IF Connectors	BNC (female) (see Table 2.2 for connector options)
10 MHz Connectors	BNC (female), 50Ω/75Ω (**option -E**)
Alarm/Remote Connector	DB9 (female) - NO or NC contact closure on Alarm
Size	19 inch, 1RU standard chassis 1.75"H X 16.0"D
Power	100-240 ±10% VAC, 47-63 Hz, 45 watts max

Options

E	External 10 MHz ref input & output w/ RF insertion
O	Frequency reference offset adjust
Q	RS485 Remote Interface
X	125 kHz frequency steps
Z	0.1dB steps on Upconverter
Connectors/Impedance	see Table 2.2

*+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

Female DB-9
PC Com Port

Male DB-9
2015/16/17 M&CPort

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Connector: Rear panel, DB-9 female

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 2017-64 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 1.1 2017-64 Status Requests		
Command	**Syntax***	**Description**
Command Status	{aaS1}	Returns {aaS1bbbbbbbccccccccdddeeffMNOP} where:
		• bbbbbbb = Tx frequency
		• ccccccc = Rx frequency
		• ddd = Tx gain (-10 to +30)
		• ee = Rx gain (00 to 50)
		• ff = Tx input level (10 to 40)
		• M = 0 - Receiver synth alarm
		• N = 0 - Transmitter synth alarm
		• O = 0 - Summary alarm
		• P = 0 - Transmit signal disabled (muted)
External 10MHz	{aaS2}	Returns {aaS2bc} where:
(option E only)		• b = 0 (Internal), 1 (External), or 2 (Auto) Reference
		• c = 1 - FAULT! occured in Auto Reference mode **

** **FAULT! occurs when in Auto Reference mode and the external reference fails. This status will be reset ONLY upon manually or remotely resellecting Internal, External, or Auto Reference mode (see Table 1.2 and Fig 2.4).**

C) Commands

Table 1.2 lists the commands for the 2017-64 and briefly describes them. After a command is sent the 2017-64 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 **option -Q**)

       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

* 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 2017-64 Commands		
Command	**Syntax***	**Description**
Set Transmitter Frequency	{aaC1xxxxxxx}	where:
		• xxxxxxx = 7 characters
		• Range: 5850000 to 6425000 kHz
Set Transmitter Input Level	{aaCIxx}	where:
		• xx = 2 characters
		• Range: 10 to 40 (-10 to -40 dBm)
Set Receiver Frequency	{aaC2xxxxxxx}	where:
		• xxxxxxx = 7 characters
		• Range: 3625000 to 4200000 kHz
Set Transmit Gain	{aaC3xx}	where:
		• xx = 2 characters
		• Range: 0 to +30 (00 dB to 30 dB, in 1 dB steps)
Set Receiver Gain	{aaC4xx}	where:
		• xx = 2 characters
		• Range: 30 to 50 (30 dB to 50 dB, in 1 dB steps)
Enable Tx	{aaCAx}	where x =:
		• 0 to disable Tx signal
		• 1 to enable Tx signal
External 10MHz	{aaCEx}	where x =:
(option -E only)		• 0 for Internal 10MHz Reference signal
		• 1 for External 10MHz Reference signal
		• 2 for Auto 10MHz Reference
Reference Offset	{aaC8xxxx}	where xxxx =:
		• -2000 to +2000
Enable Remote	#	Just # sign
Disable Remote	{aaCR0}	{CR and zero}

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.

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 unit 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 2017-64 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching, ± 12, +5, +24 VDC power supply provides power for the assemblies. The 2017-64 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2017-64 is assembled.
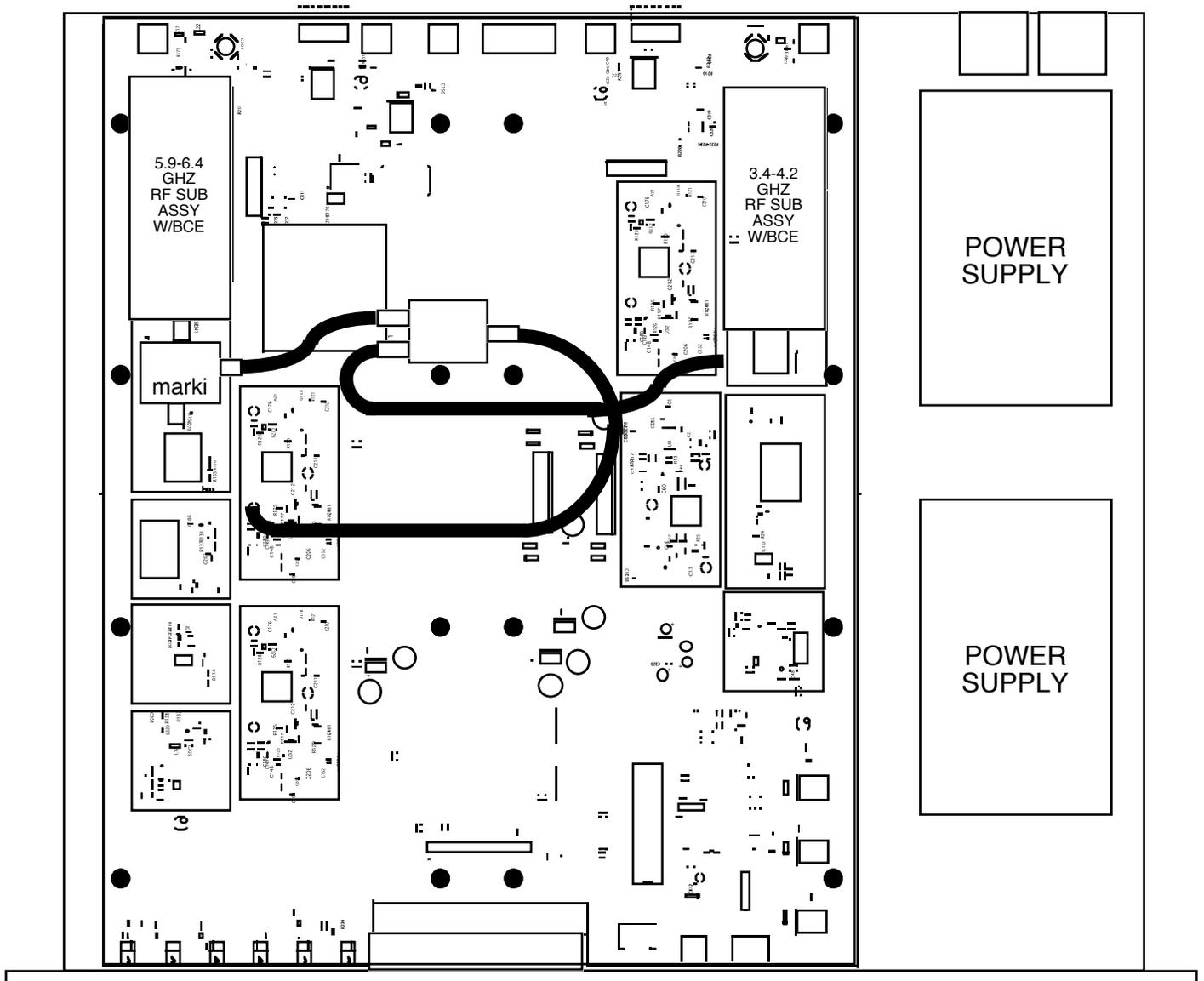

Figure 2.0 Mechanical Assembly

2.2 Rear Panel Input/Output Signals and Control

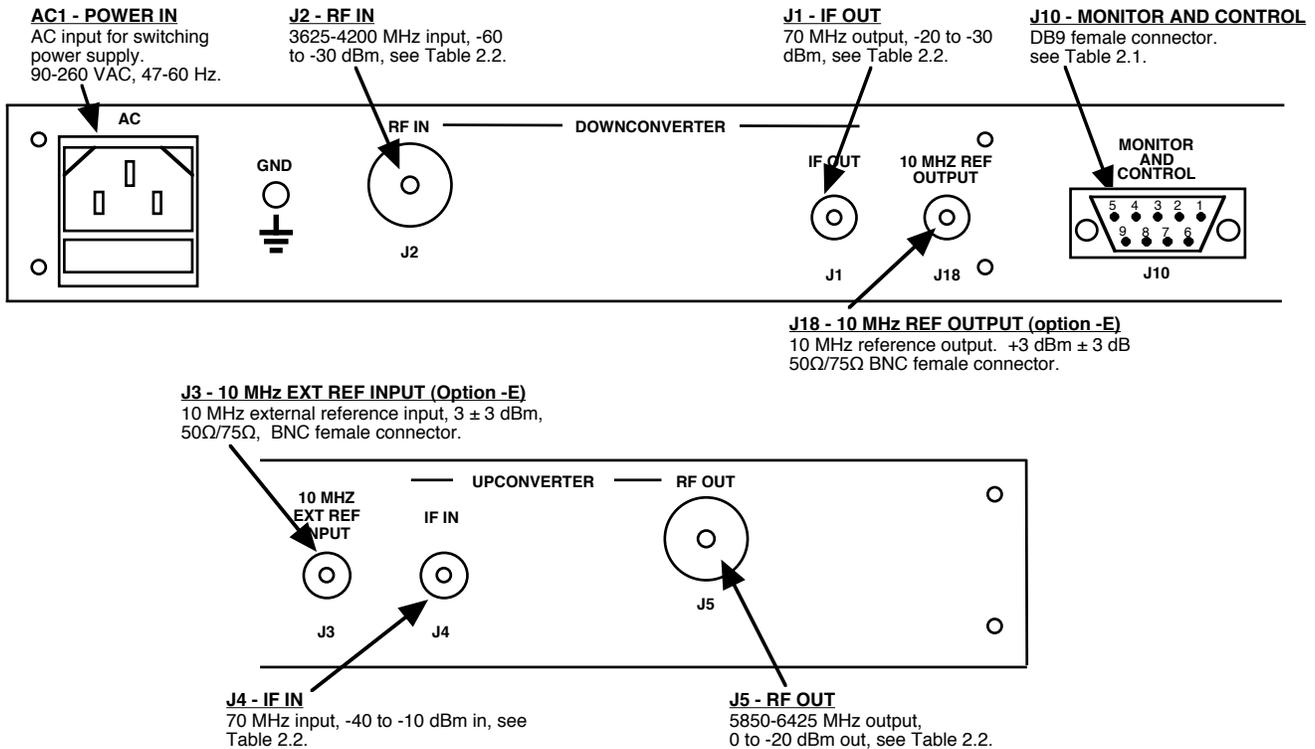Figure 2.1 shows the input and output connectors on the rear panel.

AC1 - POWER IN
AC input for switching power supply.
90-260 VAC, 47-60 Hz.

J2 - RF IN
3625-4200 MHz input, -60 to -30 dBm, see Table 2.2.

J1 - IF OUT
70 MHz output, -20 to -30 dBm, see Table 2.2.

J10 - MONITOR AND CONTROL
DB9 female connector.
see Table 2.1.

J18 - 10 MHz REF OUTPUT (option -E)
10 MHz reference output. +3 dBm ± 3 dB
50Ω/75Ω BNC female connector.

J3 - 10 MHz EXT REF INPUT (Option -E)
10 MHz external reference input, 3 ± 3 dBm,
50Ω/75Ω, BNC female connector.

J4 - IF IN
70 MHz input, -40 to -10 dBm in, see Table 2.2.

J5 - RF OUT
5850-6425 MHz output,
0 to -20 dBm out, see Table 2.2.

Figure 2.1 Rear Panel I/O's

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

*Remote Serial Interface
Interface: DB-9 Female
Protocol: RS-232C (RS-232C/422/485 **option -Q**),
9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.

TABLE 2.2 IF/RF Connector Options

Option	IF	RF
STD	BNC, 75Ω	Type N, 50Ω
-M	BNC, 50Ω	Type N, 50Ω
-B	BNC, 75Ω	BNC, 75Ω
-C	BNC, 75Ω	BNC, 50Ω
-D	BNC, 50Ω	BNC, 50Ω
-N	BNC, 75Ω	Type N, 50Ω

2.3 Front Panel Controls and Indicators

Figure 2.2 shows the front panel controls and indicators.

DS3 - DOWN ALARM LED
Red LED indicates
downconverter alarm.

DS1 - REMOTE LED
Yellow LED indicates
remote operation.

LCD DISPLAY
Display shows Up and
Downconverter frequency in MHz
and Gain in dB

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

DOWNCONVERTER

UPCONVERTER

```
U F=5850.000 G=+10
D F=3625.000 G=+30
```

MENU

EXECUTE

ALARM   REMOTE   POWER   MUTE   ALARM

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

DS5 - UP MUTE LED
Yellow LED indicates
upconverter mute.

DS2 - UP ALARM LED
Red LED indicates
upconverter 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
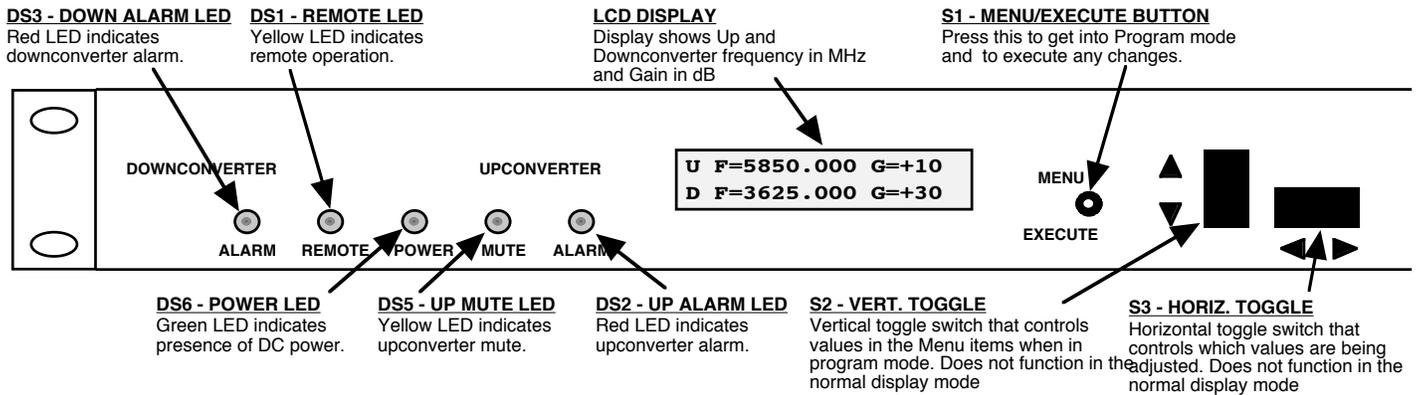normal display mode

Figure 2.2 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2017-64, Upconverter Section
1. Connect a -10 dBm to -40 dBm signal to IF In, J4 (Figure 2.1).
2. Connect the RF OUT, J5, to the external equipment.
3. Connect 100-240 ±10% VAC, 47 - 63 Hz to AC on the back panel.
4. Set the desired output frequency - Downconverter frequency will track with the Upconverter frequency (See Section 2.5 Menu Settings).
5. Set the input level (See Section 2.5 Menu Settings).
6. Set the gain (See Section 2.5 Menu Settings).
7. Be sure DS6 (green, DC Power) is on and DS2 (red, Downconverter Alarm) is off (Figure 2.2).

2.4.2   Installing and Operating the 2017-64, Downconverter Section
1. Connect a -60 dBm to -30 dBm signal to RF In, J2 (Figure 2.1).
2. Connect the IF OUT, J1, to the external equipment.
3. Connect 100-240 ±10% VAC, 47 - 63 Hz to AC on the back panel.
4. Set the desired input frequency - tracks with the Upconverter frequency (See Section 2.5 Menu Settings).
5. Set the gain to get an output level in the -15 to +5 dBm range (See Section 2.5 Menu Settings).
6. Be sure DS6 (green, DC Power) is on and DS3 (red, Upconverter Alarm) is off (Figure 2.2).
7. 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 2.3. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.
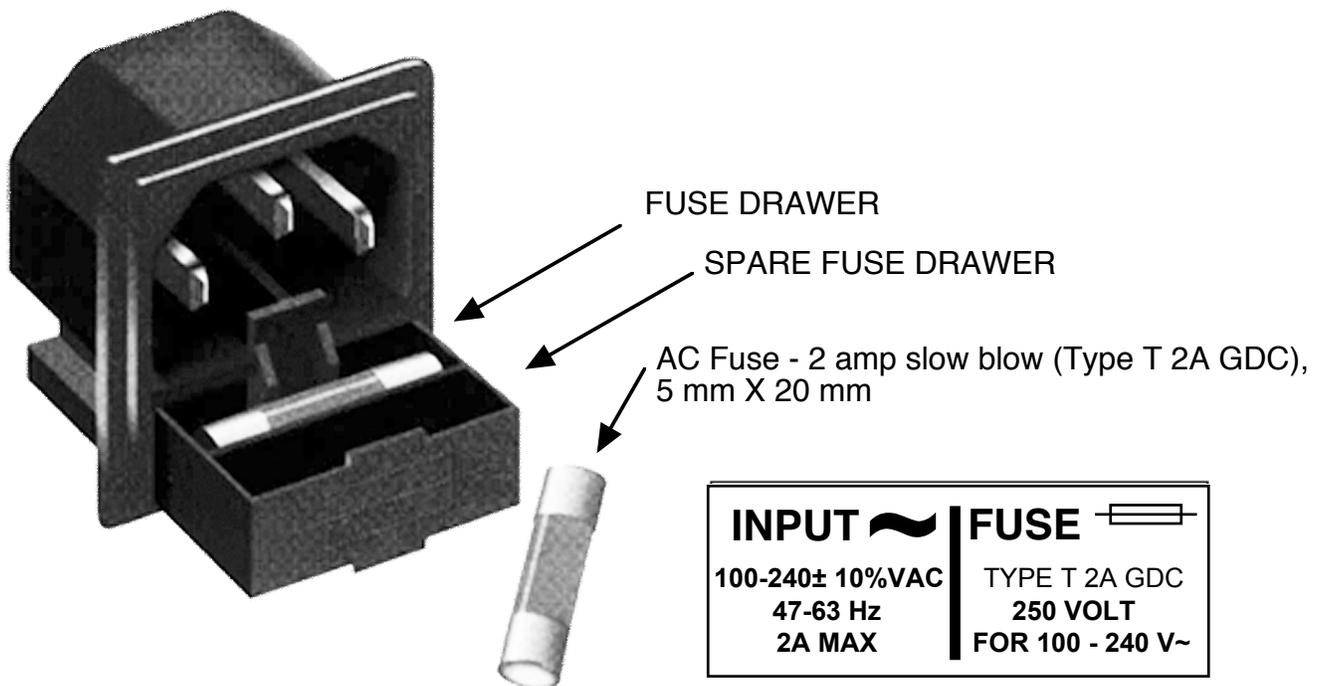

FUSE DRAWER

SPARE FUSE DRAWER

AC Fuse - 2 amp slow blow (Type T 2A GDC), 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 Up/Down Frequency in MHz (Down frequency tracks with Up frequency as it is changed)
Menu 2 Up Input Level (Set from -40 to -10)
Menu 3 Up Gain (0 to +30)
Menu 4 Down Gain (set +30 to +50 for -15 to +5 dBm out range)
Menu 5 Up Mute
Menu 6 Set Unit to Remote Operation
Menu 7 Select Internal, External, or Auto 10 MHz Ref (option -E)
Menu 8 Frequency Reference Offset (option -O)
Menu 9 Set Remote mode (option -Q)
Menu 10 Set RS-485 address (option -Q)

Save Menu When "R" is selected in any above menu or after last menu.

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. No program changes will be evident until they are verified at the "**SAVE SETTINGS?**" Menu

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 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 software version will be displayed.

```
REV 1.00

```

      3. The present frequency and gain of the up and downconverter is shown.

```
U   F=5850.000   G=+00
D   F=3625.000   G=+30
```

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 cursor left or right.
3. <u>Vertical Switch</u> - This switch is mounted so its movement is vertical and has two functions:
    a. During frequency , gain, input level changes, the vertical movement will raise or lower the number in the direction of the arrows.
    b. For other functions such 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, scroll to **"R"** and push the Menu/Execute switch and select **"NO"** in the **"SAVE SETTINGS?"** menu.

To change the FREQUENCY:

> Operate the Menu/Execute switch until you get to the menu item you want to change (see Figure 2.4 for the sequence of menu options). The following display is for changing the upconverter frequency:

```
UP F= 5850.000        R
DN F= 3625.000
```

Pressing the Up/Down switch down will toggle the frequency (the Downconverter frequency will track linearly with the Upconverter frequency) to:

```
UP F= 5950.000        R
DN F= 3725.000
```

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

```
UP F= 5950.000        R
DN F= 3725.000
```

NOTE: CHANGES DO NOT TAKE PLACE ON FREQUENCY UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

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

```
UP INLVL= -20         R
```

NOTE: CHANGES DO NOT CHANGE OR GET SAVED UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

> 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 :

```
U   F=5950.000   G=+00
D   F=3725.000   G=+30
```

Figure 2.4 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?"** menu.

2.5.5.1 Upconverter Gain

To set the upconverter 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 2.4 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 INLVL= -20          R
```

> Pressing the Up/Down switch to change the level in 1 or 10 dB steps (depending on the character that is selected), and then push the Menu/Execute switch to get to the Gain setting:

```
 UP G= +00              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 NOT BE CHANGED OR STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW. DO NOT SET A GAIN THAT WOULD EXCEED A 0 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 the :

```
 U   F=5950.000   G=+10
 D   F=3725.000   G=+30
```

Figure 2.4 shows all the menu items and how to make changes.

2.5.5.2 Downconverter Gain

To set the downconverter 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 2.4 for the sequence of menu options.

The following display is for changing the downconverter gain. This is an important setting to optimize spurious and should be made as accurately as possible to provide an output in the -15 to +5 dBm level range:

```
 DN  G=  +30                R
```

Pressing the Up/Down switch to change the level in 1 or 10 dB steps. 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 NOT BE CHANGED OR STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW.

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 the :

```
 U   F=5950.000   G=+10
 D   F=3725.000   G=+40
```

Figure 2.4 shows all the menu items and how to make changes.

2.5.5 Alarm Indications

An alarm condition for will occur if any local oscillator phase lock loop (PLL) comes out of lock.

Power Up

ON POWER UP
```
REV 1.00
```

Normal Display

NORMAL DISPLAY
```
U  F=5850.000  G=+00
D  F=3625.000  G=+20
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Up Frequency
```
U  F=5850.000        R
D  F=3625.000
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 2 Up Input Level (Set from -40 to -10)
```
UP INLVL = -20       R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 3 Up Gain (0 to +30)
```
UP  G = +00.0        R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 4 Down Gain (set +30 to +50 for -15 to +5 dBm out level)
```
DN  G = +30.0        R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 5 Up Mute
```
UP MUTE   OFF        R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 6 Set Unit to Remote Operation
```
REMOTE  OFF          R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 7 Select 10 MHz Reference INT, EXT, or AUTO (option -E)
```
INT REF   _          R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 8 Reference Offset (option -O)
```
FREQ  ADJUST         R
Offset = +0000
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 9 Set Remote Mode (option -Q)
```
RS 232    _          R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Menu 10 Set RS-485 Address (option -Q)
```
ADDRESS = 00         R
```
SCROLL <>
SCROLL ⌄⌃   PUSH BUTTON

Save? When "R" is selected in any above menu or at the end
```
SAVE SETTINGS?    Y N
```
SCROLL <>   PUSH BUTTON

Figure 2.4 Menu Display and Sequence

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