Instruction Manual

Model: 2019-41
2019-42
2019-43
Upconverter

March 2011, Rev 0

		1	2	3	4
FREQ		274	354	514	682
GAIN		−07	OFF	+08	+09

ALARM REMOTE POWER

MENU
EXECUTE

MODEL 2019
UPCONVERTER

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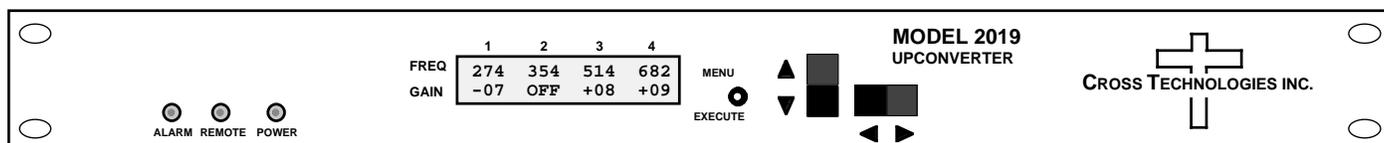
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INSTRUCTION MANUAL

MODEL 2019-4x Upconverter

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2019-4x Upconverter, Four Output Frequencies

1.0 General

1.1 Equipment Description

The 2019-4x Upconverter converts one 70 ±18 MHz input signal to four individual frequencies (combined to one output). The output frequency ranges are: 250 to 750 MHz for Model 2019-41; 1650 to 2150 MHz for Model 2019-42 and 950 to 2150 MHz for Model 2009-43. All outputs are tunable in 1 MHz steps. Synthesized local oscillators (LO) provide frequency selection. Multi-function switches select the RF frequencies, gain, and other parameters. Front panel LEDs provide indication of DC power (green), Unit alarm (red), and remote operation (yellow). Variable attenuators for each channel provide a gain range of -10 to +10 dB as adjusted by the front panel multi-function switches. Remote operation allows selection of frequency, mute, and gain of each signal. The LCD will display parameter selection during setup and frequency and gain/mute settings during operation. Connectors are 75 ohm BNC female for IF and the optional external reference input and SMA for the combined four-frequency output. The unit is powered by a 100-240 ±10% VAC power supply, and housed in a 1 3/4" X 19" X 16" rack mount chassis.
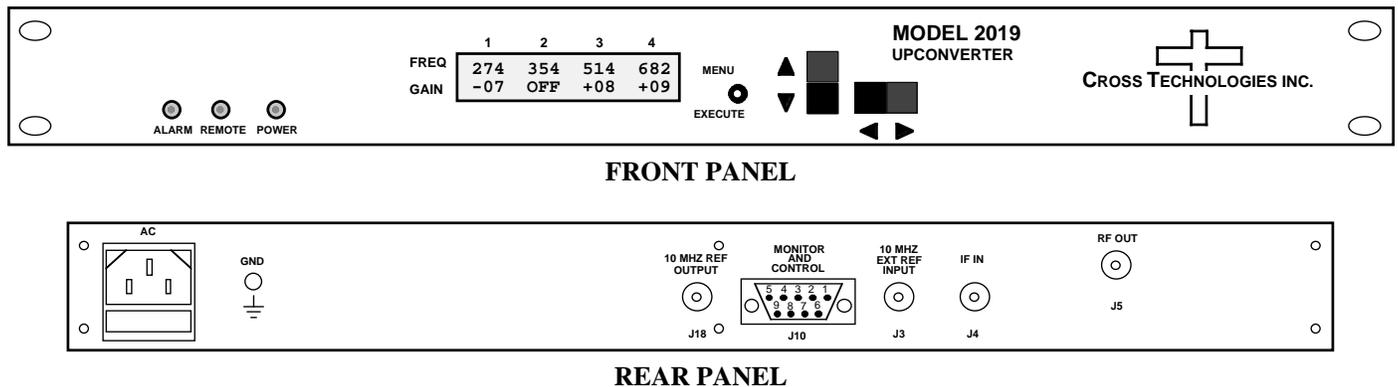

FIGURE 1.1   Model 2019-4x Front and Rear Panels
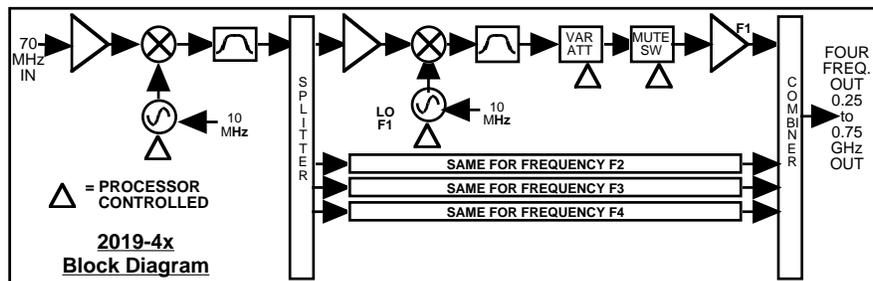

FIGURE 1.2   Model 2019-4x Upconverter, Block Diagram

1.2 Technical Characteristics

TABLE 1.0   2019-4x Upconverter Specifications*

Input Characteristics (IF)

Impedance/Return Loss	75 Ω /18 dB (see TABLE 2.2 for connector options)
Frequency	70 ± 18 MHZ
Input Level	-25 to -15 dBm

Output Characteristics (RF)

Impedance/Return Loss	50 Ω/12 dB (see TABLE 2.2 for connector options)
Frequency	Model 2019-41; 250 to 750 MHz
	Model 2019-42; 1650 to 2150 MHz
	Model 2019-43; 950 to 1450 MHz
Output level/carrier	-30 to -10 dBm
Output 1 dB compression	+5 dBm
Carrier Intermod	<-40 dBC, 3 ON, 1 OFF
Carrier Level Variation	±1.5 dB, 0.25 to 0.75 GHz
Mute Level	-40 dBC min, -45 dBC typical

Channel Characteristics

Gain range (adjustable)	-10 to +10, 1 dB steps
Spurious Response	<-40 dBC, 0.25 to 0.75 GHz (non-intermod related)
Frequency Response	±0.7 dB, 36 MHz BW
Group Delay, max	0.015 ns/MHz^2 parabolic; 0.03 ns/MHz linear; 1 ns ripple
Frequency Sense	All Four Frequencies Non-inverting

Synthesizer Characteristics

Frequency Accuracy	± 1.0 ppm internal reference; external reference optional
Frequency Step	1.0 MHz minimum
10 MHz level	3 dBm, ± 3 dB (**for option -E**)

Phase Noise @ Freq	100 Hz	1kHz	10kHz	100kHz	1MHz
dBC/Hz	-70	-70	-80	-95	-110

Controls, Indicators

Power; Alarm; Rem; Mute	Green LED; Red LED; Yellow LED; "OFF" on LCD
Remote	RS232C, 9600 baud
Freq/Gain Selection	Direct readout LCD; multi-function switches or remote selection

Other

IF & 10 MHz/RF Conn.	75 ohm BNC (female) SMA
Alarm/Remote Connector	DB9 - NO or NC contact closure on Alarm
Size	19 inch, 1RU standard chassis 1.75" high X 16.0" deep
Power	100-240 ±10% VAC, 47-63 Hz, 45 watts max

Options
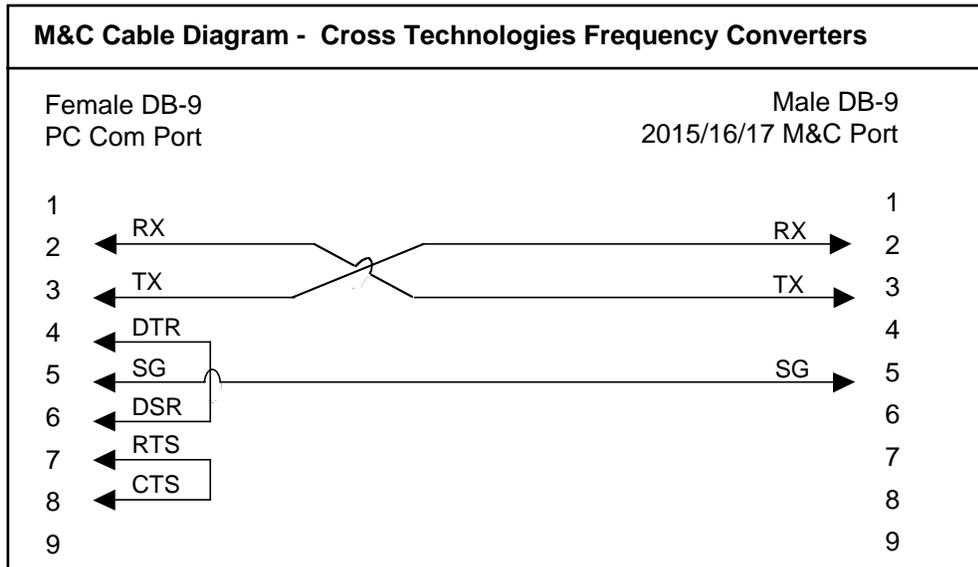
-E	Allows ext. 10 MHz ref input, 10 MHz ref can be inserted on the RF in
-Q	RS-422/RS-485 Remote capability
-W8	Ethernet M&C Remote Interface
Connector options	See TABLE 2.2

---

*+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                                      Male DB-9
PC Com Port                                  2015/16/17 M&C Port

1                                                              1
        RX                                          RX
2   ◄────────                                          ────────►  2
        TX                                          TX
3   ◄────────          ╲  ╱              ────────►  3
        DTR                 ╳
4   ◄────                ╱  ╲                                  4
        SG                                          SG
5   ◄────                        ────────────────────────►  5
        DSR
6   ◄────                                                      6
        RTS
7                                                              7
        CTS
8   ◄────                                                      8

9                                                              9
```

Connector: Rear panel, DB-9 male

J10 Pinouts (RS-232C/422/485)	
Pin	Function
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

B) Status Requests Table 1.1 lists the status requests for the 2019-4x and briefly describes them.

* PLEASE NOTE: The two character {aa}(OO-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

TABLE 1.1 2019-4x Status Requests		
Command	Syntax *	Description
Query Frequency	{aaSFn}	Returns {aaSFn;xxxx} where:
		n = 1,2,3, or 4 to select Carrier 1,2,3, Or 4 respectively
		xxxx = Frequency of Carrier n
Query Gain	{aaSGn}	Returns {aaSGn;xxx} where:
		n = 1,2,3, or 4 to select Carrier 1,2,3, or 4 respectively
		xxx = Gain of of Carrier n
Mute Status	{aaSMn}	Returns {aaSMn;x} where:
		n = 1,2,3, or 4 to select Carrier 1,2,3, or 4 respectively
		x = O if Carrier n is not muted, x = 1 if Carrier n is muted
Alarm Status	{aaSA}	Returns {aaSAx} where:
		x = 1 if the unit's alarm is on, x = O if the unit's alarm is off
Product Information	{aaSV}	Returns {aaSVxxxx-xxy,yy} where:
		xxxx-xx is the model number, y.yy is the firmware revision

C) Commands Table 1.2 lists the commands for the 2019-4x and briefly describes them. After a command is sent the 2019-4x sends a return ">" indicating the command has been received and executed.

General Command Format - The general command format is {CND...}, where:

   { = start byte
   C = 1 character, either C (command) or S (status)
   N = 1 character command or status request
   D = 1 character or more of data (depends on command)
   } = stop byte

   * PLEASE NOTE: The two character {aa}(OO-31) prefix, in the table below,
     should be used ONLY when RS-485, (OPTION-Q), is selected.

Table 1.2 2019-4x Commands		
Command	Syntax*	Description
Set Frequency	{aaCFn;xxxx}	n = 1,2,3, or 4 to select Carrier 1,2,3, or 4 respectively
		xxxx = desired frequency in MHz
		Frequency Range: 2019-41 : 250-750 MHz
		Frequency Range: 2019-42 :1650-2150 MHz
		Frequency Range: 2019-43 : 950-1450 MHz
		example: Set Frequency command for model 2019-41
		{CF2;0742} Set Carrier 2's frequency to 0742 MHz
Set Gain	{aaCGn;xxx}	n = 1,2,3, or 4 to select Carrier 1,2,3, or 4 respectively
		xxxx = desired gain in dB
		All 2019-4x models have a gain range of -10 to +10 dB
		example: Set Gain command:
		{CG3;-10} Set Carrier 3's gain to -10 dB
Set Mute	{aaCMn;x}	n = 1,2,3, or 4 to select Carrier 1,2,3, or 4 respectively
		x = 1 to mute carrier N, x = 0 to un-mute carrier N
		example: Set Mute command:
		{CM4;1} Mute (disable) carrier 4
Disable Remote	{aaCRO}	{CR and zero}
Enable Remote	#	Just # sign

2.0 Installation

2.1 Mechanical - The 2019-4x consists of an RF/Controller PCB and a splitter/combiner PCB 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 assemblies. The 2019-4x can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2019-4x is assembled.
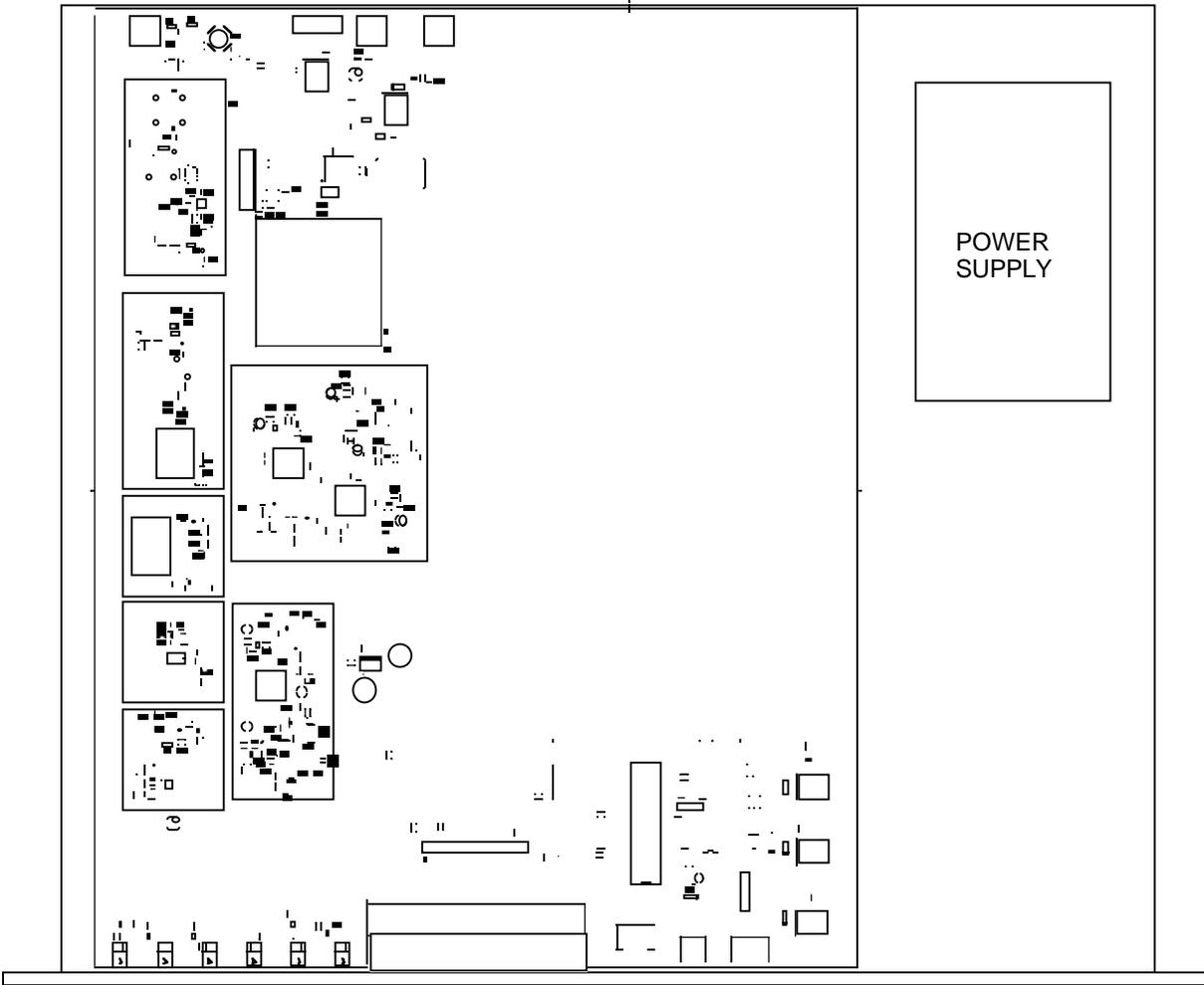
POWER
SUPPLY

FIGURE 2.0   2019-4x Mechanical Assembly

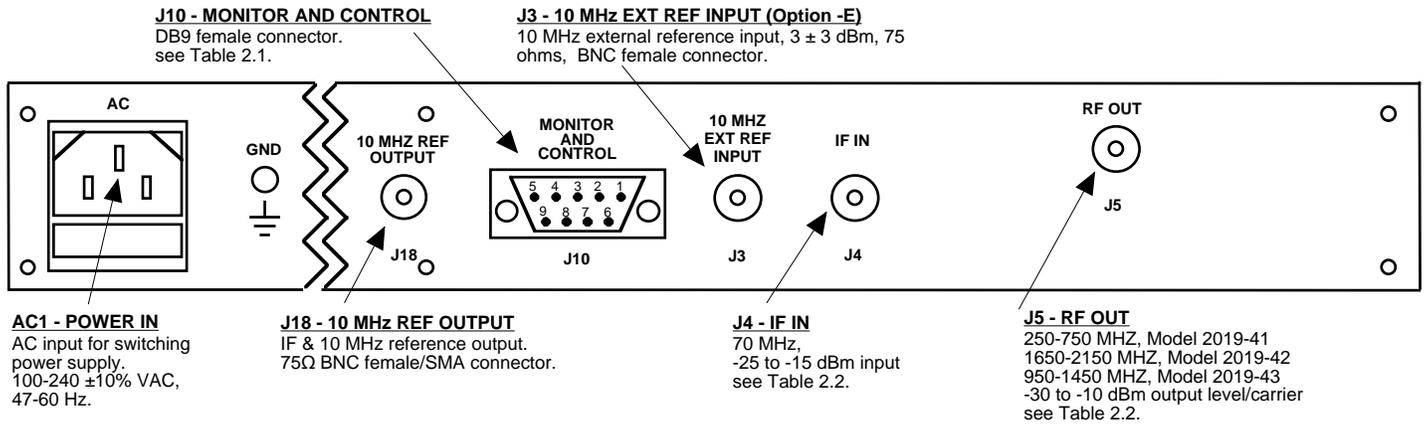## 2.2 Rear Panel Input/Output Signals - Figure 2.1 shows the input and output connectors on the rear panel.

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

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

AC
GND
10 MHZ REF OUTPUT
MONITOR AND CONTROL
10 MHZ EXT REF INPUT
IF IN
RF OUT
J18
J10
J3
J4
J5

AC1 - POWER IN
AC input for switching power supply.
100-240 ±10% VAC, 47-60 Hz.

J18 - 10 MHz REF OUTPUT
IF & 10 MHz reference output.
75Ω BNC female/SMA connector.

J4 - IF IN
70 MHz,
-25 to -15 dBm input
see Table 2.2.

J5 - RF OUT
250-750 MHZ, Model 2019-41
1650-2150 MHZ, Model 2019-42
950-1450 MHZ, Model 2019-43
-30 to -10 dBm output level/carrier
see Table 2.2.

FIGURE 2.1   2019-4x 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 Male
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 F, 75Ω
-B	BNC, 75Ω	BNC, 75Ω
-C	BNC, 75Ω	BNC, 50Ω
-D	BNC, 50Ω	BNC, 50Ω
-N	BNC, 75Ω	Type N, 50Ω
-M	BNC, 50Ω	Type N, 50Ω

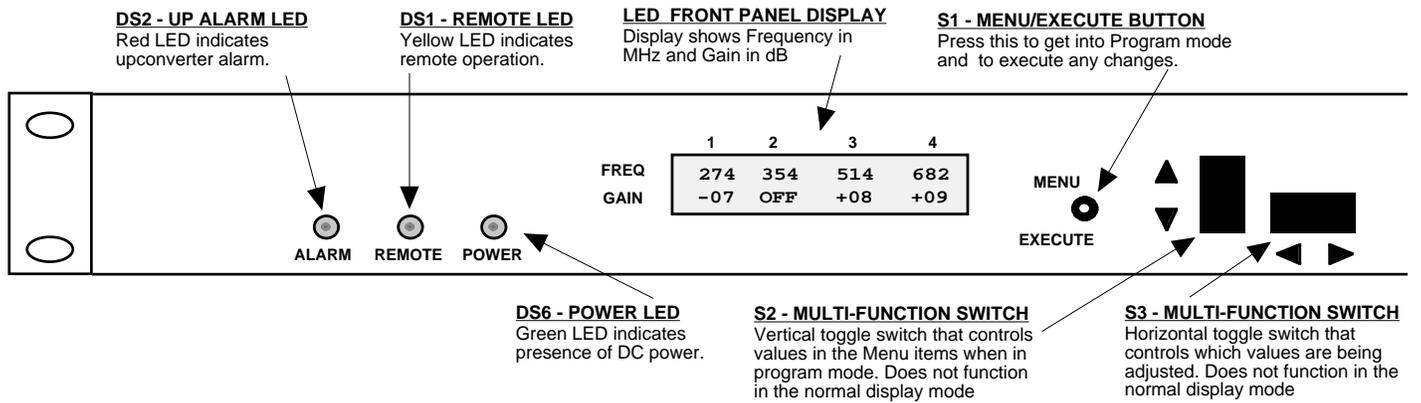**2.3 Front Panel Controls and Indicators -**The following are the front panel controls and indicators.

DS2 - UP ALARM LED
Red LED indicates
upconverter alarm.

DS1 - REMOTE LED
Yellow LED indicates
remote operation.

LED FRONT PANEL DISPLAY
Display shows Frequency in
MHz and Gain in dB

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

	1	2	3	4
FREQ	274	354	514	682
GAIN	-07	OFF	+08	+09

MENU

EXECUTE

ALARM   REMOTE   POWER

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

S2 - MULTI-FUNCTION SWITCH
Vertical toggle switch that controls
values in the Menu items when in
program mode. Does not function
in the normal display mode

S3 - MULTI-FUNCTION SWITCH
Horizontal toggle switch that
controls which values are being
adjusted. Does not function in the
normal display mode

FIGURE 2.2   2019-4x Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2019-4x, Upconverter Section

1. Connect a -25 dBm to -15 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 AC1 on the back panel.
4. Set the desired output frequency (See Section 2.5 Menu Settings).
5. Set the gain for -10 to +10 dB. Make sure the output stays within -30 to -10 dBm with the gain selected and the input level provided.
6. Be sure DS6 (green, DC Power) is on and DS2 (red, 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.
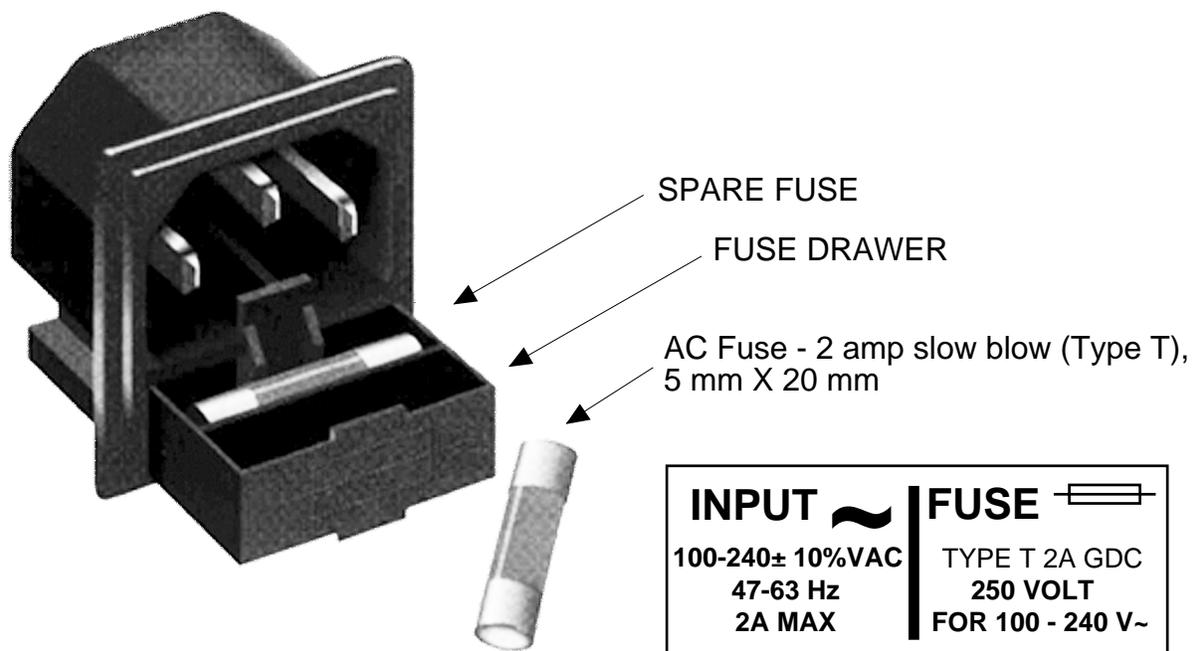
SPARE FUSE

FUSE DRAWER

AC Fuse - 2 amp slow blow (Type T), 5 mm X 20 mm

INPUT ~ | FUSE ▭

100-240± 10%VAC | TYPE T 2A GDC
47-63 Hz | 250 VOLT
2A MAX | FOR 100 - 240 V~

FIGURE 2.3   Fuse Location and Spare Fuse

2.5 Menu Settings

2.5.1   Functions - This section describes operation of the front panel controls. There are three operator switches, the LCD display and alarm indicator LEDs. All functions for the equipment are controlled by these components. The functions are (see Figure 2.4):

Power Up
Normal Display

Menu   1   Frequency of carrier 1
Menu   2   Frequency of carrier 2
Menu   3   Frequency of carrier 3
Menu   4   Frequency of carrier 4
Menu   5   Gain of carrier 1
Menu   6   Gain of carrier 2
Menu   7   Gain of carrier 3
Menu   8   Gain of carrier 4
Menu   9   Mute carrier 1
Menu   10   Mute carrier 2
Menu   11   Mute carrier 3
Menu   12   Mute carrier 4
Menu   13   Set unit to Remote Operation
Menu   14   Set Remote Mode (option -Q)
Menu   15   Set RS-485 address

Save Menu When go to 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

<u>NOTE</u>: 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.

```
2019-41
4.02
```

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

```
274      354      514      682
-07      OFF      +08      +09
```

      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 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, **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 2.4 for the sequence of menu options. The following display is for changing the upconverter frequency:

```
FREQ C1 = 0 4 5 0     R
```

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

```
FREQ C1 = 0 3 5 0     R
```

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

```
FREQ C1 = 0 3 5 0     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:

```
FREQ C2 = 0 2 5 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 :

```
274     354     514     682
-07     OFF     +08     +09
```

Figure 2.4 gives 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.

NOTE: CHANGES TAKE PLACE ON 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:

```
GAIN = -2 O            R

```

> Use the horizontal rocker switch to move 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.

> 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 :

```
274     354     514     682
-07     OFF     +08     +09
```

Figure 2.4 gives 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.
The Mute LED will light if you select Mute and the Remote LED will light when you select the Remote mode.

Power Up

ON POWER UP

```
2019-41
4.02
```

Normal Display

NORMAL DISPLAY

```
274   354   514   682
-07   OFF   +08   +09
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Set Frequency C1

```
FREQ C1 = 0450        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 2 Set Frequency C2

```
FREQ C2 = 0250        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 3 Set Frequency C3

```
FREQ C3 = 0350        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 4 Set Frequency C4

```
FREQ C4 = 0350        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 5 Set Gain C1

```
GAIN C1 =   -10       R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 6 Set Gain C2

```
GAIN C2 =   -10       R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 7 Set Gain C3

```
GAIN C3 =   -10       R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 8 Set Gain C4

```
GAIN C4 =   -10       R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 9 Mute C1

```
MUTE C1    OFF        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 10 Mute C2

```
MUTE C2    OFF        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 11 Mute C3

```
MUTE C3    OFF        R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 12 Mute C4

```
MUTE C4    OFF
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 13 Set Unit to Remote Operation

```
REMOTE OFF           R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 14 Set Remote Interface

```
INTERFACE   485      R
```
PUSH BUTTON

Menu 15 Mute C1

```
RS485  ADDR          R
```
PUSH BUTTON

Save? When "R" is selected from any above menu or at the end

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

FIGURE 2.4   Menu Display and Sequences

1.4 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.

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