Instruction Manual

Model 2017-74
Up/Downconverter

October 2010   Rev. B

```
              DOWNCONVERTER              UPCONVERTER          U F=6850.000 G=+10      MENU        ▲  ███                MODEL 2017
                                                              D F=4600.000 G=+30                     ███      UP/DOWNCONVERTER     ✚
                ○    ○    ○      ○    ○                                                 ○          ▼  ███                  CROSS TECHNOLOGIES INC.
              ALARM REMOTE POWER MUTE ALARM                                          EXECUTE        ◄ ►  ███
```

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MODEL 2017-74 Up/Downconverter

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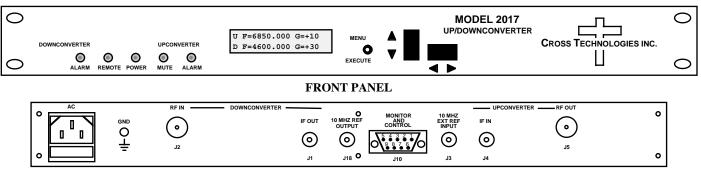
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Model 2017-74 Up/Downconverter

1.0 General

1.1 Equipment Description

The 2017-74 C-band Up/Downconverter converts 70 MHz to **6.7 - 7.025** GHz (Up) and **4.5 - 4.8** GHz 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.
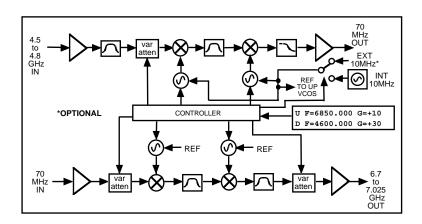

Figure 1.1 Front and Rear Panels

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	6.7 to 7.025 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	4.5 to 4.8 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	-10 to 0 dBm
Output 1 dB compression	+10 dBm

Channel Characteristics

Gain range (adjustable)	+30 dB to +50 dB
Image rejection	> 50 dB, min
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 Frequency Steps (**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

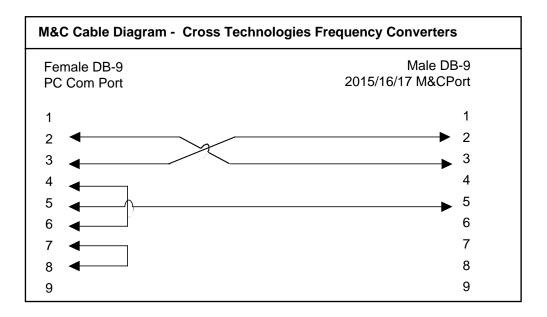|	
Frequency Selection	direct readout LCD; manual or remote selection
Gain Selection	direct readout LCD; manual or remote selection
Power	Green LED
Down/Up Alarm	Red LEDs
Up Mute	Yellow LED
Remote	Yellow LED; RS232C, 9600 baud (RS485, **option -Q**)

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"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 Reference with RF insertion
O	Frequency Reference Offset Adjust
L	LNB Voltage, +24VDC, 0.4 amps
V	SSPB Voltage, +24VDC, 2.5 amps
Q	RS485 Remote Interface
T	PCB Temperature Sensor
W8	Ethernet M&C Remote Interface with Web Browser
W18	Ethernet M&C Remote Interface with Web Browser & SNMP
X	125 kHz Frequency Steps
X1	100 kHz Frequency steps
Connectors/Impedance	See Table 2.2, Page 10

*+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

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 2017-74 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 2017-74 Status Requests		
Command	**Syntax***	**Description**
Command Status	{aaS1}	Returns {aaS1bbbbccccddeeffLMNOP} where:
		• bbbb = Tx frequency (bbbbbbb, option -X)
		4 characters - standard (7 characters - Option-X)
		• cccc = Rx frequency (ccccccc, option -X)
		4 characters - standard (7 characters - Option-X)
		• dd = Tx gain (00 to 30)
		• ee = Rx gain (00 to 50)
		• ff = Tx input level (10 to 40 => -10 to -40 dBm)
		• M = 0 - Receiver synth alarm
		• N = 0 - Transmitter synth alarm
		• O = 0 - Summary alarm
		• P = 0 - Transmit signal disabled (muted)
External 10MHz (option -E)	{aaS2}	Returns {aaS2bcd} where:
		• b = 1 - External 10MHz selected
		• c = 1 - 10MHz inserted on upconverter RF (J5)
		• d = 1 - 10MHz inserted on downconverter RF (J2)
LNB Current (option -L)	{aaS3}	Returns {aaS3bb} where:
		• bb = LNB current, range 00 to 50 (0 to 500 ma)
SSPB Current (option-V)	{aaS4}	Returns {aaS4bbb} where:
		• bbb = SSPB current, range 000 to 250 (0 to 2500 ma)

C) Commands

Table 1.2 lists the commands for the 2017-74 and briefly describes them. After a command is sent the 2017-74 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}(OO-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

Table 1.2 2017-74 Commands		
Command	Syntax*	Description
Set Transmitter Frequency	{aaC1xxxxxxx}	where:
		• xxxxxxx = 7 characters
		• Range: 6700000 to 7000000 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: 4500000 to 4800000 kHz
Set Transmit Gain	{aaC3xx}	where:
		• xx = 2 characters
		• Range: 0 to +30 (OO 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 (option -E only)	{aaCEx}	where x =:
		• 0 for Internal 10MHz Reference signal
		• 1 for External 10MHz Reference signal
		• 2 for Auto 10MHz Reference
Reference Offset (option - O only)	{aaC8xxxx}	where xxxx =:
		• -2000 to +2000
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}	{CR and zero}

1.4 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 Tmra.

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 servicable 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 RE-INSTALLED 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 2017-74 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 2017-74 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2017-74 is assembled.
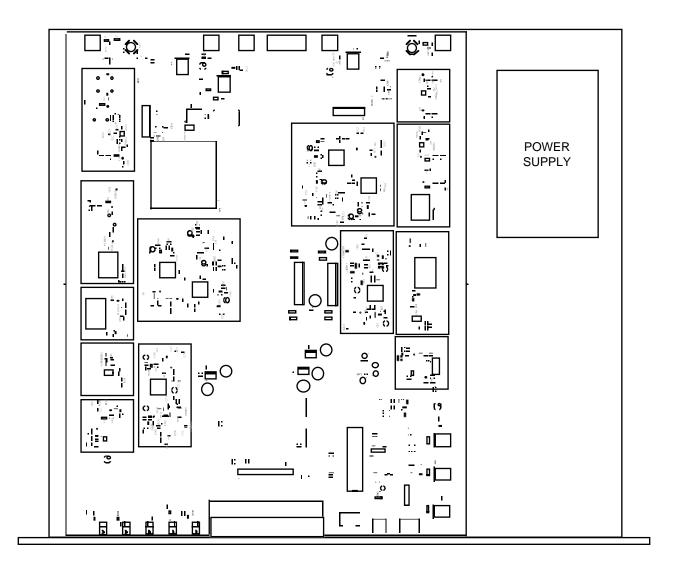

POWER
SUPPLY

Figure 2.0 Mechanical Assembly

2.2 Rear Panel Input/Output Signals and Control

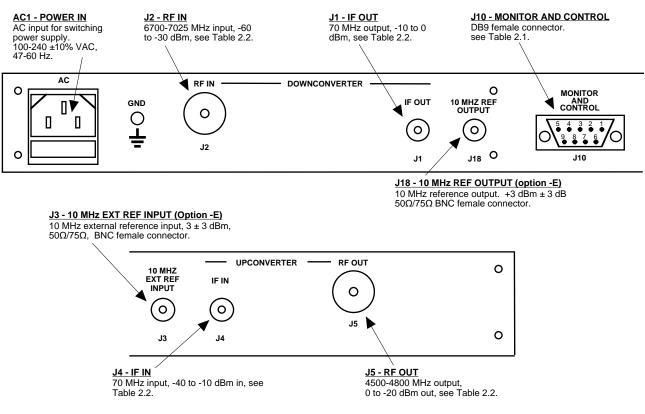Figure 2.1 shows the input and output connectors on the rear panel.

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

J2 - RF IN
6700-7025 MHz input, -60 to -30 dBm, see Table 2.2.

J1 - IF OUT
70 MHz output, -10 to 0 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
4500-4800 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

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

*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.

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=6800.000 G=+10
D F=4600.000 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
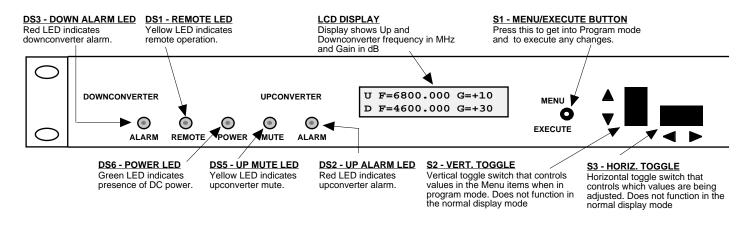adjusted. Does not function in the
normal display mode

Figure 2.2 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2017-74, 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.
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 2017-74, 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.
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.
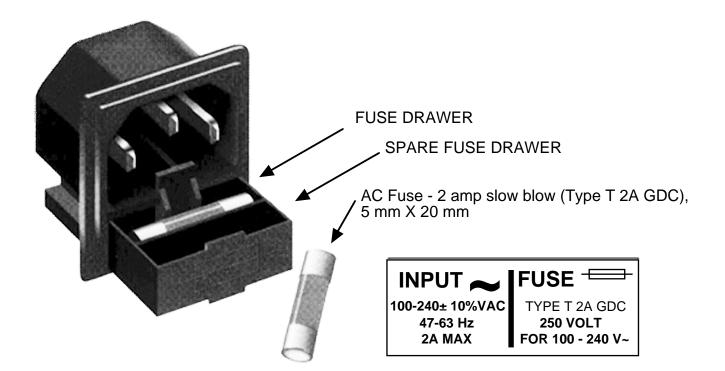   If a fuse continues to open, the power supply is most likely defective.

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   Upconverter Frequency in MHz
Menu 2   Up Input Level (Set from -40 to -10)
Menu 3   Up Gain (0 to +30)
Menu 4   Downconverter Frequency in MHz
Menu 5   Down Gain (set +30 to +50 for -15 to +5 dBm out range)
Menu 6   Up Mute
Menu 7   Set Unit to Remote Operation
Menu 8   Select Internal or External, 10 MHz Ref (option -E)
Menu 9   Frequency Reference Offset (option -O)
Menu 10   Set Remote mode (option -Q)
Menu 11   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 (except for gain adjustments) 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=6850.000   G=+00
D   F=4600.000   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 vertica l 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:

```
U  F=6850.000   G=+00
D  F=4600.000   G=+30
```

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

```
UP F= 6850.000       R
DN F= 4600.000
```

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

```
U  F=6850.000   G=+00
D  F=4600.000   G=+30
```

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=6850.000   G=+00
D  F=4600.000   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.

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=6850.000   G=+00
D   F=4600.000   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.
>
> 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=6850.000   G=+00
D   F=4600.000   G=+30
```

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=6850.000  G=+00
D F=4600.000  G=+20
```
PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 Up Frequency

```
U F=6850.000        R
```
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 Downconverter Frequency in MHZ

```
DN  F = 4600.000    R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 5 Down Gain (set +30 to +50 for -15 to +5 dBm out level)

```
DN  G = +30.0       R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 6 Up Mute

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

Menu 7 Set Unit to Remote Operation

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

Menu 8 Select Internal or External, 10 MHz Ref (option - E)

```
INT REF   _         R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 9 Reference Offset (option -O)

```
FREQ ADJUST         R
Offset = +0000
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 10 Set Remote Mode (option -Q)

```
RS 232   _          R
```
SCROLL <>
SCROLL ⬍   PUSH BUTTON

Menu 11 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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