

# **INSTRUCTION MANUAL**

## **MODEL 2099-1004 10MHz Frequency Source**

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# MODEL 2099-1004 10MHz Frequency Source

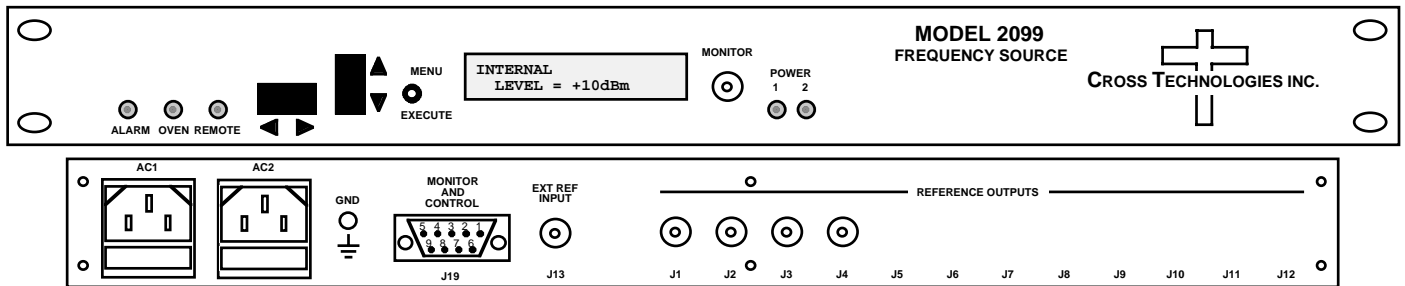
## 1.0 General

### 1.1 Equipment Description

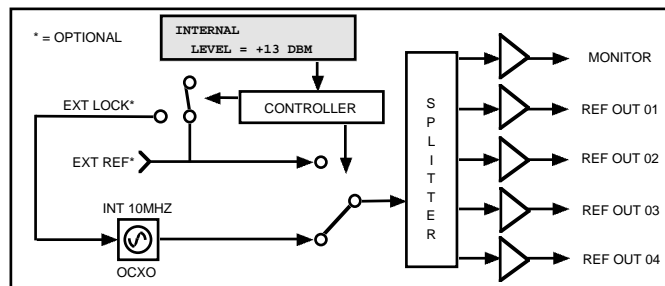
The Model 2099-1004 Frequency Source provides four (4) 10MHz reference outputs from a 0.01 ppm high stability oven controlled crystal oscillator (OCXO). Front panel LEDs indicate alarm (red), oven warm-up (yellow), remote (yellow), and power from two redundant power supplies (green). The output level of the internal frequency reference is adjustable from -10 to +13 dBm, and the 2099-1004 works into either a 75Ω or 50Ω load. An LCD display shows either the internal 10MHz output level in dBm or the external reference pass-through gain in dB (**option -E only**), depending on which reference is present on the outputs. Connectors are BNC female. A relay contact closure or open indicates when an alarm occurs. The 2099-1004 is powered by two separate fused 90-260 VAC power supplies, and is mounted in a 1RU rack mountable chassis.

The available External Reference option (**option -E**) provides an external reference input which can be used to lock the internal source to an external reference or it may be redistributed with an adjustable pass-through gain of -10 to +10 dB. Option -E includes the following operational modes:

1. Internal - Internal reference is present on the reference outputs (only mode for units without option -E).
2. Ext Pass - The external reference is passed to the reference outputs regardless of alarm condition. An alarm condition occurs when the external reference input level drops below 0 dBm ± 1 dB (signal is lost).
3. Ext Pass Auto - The external reference is passed to the reference outputs, but upon an alarm condition (ext ref signal loss) the unit will switch to the internal reference until the alarm condition is cleared.
4. Ext Lock - The internal reference is present on the reference outputs and locked to the external reference signal (1, 5, 10, 20, or 25 MHz as set by the user) regardless of alarm condition. An alarm condition occurs when the internal PLL is unable to lock to the external reference signal.
5. Ext Lock Auto - Same operation as Ext Lock mode except that the unit will revert to the internal mode upon an alarm condition. Once the external reference is present again and the PLL locks to it, the alarm is cleared, and the internal reference will lock to the external signal again.



**FIGURE 1.1 Model 2099-1004 Front and Rear Panels**



**FIGURE 1.2 Model 2099-1004 10MHz Frequency Source Block Diagram**

## 1.2 Technical Characteristics

**TABLE 1.0 2099-1004 10MHz Frequency Source Specifications\***

### Output Characteristics

Number of Outputs	4 (plus a front panel monitor)
Frequency	10.0000 MHz
Impedance	50Ω/75Ω
Return Loss	> 18 dB
Level (int ref)	-10 dBm to +13 dBm
Pass-Through Gain (ext ref)	-10 dB to +10 dB ( <b>option -E ONLY</b> )
Harmonics	< -30 dBC, < -40 dBC typical
Spurious	< -75 dBC

### External Reference Input Characteristics

Impedance	50Ω/75Ω
Return Loss	> 18 dB
Level	+3 dBm ± 3 dB

### Oscillator Characteristics

Over Temperature	± 0.01 ppm max 0°C to 50°C
Aging	± 0.001 ppm per day ± 0.1 ppm per year
Warm Up	± 0.1 ppm, 4 minutes ± 0.01 ppm, 1 hour
Phase Noise (dBC/Hz)	≤ -110 @ 10Hz; ≤ -140 @ 100Hz; ≤ -155 @ 1kHz; ≤ -160 @ 10kHz

### Controls & Indicators

Output Level Adjust	direct readout LCD; push-button switches or remote selection
Power	Green LEDs
Remote	Yellow LED, RS232C/422/485
Oven Warm-Up	Yellow LED
Alarm	Red LED, external contact closure

### Other

10 MHz Connectors	BNC (female) 50Ω/75Ω impedance
Alarm/Remote Connector	DB9 (female) - NO or NC contact closure on Alarm
Size	19 inch, 1RU standard chassis • 1.75”H x 12.0”D
Power	Redundant 90-260 VAC, 47-63 Hz, 20 W max. power supplies

### Options

-E	Ext. Ref. Input - Ext Pass, Ext Pass Auto, Ext Lock, Ext Lock Auto modes
----	--

\*+10°C to +40°C; Specifications subject to change without notice.

### 1.3 Monitor and Control Interface

#### A) Remote serial interface

**Protocol:** RS-232C/422/485, 9600 baud rate, no parity, 8 data bits, 1 start bit, and 1 stop bit.

**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 2099-1004 and briefly describes them.

Table 1.1 2099-1004 Status Requests		
Command	Syntax*	Description
Command Status (units WITH option E)	{aaS1}	Returns {aaS1bbbcccddeeeefghijk} where:
		• bbb = Output Level (-10 to +13 dBm)
		• ccc = Gain (-10 to +10 dB)
		• dd = External Reference Frequency (1, 5, 10, or 25 MHz)
		• eeeee = Reference Offset (-2000 to +2000)
		• f = 1 - Oven Warm Up Alarm
		• g = 1 - PLL Lock Detect
		• h = 1 - External Reference Present
		• i = 1 - Internal Reference Present
		• j = 1 - Summary Alarm
		• k = 1 - FAULT Occured (EXT LOCK AUTO Mode)**
Command Status (units WITHOUT option E)	{aaS2}	Returns {aaS2bbbccccdef} where:
		• bbb = Output Level (-10 to +13 dBm)
		• ccccc = Reference Offset (-2000 to +2000)
		• d = 1 - Oven Warm Up Alarm
		• e = 1 - Internal Reference Present
		• f = 1 - Summary Alarm

\* PLEASE NOTE: The Address (aa) should only be used when RS-485 is selected.

\*\* FAULT occurs when in EXT LOCK AUTO mode and the external reference fails. This status can be reset remotely using the command in Table 1.2 or manually by pressing Menu/Execute followed by pressing up once or down once on the vertical toggle switch on the front panel (see Figure 2.2).

## C) Commands

Table 1.2 lists the commands for the 2099-1004 and briefly describes them. After a command is sent the 2099-1004 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-digit command or status number, 1 through 9
- D = 1 character or more of data (depends on command)
- } = stop byte

Table 1.2 2099-1004 Commands		
Command	Syntax*	Description
Set Operating Mode	{aaC1x}**	where x = 1 ASCII character (range 0 to 4) where: <ul style="list-style-type: none"> <li>• 0 = Internal Reference</li> <li>• 1 = External Pass</li> <li>• 2 = External Pass Auto</li> <li>• 3 = External Lock</li> <li>• 4 = External Lock Auto</li> </ul>
Set Output Level	{aaC2xxx}	where xxx = 2 or 3 characters <ul style="list-style-type: none"> <li>• Range: -10 to 13 (-10 to +13 dBm)</li> </ul>
Set Pass-Through Gain	{aaC3xxx}**	where xxx = 2 or 3 characters <ul style="list-style-type: none"> <li>• Range: -10 to 10 (-10 to +10 dB)</li> </ul>
Set External Reference Frequency	{aaC4xx}**	where xx = 1 or 2 characters <ul style="list-style-type: none"> <li>• Only valid values are 1, 5, 10, or 25 (MHz)</li> </ul>
Clear FAULT (EXT LOCK AUTO Mode)	{aaC5x}**	where x = 1 to clear FAULT
Frequency Offset Adjust	{aaC8xxxxx}	where xxxxx = 4 or 5 characters <ul style="list-style-type: none"> <li>Range: -2000 to 2000</li> </ul>
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}	{CR and zero}

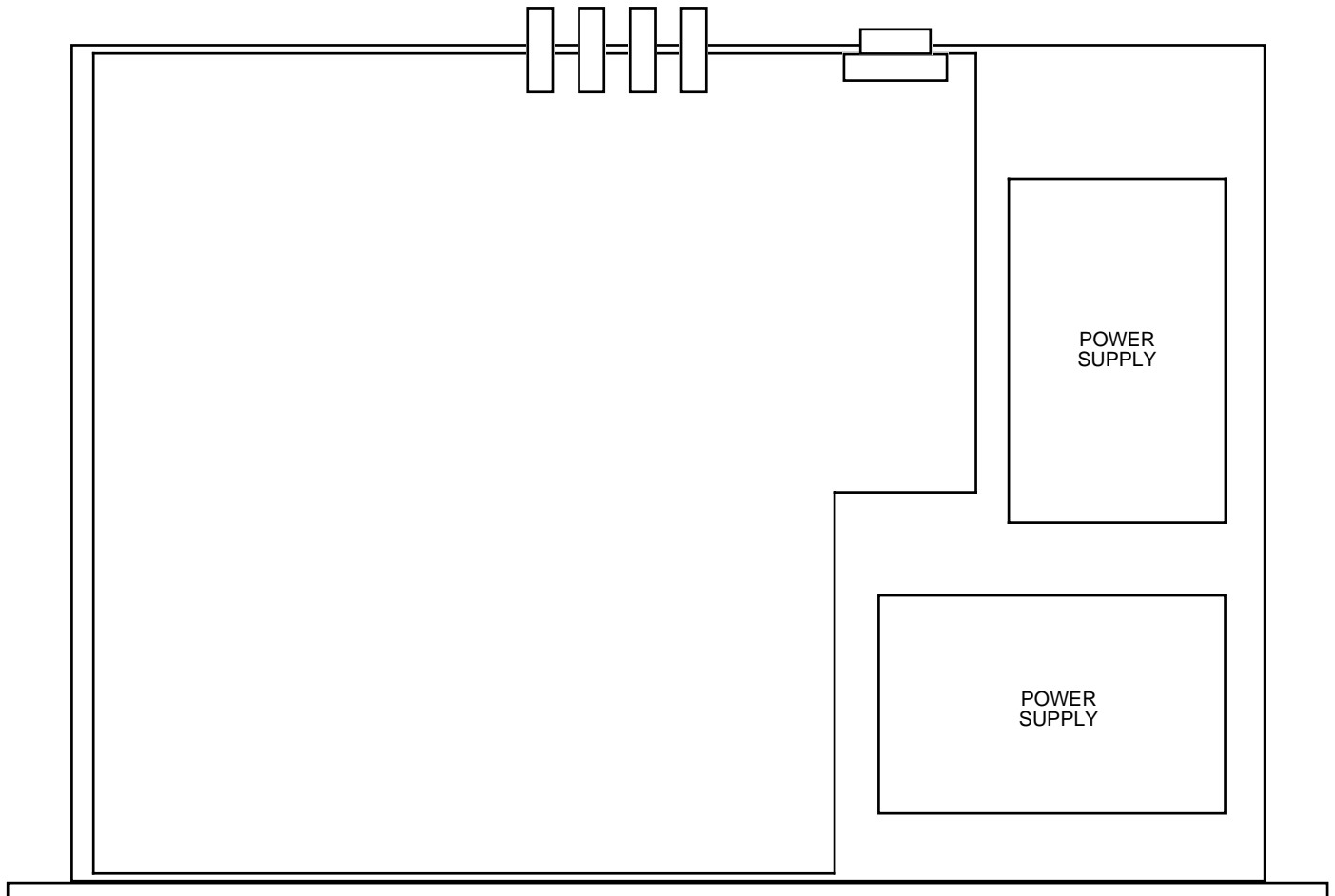
\* **PLEASE NOTE: The Address (aa) should only be used when RS-485 is selected.**

\*\* **ONLY used for units WITH option E.**

## 2.0 Installation

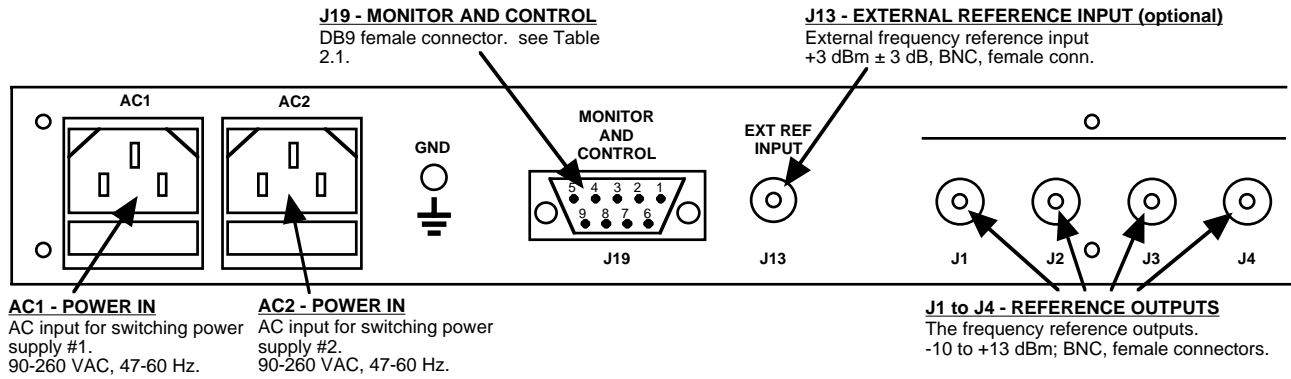
### 2.1 Mechanical

The 2099-1004 consists of one RF PCB housed in a 1 RU (1 3/4 inch high) by 12 inch deep chassis. Redundant switching,  $\pm 12$ , +24, +5 VDC power supplies provides power for the assemblies. The 2099-1004 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2099-1004 is assembled.

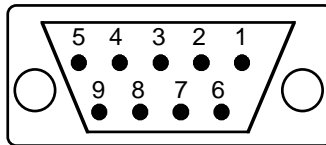


**FIGURE 2.0 2099-1004 Mechanical Assembly**

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



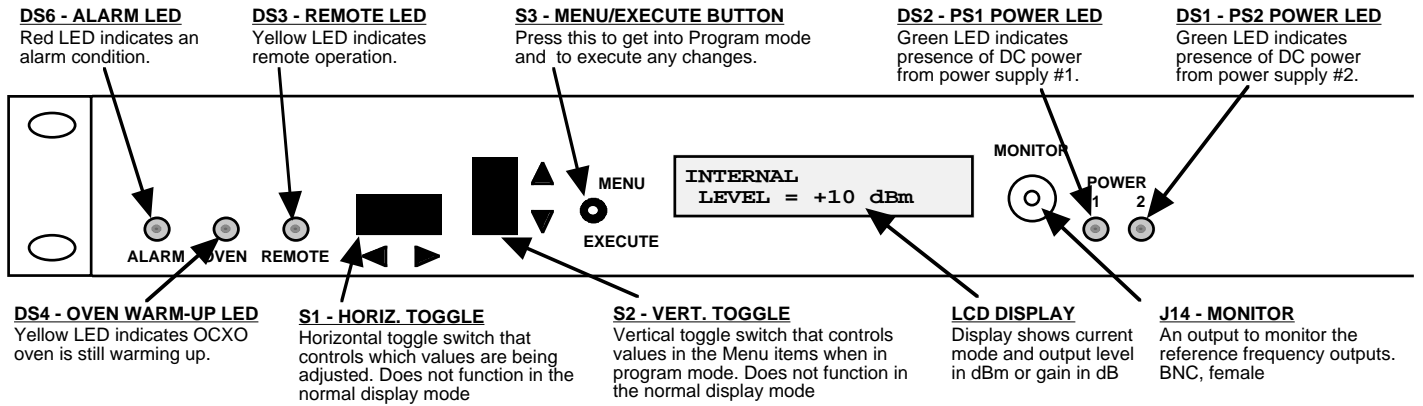
**FIGURE 2.1 2099-1004 Rear Panel Outputs**



Pin	Function
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Open=ALARM
8	Not Used
9	Alarm Relay: Closed=ALARM



## 2.3 Front Panel Indicators -The following are the front panel indicators.

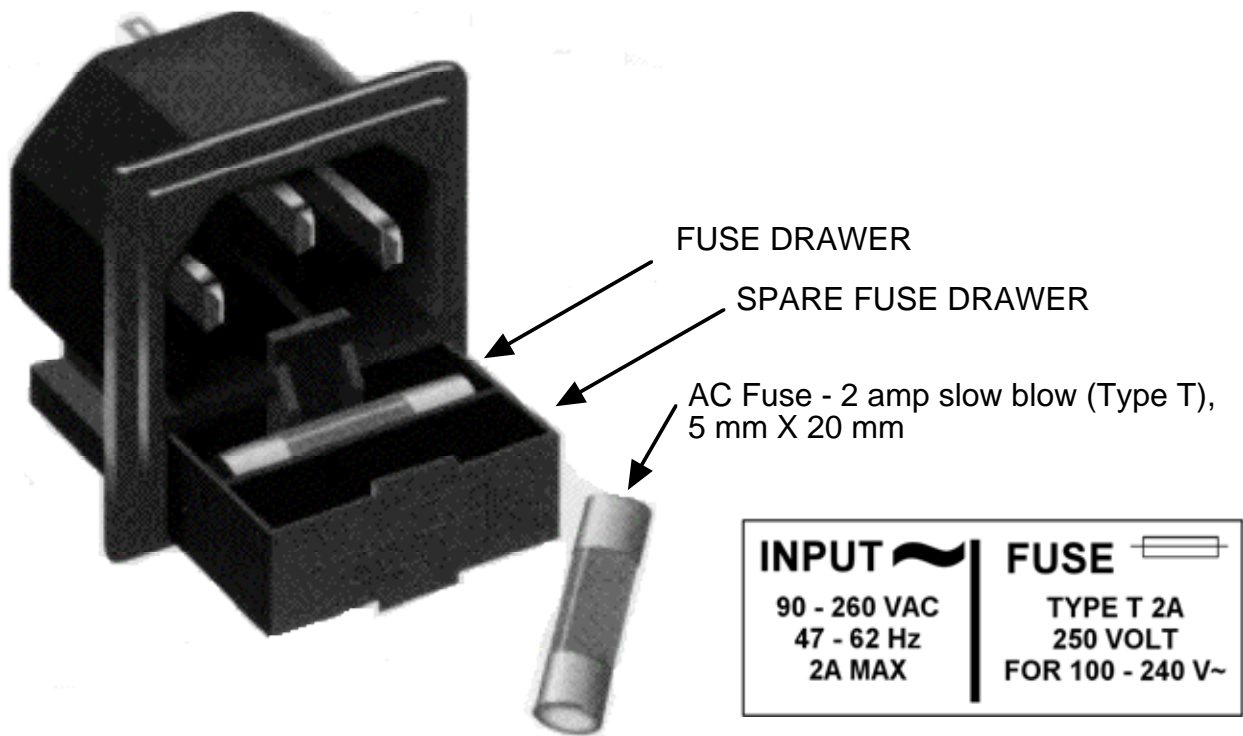


**FIGURE 2.2 2099-1004 Front Panel Controls and Indicators**

## 2.4 Installation / Operation

### 2.4.1 Installing and Operating the 2099-1004 10MHz Frequency Source

1. Connect 90-260 VAC, 47-63 Hz to AC1 and AC2 connectors (Figure 2.1).
2. Be sure DS1 and DS2 LEDs (green, POWER) are on (Figure 2.2).
3. Be sure DS6 (red, ALARM) is off and/or contact closure at DB9 ALARM connector, J19, to occur to insure that the unit is not in an alarm condition.
4. Wait for DS4 LED (yellow, OVEN) to go off to insure that the oscillator oven is stabilized.
5. (option -E only) Choose one of the five (5) modes (Internal, Ext Pass, Ext Pass Auto, Ext Lock, or Ext Lock Auto) in which to operate the unit.
6. Set desired internal reference output level or pass-through gain, if applicable (option -E only).
7. Connect J1 thru J4 (REFERENCE OUTPUTS) to desired equipment (Figure 2.1).
8. Monitor reference output signal with J14 (MONITOR) (Figure 2.2).
9. 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.



**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** Mode Select (Int, Ext Pass, Ext Pass Auto, Ext Lock, Ext Lock Auto) - **option -E only**

**Menu 2** Level Adjust (from -10 to +13 dBm) for Internal and Lock modes OR

**Menu 2** Gain Adjust (from -10 to +10 dB) for all Pass modes - **option -E only**

**Menu 3** Reference Frequency Offset

**Menu 4** Set Unit to Remote Operation

**Menu 5** Select Remote Mode (RS232, RS422, or RS485)

**Menu 6** Set RS-485 address

**Save Menu** When “R” is selected from any above menu or at the end

Alarm indications appear on the LED (see Figure 2.2).

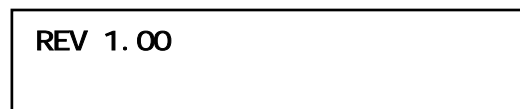
All program changes must start with the operation of the Menu/Execute switch and must also end with the operation of the Menu/Execute switch verified by the “**SAVE SETTINGS?**” Menu. If this sequence is not followed, none of the changes will take effect. No program changes will be evident until they 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.**

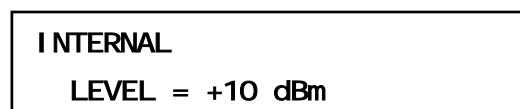
When power is first applied, the LCD display goes through three steps.

1. The LCD goes black to show all segments are functioning.
2. The software version will be displayed.



REV 1.00

3. The present mode and output (or gain) level is shown.

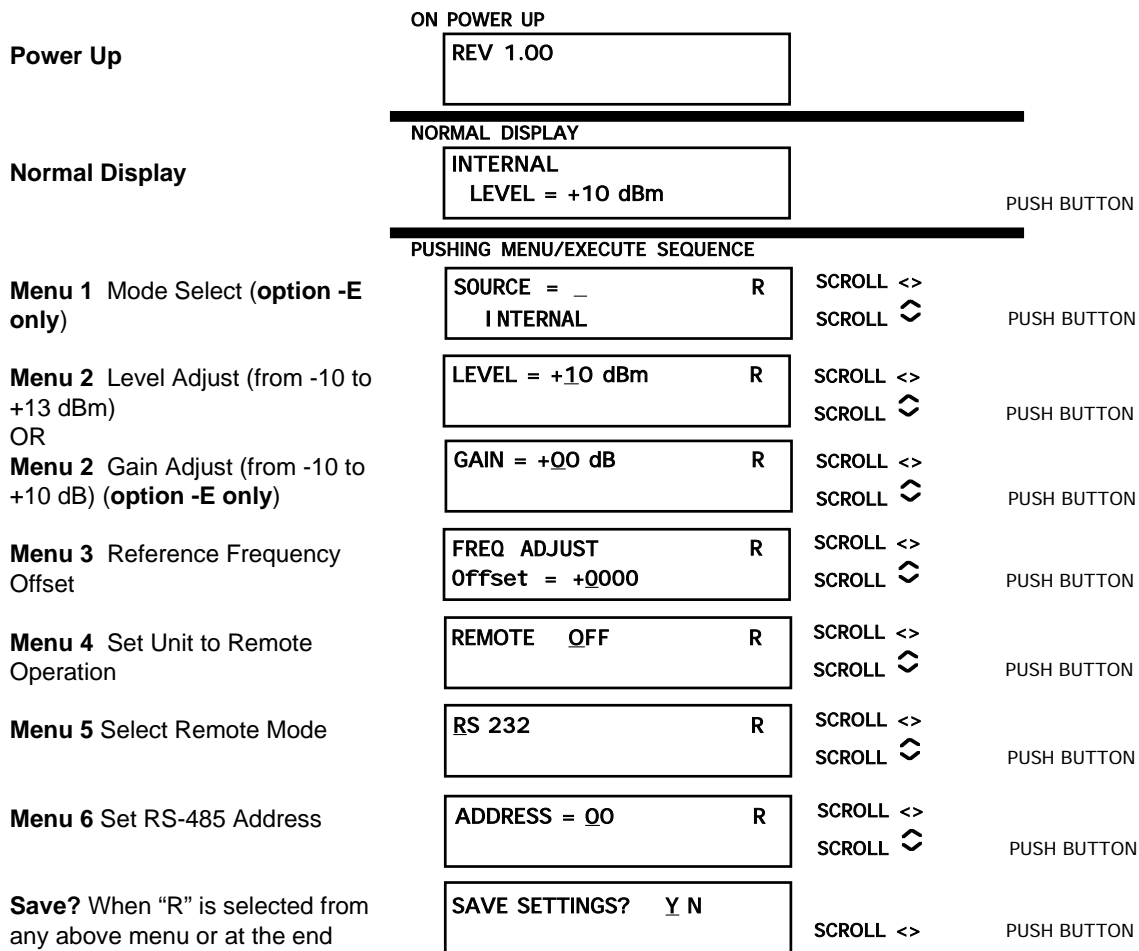


INTERNAL  
LEVEL = +10 dBm

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 will toggle settings such as ON/OFF and RS232/422/485. In the case of the LEVEL setting, the vertical switch will increase or decrease the digit that is selected (within the limits of operation).



**Figure 2.4 Menu Display and Sequence**

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