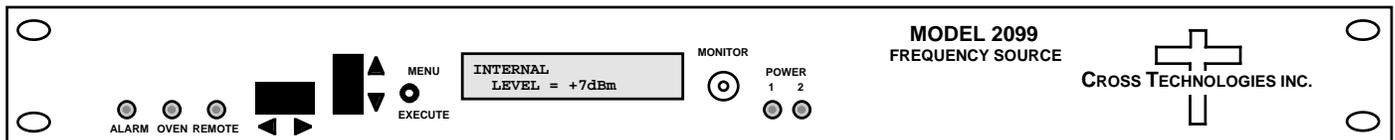


# Instruction Manual

# Model 2099-100xx 100MHz Frequency Source

July 2009 Rev A



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# INSTRUCTION MANUAL

## MODEL 2099-100xx, 100MHz Frequency Source

<b><u>TABLE OF CONTENTS</u></b>	<b><u>PAGE</u></b>
<b>Warranty</b>	<b>2</b>
<b>1.0 General</b>	<b>3</b>
1.1 Equipment Description	<b>3</b>
1.2 Technical Characteristics	<b>4</b>
1.3 Monitors and Controls	<b>5</b>
<b>2.0 Installation</b>	<b>7</b>
2.1 Mechanical	<b>7</b>
2.2 Rear Panel Outputs	<b>8</b>
2.3 Front Panel Indicators	<b>9</b>
2.4 Operation	<b>10</b>
2.5 Menu Settings	<b>11</b>
<b>3.0 Environmental Use Information</b>	<b>13</b>

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# MODEL 2099-100xx 100MHz Frequency Source

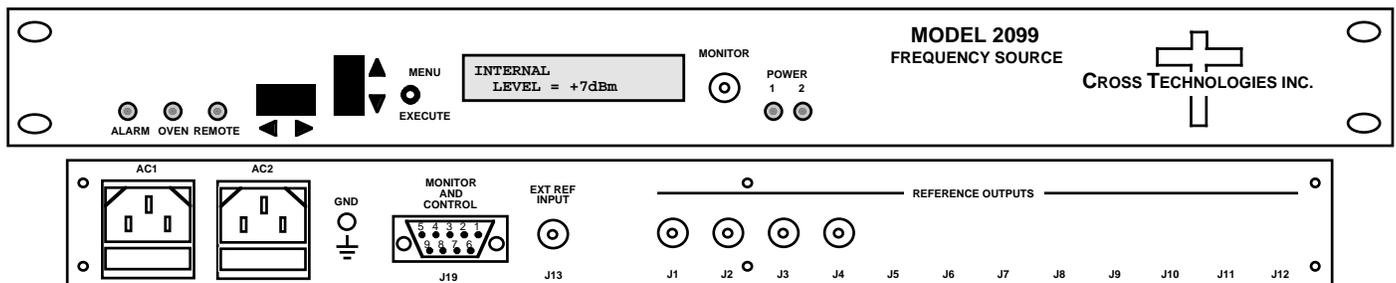
## 1.0 General

### 1.1 Equipment Description

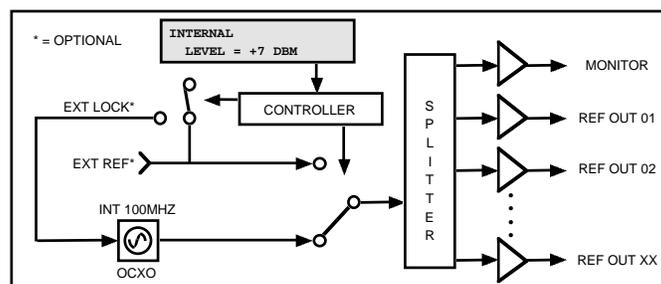
The Model 2099-100XX Frequency Source provides four (xx=04), eight (xx=08) or twelve (xx=12) 100 MHz reference outputs from a 0.1 ppm high stability oven controlled crystal oscillator (OCXO). Front panel LEDs indicate alarm (red), oven warm-up (yellow), remote (yellow), and power from the two redundant power supplies (green). The output level is +7 dBm (max), and the 2099-100XX works into either a 75Ω or 50Ω load. An available External Reference option (Option E) provides an external reference input which can be used to lock the internal 100 MHz source to a high stability external reference. An LCD display shows the 100 MHz output level (and mode setting, gain, lock reference frequency). Connectors are 50/75 Ohm BNC female. A relay contact closure or open indicates when an alarm occurs. The 2099-100XX is mounted in a 1RU rack mountable chassis with redundant power supplies fed by separate fused 100-240 ±10% VAC AC input connectors and provides RS232/422/485 M&C Interface.

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 +3 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 Lock - The internal reference is present on the reference outputs and locked to the external reference signal (1, 5, 10, 20, 25, or 100 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.
3. 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 Front and Rear Panels**



**FIGURE 1.2 Block Diagram**

## 1.2 Technical Characteristics

**TABLE 1.0 2099-100xx 100MHz Frequency Source Specifications\***

### Output Characteristics

Number of outputs	4, 8 or 12 (including monitor)
Impedance; Return Loss	50Ω/75Ω; >18dB
Frequency	100 MHz
Level, adjustable (int ref)	-7 dBm to +7 dBm
Gain, adjustable (ext ref)	-10 dB to +3 dB (option -E only)
Harmonics	< -30 dBC, < -40 typ.
Spurious	< -75 dBC

### External Reference Input Characteristics

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

### Oscillator Characteristics

Over Temperature	± 0.03 ppm max 0°C to 50°C
Aging	± 0.01 ppm per day, ± 0.5 ppm per year
Warm Up	± 1.0 ppm in 4 minutes, ± 0.1 ppm in 1 hour
Tuning Adjustment	± 0.5 ppm

Phase Noise @ Freq	10Hz	100Hz	1kHz	10kHz
dBC/Hz	-90	-125	-145	-155

### 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

100 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 100-240 ±10% VAC, 47-63 Hz, 20 W max. power supplies

### Options

E	External Reference Input (includes INTERNAL, EXTERNAL LOCK, and EXTERNAL 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 2099-100xx 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 2099-100xx Status Requests		
Command	Syntax*	Description
Command Status (units WITH option E)	{aaS1}	Returns {aaS1bbbccccdddddghijk} where: <ul style="list-style-type: none"> <li>• bbb = Output Level (-07 to +07 dBm)</li> <li>• ccc = External Reference Frequency (1, 5, 10, 25, or 100 MHz)</li> <li>• dddd = Reference Offset (-1000 to +1000)</li> <li>• f = 1 - Oven Warm Up Alarm</li> <li>• g = 1 - PLL Lock Detect</li> <li>• h = 1 - External Reference Present</li> <li>• i = 1 - Internal Reference Present</li> <li>• j = 1 - Summary Alarm</li> <li>• k = 1 - FAULT Occured (EXT LOCK AUTO Mode)**</li> </ul>
Command Status (units WITHOUT option E)	{aaS2}	Returns {aaS2bbbccccdef} where: <ul style="list-style-type: none"> <li>• bbb = Output Level (-07 to +07 dBm)</li> <li>• cccc = Reference Offset (-1000 to +1000)</li> <li>• d = 1 - Oven Warm Up Alarm</li> <li>• e = 1 - Internal Reference Present</li> <li>• f = 1 - Summary Alarm</li> </ul>

\*\* 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 2099-100xx and briefly describes them. After a command is sent the 2099-100xx 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)
- 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

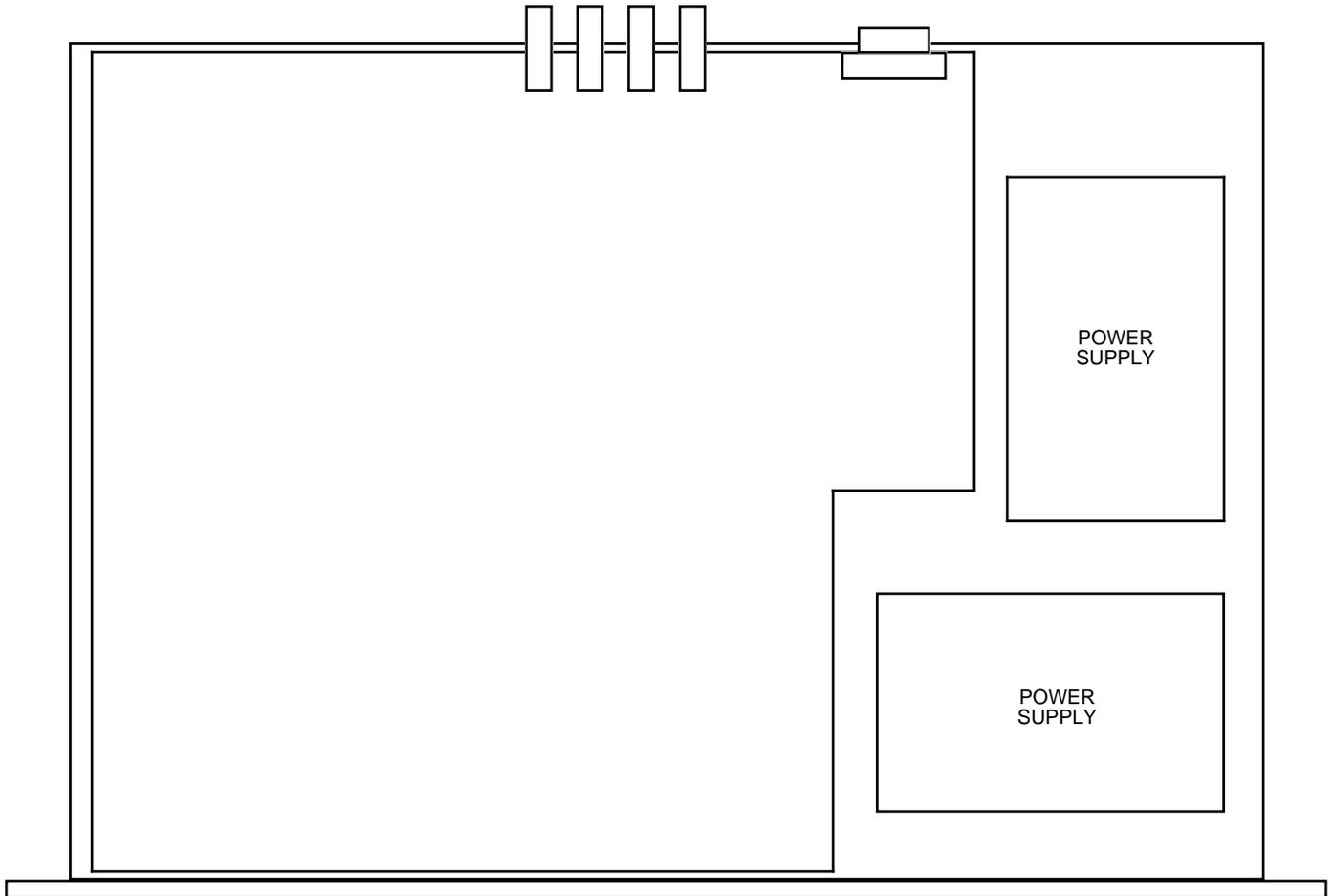
\* PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

Table 1.2 2099-100xx Commands		
Command	Syntax*	Description
Set Operating Mode (option E ONLY)	{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 Lock</li> <li>• 2 = External Lock Auto</li> </ul>
Set Output Level	{aaC2xxx}	where xxx = 2 or 3 characters <ul style="list-style-type: none"> <li>• Range: -07 to 07 (-7 to +7 dBm)</li> </ul>
Set External Reference Frequency (option E ONLY)	{aaC4xxx}	where xxx = 1, 2, or 3 characters <ul style="list-style-type: none"> <li>• Only valid values are 1, 5, 10, 25, or 100 (MHz)</li> </ul>
Clear FAULT (EXT LOCK AUTO Mode) (option E ONLY)	{aaC5x}	where x = 1 to clear FAULT
Frequency Offset Adjust	{aaC8xxxxx}	where xxxxx = 4 or 5 characters Range: -1000 to 1000
Enable Remote	#	Just # sign
Disable Remote	{aaCRO}	{CR and zero}

## 2.0 Installation

### 2.1 Mechanical

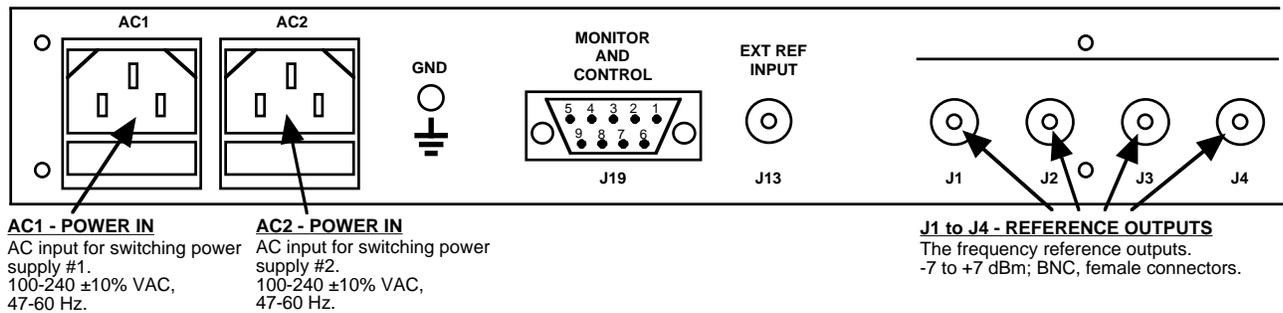
The 2099-100xx consists of one RF PCB housed in a 1 RU (1 3/4 inch high) by 12 inch deep chassis. Redundant switching,  $\pm 12$ , +24, +5 VDC power supplies provides power for the assemblies. The 2099-100xx can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2099-100xx is assembled.



**FIGURE 2.0 Mechanical Assembly**

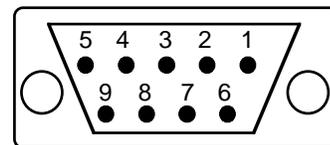
## 2.2 Rear Panel Output Signals

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



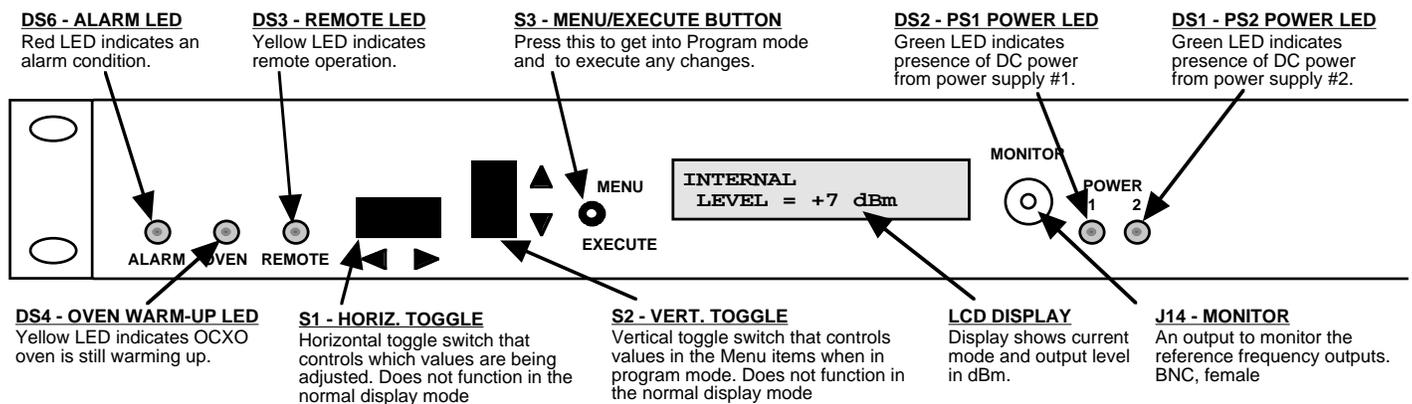
**FIGURE 2.1 2099-10004 Rear Panel Outputs**

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

Figure 2.2 shows the front panel indicators.

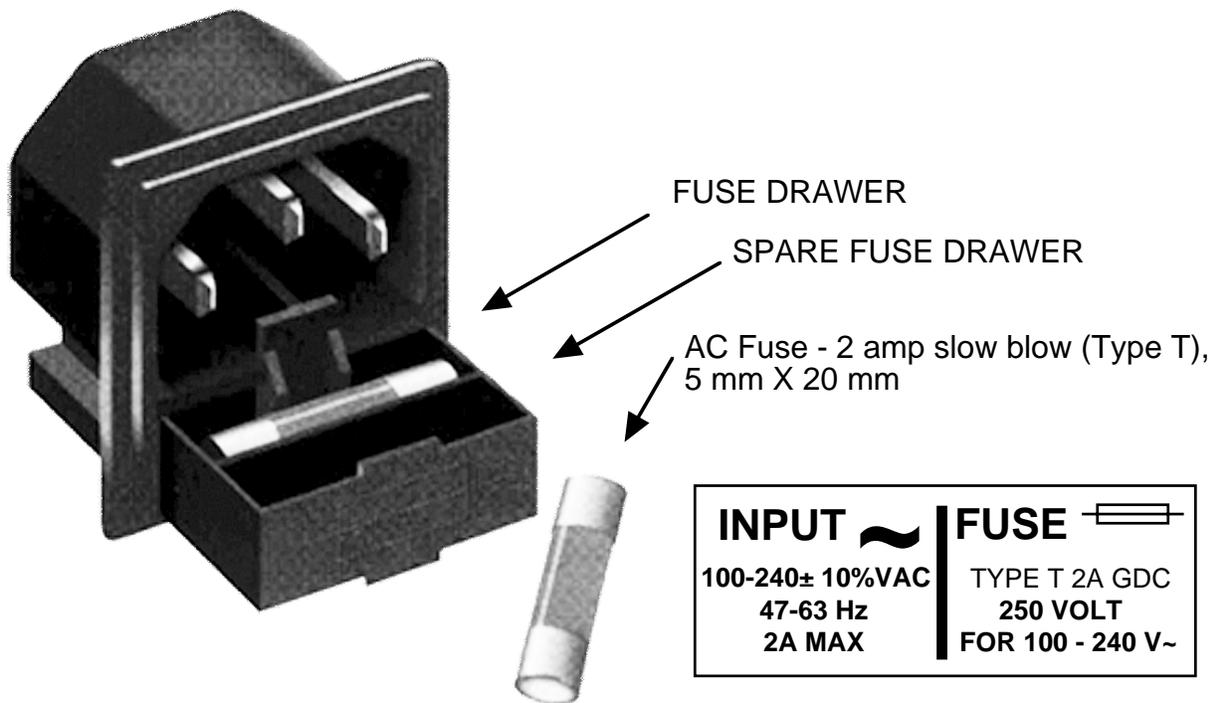


**FIGURE 2.2 Front Panel Controls and Indicators**

## 2.4 Installation / Operation

### 2.4.1 Installing and Operating the 2099-100xx 100MHz Frequency Source

1. Connect 100-240  $\pm$ 10% 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 three (3) modes (Internal, Ext Lock, or Ext Lock Auto) in which to operate the unit.
6. Set desired frequency reference output level.
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 -7 to +7 dBm)

**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.

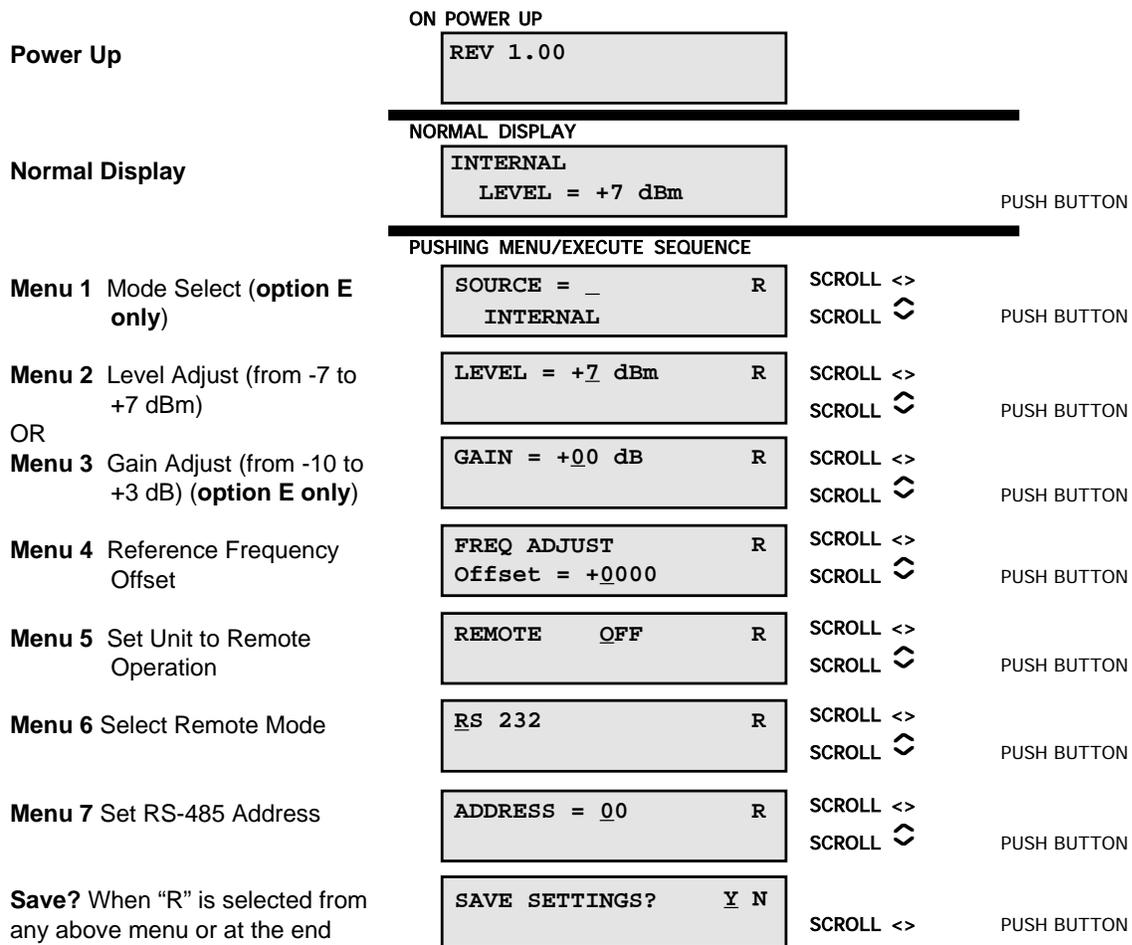


INTERNAL  
LEVEL = +7 dBm

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**

### 3.0 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.



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