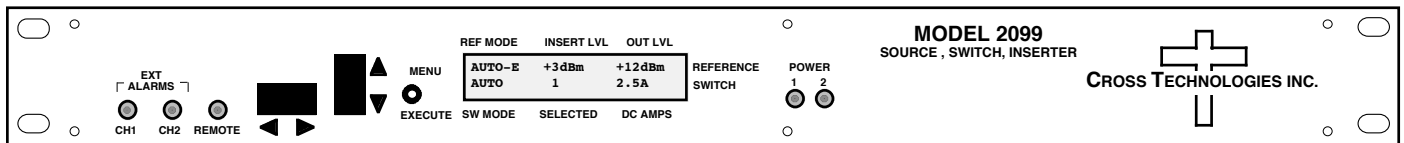


# Instruction Manual

# Model 2099-1004-21L

## 10MHz Frequency Source, Switch, Inserter

April 2011, Rev. O



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# INSTRUCTION MANUAL

## MODEL 2099-1004-21L 10 MHz FREQUENCY SOURCE, SWITCH, INSERTER

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## MODEL 2099-1004-21L Protection Switch

### 1.0 General

#### 1.1 Equipment Description

The Model 2099-1004-21L Frequency Source, Switch Inserter provides four 10MHz reference outputs from a 0.01 ppm high stability oven controlled crystal oscillator (OCXO), provides an L-Band RF A/B switch and inserts the 10MHz reference and/or +24V DC on the output of the L-Band Switch. Front panel LEDs indicate Alarm 1 or Alarm 2 (red) based on the alarm inputs, remote (yellow), and power from the two redundant power supplies (green). A Rear Panel LED indicates the presence of DC Power on the L-Band Output (J11). The reference output level is +13 dBm (max) into a 50Ω load. The unit provides an external reference input which can be used to lock the internal 10 MHz source to a high stability external frequency reference. An LCD display shows the 10MHz output level and insertion level, reference mode setting (Internal, External, Auto), Switch Mode (AUTO, REMOTE, MANUAL) and the DC Current of the inserted +24VDC. Connectors are 50Ω BNC female. A relay contact closure or open indicates when an alarm occurs. The 2099-1004-21L is mounted in a 1RU rack mountable chassis, and is powered by redundant power supplies fed by separate fused 100-240 ±10% VAC AC input connectors. An RS232/422/485 (selectable) M&C interface provides remote control of the unit.

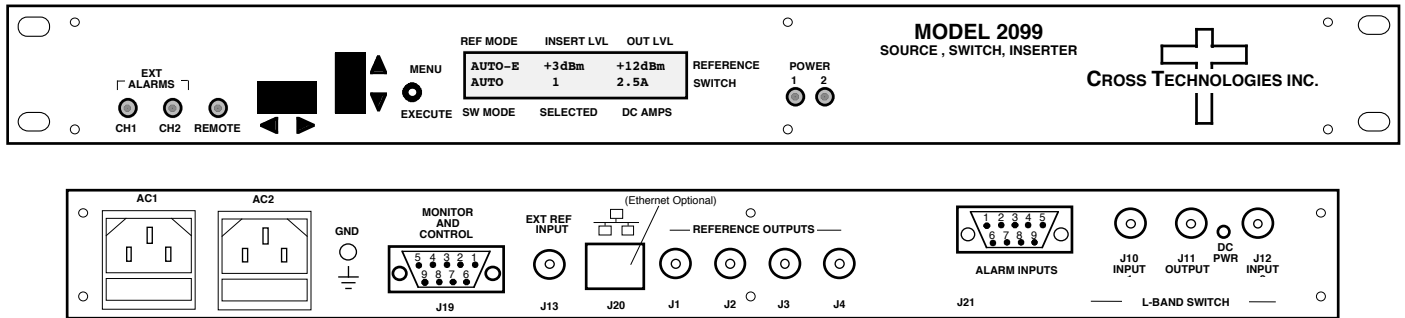


FIGURE 1.1 2099-1004-21L FRONT AND REAR PANELS

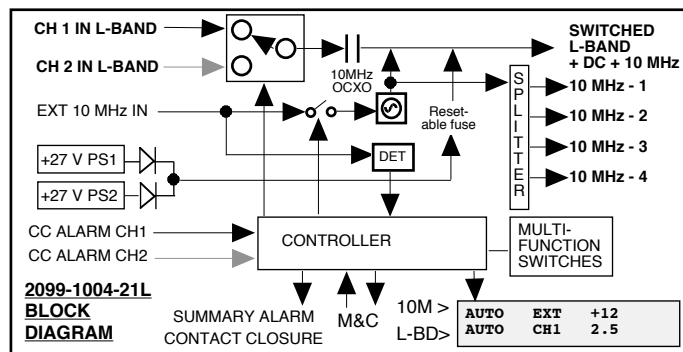


FIGURE 1.2 Model 2099-1004-21L 10MHz Block Diagram

## 1.2 Technical Specifications

**TABLE 1.0 2099-1004-21L 10MHz Frequency Source, Switch, Inserter Specifications\***

### Output Characteristics

Reference outputs	4
Impedance	50Ω
Return Loss:	
Reference Outputs	>18dB
Switch Inputs/Outputs	12dB min (950-2150 MHz)
Reference Frequency	10.0000 MHz
Reference Output Level	-10 dBm to +13 dBm (adjustable)
Reference Insertion Level	-3 dBm to +6dBm (adjustable)
Harmonics	< -30 dBc, < -40 typ.
Spurious	< -75 dBc
DC Insertion	+24VDC ± 2VDC @ 2.5Amp Max.

### External Reference Input Characteristics

Impedance	50Ω
Return Loss	> 14 dB
Level	+3 dBm ± 3 dB
Frequency	10.000 MHz +/- 1 PPM

### Alarm Input Characteristics

Sense (selectable)	Normally High (Open) or Normally Low (Closed)
Logic Inputs	TTL compatible
Input Logic Voltage	-.3VDC to +5.0VDC Max.
Impedance	10KΩ pull-up to +5VDC

### 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 @ Freq	10Hz	100Hz	1kHz	10kHz
dBC/Hz	-110	-140	-155	-160

### Controls & Indicators

#### Front Panel

Output Level Adjust	direct readout LCD; push-button switches or remote
Power	Green LEDs
Remote	Yellow LED, RS232C/422/485 (Optional Ethernet)
Alarm 1 & 2	Red LEDs, external contact closure

#### Rear Panel

DC Power	Yellow LED indicates presence of +24VDC on L-Band Output
----------	----------------------------------------------------------

#### Other

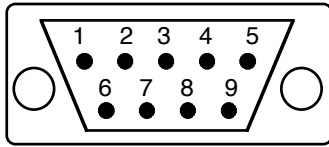
10 MHz Connectors	BNC (female) 50Ω impedance
Alarm Form-C/Remote	DB9 (female)
Alarm Inputs	DB9 (male)
Size	19 inch, 1RU standard chassis • 1.75”H x 12.0”D
Power	Redundant 100-240 ±10% VAC, 47-63 Hz, 20 W max. power supplies

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

## 1.3 Monitor and Control Interface

### A) Alarm Inputs

**Connector:** Rear panel, DB-9 male (**Mirror Image of J18 M&C Connector**)

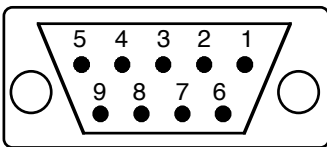


Pin	Function
1	Alarm 1 Input
2	GND
3	GND
4	Alarm 2 Input
5	GND
6	Not Used (No Connection)
7	Not Used (No Connection)
8	Not Used (No Connection)
9	Not Used (No Connection)

### B) 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 (**Mirror Image of Alarm Input Connector**)



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

### C) Status Request

Table 1.1 lists the status requests for the 2099-1004-21L and briefly describes them.

\* **PLEASE NOTE:** The two character {aa} prefix, shown in the table below, is present ONLY when RS485 is selected.

<b>Table 1.1: Model 2099-1004-21L M&amp;C Status Request</b>		
<b>Command</b>	<b>Syntax</b>	<b>Description</b>
Switch Status	{aaSS}	Returns {aaSSxy} where: x = A for Auto, R for Remote, M for Manual y = 1 for CH1 or 2 for CH2
Alarm Status	{aaSA}	Returns {aaAxy} where: x = Alarm 1, y = Alarm 2 1 = Alarm, 0 = No Alarm
Reference Mode	{aaSR}	Returns {aaSRxy} where: x = R for Remote, M for Manual y = 1 for Internal, x = 2 for External and x = 3 for Auto
Reference Output Level	{aaSO}	Returns {aaSOxxx} where: $-10 \leq xxx \leq +13$ in dBm
Reference Insertion Level	{aaSC}	Returns {aaSCxxx} where: $-3 \leq xxx \leq +10$ in dBm <b>or</b> 0 = Off
DC Insertion	{aaSE}	Returns {aaSExxxx} where: $0.00 \leq xxxx \leq 2.50$ in Amps <b>or</b> 0 = Off
Reference Offset	{aaSO}	Returns {aaSOxxxxx} where: $-2000 \leq xxxxx \leq +2000$
Alarm Sense	{aaSF}	Returns {aaSASx} where: x = 1 Normally Open, x = 2 Normally Closed

### D) Commands

Table 1.2 lists the commands for the 2099-1004-21L and briefly describes them. After a command is sent the 2099-1004-21L sends a return ">" indicating the command has been received and executed.

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

{ = start byte

aa = address (RS-485 only)

C = 1 character, either C (command) or S (status)

P = 1 or more characters identifying the parameter (depends on command)

x = 1 or more numbers (with + or - if applicable) to set a numerical value or state } = stop byte

\* **PLEASE NOTE:** The two character {aa} prefix, shown in the table below, is present ONLY when RS485 is selected.

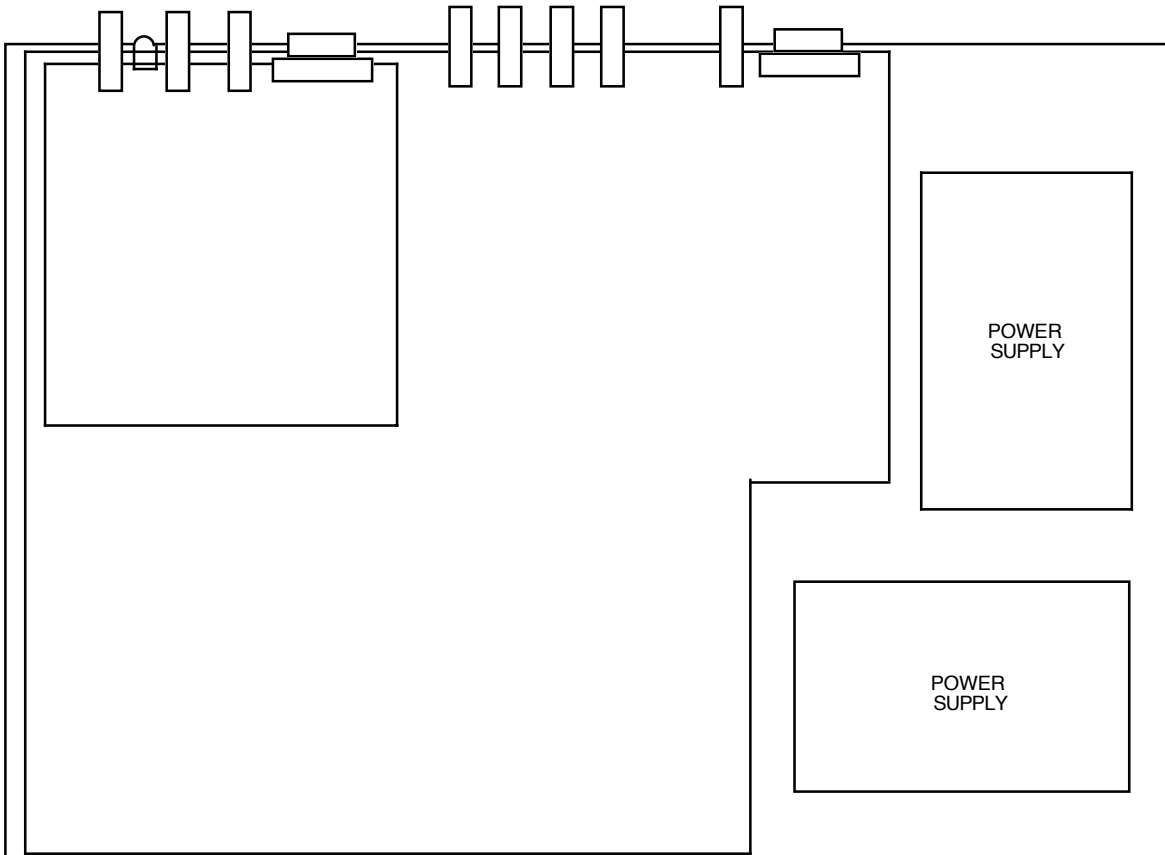
<b>Table 1.2: Model 2099-1004-21L M&amp;C Commands</b>		
<b>Command</b>	<b>Syntax</b>	<b>Description</b>
Set Switch Mode	{aaCMx}	x = 1 to Set Switch Mode to Auto
		x = 2 to Set Switch Mode to Remote
Set Switch Initial Channel Select	{aaClx}	x = 1 to Set Initial Channel to CH1 (Auto Only)
		x = 2 to Set Initial Channel to CH2 (Auto Only)
Set Switch Channel Select	{aaCSx}	x = 1 Remotely Set Switch to CH1*
	{aaCSx}	x = 2 Remotely Set Switch to CH2*
Set Reference Mode	{aaCAx}	x = 1 to set reference to Internal
		x = 2 to set reference to External (lock)
		x = 3 to set reference to auto-select
Set Reference Output Level	{aaCBxxx}	where: $-10 \leq xxx \leq +13$
Set Reference Insertion Level	{aaCCxxx}	where: $-3 \leq xxx \leq +10$
Set Reference Insertion On/Off	{aaCDx}	x = 1 Reference Insertion On
		x = 2 Reference Insertion Off
Set Reference Offset	{aaCOxxxxx}	where: $-2000 \leq xxxxx \leq +2000$
Set DC Insertion On/Off	{aaCEx}	x = 1 DC Insertion On
		x = 2 DC Insertion Off
Disable Remote	{aaCR0}	{aaCR and zero}
Set Alarm Sense	{aaCFx}	x = 1 Normally Open (+5VDC)
		x = 2 Normally Closed (0VDC)
Enable Remote	#	Just # sign

## 2.0 Installation

### 2.1 Mechanical

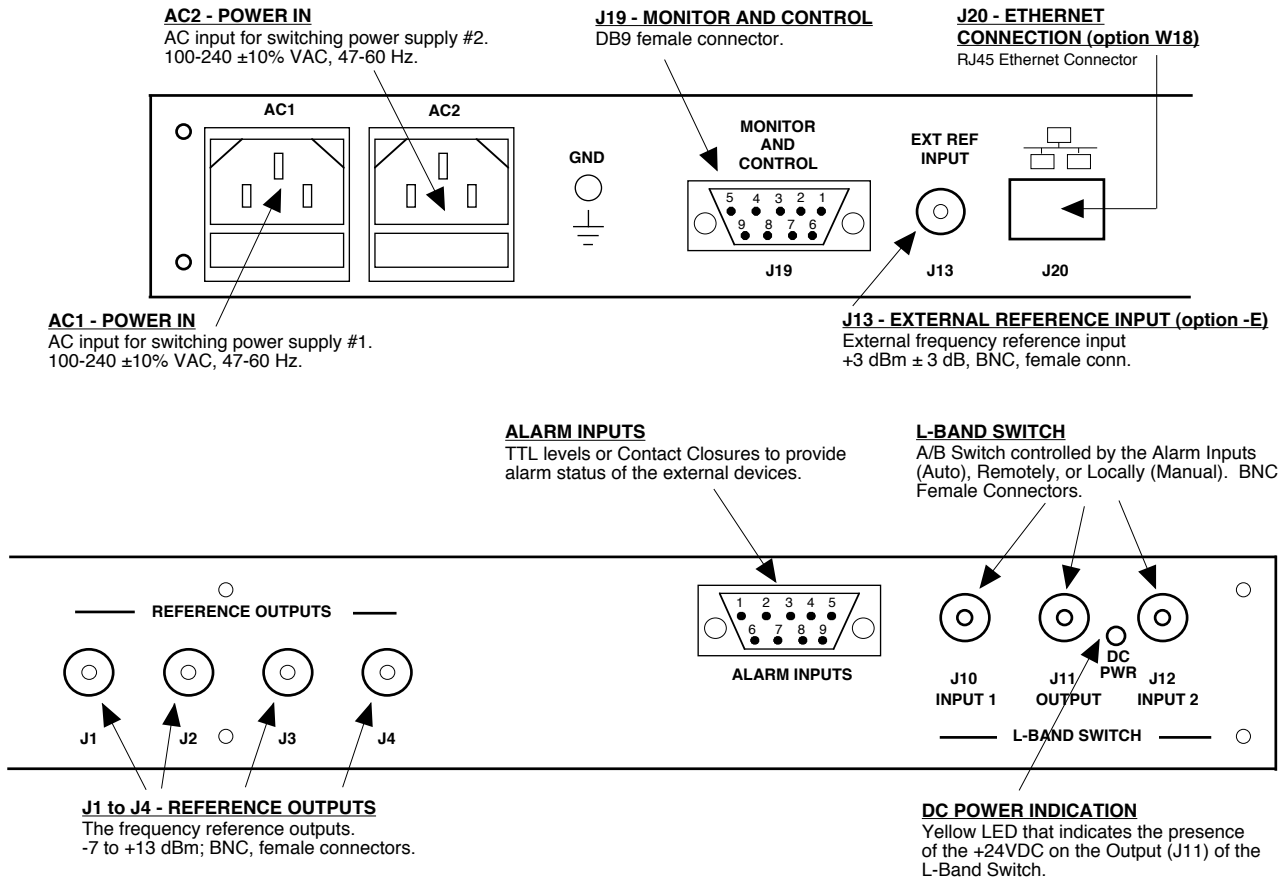
The 2099-1004-21L consists of one RF PCB housed in a 1 RU (1 3/4 inch high) by 12 inch deep chassis. Redundant switching,  $\pm 12$ , +24, +5 VDC power supplies provides power for the assemblies.

The 2099-1004-21L can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2099-1004-21L is assembled.

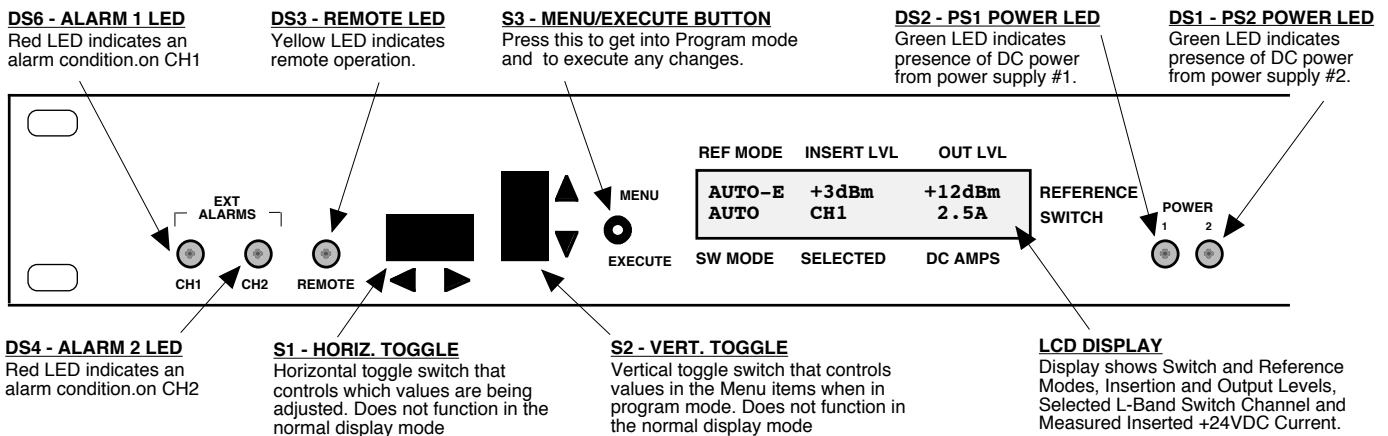


**FIGURE 2.0 2099-1004-21L Mechanical Assembly**

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



**FIGURE 2.1 2099-1004-21L Rear Panel Input/Outputs**



**FIGURE 2.2 2099-1004-21L Front Panel Controls and Indicators**

## 2.4 Installation / Operation

### 2.4.1 Installing and Operating the 2099-1004-21L 10MHz Frequency Source

1. Connect 100-240  $\pm$ 10% VAC, 47-63 Hz to AC1 and AC2 connectors (Figure 2.1).

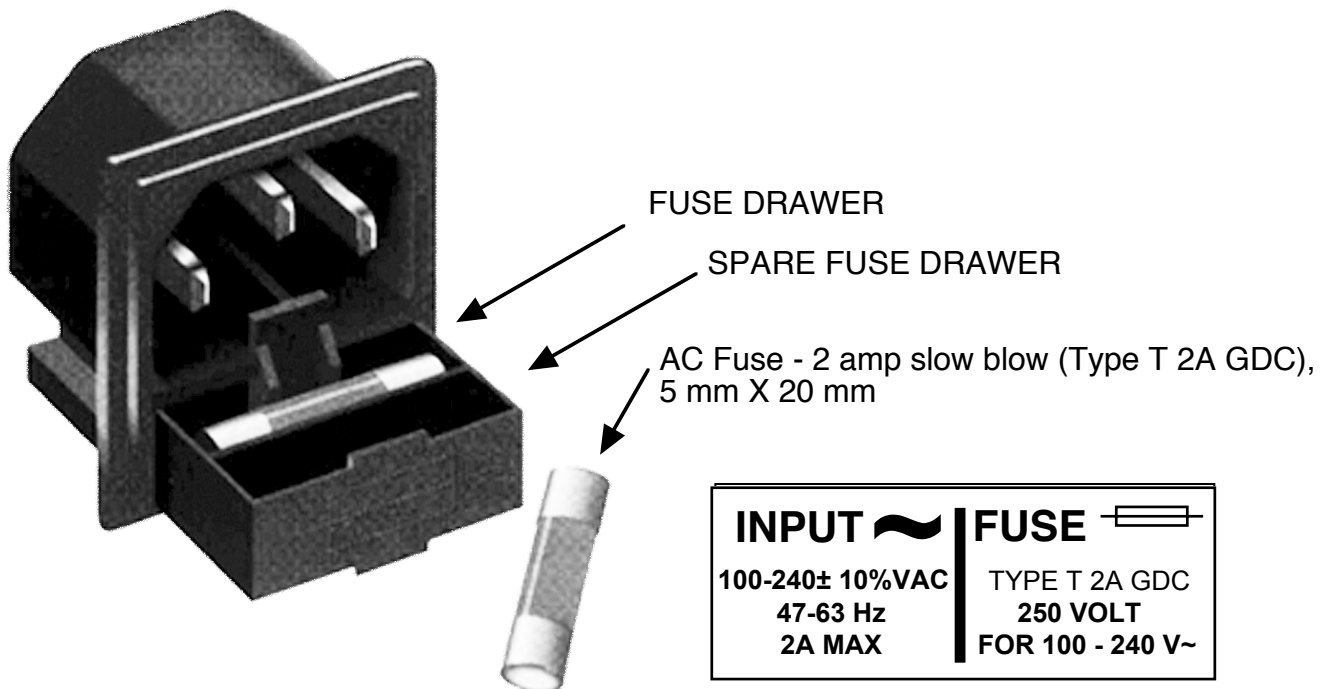
Be sure DS1 and DS2 LEDs (green, POWER) are on (Figure 2.2).

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.

2. Set desired reference output level and inserted output level.

3. Connect J1 thru J4 (REFERENCE OUTPUTS) to desired equipment (Figure 2.1).

**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 2.4** 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** Switch Mode Select (Auto or Manual).
- Menu 2a** Initial Channel Select (CH1 or CH2) Sets the initial switch position in Auto mode.  
The unit will switch to the non-selected channel if the selected channel has an alarm and the non-selected channel does not have an alarm.
- Menu 2b** Manual Select (CH1 or CH2) Forces the Switch to CH1 or CH2 regardless of alarms or Remote Commands.
- Menu 3** Reference Mode Select (Internal or External [Locked to an external source]).
- Menu 4** Reference Output Level Select (-10 to +13dBm) Allows the user to set the output level on J1-J4 Rear Panel BNC connectors.
- Menu 5** Reference Switch Output Insertion (On or Off). Selects whether the reference is inserted on the Switch output connector (J11).
- Menu 6** Reference Insertion Level Select (-3 to +6 dBm). Allows the user to set the insertion level on the Switch output connector (J11).
- Menu 7** Reference Frequency Offset (+/-2000 [Internal Only]). Allows the user to vary the internal reference frequency approximately +/- 1PPM.
- Menu 8** DC Switch Insertion. Selects whether the DC voltage is inserted on the Switch output connector (J11).
- Menu 9** Set Unit to Remote Operation.
- Menu 10** Select Remote Interface (RS232, RS422, or RS485).
- Menu 11** Set RS-485 address (RS-485 mode only).
- Menu 12** Alarm Sense of External Alarm Inputs (Normally Open [+5Volts] or Normally Closed [0Volts]).

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

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.

<b>R E V. 4.0</b>
-------------------

3. The selected output of the switch is displayed.

<b>AUTO-E</b>	<b>+3dbM</b>	<b>+12dbM</b>
<b>Auto</b>	<b>CH1</b>	<b>OFF</b>

The unit is now operational and ready for any changes the operator may desire.

## 2.5.3 Control Switches

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.

Horizontal Switch - This switch is mounted so its movement is horizontal and moves the cursor left or right.

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).

ON POWER UP	
<b>Power Up</b>	REV 4.00
<hr/>	
<b>Normal Display</b>	REF MODE INSERT LVL OUT LVL AUTO-E +3dBm +12dBm REFERENCE AUTO CH1 OFF SWITCH SW MODE SELECTED DC AMPS PUSH BUTTON
<hr/>	
PUSHING MENU/EXECUTE SEQUENCE	
<b>Menu 1</b> Switch Mode Select (AUTO or MANUAL)	SWITCH = <u>A</u> UTO R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 2a</b> Initial Channel Select (CH1 or CH2 [AUTO ONLY]) <b>OR</b> <b>Menu 2b</b> Manual Select (CH1 or CH2 [MANUAL ONLY])	INITIAL CHANNEL SELECT = <u>1</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 3</b> Reference Mode Select (Internal, External [Lock] or Auto)	REF MODE = <u>A</u> UTO R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 4</b> Reference Output Level Adjust (from -10 to +13 dBm)	REFERENCE OUTPUT LEVEL = <u>+10</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 5</b> Reference Switch Output Insertion (On or Off)	REFERENCE INSERTION = <u>ON</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 6</b> Insertion Level Adjust (from -3 to +6 dBm)	REFERENCE INSERT LEVEL = <u>+03</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 7</b> Reference Frequency Offset (+/- 2000 [Internal only])	INTERN FREQ ADJUST OFFSET = <u>+0000</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 8</b> +VDC Switch Insertion (On or Off)	DC INSERTION = <u>OFF</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 9</b> Set Unit to Remote Operation	REMOTE = <u>ON</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 10</b> Select Remote Interface	INTERFACE = <u>RS-232</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 11</b> Set RS-485 Address (RS-485 Mode Only)	RS485 ADDRESS = <u>00</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Menu 12</b> Alarm Input Sense (Normally Open [+5V] or Normally Closed [0V])	ALARM SENSE = <u>NORMALLY OPEN (+5V)</u> R SCROLL ⇐ SCROLL ⇓ PUSH BUTTON
<b>Save?</b> When "R" is selected from any above menu or at the end	SAVE SETTINGS? <u>Y</u> N SCROLL ⇐ PUSH BUTTON

**Figure 2.4 Menu Display and Sequence**

## **2.6 10 MHz Reference Operation**

### **2.6.1 AUTO Mode**

When the reference mode is set to AUTO the unit will attempt to lock to a reference signal applied to the external reference input (EXT REF INPUT, J13) on the rear panel. The front panel will display AUTO-E to indicate that the unit is locked, or in the process of locking, to an external reference.

If no signal is detected on the EXT REF INPUT then the unit's internal reference will switch to internal control and the front panel will display AUTO-I to indicate internal control. If the unit's external reference is restored then the unit will restart the lock process and the front panel will display AUTO-E.

If the unit detects an external reference and is unable to lock to it after about 7 seconds the unit will switch to internal control (AUTO-I) and remain there until either the power is cycled, the external 10 MHz reference is removed and then reapplied, or the user goes into the REF MODE menu and toggles the reference mode and then reselects AUTO.

The external reference must be accurate to within +/- 1 ppm for the unit to be able to lock to it.

### **2.6.2 Internal Mode**

When the unit is set to internal mode the frequency of the internal reference is controlled by the front panel Reference Frequency Offset adjustment. The frequency is adjustable to about +/- 1 ppm.

### **2.6.3 External Mode**

When the unit is set to external mode the unit will lock to a reference signal applied to the external reference input. There is no automatic switchover to internal control when the unit is in external reference mode.

## **2.7 RF A/B Switch Operation**

### **2.7.1 AUTO Mode**

Auto is the normal mode for the switch. The unit will monitor the external alarm inputs and switch if the currently selected channel is alarmed and the other channel is not. The switch will always go to the channel selected in initial channel select when AUTO mode is entered as long as that channel is not alarmed.

### **2.7.2 Remote Mode**

Remote mode may only be entered via remote M&C commands. Remote selection of switch channel position will override the AUTO mode. The remote mode is for the user to test signal continuity and switch operation from a remote location.

### **2.7.3 Manual Mode**

Manual mode overrides both remote and auto mode. Manual mode is for the user to test signal continuity and switch operation from the front panel.

### 3.0 Environmental 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  $T_{mra}$ .
- 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 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 RE-INSTALLED** prior to Top Cover screw replacement. **FAILURE TO DO** this may cause **INGRESS** and/or **EGRESS** emission problems.



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