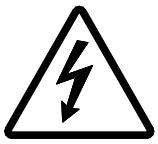
OEM-25B

RF Plasma Generator



HIGH RF VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. *All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with this manual.*

DO NOT USE ANY CFC (CHLOROFLUOROCARBON) SOLVENT IN THE MAINTENANCE OF THIS PRODUCT. In recognition of our responsibility to protect the environment, this product has been manufactured without the use of CFCs. The no-clean flux now used in all soldering operations may leave a small inert residue that will not affect the performance of the product. The use of CFCs for cleaning or maintenance may result in partial liquification of the no-clean flux residue, which will damage the unit and void the warranty.

This product is manufactured at an MKS Instruments' ISO-9001:2000-Quality-System-compliant facility.

Notice

Manual Order Number: 1040-001
Revision Level: D 11/15/06

Warranty

MKS, ENI Products warrants to the original purchaser for a period of one year from the date of delivery, each instrument to be free from defects in materials and workmanship. For a period of one year, MKS, ENI Products will, at its option, adjust, repair, or replace defective parts, without charge to the original purchaser, so that the instrument performs according to its specifications.

When warranty service is required, the instrument must be returned, transportation prepaid, to the factory or to one of MKS, ENI Products' designated service centers. If, in our opinion, the instrument has been damaged by accident, unreasonable use, buyer-supplied software or interfacing, improper site preparation or maintenance, or abnormal conditions of operation, repairs will be billed at standard rates. In this case, an estimate will be submitted before the work is started.

THIS LIMITED WARRANTY IS EXCLUSIVE AND MKS, ENI PRODUCTS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, AND ALL OTHER EXPRESS ORAL OR WRITTEN WARRANTIES AND ALL WARRANTIES IMPLIED BY LAW, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY ARE EXCLUDED AND DISCLAIMED. IN NO EVENT SHALL MKS, ENI PRODUCTS BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM BREACH OF ANY WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR FROM ANY CAUSE WHATSOEVER, INCLUDING NEGLIGENCE. Buyer's sole and exclusive remedy under this warranty shall be repair or replacement as set forth above, or if MKS, ENI Products is unable to repair or replace the defective part within a reasonable time, a refund of the price of the part or goods which give rise to the warranty claim.

Service And Technical Assistance

For Service or Repair contact the closest Customer Service Department with the following information:

- Model and serial number
- Purchase order number
- Detailed description of malfunction
- Your company's "Bill To" and "Ship To" address

You will receive a RMA (Return Materials Authorization) number, the warranty status of the unit to be returned and estimated repair charge, if any. The RMA number is your authorization number. Please type this number on your purchase order and shipping label. After MKS, ENI Products receives the unit, a firm quote and estimated date of completion will be given.

For Technical Assistance for your particular application, contact the nearest MKS, ENI Products Sales and Service Center. The following information will help us provide you with prompt and efficient service:

- All of the information contained on the unit's nameplate.
- Names and telephone numbers of important contacts.
- Detailed description (i.e. physical damage and/or performance anomalies, quantitative and/or qualitative deviation from specifications), including miscellaneous symptoms, dates and times.
- The environment and circumstances under which the issue developed.
- Supporting test data and/or records that can be provided.
- Any previous, related conversations and/or correspondence with MKS, ENI Products.

Sales & Service Locations

ROCHESTER, NY	MKS Instruments, Inc. 100 Highpower Road Rochester, NY 14623 **Toll Free USA Sales Hotline:** **Toll Free USA Technical Support Hotline:**	Tel: (585) 427-8300 Fax: (585) 427-7839 **1-800-267-5362** **1-877-464-2789**
SAN JOSE, CA	MKS Instruments, Inc. 70 Rio Robles San Jose, CA 95134	Tel: (408) 750-0300 Fax: (408) 428-0390
AUSTIN, TX	MKS Instruments, Inc. 1321 Rutherford Lane Suite 200 Austin, TX 78753	Tel: (512) 719-8000 Fax: (512) 719-8095
ENGLAND	1 Anchorage Court Caspian Road Altrincham, Cheshire WA14 5HH, England	Tel: 44-161-929-5500 Fax: 44-161-929-5511
GERMANY	Sielminger Str. 63 D-70771 Leinfelden-Echterdingen (Stetten) Stuttgart, Germany	Tel: 49-711-947700 Fax: 49-711-9477025
JAPAN	1-21-15 Aoyagi Kunitachi Tokyo 186-0013 Japan	Tel: 81-425-229-011 Fax: 81-425-222-636
KOREA	1ST Floor, DK Plaza-I 375-1, Geumgok-dong City Bundangogu, Seongnam Kyonggi-do, Korea 463-805	Tel: 82-31-717-9244 Fax: 82-31-717-9244
SINGAPORE	Blk 4010 Techplace 1 #01-07/08/09 Ang Mo Ko Ave 10 Singapore 569626	Tel: 65-6451-1062 Fax: 65-6451-0172
TAIWAN	2F, No. 47, Ln. 2, Sect. 2 Kuang Fu Rd. Hsinchu 300 Taiwan, ROC	Tel: 886-3-575-3040 Fax: 886-3-575-3048
P.R. of CHINA	West end of 2nd floor, No. 3 building (T20-3) No. 258 Jinzang Rd., Shanghai Jin Qiao Export Processing Zone Pudong, Shanghai 201206 P.R. of China	Tel: 86-21-5834-7934 or 86-21-5834-7914 Fax: 86-21-5834-7794

Product and Applications information also available on the Internet at:

http://www.mksinst.com

This page intentionally left blank.

PRODUCT MANUAL REVISION CONTROL FORM

Title:	OEM-25B	Part #:	1040-001	Final Assy #:	OEM-25B-01
	Operation Manual	Rev #:	D	Eff. Date:	11/15/06

CONTENTS	DESCRIPTION	REV LEVEL
SCHEMATICS		
1040-999	OEM-25B MTG & OUTLINE	A
PARTS LIST		

This page intentionally left blank.

TABLE OF CONTENTS

Introduction

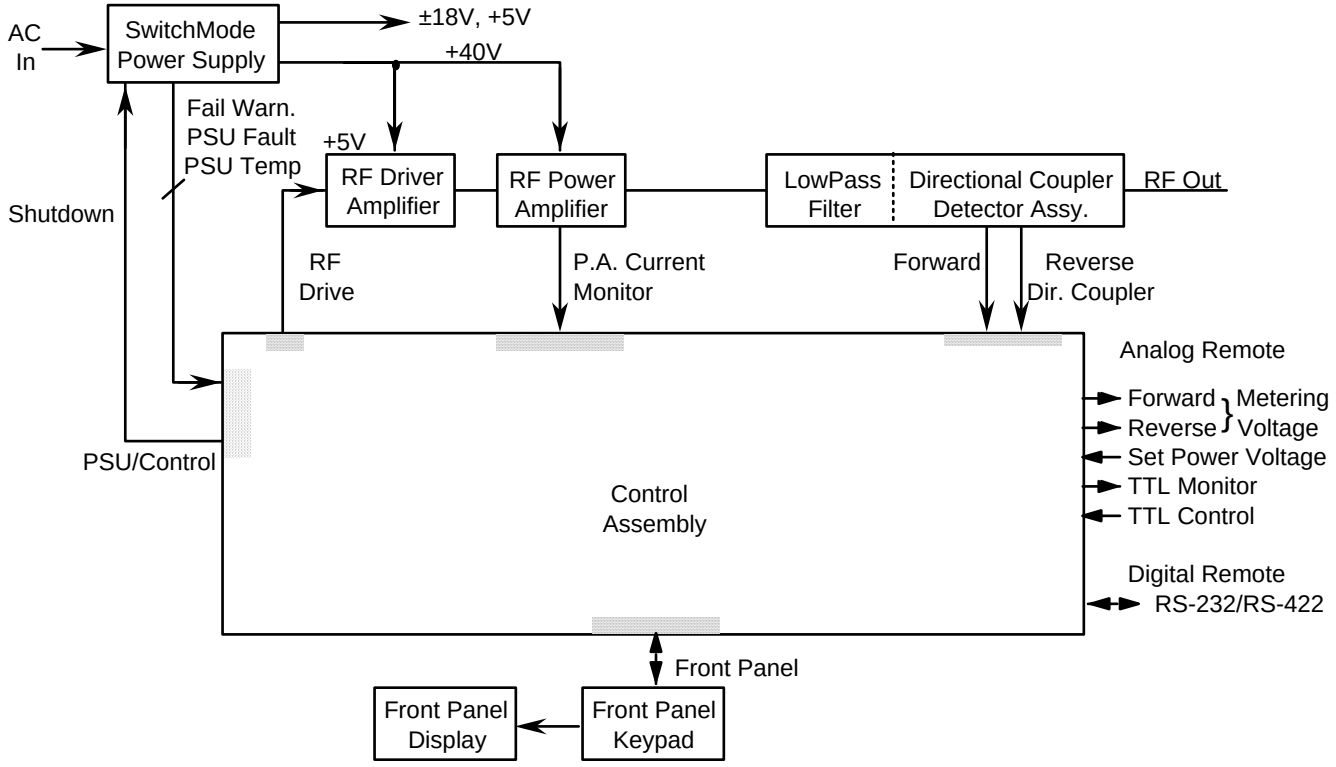
The ENI Model OEM-25B Power Generator is totally solid state. This generator is a water-cooled power source expressly designed for use in gas plasma and sputtering applications. Completely self-contained, the OEM-25B provides all of the control and monitoring functions needed in a state-of-the-art power generator. It will provide power output of 2500 W into a 50Ω impedance.

The reliable operation of any solid-state power generator is directly influenced by the sophistication of its power control circuitry. The OEM-25B automatic power control module measures forward RF power, reflected RF power, and the current drawn by each RF power amplifier section. Should any of these parameters exceed a preset limit, the automatic power control will immediately limit RF output power so that the components always remain within their safe operating limits. Besides assuring safe operation, the OEM-25B's automatic power control module provides constant RF output power to within ±2% of the command power setting above 200 W or ±4 W below 200 W into VSWRs up to 3:1. Automatic power control also eliminates power output drift due to line voltage variations, component aging, and reduces output hum and ripple to insignificant levels.

The OEM-25B is provided with two interface connectors. One connector provides simple analog control and monitoring of the generator through the use of voltage levels and TTL-compatible signals. The other connector provides full digital remote control of the generator using a simple protocol on an RS-232 or RS-422 serial link.

Reliable, continuous performance of the OEM-25B is ensured with the use of conservatively rated solid-state components and automatic power control. Plug-in modules are easily removed for replacement or repair should service be required. Only minimum maintenance is required to guarantee successful operation and endurance of your generator. When compared with vacuum tube equipment, greatly reduced DC voltages used in the OEM-25B greatly reduce potential hazards associated with servicing.

The following diagram outlines each assembly's function.



OEM-25B Overall Block Diagram

Figure 1

Documentation Conventions

Many parts of this manual refer to computer commands and data. It is important to recognize the conventions used in this manual in order to understand the meaning of these commands.

Angle Brackets	**< >**	These brackets are shown for command parameters. They are not part of the command and should not be entered.
Rounded Brackets	**( )**	These brackets contain hex equivalent numbers for printable or non-printable characters. The lower-case h (h) stands for hexadecimal.
Square Brackets	**[ ]**	These brackets indicate a symbol name for special control codes or non-printable characters. Examples of commonly used control codes are listed below.

[LF]	Line Feed	(0Ah)
[CR]	Carriage Return	(0Dh)
[ESC]	Escape	(1Bh)

This manual is divided into four chapters and an appendix. Please refer to the following descriptions to help you locate the information you need.

Chapter 1	Deals with precautionary details. Please read this section if you are unfamiliar with the OEM-25B or MKS, ENI Products' warranty procedures.
Chapter 2	Tells you how to install and power up the system for the first time.
Chapter 3	Describes operational details of the OEM-25B.
Chapter 4	Provides troubleshooting solutions to common problems in operating the OEM-25B.
Appendix A	This appendix provides complete operating specifications for the OEM-25B.

This page intentionally left blank.

Chapter 1

Safety

It is essential that the user become thoroughly familiar with the contents of this manual prior to using the OEM-25B. If used properly, the information contained in this manual not only will promote reliable product performance, but also will encourage a safe operating or service environment for all individuals.

Certain safety-related considerations must be observed before installing, operating, or servicing this equipment. Symbolic and/or textual labels and markings are used in and/or on the equipment, as well as in this product manual, to convey and/or identify such important information. Among other things, this information is provided to alert equipment operators and service personnel to hazardous conditions that may result in personal injury and/or damage to the equipment. Please look for these labels and markings and follow their direction.

1.1 Symbols

The following symbols appear in and/or on the equipment either as silk-screened markings or as part of adhesive labels.

1.1.1 Exclamation Point Within a Triangle

Symbol Definition: Caution, refer to accompanying documents.

The “exclamation point within a triangle” symbol (reference ISO Publication 3864, No. B.3.1) is used in and/or on the equipment to alert the installer, operator, or service personnel to the presence of important related installation, operation, and/or service instructions and to direct such personnel to the product manual for that information. This symbol is also used within the product manual itself to identify important instructions.

1.1.2 Lightning Bolt within a Triangle

Symbol Definition: Caution, risk of electric shock

The “lightning bolt within a triangle” symbol (reference IEC Publication 417, Symbol No. 5036, and ISO Publication 3864, No. B.3.6) is used in and/or on the equipment to alert the user, operator or service personnel to the presence of un-insulated voltage within the enclosure of sufficient magnitude to constitute a risk of electric shock. Only authorized service personnel with a schematic diagram and a thorough knowledge of the voltages existing within the equipment shall remove covers or panels bearing this symbol. This symbol is also used within the product manual itself to identify important operating and/or maintenance instructions, which, if not followed carefully, could result in personal injury or even death.

1.1.3 Non-ionizing Electromagnetic Radiation Warning Triangle

Symbol Definition: Caution, non-ionizing electromagnetic radiation

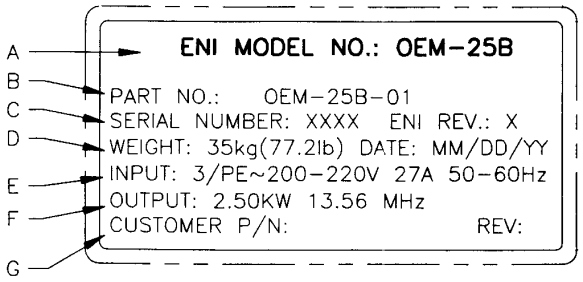
The “non-ionizing electromagnetic radiation warning triangle” symbol (reference IEC Publication 417, Symbol No. 5140, and ISO Publication 3864) is used on the equipment to alert the installer, operator, or service personnel that the equipment is capable of producing elevated, potentially dangerous, levels of non-ionizing electromagnetic radiation, particularly RF radiation.

1.2 Adhesive Labels

The following adhesive labels appear in and/or on the equipment.

1.2.1 Nameplate

This OEM-25B can be identified by an external nameplate (or serial number label) located on the unit's rear panel.



A. Manufacturer:
MKS, ENI Products
100 Highpower Road
Rochester, NY 14623-3498 USA
Model No.:
Identifies the general category of ENI products to which the unit belongs.

B. Part No.:
Identifies the top-level ENI part number that uniquely defines product construction/configuration of the unit.

C. Serial No.:
Identifies the serial number of the unit. This number (sequentially assigned as the product is manufactured) corresponds only to the individual unit bearing this label.
ENI Rev.:
Identifies the revision level of the ENI part number that appears in line "B" above.

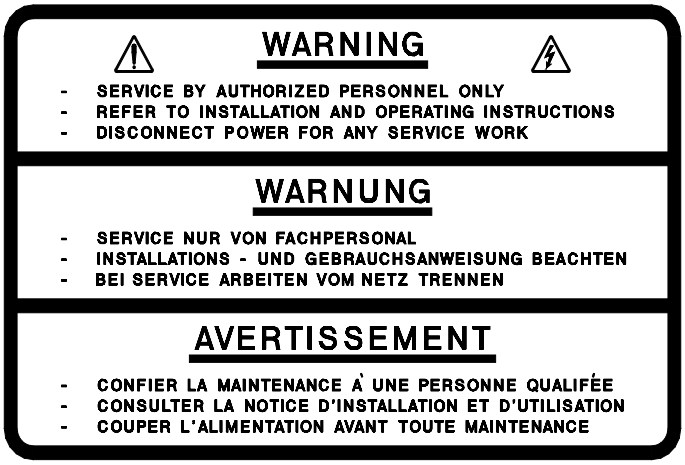
D. Weight:
Identifies the nominal weight of the unit in both kilograms and pounds.
Date:
Identifies the date of manufacture (MM/DD/YY convention) of the unit.

E. Input:
Identifies the AC input ratings (voltage, current and frequency) of the unit.

F. Output:
Identifies the RF output ratings (power and frequency) of the unit.

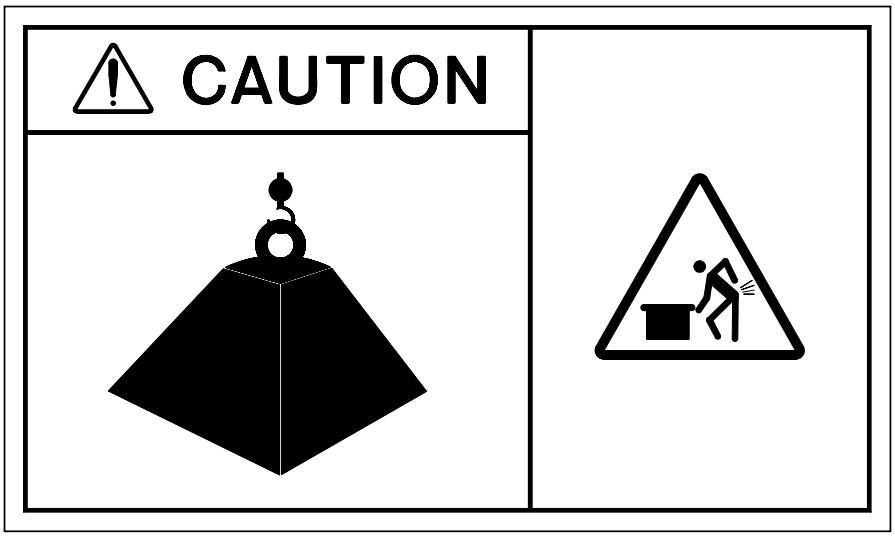
G. Customer P/N:
Identifies the customer part number that corresponds to the unit.
Rev:
Identifies the revision level of the customer part number that also appears in line "G".

1.2.2 Service Warning Label



This external label can be found centered and forward-justified on unit's top cover panel.

1.2.3 Heavy Object Warning Label



This external label can be found centered and forward-justified on unit's top cover panel, just rearward of the Service Warning Label.

1.2.4 Exclamation Point within a Triangle Label

This external label can be found on the rearward-facing surface of the metal cover that restricts access to the line-side terminals of the EMI filter.

1.2.4 Lightning Bolt within a Triangle Label

This label can be found internally (with unit's top cover panel removed) on the top surface of the clear, polycarbonate cover that restricts access to the circuit breaker terminal area and externally on the rearward facing surface of the metal cover that restricts access to the line-side terminals of the EMI filter.

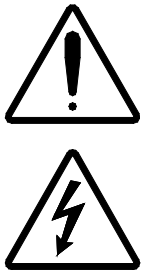
1.2.5 RF Radiation Warning Triangle Label

This external label can be found on the unit's rear panel adjacent to the RF Output port.

1.3 Silk-screened Markings

The following silk-screened markings appear in and/or on the equipment.

1.3.1 RF Output Port Warnings



This pair of external symbolic markings can be found on the unit's rear panel adjacent to the RF Output port.

Chapter 2

System Installation

2.1 Initial Inspection

2.1.1 Mechanical Inspection

If damage to the shipping carton is evident, request the carrier's agent be present when the unit is unpacked. Check for equipment damage and inspect the cabinet and panels for dents and scratches.

2.1.2 Claim for Damage

Please notify MKS, ENI Products directly or your authorized MKS, ENI Products representative if the OEM-25B is mechanically damaged or fails to meet specifications upon receipt. Retain our shipping carton and packing material for the carrier's inspection, as well as for subsequent use to return the unit should this become necessary.

2.1.3 Packaging for Reshipment

Whenever possible, the original shipping carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If a cardboard carton is used, it should be at least 200-lb. test material.

Use shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping carton. Make sure that the instrument cannot move in the container during shipping. Seal the carton with a good grade of shipping tape and mark the container: **FRAGILE! ELECTRONIC INSTRUMENT.**

Drain water before shipment.

2.2 Installation Requirements

2.2.1 Rack Mounting

The unit is provided with rack-mounting ears to allow installation in JIS standard racks. The rack must provide a shelf on which the generator rests. Front panel rack-to-ear mounting hardware must be customer supplied.

2.2.2 Cooling and Ventilation

Water Flow

Connections are provided to accept 1/4-inch NPT male pipefittings. Connect the appropriate customer-supplied fittings for the customer's water system. The unit is designed to operate normally with not less than 7.0 liters per minute. If the available process water flow is near this flow rate, the actual flow should be checked.

The OEM-25B is protected against damage caused by lack of coolant flow. However, inadequate coolant flow will result in an OVERHEAT condition and the generator will turn off its RF power until normal internal temperatures are restored.

Distilled water should be used to eliminate possible build-up of corrosion or scale inside the heat sink tubing and copper heat exchanger. Poor water conditions will reduce the electrical ruggedness of the OEM-25B by reducing the amount of cooling available to the power transistors.

If conditions exist where the water coolant temperature is below the ambient dew point temperature, MKS, ENI Products recommends that either 1.) in-line solenoid valves be installed on the water connections to the generator and be closed when generator RF has been disabled or 2.) coolant water temperature be adjusted to prevent condensation.

Follow this recommendation to prevent condensation from forming when the generator is off; failure to do so may result in extensive damage to the generator! Contact MKS, ENI Products Service for more information.

If tap water with a high mineral content is used for cooling, it may be necessary to periodically flush the unit by pumping a commercial lime- or scale-removing agent through the unit. Typically, this agent is a household or industrial product. The unit should be flushed for approximately five minutes or until the scale is totally removed. Consult the factory for further recommendations.

Ventilation

Adequate air space (2" or 5 cm) should be provided around the sides and rear of the unit for convection cooling.

2.2.3 Remote Control Connector Assembly

Each generator may be supplied with a connector that will plug into the remote control connector. The following list describes how to install this connector, if one is supplied:

1. Remove cable clamp and hood from the connector.
2. Thread the wires through the cable clamp and hood.
3. Connect wires to the connector terminals as explained in section 3.2.
4. Replace the cable clamp and hood. Tighten all screws.
5. Tighten the cable clamp screws so that the cable is held securely without any pinching.

2.3 AC Input

2.3.1 Power Source

The OEM-25B is characterized by the following nominal AC Input ratings:

3/PE ~ 200-220 V ± 10% 27 A 50-60 Hz ± 3 Hz

A corresponding three-phase, four-conductor AC power source (with reasonable current headroom) is required. As implied in the above ratings, the OEM-25B operates over a wide range of input voltages without the need to manually change transformer tap settings inside the equipment.

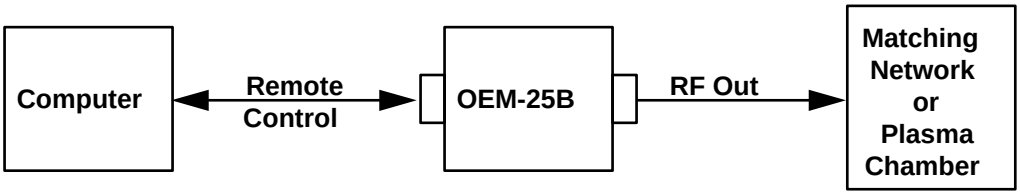
2.3.2 Power Cable

The OEM-25B comes equipped with a four-conductor, size 10 AWG AC power cord. The free end of this power cord is not terminated and must therefore be prepared by the installer for connection to the local AC power supply. For reference, the black wire, the red wire and the white wire are the three phase conductors, and the green wire serves as the protective earth (ground) conductor for the unit. The green wire must be correspondingly connected to frame ground through the AC distribution panel of the system into which the unit is installed.

If the installer properly terminates the free end of the OEM-25B power cord with a suitable plug-type connector, then the unit may be either bench mounted or permanently installed into an equipment rack. Otherwise, in order to maintain Product NRTL approval, this generator must be permanently installed into an equipment rack. In either case, the installation must also comply with the applicable local installation codes for electrical equipment.

2.4 System Interconnection

The following diagram shows the normal interconnection of an OEM-25B to a system:



The remote control connection allows a computer or external control unit to adjust and read back power via the accessories connector (see section 3.2). The RF Out connection is made to either a load (often a plasma chamber) or a matching network.

2.4.1 RF Coaxial Cable

RG-393 coaxial cable or equivalent is recommended.

2.4.2 I/O Cabling

I/O cables use subminiature D-type connectors. The following features are required to ensure that radiated emissions and electromagnetic immunity requirements are met:

1. Shielded cable (Alpha Suprashield 5110, 5120 or equivalent) must be used for I/O connections.
2. A shielded connector backshell (AMP 745171/2/3 shielded cable clamps or equivalent) must be used. The cable shield must be connected to the connector backshell.
3. The connector shell must be grounded to the equipment chassis with jackscrews or clips.

2.5 System Check

The following items should be checked before applying power for the first time:

1. Check for any physical damage that could affect safety. For instance, a dent could indicate that internal components could have shifted and could also cause a short circuit.
2. Be sure that the front panel AC power switch is in the OFF position (down).
3. Make sure the AC power cable frame-ground conductor is connected to the ground terminal of the AC input barrier strip. This terminal is internally connected to the OEM-25B chassis.
4. Ensure that the interlock circuit is closed at the accessories connector, located on the rear panel. If an interlock circuit is not being used, the interlock can be satisfied by plugging a connector in with Pins 3 and 21 jumpered together (see section 3.2.3).
5. Connect the output of the power generator to a suitable 2500 W, 50Ω load.
6. Finally, check all cables, making sure that they are correctly installed and firmly inserted.

2.6 Initial Turn-on Procedure

The following procedure outlines how the OEM-25B should react as power is applied for the first time.

1. Ensure that proper coolant flow has been established. Connect the RF output to a 50Ω dummy load.
2. Turn on the AC line switch. The front panel display should be illuminated and the status should be normal, indicating that there are no faults. The internal cooling fans should be operating. Forward and reverse fields of the display should read “0.” The set field should indicate the command power level.
3. Turn on RF power. The RF On light should be on. The status should be normal, indicating that there are no faults. The forward meter field should closely agree with the set field.
4. Use the set point buttons to obtain at least 2500 W of forward power. MAX POWER may be indicated at 2500 W or less if there is appreciable reflected power from the RF load. This is normal.
5. Select load leveling. The display will switch to the LOAD field and should read the same as when forward leveling is selected.
6. Reselect forward leveling and turn off RF power.
7. Disconnect the OEM-25B output connector from the 50Ω load and turn on RF power. Observe that, when in forward leveling mode, the reverse meter reading should be 500 W and the forward meter should agree closely. MAX REVERSE should be indicated, showing that the OEM-25B is being limited by the internal protection circuit and is no longer controlled by the front panel set point buttons.
8. Use the set point buttons to reduce the output power below 500 W. The MAX POWER indication should be removed as normal power control and leveling is restored.
9. Use the set point buttons to reduce the output power to zero. There should be no power reading. Turn off the AC line switch.
10. The initial test is now complete.

This page intentionally left blank.

Chapter 3

OEM-25B Operation

3.1 Front Panel

Please refer to the Mounting & Outline Drawing in the rear of this manual.

3.1.1 Vacuum Fluorescent Display

The OEM-25B display consists of two lines of 20 dot-matrix characters that are used to display the present operating status of the generator. Each field in the display is grouped by a front panel marking to indicate its purpose.

- The **Forward** field displays the generator's forward power when the leveling mode is set to forward leveling.
- The **Load** field displays the generator's load power when the leveling mode is set to load leveling.
- The **Reverse** field displays the generator's reverse power.
- The **Status** field indicates either:
    - The operating status of the generator.
    - The error status if a fault has occurred.
- The **Set Point** field shows the currently selected power set point that is used when generator RF output is enabled (with RF ON button).
- The following LEDs provide annunciation of specific generator settings:
    - Remote Enable (in button)
    - RF On
    - Fault
    - Remote

3.1.2 Controls

The front panel incorporates six momentary push buttons for control of the generator and one switch for power on/off.

- The **Remote Enable** button is used to enable remote control via the analog remote control connector. If remote enable is selected, the "Remote" input selects whether control is by the front panel or the remote interface signals.
- The **FWD Load Leveling** button selects between load and forward power leveling.
- The **RF On** button allows the power to be toggled between zero and the power set point.
- The **Fault Reset** button allows faults to be reset if the generator is now in an operational state. Also, pressing this button will cause RF to be turned off.
- The **Set Power** buttons allow the output power to be ramped up and down between zero and 2500 W.
- The **Main Breaker** allows the AC power to the generator to be protected and switched on and off.

3.2 Back Panel

Please refer to the Mounting & Outline Drawing in the rear of this manual. The back of the OEM-25B contains

- One terminal block for AC power input
- One connector for RF output
- Two connectors for analog and digital remote control
- One pair of water fittings for cooling water
- One fan

Descriptive text on each of these connections is presented throughout the remainder of this section.

3.2.1 RF Output Connector

The RF output of the generator is delivered through this “HN” connector. The "Caution High RF Voltage" indicates that an AC potential of up to 500 V may appear between the center pin of the connector and ground. Normal caution should be exercised when working with these voltages.

3.2.2 Water Input/Output Connectors

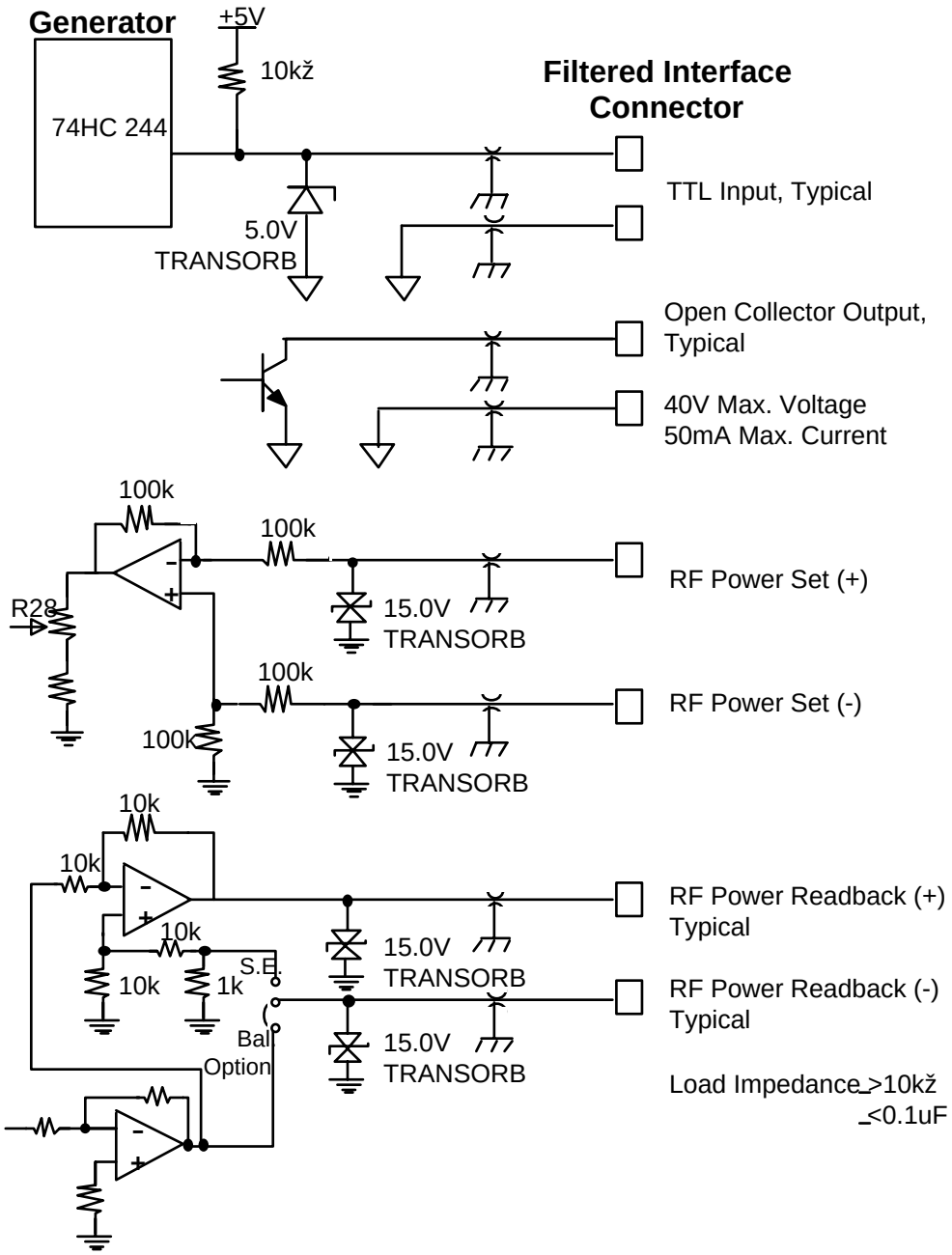
The water inlet and outlet connectors are provided for attachment of a water-cooling system having a minimum flow rate of 7.0 liters per minute. The connections provided accept a 1/4-inch male (NPT) pipe thread. The water inlet temperature must not exceed +35°C.

3.2.3 Analog Remote Control Connector

Connector P3 allows remote control and monitoring of the OEM-25B generator functions, using analog control voltages and TTL/Open collector logic signals.

Note: *A differential-output option is internally jumper-selectable on the interface board. If selected, the negative-going output should not be ground-referenced. For those systems that ground the negative output, the single-ended output option must be selected. P10 selects the forward-output option while P11 selects the reverse-output option.*

Consult table 3.2.3 for a complete description of each pin's function.



Analog Remote Control

Figure 3.2.3a

Pin	Function	Description
1	+5 V Pull-Up	+5 V supply with 100Ω internal resistor. This is used to power LEDs in a remote test box.
2 **20**	RF On Input	This TTL input allows RF to be turned on and off when the generator is in remote mode. A logic low is required to turn RF on. Pin 2 is the input; Pin 20 is the ground reference.
3 **21**	Interlock OK Input	This TTL input must be low to allow RF to be turned on. Pin 3 is the input; Pin 21 is the ground reference.
4 **22**	Alarm Reset Input	This TTL input allows generator faults to be reset if the generator is in remote mode and the generator is now in an operational state. A falling edge held low for a minimum of 50ms is required to cause a reset. Pin 4 is the input; Pin 22 is the ground reference.
5 **23**	Remote Input	This TTL input puts the generator in remote mode if the front panel has "remote enable" selected. A logic low selects remote mode. Pin 5 is the input; Pin 23 is the ground reference.
6 **24**	Load-Leveling Input	This TTL input is used if option jumpers P8 and P9 are installed on the interface board. If in remote mode, a TTL logic low places the generator in load leveling mode. Pin 6 is the input; Pin 24 is the ground reference.
8 **26**	Power On Readback Output	This open collector output indicates that power is on when Pin 8 is active low. Pin 26 is the ground reference.
9 **27**	RF On Readback Output	This open collector output indicates that RF is on when Pin 9 is active low. Pin 27 is the ground reference.
10 **28**	Remote Readback Output	This open collector output indicates that the generator is in remote mode when Pin 10 is active low. Pin 28 is the ground reference.
11 **29**	Alarm Readback Output	This open collector output indicates that the generator is in a faulted inactive state when Pin 11 is open. Pin 29 is the ground reference. Active low indicates a normal condition.
14 **32**	RF Power Set Input	This analog input allows control of the generator output when the generator is in remote mode. The input is scaled so that a differential value of 10 V causes an output power of 2500 W. Pin 14 is the positive-going input and Pin 32 is the negative-going input of a differential amplifier.
16 **34**	Forward Power Readback Output	This analog output indicates the forward power of the generator. The output is scaled so that a differential output of 10 V represents a Forward Power of 2500 W. Pin 16 is the positive going output and Pin 34 is the negative going output. See note at the beginning of this section for P10.
17 **35**	Reverse Power Readback Output	This analog output indicates the reverse power of the generator. The output is scaled so that a differential output of 10V represents a reverse power of 500W. Pin 17 is the positive going output and Pin 35 is the negative going output. See note at the beginning of this section for P11.

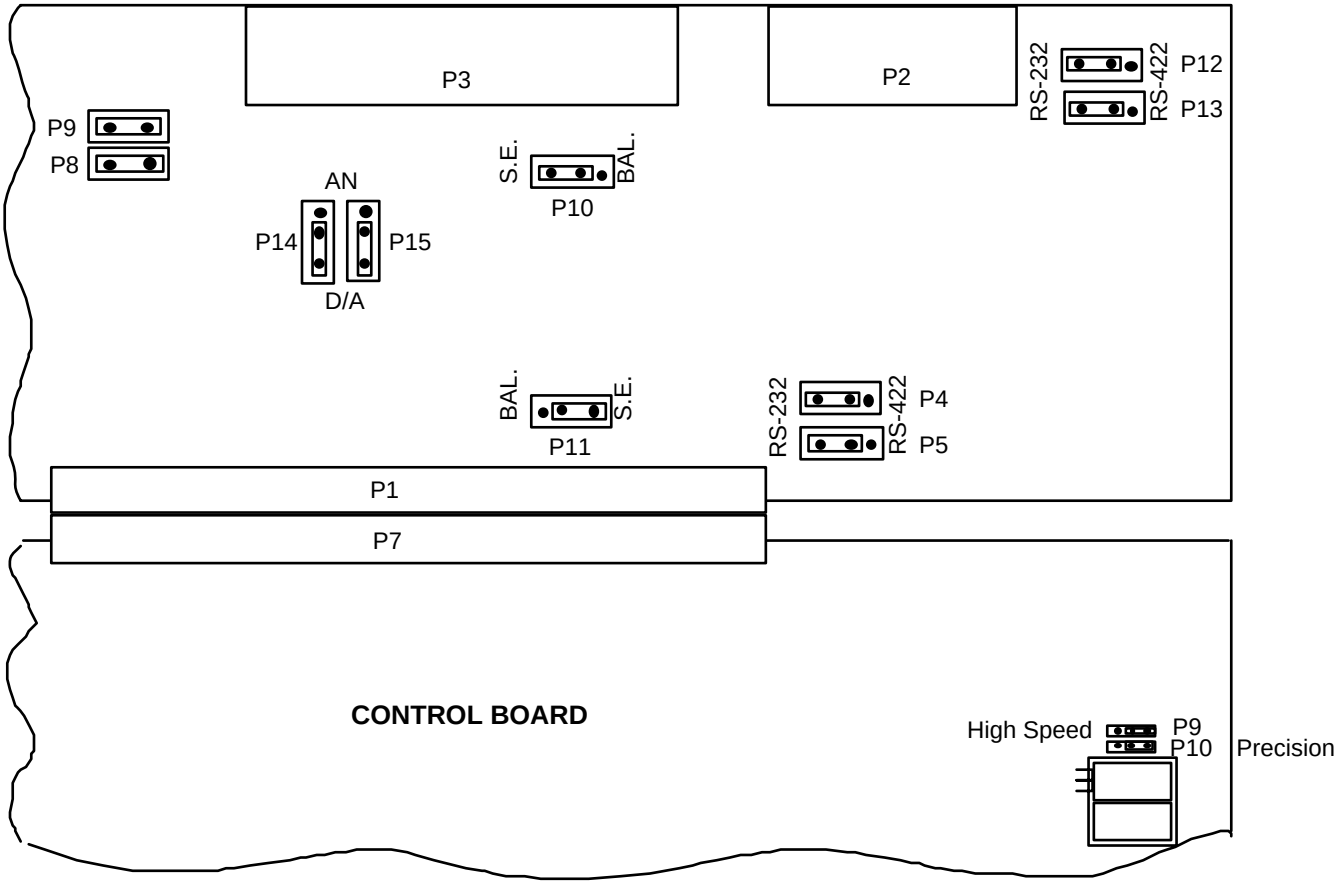
Note: *No Connection on Pins 7, 12, 13, 15, 18, 19, 25, 30, 31, 33, and 36.*

Analog Remote Control Connector

Table 3.2.3

Analog Remote Configuration Options

Jumper plugs are provided on the interface board for configuring the analog outputs as either single-ended ground-referenced or balanced outputs. If the RF power readback (-) lines are to be grounded, place shorting jumpers on the pins located next to the S.E. label as shown in the following diagram.



Analog Remote Configuration Options

Figure 3.2.3b

Analog Readback Voltage Options

Option jumpers are also provided on the control board for selection of high-speed analog readback or digitally compensated analog readback voltages. Position shorting bars are at control board P9 and P10 as shown in the above diagram. Shorting pins nearest the P9 and P10 labels provide analog output voltages with digitally corrected accuracy.

Remote Load Leveling Selection

An option jumper may be installed at P8 to allow remote control over selection of generator load power-leveling mode of operation. If remote load power selection is desired, short the pins of P8 together.

3.2.4 Digital Remote Control Connector

The serial interface provides control and monitoring of the OEM-25B using standard RS-232 or RS-422 voltage levels in a 7- or 8-bit serial packet. The interface also supports parity and either 1 or 2 stop bits. Data rates may be up to 19.2 kbaud. The available selections are defined in the section entitled "Serial Remote Control Selections."

Pin 1	Tx -	Pin 6	CTS -
Pin 2	Tx +	Pin 7	CTS +
Pin 3	Rx +	Pin 8	RTS +
Pin 4	Rx -	Pin 9	RTS -
Pin 5	GND		

P2 Digital Interface

Table 3.2.4a

Hardware Configuration

RS-232 or RS-422 operation is selected by the position of four three-pin jumpers on the interface board (P4, P5, P12, P13).

Figure 3.2.3b shows the jumpers configured for RS-232 operation.

RS-422 operation is selected by moving the jumpers so that the right-most two pins are shorted. A standard, 9-way female “D” connector provides the electrical connection as defined below:

Pin	Function	Description
1	**Tx Data -**	This pin is the minus (-) side of the RS-422 Tx data output.
2	**TX Data +**	This pin provides either the plus (+) side of the RS-422 TX data output or the RS-232 Tx data output, depending on jumper P13's position.
3	**Rx Data +**	This pin provides either the plus (+) side of the RS-422 Rx data input or the RS-232 Rx data input, depending on jumper P4's position.
4	**Rx Data**	This pin is the minus (-) side of the RS-422 Rx data input.
5	**Digital Ground**	This pin is connected to the digital ground of the controller.
6	**CTS -**	This pin is the minus (-) side of the RS-422 CTS signal input.
7	**CTS +**	This pin provides either the plus (+) side of the RS-422 CTS signal input or the RS-232 CTS signal input, depending on jumper P5's position.
8	**RTS +**	This pin provides either the plus (+) side of the RS-422 RTS signal output or the RS-232 RTS signal output, depending on jumper P12's position.
9	**RTS -**	This pin is the minus (-) side of the RS-422 RTS signal input.

RS-422 Pin-out Configuration

Table 3.2.4b

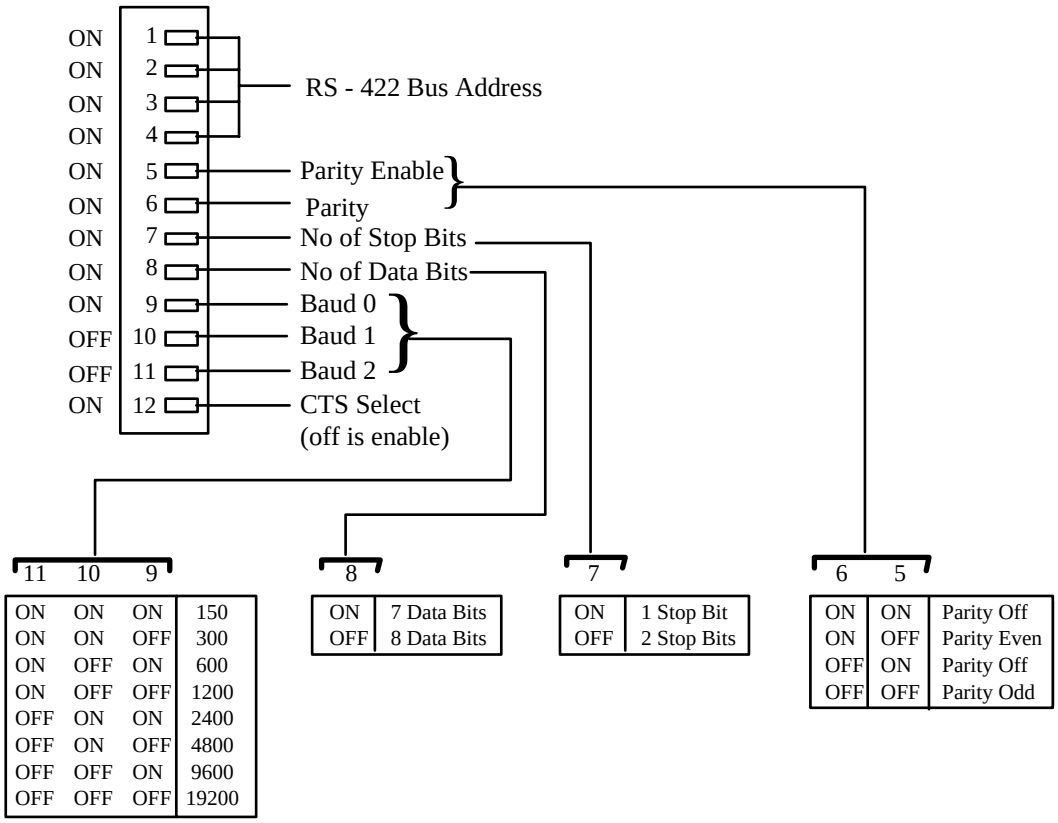
Serial Remote Control Selections

The CPU card contains one 12-way DIP switch that selects the function of the serial interface. The first four positions select the serial bus address and the remaining eight positions select baud rate and serial data format.

The DIP switch is only read when the power is turned on. It is necessary to remove and reapply power before the new setting is used by the controller. Note, the following serial configurations are not available:

- RX of 7 data, 1 stop, no parity
- TX of 8 data, 2 stop, parity

The DIP switches are configured as follows:



Serial Remote Control Selections

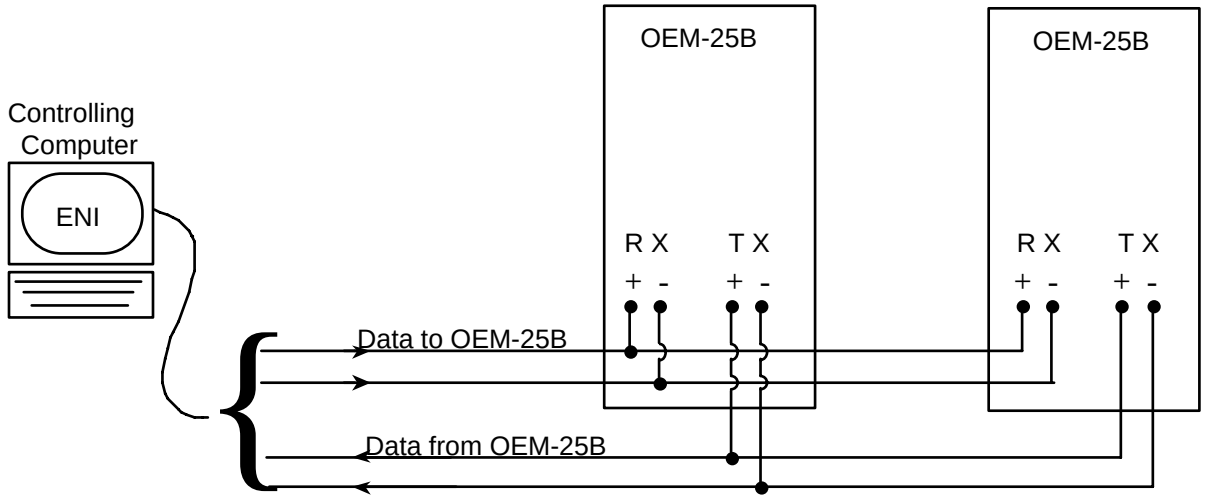
Figure 3.2.4a

When a switch is set to the ON condition (marked on switch package) the logic level is “0.” For instance, to set the RS-422 bus address to 5, turn **on** switches 2 and 4 and turn **off** switches 1 and 3. This generates the code 0101 or 5 in hexadecimal format.

Verify that the bus address is set to **0000** for RS-232 operation.

RS-422 Busing

One controlling computer or terminal can be connected to more than one OEM-25B generator by connecting RS-422 **receive** and **transmit** data lines in parallel as shown in the following diagram.



RS-422 Busing

Figure 3.2.4b

When this mode of operation is used, it is necessary to use the IDE command and link release character as described in the sections entitled "Basic Monitor Commands" and "Link Release Character."

3.2.5 Communication Protocol

Data is transferred to and from the CPU using a simple ASCII protocol that functions with a standard terminal.

All commands are composed of three ASCII characters followed by numbers, where applicable, and terminated by a carriage return. All three command characters must be correct for a command to be accepted. Since all characters including the watchdog character are echoed, the main controller can check that commands were correctly received by comparing the echoed characters with what was sent.

Commands containing numerical fields will only be accepted if the numerical portion is in a specified range.

Upon receipt of a carriage return (0D), the controller returns a carriage return and a line feed (0A) so that the terminal screen is correctly formatted. In addition, an asterisk (*) is used to indicate that the command has been accepted and executed. If a bad command is received, a question mark (?) and bell character (07) are returned instead. The response is ordered as follows:

[CR] [LF] [*]
or [CR] [LF] [BELL] [?]

The protocol always returns one of these two responses after command execution. In addition, there are no unprompted responses with the exception of the power-up message.

The following commands illustrate the types of messages that are available and accompanying formats:

HEL	**n**	Causes a help screen to print. The required screen number is n.
RFV		Causes a 16-bit fault vector to be reported, showing the system's health.
RUT		Causes total on time of the unit to be reported.

Space Characters

To allow screen formatting, space characters (20) are ignored. However, when received, they are returned on the serial link in the same way as any other character.

Illegal Commands

Unrecognized commands or out-of-range numerical values are ignored and annunciated by the return of a question mark character and a bell character. The same response occurs if the limits of the line buffer are exceeded (16 characters).

Note: *A carriage return on its own is a valid command that does nothing (no operation).*

Leading Zeros

The numerical part of the field sent by the terminal need not contain leading zeros although leading zeros will be echoed and accepted if they are sent. If a numerical field is empty, it is assumed to be zero.

Special Characters

Five characters have a special purpose and are the only characters not echoed on the serial link. The escape character allows the operator to break out of continuous loops. The control W character (^W) is used to maintain link integrity. The exclamation mark (!) is used to cause an immediate release of the RS-422 buffer if two consecutive exclamation marks are received in a row. The XON and XOFF characters (^Q and ^S) allow flow control out of the transmit serial port.

Link Integrity

This function is disabled when power is applied.

Upon receipt of the first ^W character, the link integrity function is enabled and a ^W must be received at the rate of one per second (or less). Otherwise, a link integrity fault will be generated and power output will be disabled.

Power-up Message

Power up is annunciated by a message terminated by a special prompt, an asterisk enclosed in curly brackets {*}. This is the only time that this prompt is used. Therefore, a controlling computer can use this to see that a unit has been powered up. The complete power-up string is as follows:

[CR] [LF] [message string] [CR] [LF] [BELL] [{] [*] [}]

Backspace Characters

Backspace or delete characters (ASCII 08 or 7F) allow limited editing. When one of these characters is received, the last character in the line buffer is deleted and the following three characters are returned:

[BS] [SPACE] [BS]

This ensures that a terminal screen backspaces its cursor and removes the last character.

Escape from Indefinite Loops

Some commands continue indefinitely, for example, the DOS command when used with the dash option. The escape character is used to exit from this condition. Upon receipt of the escape character, the controller will terminate the loop and respond with the standard command completion string:

[CR] [LF] [*]

Link Release Character

When two exclamation marks are received immediately after one another, the controller instantly tri-states the RS-422 output. Collisions are thus avoided on the RS-422 bus if multiple controllers are being used. The correct way to switch from one controller to another is to execute a link release (!!) and then use the IDE command to select the new controller. The IDE command will work on its own, but will occasionally suffer from a collision when the old controller does not release before the new controller takes over.

XON and XOFF

When XOFF is received (control S), transmission of serial data is halted. When XON is received (control Q), transmission of serial data is restarted.

3.2.6 User Commands

OEM-25B specific user commands are grouped into the following four categories:

Commands:

- Basic Monitor
- Readback
- Direct Control
- Level A Extra

Basic Monitor Commands

The basic monitor commands allow the user limited access to the controller software. They are intended for servicing and fault finding.

Command	Syntax	Description
HEL	<n>	Decimal values of n from 0 to 9 display each of the ten possible help screens. Values between A and F will show help screen 0. Values greater than sixteen show help screen 0.
CHK	<Addr> - <Addr>	This command calculates the checksum of the program memory range specified. The address may be in the range 0 to FFFF. The checksum is a simple additive type where each byte in the specified range is added to the next. If a range 0-FFFD is specified, the least significant two bytes will be the same as the internal checksum of the EPROM stored in locations FFFE and FFFF.
IDE	<Ident>	The Ident may have values from 0-255. However, the controller can only be enabled with values of 0-15 since it only has four switches for address selection. All other values will cause the controller to be disabled. This command works in association with the ident DIP switch. When the ident in the command is the same as the ident on the DIP switch, it is possible to communicate with the controller. If the idents do not match, communication is disabled. This command is designed to work with the RS-422 port only since the output buffer can be tri-stated, allowing a bus to be formed with multiple generators and/or MATCHWORKS®. The RS-232 port cannot be tri-stated.

Basic Monitor Commands

Table 3.2.6a

See also, Link Release Character in Section 3.2.5, and RS-422 busing in Section 3.2.4.

Readback Commands

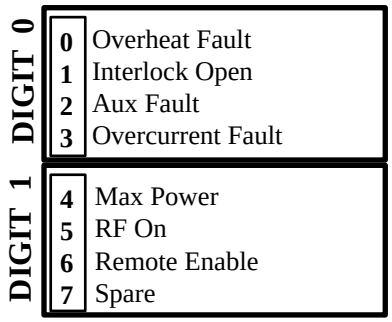
The following commands are known as passive commands. They simply read back a value or status.

Command	Syntax	Description
ACT	<->	Returns three power readback values and the system status vector in the following format: (Forward Power)(Reverse Power)(Load Power)(Status Vector) Data will be read back continuously if the optional dash is used until the escape character is received.
REP	<->	Prints out the Name, Date, and Serial Number information for the controller and tuner unit.
ROF		Returns the metered forward power in watts using decimal format.
ROL		Returns the metered load power in watts using decimal format.
ROR		Returns the metered reverse power in watts using decimal format.
ROT		Returns the number of hours that the OEM-25B has had RF turned on.
RSE		Allows the power set point loaded by the OEM command to be read back for verification purposes.
RUT		Returns the total time in hours that the OEM-25B has been turned on.
RVE		Returns the version number of the software. Numbers in front of the decimal point denote a major software revision while numbers after the decimal point denote a minor software revision.
RFV	<=>	Returns a 16-bit value called the fault vector and is formatted as four hexadecimal digits. RFV <=> lists all errors in a word format so that interpretation of hexadecimal is not necessary if the equal option is used. Bits in the fault vector are positioned as follows: **DIGIT 0** **0** Overheat Fault **1** Interlock Open **2** Aux Fault **3** Overcurrent Fault **DIGIT 1** **4** Max Reverse Power Fault **5** Max Forward Power Fault **6** PSU Fault **7** RF Metering Cable Break **DIGIT 2** **8** Internal (80C552) RAM Fault **9** External RAM Fault **A** Code ROM Fault **B** Spare **DIGIT 3** **F** Spare **E** Spare **D** IIC Fault **C** Watchdog Timeout Fault

Readback Commands

Table 3.2.6b

Command	Syntax	Description
RPS		Returns the generator status and is formatted with four ASCII hexadecimal digits. The four digits represent 8 status bits as follows:



Readback Commands (Cont'd.)

Table 3.2.6b

Direct Control Commands

The following commands cause an immediate change to the system. Please note the following before employing any command:

1. The controller will respond with a question mark for the following commands when an out-of-range value is specified.
2. In-range values will be responded to with an asterisk (*) when the command has been successfully completed.
3. Excluding the BUT <b> command, each command is inoperative when the generator is in remote mode (remote lamp lit). Read BUT <n> carefully to ascertain its unique difference in command response format.

Command	Syntax	Description
REM	<Switch>	Allows selection of the analog or digital remote control when remote operation is enabled (REM 0 for analog, REM 1 for digital (serial)). Note that the following commands will only function if REM 1 has been used with remote enabled: OEM, OFF, TRG, LLT
LIT		Disables the link integrity function. See section 3.2.4.
OEM	<Power>	Allows the power set point to be changed. The power is entered in decimal watts between 0 and 2500.
OFF		Turns RF power off.
TRG		Turns RF power on at the power level selected by the OEM command.
LLT	<Type>	Allows either load leveling or forward leveling to be selected. A type of 0 selects forward leveling and a type of 1 selects load leveling.
BUT	<n>	Does the same as the front panel buttons. The value “n” selects the button to be pressed while 1 selects the top left button, 2 selects the button below it, 3 selects the next top left button over and so on. If the generator is in remote mode (remote lamp lit) the command only allows the remote enable button to be activated. This command always returns a * for valid buttons, irrespective of remote mode.
FRE		Causes all fault status bits in the system to be cleared as long as the actual faults have cleared.

Direct Control Commands

Table 3.2.6c

Remember, if any of the above commands are selected, a **?** is returned to indicate out-of-range value errors, while an ***** denotes in-range values and the successful completion of any command.

Level A Extra Commands

The following commands are available after using the KEY **<code>** command. If the correct code is entered (code available for factory), these commands may be used until power is removed and reapplied or an invalid key code is entered.

Command	Syntax	Description
CAL		This command allows calibration of the MAX thresholds, metering, and front panel set point control. When CAL is typed, a menu is displayed.
FFI		This command allows faultfinding within the generator. Typing FFI displays the menu.
XRT		This command tests the external RAM. If the RAM is good, a message of [PASS] is returned; if the RAM is bad, a message of [FAIL] is returned.

Level A Extra Commands
Table 3.2.6d

Chapter 4

Troubleshooting

Refer to this simplified table should you believe that the OEM-25B is not functioning properly. This table is an itemized listing of the most frequent type difficulty anyone might encounter while operating the OEM-25B.

The first step in isolating a malfunction is to review the conditions under which the symptoms were observed. Unplug any rear panel interface connectors. Determine that the problem was not due to external cabling or abnormal line voltages. If the equipment is being operated by remote control, verify that proper commands are being received by the OEM-25B. After the problem has been definitely attributed to the OEM-25B, refer to the Troubleshooting Guide. Note that many of the circuits can be checked without the application of RF Power. A systematic fault-localizing procedure is mandatory for rapid troubleshooting. When the problem has been isolated to a particular circuit, refer to **Chapter S1, Technical Description** in the Service Manual as well as to the appropriate schematic for an explanation of the circuit.

Symptoms	Probable Cause	Recommendations
Vacuum fluorescent display does not light.	Defective line cord or AC wiring.	Verify proper AC voltage at rear panel line terminals.
	Cable to front panel display disconnected or HK supply AC cable disconnected.	Check cable connections.
	Blown HK supply fuse.	Replace fuse; verify proper HK supply operation. DSI LED should be lit.
	Defective circuit breaker.	Test circuit breaker. Replace if necessary.
	Cabinet interlock switch activated.	Ensure top cover is fastened in place. Alternately defeat interlock switch by pulling up on plunger until it clicks.
Vacuum fluorescent display lights but no power-up message appears.	EPROM not installed correctly.	Check EPROM to ensure correct installation with Pin 1 properly oriented and no pins bent.
	Micro-controller not powering up properly or I^2C bus problem.	Check +5 V supply at ICs on board. Check ALE for activity. Check SCL, SDA lines for activity or +5 V on these lines.
INTERLOCK OPEN	Rear panel interlock circuit open.	Check connections at analog interface connector.
RF OVERHEAT	PAI monitor cable disconnected.	Reattach cable. Verify thermal switch plug attached.
	Reduced coolant flow or high coolant temperature.	Check system water flow per section 2.2.2 in this manual.
		Perform procedure for locating faulty RF module per section S2.3.1.2 in Service Manual.
	High reflected power.	Check external tuner or load for proper operation.
METER FAULT	Directional coupler detector to control board cable disconnected.	Reattach cable to “D” connectors at directional coupler and at control board.

Symptoms	Probable Cause	Recommendations
MAX CURRENT	High VSWR Load.	Check MATCHWORK® tuning and reflected power level. Correct load problems.
	Loss of PA transistor.	Check each PA current using FFI routine. Replace defective transistor.
	Loss of power supply regulation.	Check PSU output voltage if less than 39 VDC. Check AC line voltage. If above 180 VAC, troubleshoot power supply.
	MAX current calibration.	Check trim voltage level on control board comparator input. Compare to voltages expected.
MAX REVERSE	High VSWR Load.	Check MATCHWORK tuning and reflected power level. Correct load problems.
PSU OVERHEAT	Defective internal fan.	Ensure fan rotor spins freely. Verify that fan power is OK. Replace fan.
	PSU temperature signal open or short.	Verify continuity of cable and expected voltages at control board.
PSU FAULT	Interface board test jumper at P7 in service position.	Be sure jumper is in normal position after service.
	Short circuit failure of RF amplifier or P. S. output.	Isolate short circuit and repair.
	Short circuit on +40 V line.	Isolate short to PA modules of power supply by disconnecting supply wires at output studs. If short in supply, disassemble and isolate short. Check diodes on output rectifier card by measuring (at transformer) the secondary connections.
PSU VOLT FAULT	Controller detects main supply voltage is out-of-range.	Troubleshoot fiber-optic cables and controller shut-down line. Check FFI 3.
WATCHDOG FAULT	Failure of control board digital hardware.	Troubleshoot or replace control board assembly. Recalibrate unit.
Incorrect front panel meter reading.	Improper calibration of the meter or the VSWR Bridge.	Perform adjustment per sections S2.3.1.4 and S2.3.2 in the Service Manual.

Symptoms	Probable Cause	Recommendations
Low RF output.	Defective RF amplifier. Loss of power supply regulation.	Perform procedure for locating a faulty RF module per section S2.3.1.2 in the Service Manual. Check PSU output voltage. If less than 39 VDC, check AC line voltage. If above 180 VAC, troubleshoot power supply.
No RF output.	RF interlock or RF OFF command.	Check field of VF display and LED status indicators. Fault LED should be OFF; RF on LED should be ON. VFD should show "normal." Press FAULT RESET button and press RF ON button.
	RF interface cables left unconnected during maintenance.	Verify connections of RF coaxial cables at output connector--from the interface assembly P6 to the RF driver assembly J1; from the RF driver assembly output jack(s) J2 (J3) to the PA module input (s) J1 and the PA module output J2 to the combiner assembly (or low-pass filter assembly).
	Main power supplies inoperative or no RF drive.	With an external terminal, perform faultfinding routine. FFI 2 displays PA module current draw. 12-13 A is normal for full RF output. FFI 3 displays power supply output voltage measured at PA modules. 40 V ±2 V is normal with RF ON. 0V is normal with RF off.
	Defective output cable.	Visually inspect cable at output connector. Measure cable with ohmmeter.

Appendix A

OEM-25B Specifications

The following appendix lists complete physical and operation specifications for the OEM-25B.

OEM-25B Specifications

RF Output:

Frequency	13.56 MHz
Frequency Stability	± 0.005%
Impedance	50 Ω
Connector	Type 'HN'
Power Rating	2500 W into a 50 Ω load
Regulation Modes	Forward Power, Load Power
Set Point Range	0 - 2500 W (via Front Panel Controls) 0 - 2750 W (via ANALOG REMOTE Interface) 0 - 2500 W (via DIGITAL REMOTE Interface)
Regulation Tolerance (within power foldback limits; reference ENI Power Standard)	1:1 ≤ Load VSWR ≤ 3:1 ±2 % (for 200 W ≤ set point ≤2750 W) ±4 W (for set point <200 W)
Harmonic Distortion	< -55 dBc
Line Related Noise	< -55 dBc (at rated power)
Non-Harmonic Spurious	< -60 dBc
AC Line-to-Power Regulation	± 0.5% (for any line voltage change within ratings)
Power Output Meter	0 – 3000 W digital display with an accuracy of ±2% of power output. Simultaneous forward & reverse or load & reverse power indications.
Automatic FWD/LOAD Power LEVELING	2 W to maximum power output operating into any load within power foldback limits, locally or remotely controlled.
Power Foldback Protection	Automatic; occurs when reverse power reaches 500 W or power amplifier current exceeds preset limit.

Pulsed Operation	Rise time is less than 3.0 ms; RF output may be controlled simultaneously for amplitude and pulse width by pulsing the RF power set point.
Load Mismatch Tolerance	The units will operate continuously into any load mismatch without oscillation or failure.

AC Input:

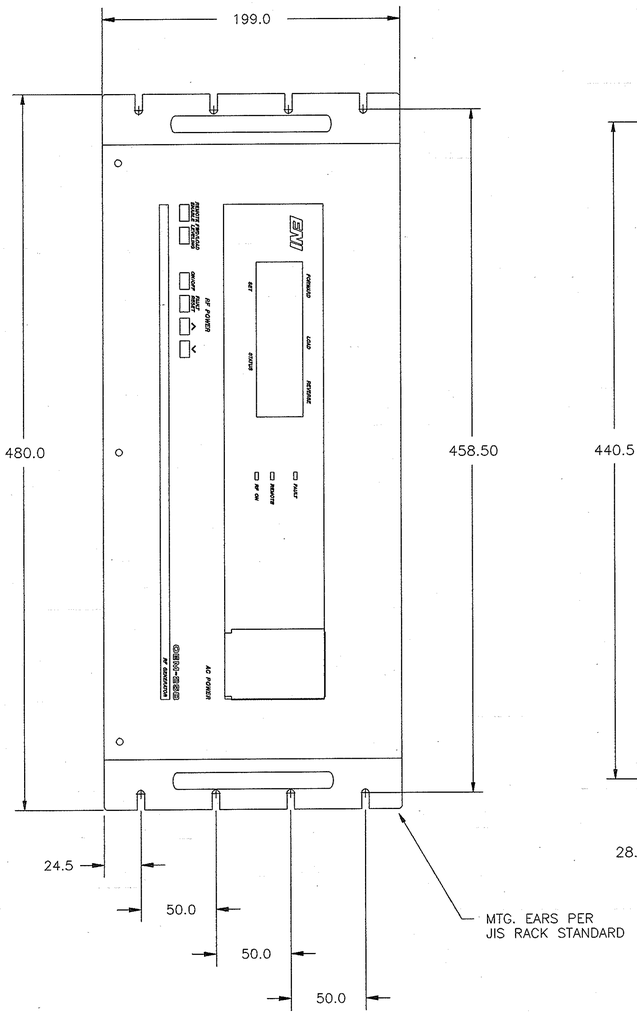
Ratings	3/PE ~, 200 - 220 V ± 10% 27 A, 50 - 60 Hz ±3 Hz (No tap selection necessary)
Connection	10 AWG, 4-Conductor AC power cord with no plug and no terminations. The green wire is connected to the generator chassis and serves as the Protective Earth (Ground) conductor for the unit. This conductor must be correspondingly connected to frame ground through the AC distribution panel of the system. Refer to Section 2.3 *AC Input* for further details.
DIGITAL REMOTE Interface	9-pin "D" subminiature type RFI suppression receptacle.
ANALOG REMOTE Interface	36-pin miniature-ribbon type RFI suppression receptacle, per customer requirement.
External RF ON/OFF Control	HCTTL-compatible; closure to ground activates RF ON.

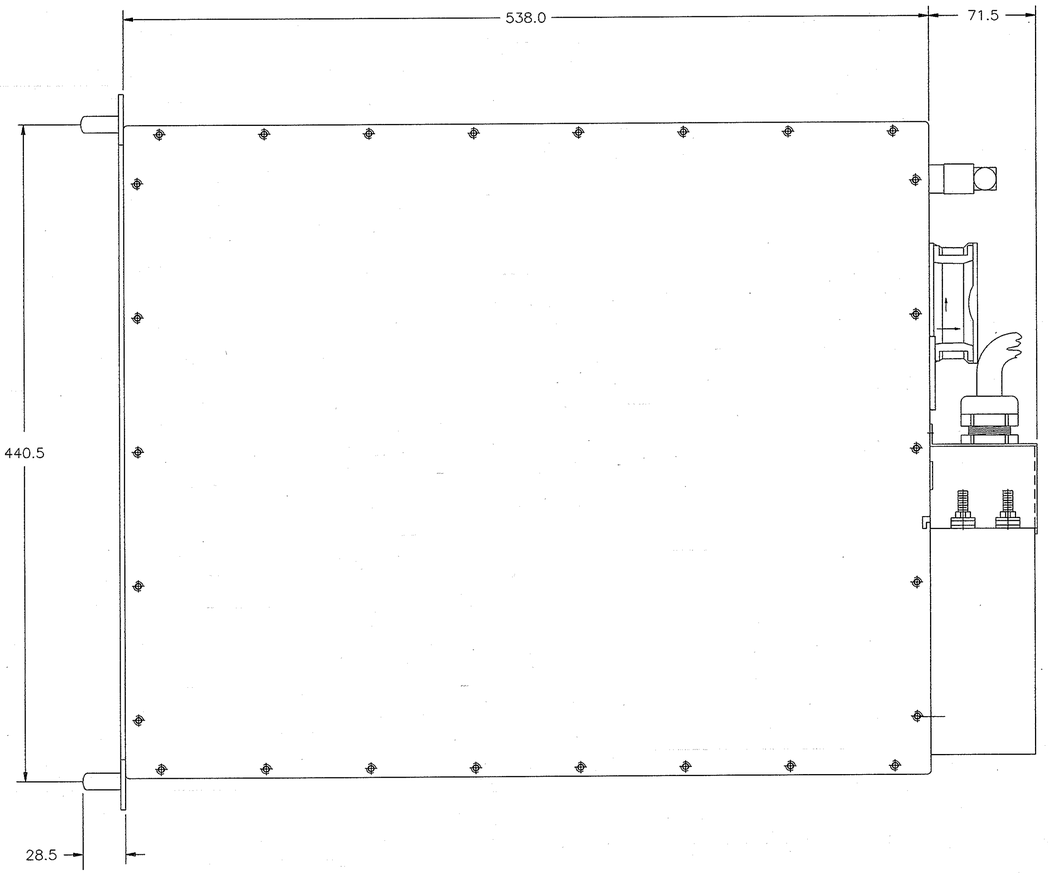
Forward Power Control (Analog Remote)	250 W/V factory calibration (i.e., 10 V = 2500 W)
Maximum RF Power Indicator	Enunciated in STATUS field on VF DISPLAY.
RF Power ON Signal	Open collector, transistor output; external pull-up voltage, 30 V maximum.
Reverse RF Power Indicator	Reading within 1 - 500 W range; 50 W/V factory calibration (i.e., 10 V = 500 W); Accuracy: ± (2% of reading + 10 W)
Forward RF Power Indicator	Reading within 1 – 3000 W range; 250 W/V factory calibration (i.e., 10 V = 2500 W); Accuracy: ± 2 % (200 W ≤ set point ≤2625 W) ± 4 W (set point < 200 W)
Maximum Operating Altitude	2000 m (6562 ft.) above sea-level
Cooling System	Combination of water-cooling and forced-air cooling.
Cooling Water:	
Inlet Temperature Rating	5 - 35 °C (41 - 95 °F)
Pressure Maximum	480 kPa (70 PSI)
Flow Rate Minimum	7.0 ltr/min. (1.8 gal./min.)
Connections	Accept ¼" male (NPT) pipe thread
External Ambient Air:	
Temperature Rating	5 - 40 °C (41 - 104 °F)
Relative Humidity Rating	80% RH (max.) at up to 31 °C (88 °F), de-rated linearly to 50% RH (max.) at 40 °C (104 °F)
Installation (Overvoltage) Category	INSTALLATION CATEGORY II: Local level, appliances, portable equipment, etc., with smaller transient overvoltages than distribution level and fixed equipment.

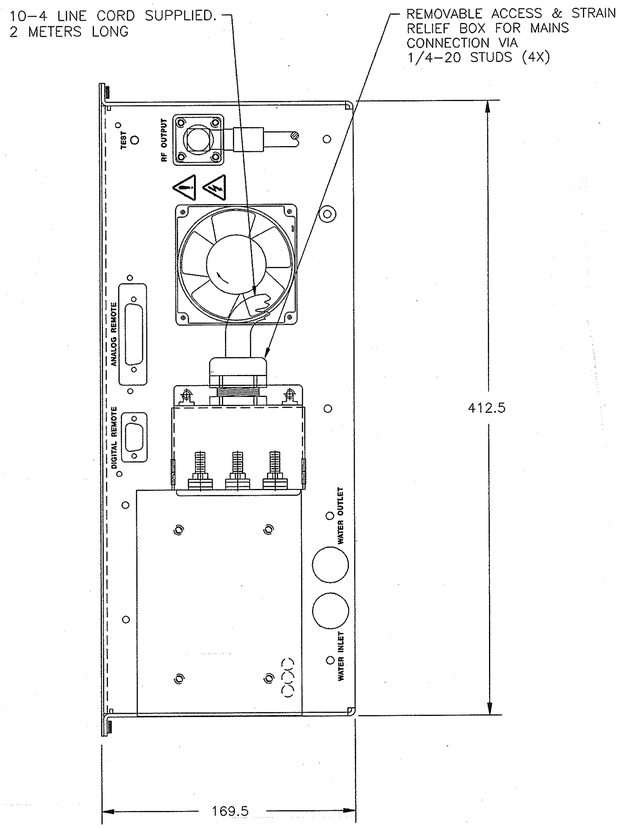
Pollution Degree	POLLUTION DEGREE 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
Product Safety	NRTL Listed to standards CAN/CSA C22.2 No. 1010.1-92 Category 290 EN 61010-1 : 1993 / A2 : 1995 Category 387 UL 3111-1 : 1994 Category 435
Dimensions (H x W x D)	200 mm × 480 mm × 638 mm (7.9 in. × 18.9 in. × 25.1 in.)
Weight	35 kg (77 lbs.)
Rack Mounting	200 mm JIS rack-mounting ears supplied.
Equipment Internal Fuse Ratings	Fuse F1 on Housekeeping Power Supply PCB Assy (1001-138) 3AT, 250 V

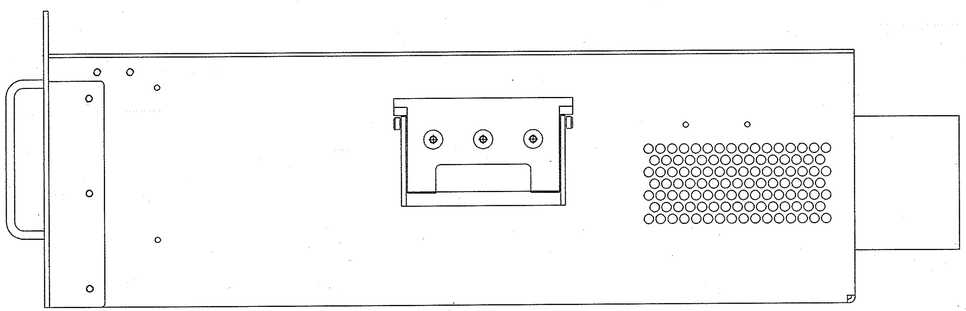
This page intentionally left blank.

REVISION					
REV	DESCRIPTION	ECO No.	CHG. BY	DATE	APPROVED
A	RELEASED TO MANUFACTURING	N/A	RAS	10/25/94	









SYM.	NOMENCLATURE OR DESCRIPTION	QTY.
	HOLE CHART	

PROPRIETARY DATA

NOTICE
THIS DRAWING MAY INCLUDE UNPUBLISHED PROPRIETARY MATERIAL DEVELOPED BY ENI AND AS SUCH IS NOT TO BE COPIED, REPRODUCED, DISCLOSED OR USED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN AUTHORIZATION FROM ENI.

MATERIAL: –

FINISH: –

METRIC

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPEC. DIMENSIONS ARE IN MM. TOLERANCES ARE:

ALL DIMENSIONS ARE ±.12

ANGULAR ±1°

ITEM	QTY.	ENI PART No.	DESCRIPTION
PARTS LIST			

DRAWN: R.A.STUHLER DATE: 10/25/94

CHECKED R. Brooks 10-25-94

ENG. J.M. Halley 10/26/94

APPROVED [illegible] 10/26/94

RELEASE DATE 10/26/94

DO NOT SCALE

ENI A DIVISION OF ASTEC AMERICA, INC.
100 HIGHPOWER ROAD
ROCHESTER, NEW YORK 14623

TITLE: OEM-25B MTG & OUTLINE

D

DWG. NO. 1040-999

REV A

SCALE 1/2

SHEET 1 OF 1

RAS 10-26-94