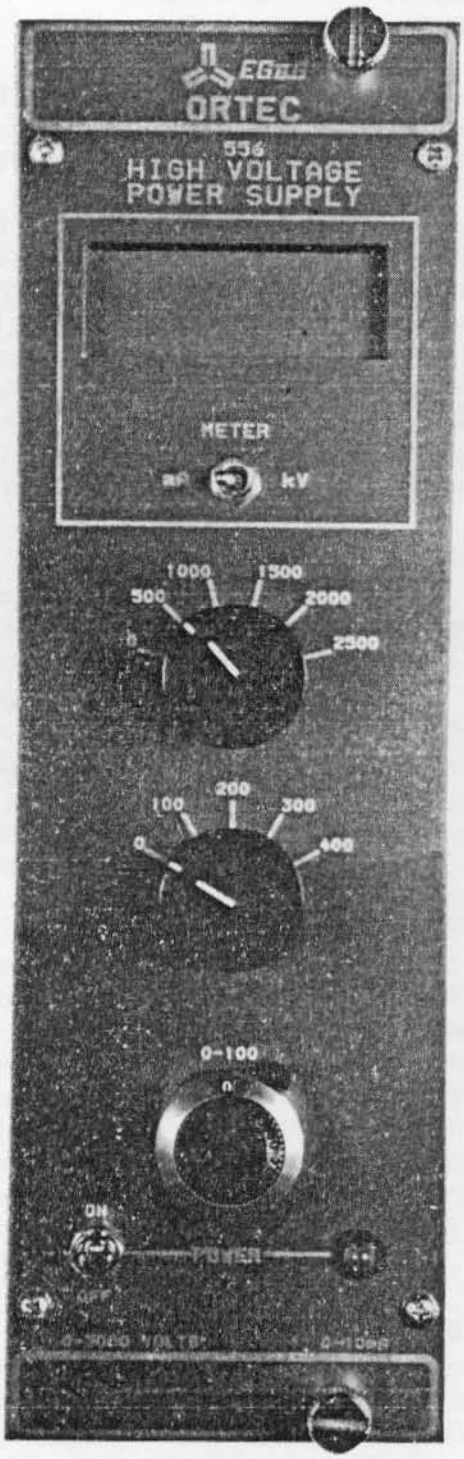
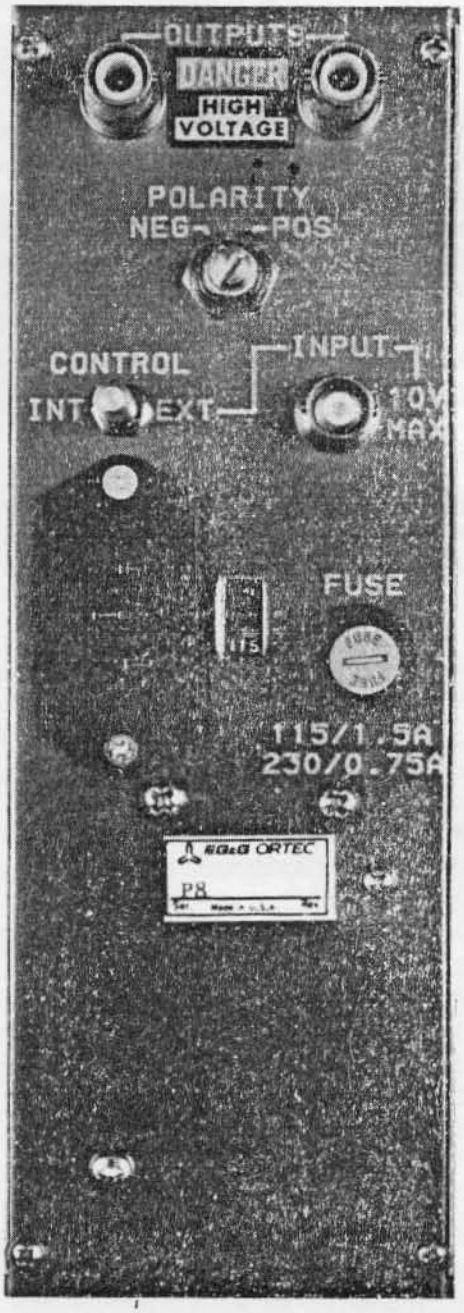

EG&G
ORTEC
556
HIGH VOLTAGE
POWER SUPPLY
METER
μA
kV
500
1000
1500
2000
2500
0
100
200
300
400
0-100
ON
OFF
POWER


OUTPUTS
DANGER
HIGH
VOLTAGE
POLARITY
NEG
POS
CONTROL
INT
EXT
INPUT
10V
MAX
FUSE
115/1.5A
230/0.75A
EG&G ORTEC
P8

EG&G ORTEC 556 HIGH VOLTAGE POWER SUPPLY

1. DESCRIPTION

The EG&G ORTEC 556 High Voltage Power Supply is a standard double-width NIM module that provides either polarity of output voltage from 50 to 3000 V, 0 to 10 mA. The adjusted output voltage of the selected polarity is available simultaneously through two SHV rear-panel connectors. A rear-panel slide switch permits operation on either 115- or 230-V ac input power, furnished through a removable power line cord and connector.

The 556 features a front-panel LCD meter which can be programmed via a front-panel toggle switch to display either output voltage or load current. The output voltage can be programmed by an external control via a rear-panel BNC connector.

The 556 provides the extremely stable, low-noise, high voltage that is required for proper bias of photomultiplier tubes, ionization chambers, and semiconductor detectors. Its accuracy and settability allow it to be used as a high voltage laboratory standard in applications requiring accuracy within ±0.25% of setting.

WARNING

THIS INSTRUMENT PRODUCES EXTREMELY HAZARDOUS VOLTAGES AT A POTENTIALLY LETHAL CURRENT LEVEL. NEVER CONNECT OR DISCONNECT THE HIGH VOLTAGE OUTPUT CONNECTOR WITH THE POWER SWITCH ON. NEVER CHANGE THE OUTPUT POLARITY SWITCH WITH THE POWER SWITCH ON. ALWAYS SWITCH POWER OFF AND WAIT AT LEAST 30 SECONDS BEFORE CONNECTING OR DISCONNECTING CABLES AND BEFORE CHANGING THE OUTPUT POLARITY.

2. SPECIFICATIONS

2.1. PERFORMANCE

OUTPUT POLARITY Positive or negative, selected by switch on rear panel.

OUTPUT RANGE 50 to 3000 V; minimum usable voltage 0 V.

OUTPUT LOAD CAPACITY 0 to 10 mA.

REGULATION ≤0.0025% variation in output voltage for combined line and load variations within operating range constant ambient temperature.

TEMPERATURE INSTABILITY ≤±50 ppm/°C after 30 minute warmup; operating range 0 to 50°C.

LONG-TERM DRIFT <0.01%/hour and <0.03%/24-hour variation in output voltage at constant input line voltage, load, and ambient temperature after 30 minute warmup.

OUTPUT RIPPLE <10 mV peak-to-peak, 20 Hz to 20 MHz.

OVERLOAD PROTECTION Internal circuitry protects against overloads including short circuits.

RESETTABILITY Output voltage can be reset to within 0.1%.

2.2. CONTROLS

POWER Front-panel toggle switch energizes unit when power cord is connected to appropriate source, and an adjacent red LED lamp indicates when power is applied.

OUTPUT LEVEL One 6-position switch, one 5-position switch, and one 10-turn precision potentiometer; output level is the sum of the 3 settings ±0.25%.

METER Front panel toggle switch selects display of output voltage in kV or load current in mA.

POLARITY Rear-panel switch selects either positive or negative output polarity.

CONTROL Rear-panel locking toggle switch selects the reference source for the output voltage.
Int Selects the internal reference source; the front-panel controls select the output amplitude.
Ext Selects the external reference source; output voltage is proportional to magnitude of reference input.

AC VOLTAGE Rear-panel slide switch selects either 115 V or 230 V ac-input voltage.

2.3. INPUTS

AC POWER 103–129 V or 206–258 V, 47–63 Hz, 70 W nominal at full output power; supplied through international standard IEC power connector on rear panel. Fuse rating: 1.5 A, 250 V fuse for 115 V ac operation or 0.75, 250 V fuse for 230 V ac operation.

EXTERNAL CONTROL Full range of output voltage can be based on an external dc reference level furnished through a rear-panel BNC connector; control voltage range is 0 through ±6.9 V dc; control voltage polarity must be the same polarity as that selected by the rear-panel Polarity switch; this input protected against over-voltages >±7 V. Input impedance >45 kΩ

2.4. OUTPUTS

REGULATED DC OUTPUT The adjusted and regulated voltage, with selected polarity, is furnished simultaneously to the two SHV connectors on the rear panel.

2.5. INDICATOR

METER Front panel LCD display indicates output voltage in kV ±10 V or load current in mA ±10 μA. Load current is sum of external load current and internal load current. Internal load resistance is ~5 MΩ.

2.6. ELECTRICAL AND MECHANICAL

POWER REQUIREMENTS 115 or 230 V ac, 47–63 Hz, 70 W nominally.

WEIGHT
Net 3.6 kg (8 lb).
Shipping 4.5 kg (10 lb).

DIMENSIONS Standard double-width NIM module, per TID-20893 (Rev).

2.7. ACCESSORIES AVAILABLE

Two 3.66 cm (12 ft) long adapter cables are available from EG&G ORTEC for connecting to the Model 556 SHV output connectors:

1. EG&G ORTEC C-34-12 cable assembly: RG-59 A/U (75 Ω) cable with one C-37 SHV female plug and one C-26 MHV male plug.
2. EG&G ORTEC C-36-12 cable assembly: RG-59 A/U (75 Ω) cable with two C-37 SHV female plugs.

2.8. RELATED EQUIPMENT

Each of the two outputs of the 556 can be used as a power source for any application that is within the operating limits of the power supply. Both output levels are identical and of the same polarity. The load on the 556 output circuit is the sum of the individual loads connected to the output connectors, and the load current can be monitored by the front panel LCD meter.

This power supply is ideal for use with either one detector or a pair of detectors where the voltage level requirements are the same for both detectors. The appropriate types of detectors for which the 556 is designed include photomultiplier tubes, ionization chambers, and semiconductor detectors.

3. INSTALLATION

3.1. GENERAL

The 556 is normally used in conjunction with other modular electronics and may be installed in a standard NIM bin such as an EG&G ORTEC 4001A. Since the bin may be rack mounted, any high temperature equipment that may be installed in the same rack as the bin must be sufficiently cooled by circulating air to prevent exceeding the +50° C (120° F) maximum operating temperature of the 556. The EG&G ORTEC M127/N NIM Fan is available for forced-air cooling of a rack of equipment.

3.2. CONNECTION TO POWER

The 556 requires a grounded ac-power source of nominal 115 V or 230 V ac. A rear panel international-standard IEC connector allows the connection of many different types of line cords between the ac outlet and the 556. A rear panel slide switch allows the choice of 115-V or 230-V ac input voltages. The 556 is shipped with a choice of two fuse holder caps to accommodate either 3AG or 5 x 20 mm size fuses. On 115 V ac operation a 1.5 A, 250 V-rated fuse should be used; on 230 V ac operation a 0.75 A, 250 V-rated fuse should be used.

This power supply may be operated entirely removed from the 4001A bin if desired, since it is totally self-contained and requires no dc-operating power levels from the NIM bin. However, precautions should be taken to ensure that personnel is aware of the shock hazard at the rear connectors, and that air space should be provided at the top and bottom of the instrument.

3.3. CONNECTING INTO A SYSTEM

1. Check to see that the power switch is in the Off position.

2. Check rear panel 115/230 V ac switch and set to appropriate position

3. Install a 1.5 A, 250 V fuse for 115 V ac setting or a 0.75 A, 250 V fuse for 230 V ac setting in the rear-panel-mounted fuseholder

4. Check the polarity switch on the rear panel and set it for either positive or negative output polarity as required for the application

5. Connect a high-voltage cable from either output connector on the 556 to the instrument to be powered. Use the other output connector if a second instrument is to be operated at the same output voltage.

6. Set the front-panel selector switches and potentiometer for the desired voltage level. This is normally specified for the instruments to which the voltage is to be applied. The adjusted output voltage will be the sum of the settings of all three controls.

7. Turn on the power with the toggle switch on the front panel. The indicator lamp next to the switch will light to show that input power is being applied. The indicating meter at the top of the front panel will also indicate the polarity and amplitude of either the 556 output voltage or load current, depending on the setting of the meter switch.

3.4. CONNECTING AN EXTERNAL REFERENCE INPUT

The 556 output voltage level can be controlled by an external reference level that is furnished through the rear-panel BNC connector when the Control locking toggle switch is set at Ext. The range of input voltage is 0 to 6.9 V to provide an output from 0 to 3000 V. The front-panel voltage level controls are ineffective for external reference operation.

For positive output the polarity selector switch on the rear panel is set at Pos, and the external reference should be positive. For negative output the polarity switch is set at Neg and the external reference should be negative. The external reference voltage should be stable and filtered since the output is linearly proportional to this reference. The external reference should be capable of driving the 45-kΩ input impedance.

4. CIRCUIT DESCRIPTION

4.1. GENERAL

Figure 4.1 is a simplified block diagram of the 556 circuits Schematic 605630 is included at the back of this manual.

The 556 requires an ac power input, regardless of the use of an internal or external reference level. The selected reference level is applied to a precision regulator and controls the low voltage input level to an internal 24-kHz oscillator. The oscillator output voltage is stepped up for the high voltage output through a converter transformer, and this signal is rectified and filtered to produce the output to each output connector

The front panel meter (M1) is connected to the output connectors through R65, R85, and R66 when monitoring output voltage. R66 is used to calibrate the front-panel display meter. In the load current display mode, the output ground return current is sensed by R69. The sensed voltage is inverted by S7 and fed to meter M1.

4.2. REGULATION

Two feedback loops, one for preregulation and one for output regulation, operate simultaneously. To maintain the output voltage at a constant voltage, U1 compares the sampled output voltage against the reference voltage appearing at its input terminals. The resulting error signal is amplified by U2, Q1, and Q5. The output (emitter) of Q5 feeds the input of the high frequency dc-to-dc converter. The converter is made up of a free-running oscillator (Q6–9) driving chopper MOSFETs Q10 and Q11, which alternately switch on to transfer energy through high-voltage transformer T2. The converter output consists of the rectified, filtered, and doubled high voltage at C17. R53 and C18 further filter the output voltage.

A preregulator circuit is necessary to limit the power dissipation by Q5. Therefore its collector and emitter voltages are compared at U3(5 and 6). The resulting output represents a request for more Q5 collector voltage.

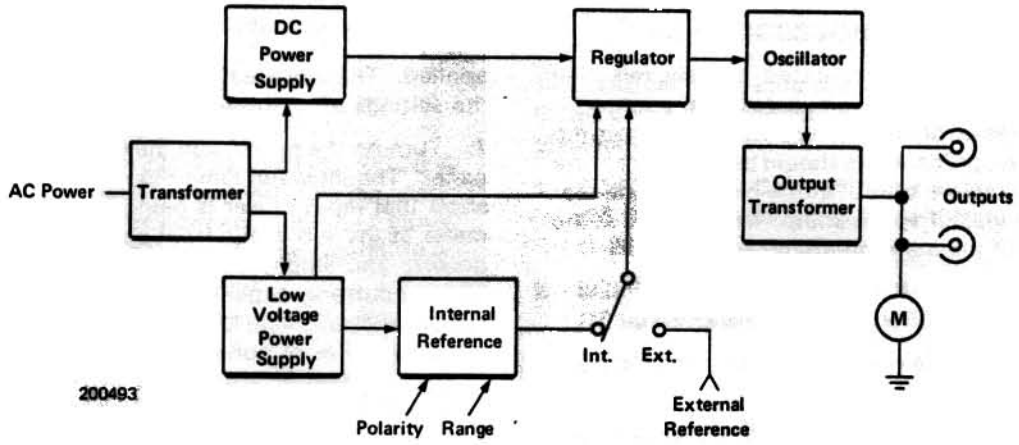


Fig. 4.1. Simplified Block Diagram of EG&G ORTEC's 556 High Voltage Power Supply.

U3(1) is synchronized with the power line frequency. This signal clocks JK flip-flop U4 and when U3(7) is high, SCR Q12 is fired in synchronization with the power line through Q2, Q3, and D8. When SCR Q12 fires, current flows through R3 and C1, boosting the collector voltage at Q5.

Current limiting transistor Q4 monitors the current through R4 and prevents damage during output overload by conducting current away from the base of Q5. Also, if a high voltage output should become shorted to ground, transistors Q14 and Q15 will conduct current away from the base of Q Current pulses in the ground return path during a sh circuit condition produce voltage pulses across R69 whi are of sufficient amplitude to turn either Q14 or Q15 depending upon the setting of the POLARITY switch (R. Q15 will become active if the switch is set for POS and Q will be active if the switch is in the NEG position. Regulat U5 and U6 provide the necessary internal ±12 V power operate the control circuitry, the reference circuit, and t oscillator.

5. CORRECTIVE MAINTENANCE

5.1. GENERAL

The 556 should not require maintenance other than cleaning to prevent leakage paths from being created by dust collection. If an apparent malfunction is noted, it is important to determine if it is within the 556 power supply by disconnecting it from its load and performing routine diagnostic tests. The 556 is short-circuit protected, and with a short-circuit load the output voltage will drop to zero. If an external short circuit has been applied to the output, the short circuit must be removed before the 556 will again produce its adjusted voltage.

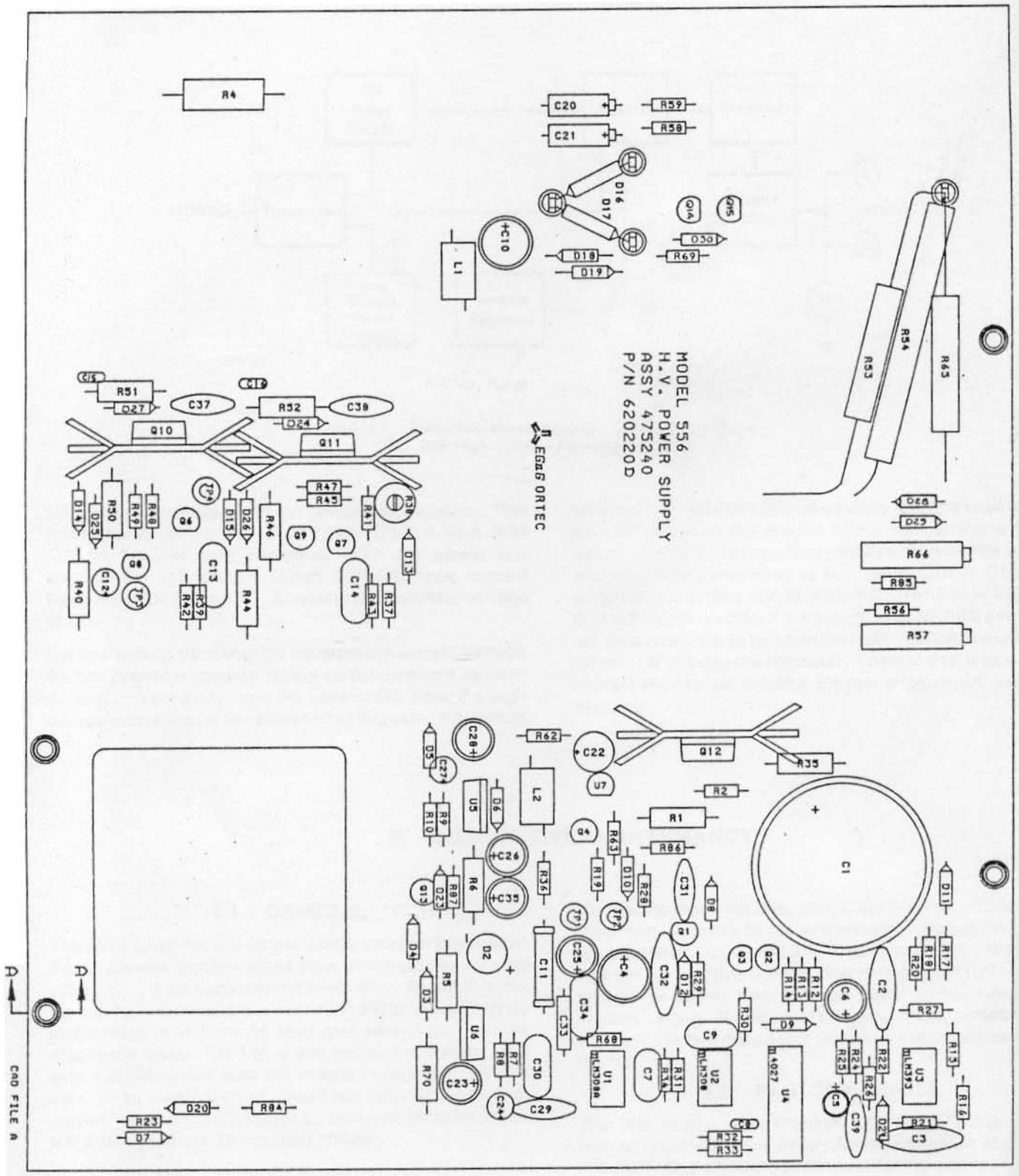
5.2. TROUBLESHOOTING SUGGESTIONS

Only service technicians trained and experienced in the service of high-voltage circuitry should attempt troubleshooting this unit. EXTREMELY DANGEROUS VOLTAGE LEVELS ARE PRESENT INSIDE THE 556 CHASSIS! OBSERVE GREAT CAUTION WHEN ANY PROTECTIVE COVERS ARE REMOVED WITH POWER APPLIED!

To troubleshoot the 556, check the internal ±12 V su plies first, then check for symmetrical conduction tim for oscillator output MOSFETs Q10 and Q11. With t 556 set for positive polarity, the voltages at U1(2 and should be nearly identical and equal to the referen voltage setting. If this is not the case, check componen through the two regulating feedback loops described Section 4.2.

5.3. FACTORY REPAIR

The 556, or any other standard EG&G ORTEC produ may be returned to the factory for repair service at a no inal cost. Our standard procedure for repair ensures t same quality control and checkout that are used fo new instrument. Always contact Customer Services EG&G ORTEC, (615) 482-4411, before sending in an strument for repair to obtain shipping instructions and that the required Return Authorization Number can assigned to the unit. Write this number on the addre label and on the package to ensure prompt attention wh it reaches the factory.



EG&G ORTEC

100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830

MODEL 556

PVB ASSY. HIGH VOLTAGE POWER SUPPLY

J. SANDERS 556

84-0297 475240

SIZE D