

ORTEC 459 5 kV HIGH VOLTAGE SUPPLY

Manual Change Sheet

April 22, 1976
ECN 459-10

On schematic 459-0101-S1, change the value of R42 from 50K to 100K.
This is a calibration on the printed circuit for the base voltage
adjustment to Q1.

Model 459
5kV Detector Bias Supply
Operating and Service Manual

This manual applies to instruments
"Rev 09" on rear panel

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QUALITY CONTROL

Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

REPAIR SERVICE

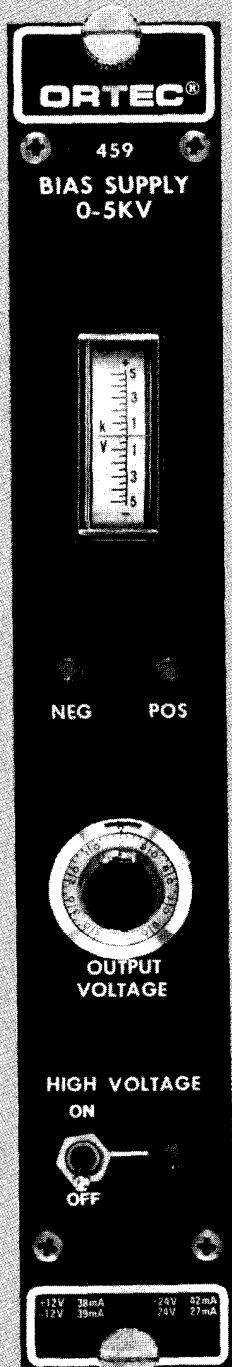
If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing or by telephone [(615) 482-4411], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped **PREPAID** via Air Parcel Post or United Parcel Service to the nearest ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty will be repaired at the standard charge unless they have been grossly misused or mishandled, in which case the user will be notified prior to the repair being done. A quotation will be sent with the notification.

DAMAGE IN TRANSIT

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment if necessary.

CONTENTS

	Page
WARRANTY	ii
PHOTOGRAPHS	iv
1. DESCRIPTION	1
2. SPECIFICATIONS	1
2.1. Performance	1
2.2. Controls	1
2.3. Inputs	1
2.4. Outputs	1
2.5. Electrical and Mechanical	2
3. INSTALLATION	2
3.1. General	2
3.2. Selection of Output Polarity	2
3.3. Connection to Power	2
3.4. Output Connections	2
4. OPERATION	2
4.1. Silicon Surface-Barrier Detectors	2
4.2. Other Types of Detectors	2
4.3. Loading Effects	3
5. CIRCUIT DESCRIPTION	3
6. MAINTENANCE AND TESTING	4
6.1. Performance Tests	4
6.2. Troubleshooting Suggestions	4
6.3. Factory Repair Service	4
APPENDIX	5
Replaceable Parts List	
Schematic	
459-0101-S1	



ORTEC 459 5KV DETECTOR BIAS SUPPLY

1. DESCRIPTION

The ORTEC 459 0–5 kV Detector Bias Supply provides a bias voltage of either polarity for a semiconductor detector or for a very low current voltage divider in a photo-multiplier tube and scintillation detector assembly. Two outputs are provided simultaneously: one for a range of 0 to 5 kV for high voltage requirements and one for a range of 0 to 500 V for lower voltage detectors. Both output voltages are adjusted by a 5-turn direct-reading control for a potentiometer located on the front panel.

Either polarity is available through both outputs. The polarity is selected by the orientation of a plug-in printed

circuit that can be attached to the main board in either of two positions. The selected polarity is indicated by a light, Neg or Pos, on the front panel. A front panel meter also indicates the selected polarity and the approximate voltage available through the 5-kV output; the 500-V output automatically provides 10% of the meter-indicated level.

The Detector Bias Supply receives its required operating power from an ORTEC 401A/402A Bin and Power Supply in which it is installed for operation. All of the input power is supplied through the rear panel module connector.

2. SPECIFICATIONS

2.1. PERFORMANCE

Bias Voltage Outputs Two output circuits, ranges 0 to 5 kV and 0 to 500 V.

Bias Control 5-turn direct-reading precision potentiometer.

Bias Polarity Either positive or negative for both outputs (both outputs same polarity), selected by internal switch and indicated on front panel.

Noise and Ripple <10 mV peak to peak from 2 Hz to 50 MHz.

Temperature Stability 0.02%/°C through 0 to 50°C operating range.

Voltage Stability <0.1%/hr variation in output voltage with constant input voltages from Bin supply, constant temperature, and constant load.

Output Current 0 to 100 μ A.

Output Linearity Within \pm 3% of dial setting from 10% to full range.

2.2. CONTROLS

Output Voltage 5-turn direct-reading potentiometer with

500 dial divisions, adjusts the output levels for both the 5-kV and 500-V outputs simultaneously.

High Voltage On/Off Toggle switch and indicator lamp show when the instrument circuits are turned on to provide an output. The lamp turns off when the remote shutdown circuit is grounded and high voltage is not available.

Polarity +/- Internal plug board selects either polarity for both outputs, and front panel indicators show which has been selected.

2.3. INPUTS

Power All input power is furnished through the rear panel module connector.

Remote Shutdown Rear panel BNC connector; shorting the center contact to ground reduces the output voltage to zero (Z_{max} of grounding circuit, < 1 k Ω).

2.4. OUTPUTS

0-5KV ($Z_o = 2 M\Omega$) Rear panel SHV connector furnishes the adjusted output voltage in the 0- to 5-kV range through an output impedance of approximately 2 M Ω .

0-500V ($Z_o = 700 k\Omega$) Rear panel SHV connector furnishes the adjusted output voltage in the 0- to 500-V range through an output impedance of approximately 700 k Ω .

2.5. ELECTRICAL AND MECHANICAL

Power Required

+24 V, 80 mA; +12 V, 40 mA;
-24 V, 60 mA; -12 V, 40 mA.

Dimensions Standard single-width NIM module (1.35 by 8.714 in.) per TID-20893.

3. INSTALLATION

3.1. GENERAL

The Detector Bias Supply is normally used in conjunction with other modular electronics and is installed in a 401A/402A Bin and Power Supply. The Bin and Power Supply is intended for rack mounting. Therefore any other equipment that may be installed in the same rack must be sufficiently cooled by circulating air to prevent any localized heating in the circuits in the 459. The temperature of equipment operating in racks can easily exceed the recommended maximum of 50°C (120°F) unless these precautions are taken.

3.2. SELECTION OF OUTPUT POLARITY

The polarity of the output voltage of the 459 is determined by the location of a rectangular plug board on the main printed circuit. Access to the plug board is obtained by removing the left side panel of the module (viewed from the front). Its two alternate locations are marked on the main printed circuit.

3.3. CONNECTION TO POWER

This instrument obtains its dc operating power from the standard Bin and Power Supply in which it is installed. Always turn off power for both the Bin Power Supply and the 459 before inserting or removing the module. When the Bin and Power Supply switch is then turned on, the polarity selection will be indicated on the 459 before high voltage is actually furnished from its output connectors. The adjusted high voltage is then available through the output connectors as soon as the 459 high-voltage switch is turned on.

3.4. OUTPUT CONNECTIONS

The Detector Bias Supply is compatible with all ORTEC preamplifiers that include provisions to accept the high voltage for the detector. The output controls are located on the front panel, and the output connectors are located on the rear panel. The output cables will require a type SHV connector at the power supply end, which is the type furnished with each ORTEC preamplifier for this purpose.

4. OPERATION

CAUTION

Always have the high voltage turned off before connecting the cable to or disconnecting it from the preamplifier.

After the high voltage is turned on, allow approximately 30 min for high-voltage stressing of the capacitor to subside before attempting to take data with high-resolution systems.

4.1. SILICON SURFACE-BARRIER DETECTORS

Operating bias voltage for a silicon surface-barrier detector should not be applied as a large step, but should be

advanced gradually from zero up to the recommended operating potential. With the 459, set the front-panel control at zero before switching on the power. Then gradually advance the setting of the 5-turn potentiometer to the recommended level for the detector.

To remove the detector bias, reduce the setting of the 5-turn control to zero at the 459 while the output cable is still connected to the preamplifier.

4.2. OTHER TYPES OF DETECTORS

Operating bias for germanium or scintillation detectors can be applied as a step from zero to the full operating value. For these applications the 5-turn potentiometer can be

adjusted to the required output voltage level while the power switch is turned off, and then power can be applied by simply turning on the power with the high-voltage switch.

4.3. LOADING EFFECTS

The actual output voltage depends on the current that is drawn from the 459 by its external circuit. To determine the actual voltage at the "0-5 KV" connector, consider the amount of voltage drop in the 2-M Ω series output resistance, which will be a function of the output current. The output voltage can be calculated with the formula

$$V_o = V_{\text{dial}} - I(2 \times 10^6),$$

where

$$\begin{aligned} V_o &= \text{output voltage,} \\ V_{\text{dial}} &= \text{setting indicated by 5-turn control,} \\ I &= \text{output current in amperes.} \end{aligned}$$

If the output current is expressed in microamperes, the formula is simplified to

$$V_o = V_{\text{dial}} - 2I.$$

For example, if $I = 50 \mu\text{A}$ and the V_{dial} setting is at maximum for 5000 V, $V_o = 5000 - 2(50) = 4900 \text{ V}$.

The actual output voltage at the "0-500 V" connector can be found in a similar manner by considering the approximately 700 k Ω output resistance. The formula will then be

$$V_o = V_{\text{dial}} - I(7 \times 10^5),$$

where the definitions are the same as before.

To find the actual voltage applied to a detector, the resistance between the 459 output and the detector itself must be identified. Since the bias voltage is usually connected through a load resistor in the preamplifier and then to the detector, the resistance can usually be identified from the preamplifier schematic. The actual detector voltage can then be found with the formula

$$V_d = V_o - I_d R,$$

where V_d is the detector voltage, V_o is the 459 output voltage, I_d is the detector current, and R is the series resistance between the 459 and the detector.

5. CIRCUIT DESCRIPTION

The 459 uses a dc-to-dc converter to charge a Cockcroft-Walton¹ multiplier circuit. The primary of the transformer is driven from an astable multivibrator operating at approximately 20 kHz. Transistors Q1 and Q2 form the multivibrator circuit, while Q3 through Q6 serve as drivers and switching transistors for transformer T1.

The output voltage is adjusted by controlling the voltage applied to the primary of the transformer. Resistor R23 controls the primary voltage through transistors Q7 and Q8.

The circuitry in the transformer secondary consists of a 7-stage Cockcroft-Walton multiplier circuit. Polarity selection is made with a plug-in board that completes the necessary circuits for either polarity by its orientation on the main printed circuit. In schematic 459-0101-S1 at the back of this manual the alternate circuit connections are shown as sections of a double-throw switch, S2. For polarity reversal the input and output terminals of the Cockcroft-Walton circuit are interchanged. The 0–500 V is

taken from the first stage of the multiplier circuit so that this output will always have the same polarity as the 0–5 kV output.

The output voltage can be adjusted with trim potentiometer R22. This adjustment should be made with an insulated screwdriver through one of the holes in the top cover. The calibration of the front panel meter is made with trim potentiometer R40, and this adjustment is also available through one of the holes in the top cover. The meter is intended as an approximate indication of the output voltage, and also shows the polarity of the output.

If the remote shutdown circuit is used, it will clamp the output voltage through both of the 459 output circuits to zero when the external circuit grounds the center contact of the BNC connector with 1000 Ω impedance or less. This turns on both Q10 and Q11. With Q10 turned on, Q7 and Q8 cannot furnish any reference drive to the primary of transformer T1 and high voltage cannot be generated. With Q11 turned on, Q12 is turned off and the front panel HV On indicator will not light.

¹ Everhart and Lorrain, "The Cockcroft-Walton Voltage Multiplying Circuit," *Rev. Sci. Instr.* **24**(3), 221 (1953).

6. MAINTENANCE AND TESTING

CAUTION

THE HIGH VOLTAGES THAT ARE PRESENT IN THIS INSTRUMENT ARE HAZARDOUS. DO NOT ATTEMPT ANY ADJUSTMENTS OR MAINTENANCE UNLESS YOU ARE EXPERIENCED IN HANDLING HIGH-VOLTAGE CIRCUITS.

Test Equipment Required:

Nuclear Standard Bin and Power Supply such as ORTEC 401A/402A

Oscilloscope with sensitivity of 10 mV or better

Voltmeter with input impedance of 100 M Ω or more on 5000-V range

Schematic diagram of the 459 Detector Bias Supply

6.1. PERFORMANCE TESTS

1. Install the 459 in the 401A/402A Bin and Power Supply.
2. Leave the High Voltage switch set at Off and connect the 0-5 KV output to the voltmeter, set for a 5000-V range.
3. Set the High Voltage switch at On and increase the 5-turn control slowly to maximum for 5000 V. Consider the loading effect of the voltmeter on the high-voltage supply and observe the output voltage. For example, a voltmeter with a 100-M Ω input impedance will have a 50- μ A current at full scale. This will cause a 100-V drop across the 2-M Ω internal resistance in the power supply and the meter will read only 4900 V maximum.

4. Return the output voltage control to zero and check the potentiometer linearity by comparing the output voltages to dial readings at several points.

5. To check ripple and noise it is necessary to place a capacitor that will withstand 5000 V in series with the 0-5 KV output of the 459 and to connect this to an oscilloscope. Set the oscilloscope for a dc input and the lowest available sensitivity until the Detector Bias Supply output has been increased slowly to 5000 V. Then the oscilloscope sensitivity can be increased to observe the ripple and noise, which should not exceed 10 mV.

6.2. TROUBLESHOOTING SUGGESTIONS

1. Ensure that the proper dc input voltage is being supplied to the 459. It requires +24 V, -24 V, +12 V, and -12 V.
2. With an oscilloscope, check carefully for a square wave at the collectors of Q1 and Q2. If no square wave is present, replace the transistors Q1 and Q2.
3. Check for a square wave at the collectors of Q5 and Q6. This square wave should vary in amplitude with the setting of the output voltage control. If no variation is seen, check Q7 and Q8.

6.3. FACTORY REPAIR SERVICE

This instrument can be returned to the ORTEC factory for service and repair at a nominal cost. Our standard procedure for repair includes the same quality control and checkout that are used for a new instrument. Always contact the Customer Service Department at ORTEC, (615) 482-4411, before sending in an instrument for repair.

APPENDIX

REPLACEABLE PARTS

ORDERING INFORMATION

The Replaceable Parts List shown below contains information needed for ordering spare and/or replacement parts. Each listing indicates the reference designator number, the part number, a description of the component, and the part manufacturer and manufacturer's part number.

All inquiries concerning spare and/or replacement parts and all orders for same should include the model serial, and revision ("Rev" on rear panel) numbers of the instruments involved and should be addressed to the Customer Service Department at 100 Midland Road, Oak Ridge, Tennessee 37830. The Manager of Customer Services can be reached

The solid-state-device (diodes, transistors, and integrated circuits) types installed in your instrument may differ from those shown in the schematic diagram and parts list. In such cases, necessary replacements can be made with either the type shown or the type actually installed in the instrument.

Replaceable Parts List

459-0100	459-0100 CHAS ASM
REFDES	PART NUMBER DESCRIPTION
	9 097 662670 CONN SHV BLK HD AMP SOLE SOURCE
	9 097 413390 CON DGE UG 1094/U W/NT-34 PLAT
C28	9 067 409700 0.01 UF 5 KV EL PLA DF50-103
C28A	9 071 425420 0.01 UF 5KV CYLIN FCI D6-50-10
LED1	9 103 637980 LED INDICAT DIL 521-9166 W/MT
LED2	9 103 637980 LED INDICAT DIL 521-9166 W/MT
LED3	9 103 637980 LED INDICAT DIL 521-9166 W/MT
M1	9 111 430000 METER 100-0-100 UA MOD. 459-0105
R23	9 051 437900 20 KOHM 3% BRN 3520-I-203
S1	9 094 642360 SW UPDT TOGGLE CXC 7201H30

459-0200	459-0200 PC BD ASM
REFDES	PART NUMBER DESCRIPTION
C1	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C2	9 059 408920 470 PF MIC 5% 500V ARC DM15-471J
C3	9 059 408920 470 PF MIC 5% 500V ARC DM15-471J
C4	9 055 408460 0.1 UF 100V DISC SPR 33C41B6
C5	9 055 408460 0.1 UF 100V DISC SPR 33C41B6
C6	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C7	9 055 408460 0.1 UF 100V DISC SPR 33C41B6
C8	9 055 408550 .01UF 20%50V DI SPRC023K101F103M
C9	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C10	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C11	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C12	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C13	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C15	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C16	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C17	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C18	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C19	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C20	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C21	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C22	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C23	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C24	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C25	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C26	9 061 458950 .01UF 10% 1KV MYL SPR 10PS-S10
C27	9 055 408470 0.1 UF 20% 500V DISC SPR 5HK-P10
C29	9 055 435990 .0047 UF 20%6KV DISC SPR60GA-D57

by telephone at (615) 482-4411. The minimum order for spare and/or replacement parts is \$25.00.

ORDERING INFORMATION
FOR PARTS NOT LISTED

In order to facilitate the ordering of a part not listed below, the following information should be submitted to the Customer Service Department:

1. the instrument model number,
2. the instrument serial number,
3. revision ("Rev" on rear panel) number,
4. a description of the part,
5. information as to the function and location of the part.

459-0200	459-0200 PC BD ASM
REFDES	PART NUMBER DESCRIPTION
C30	9 067 426870 75 UF 50V EL SPR TE1308
C31	9 055 408460 0.1 UF 100V DISC SPR 33C41B6
C32	9 065 409480 6.8 UF 20% 35V SPR150D685X0035B2
C33	9 055 408460 0.1 UF 100V DISC SPR 33C41B6
C34	9 065 495420 6.8 UF 20%35V TAN DCK U6R8GB35M
D1	9 080 442170 DIODE 75V SYL IN4153
D2	9 080 442170 DIODE IN 4156 (STABILISUR)
D3	9 080 442170 DIODE MOT IN754A
D4	9 080 442250 DIODE - IN4441 VPO
D5	9 080 442250 DIODE - IN4441 VPO
D6	9 080 442250 DIODE - IN4441 VPO
D7	9 080 442250 DIODE - IN4441 VPO
D8	9 080 442250 DIODE - IN4441 VPO
D9	9 080 442250 DIODE - IN4441 VRO
D10	9 080 442250 DIODE - IN4441 VRO
D11	9 080 442250 DIODE - IN4441 VRO
D12	9 080 442250 DIODE - IN4441 VRO
D13	9 080 442250 DIODE - IN4441 VRO
D14	9 080 442250 DIODE - IN4441 VRO
D15	9 080 442250 DIODE - IN4441 VRO
D16	9 080 442250 DIODE - IN4441 VRO
D17	9 080 442250 DIODE - IN4441 VRO
D18	9 080 442170 DIODE 75V SYL IN4153
D19	9 080 442170 DIODE 75V SYL IN4153
L1	9 092 412460 100 UH WEE DUCTOR NTC 5%
Q1	9 078 436550 TRANS MOT MPS-6531
Q2	9 078 436550 TRANS MOT MPS-6531
Q3	9 078 436550 TRANS MOT MPS-6531
Q4	9 078 436550 TRANS MOT MPS-6531
Q5	9 078 478150 TRANS-2N5978 SELECT-GRN MOT
Q6	9 078 478150 TRANS-2N5978 SELECT-GRN MOT
Q7	9 078 478150 TRANS-2N5978 SELECT-GRN MOT
Q8	9 078 436500 TRANS MOT MPS-6534
Q9	9 078 436500 TRANS MOT MPS-6534
Q10	9 078 436550 TRANS MOT MPS-6531
Q11	9 078 436550 TRANS MOT MPS-6531
Q12	9 078 436550 TRANS MOT MPS-6531
R1	9 015 402530 33 KOHM CC 1/4W 5% ABC CB
R2	9 015 402840 24 KOHM CC 1/4W 5% ABC CB
R3	9 027 406000 200 KOHM MF 1/8W 1% CGW C4 T-0
R4	9 027 437110 261 KOHM MF 1/8W 1% IRC CEA T-0
R5	9 015 402840 24 KOHM CC 1/4W 5% ABC CB
R6	9 015 402690 180 OHM CC 1/4W 5% ABC CB

Replaceable Parts List (continued)

459-0200 459-0200 PC BD ASM			459-0200 459-0200 PC BD ASM		
REFDES	PART NUMBER	DESCRIPTION	REFDES	PART NUMBER	DESCRIPTION
R7	9 015 402140	270 OHM CC 1/4W 5% ABC CB	R33	9 019 451480	6.8 M CC 1W 5% ABC GB
R8	9 015 402140	270 OHM CC 1/4W 5% ABC CB	R34	9 019 451480	6.8 M CC 1W 5% ABC GB
R9	9 015 402690	180 OHM CC 1/4W 5% ABC CB	R35	9 019 451480	6.8 M CC 1W 5% ABC GB
R10	9 015 402530	33 KOHM CC 1/4W 5% ABC CB	R36	9 019 451480	6.8 M CC 1W 5% ABC GB
R12	9 015 402040	22 OHM CC 1/4W 5% ABC CB	R37	9 019 451480	6.8 M CC 1W 5% ABC GB
R13	9 015 402310	2 KOHM CC 1/4W 5% ABC CB	R38	9 019 451490	8.2 MOHM CC 1W 5% ABC GB
R14	9 015 402520	27 KOHM CC 1/4W 5% ABC CB	R39	9 019 451490	8.2 MOHM CC 1W 5% ABC GB
R15	9 051 437610	500 OHM 10-T POT BRN 3006P-1-501	R40	9 051 437430	20 KOHM 10-T POT BRN 3006P-1-203
R16	9 015 402040	22 OHM CC 1/4W 5% ABC CB	R42	9 051 437820	50 KOHM 10-T POT BRN 3006P-1-503
R17	9 015 402840	24 KOHM CC 1/4W 5% ABC CB	R43	9 017 403270	1.5 KOHM CC 1/2W 5% ABC EB
R18	9 015 402840	24 KOHM CC 1/4W 5% ABC CB	R44	9 015 402520	27 KOHM CC 1/4W 5% ABC CB
R19	9 015 402390	5.1 KOHM CC 1/4W 5% ABC CB	R45	9 015 402450	10 KOHM CC 1/4W 5% ABC CB
R20	9 036 407240	75 OHM WW 3W 1% DLE RS-2	R46	9 015 402450	10 KOHM CC 1/4W 5% ABC CB
R21	9 015 402020	10 OHM CC 1/4W 5% ABC CB	R47	9 015 402020	10 OHM CC 1/4W 5% ABC CB
R22	9 051 437430	20 KOHM 10-T POT BRN 3006P-1-203	R48	9 015 402450	10 KOHM CC 1/4W 5% ABC CB
R24	9 015 402120	200 OHM CC 1/4W 5% ABC CB	R49	9 015 402450	10 KOHM CC 1/4W 5% ABC CB
R25	9 015 402020	10 OHM CC 1/4W 5% ABC CB	R50	9 015 402450	10 KOHM CC 1/4W 5% ABC CB
R26	9 015 402260	1 KOHM CC 1/4W 5% ABC CB	T1	9 090 434710	XFMR KMC M2278H
R27	9 015 402120	200 OHM CC 1/4W 5% ABC CB			
R28	9 029 406370	909 KOHM MF 1/4W 1% CGW C5 T-0			
R29	9 029 406370	909 KOHM MF 1/4W 1% CGW C5 T-0			
R30	9 029 406380	1 MOHM MF 1/4W 1% CGW C5 T-0			
R31	9 015 402610	240 KOHM CC 1/4W 5% ABC CB			
R32	9 015 402610	240 KOHM CC 1/4W 5% ABC CB			

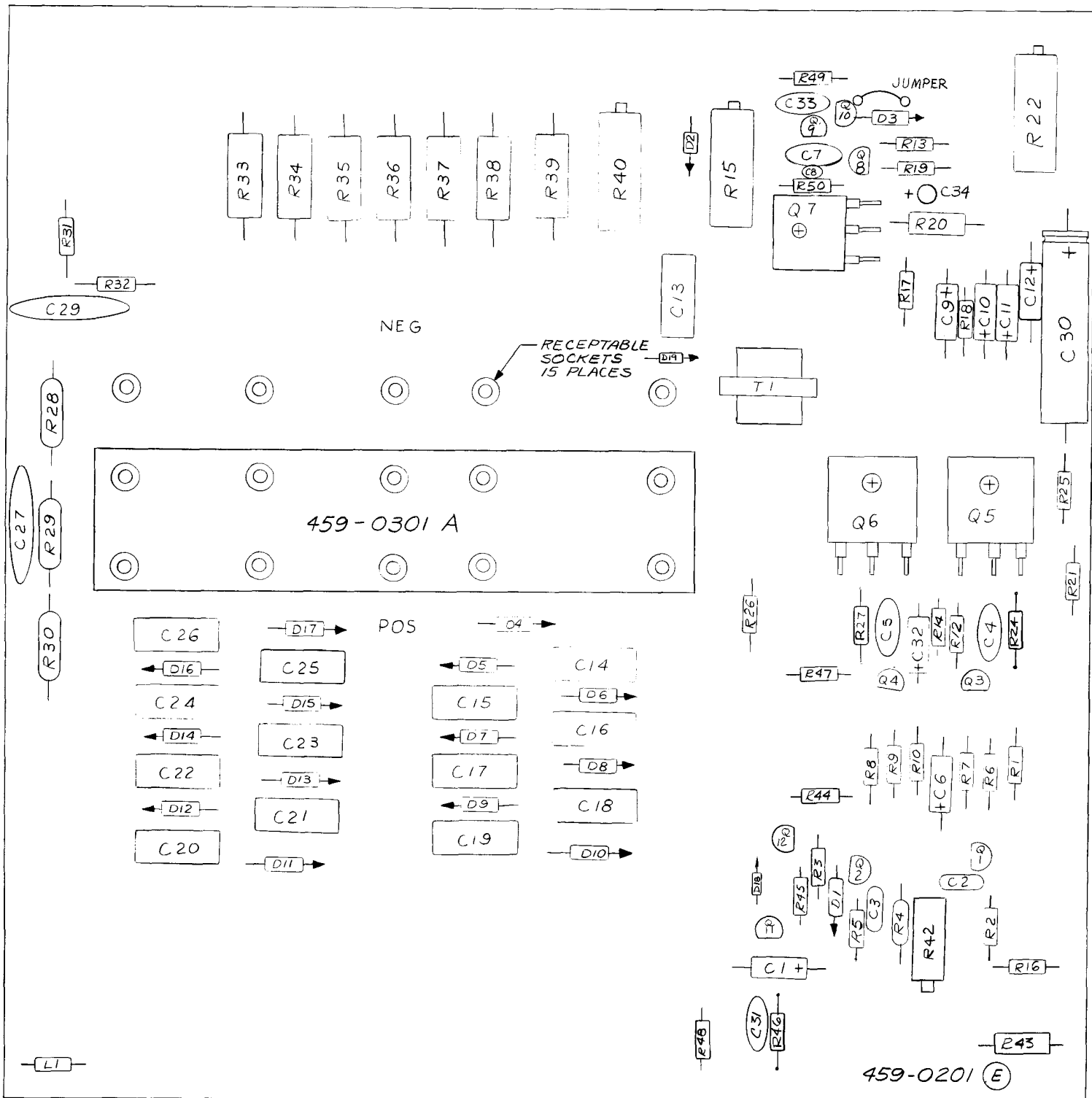
459-0300 459-0300 PC BD ASM		
REFDES	PART NUMBER	DESCRIPTION
	9 097 447020	PIN GOLD-PLATED PHP MP175-2

**BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR AEC STANDARD NUCLEAR INSTRUMENT MODULES
PER TID-20893**

Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	-3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 volts
7	Coaxial	*29	-24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 volts	32	Spare
*11	-6 volts	*33	115 volts ac (Hot)
12	Reserved Bus	*34	Power Return Ground
13	Spare	**35	Reset (Scaler)
14	Spare	**36	Gate
15	Reserved	**37	Reset (Auxiliary)
*16	+12 volts	38	Coaxial
*17	-12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	115 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC 401A and 401B Modular System Bins.

Pins marked (*) and (**) are installed and wired in EG&G/ORTEC-HEP M250/N and M350/N NIMBINS.



Replaceable Parts List (continued)

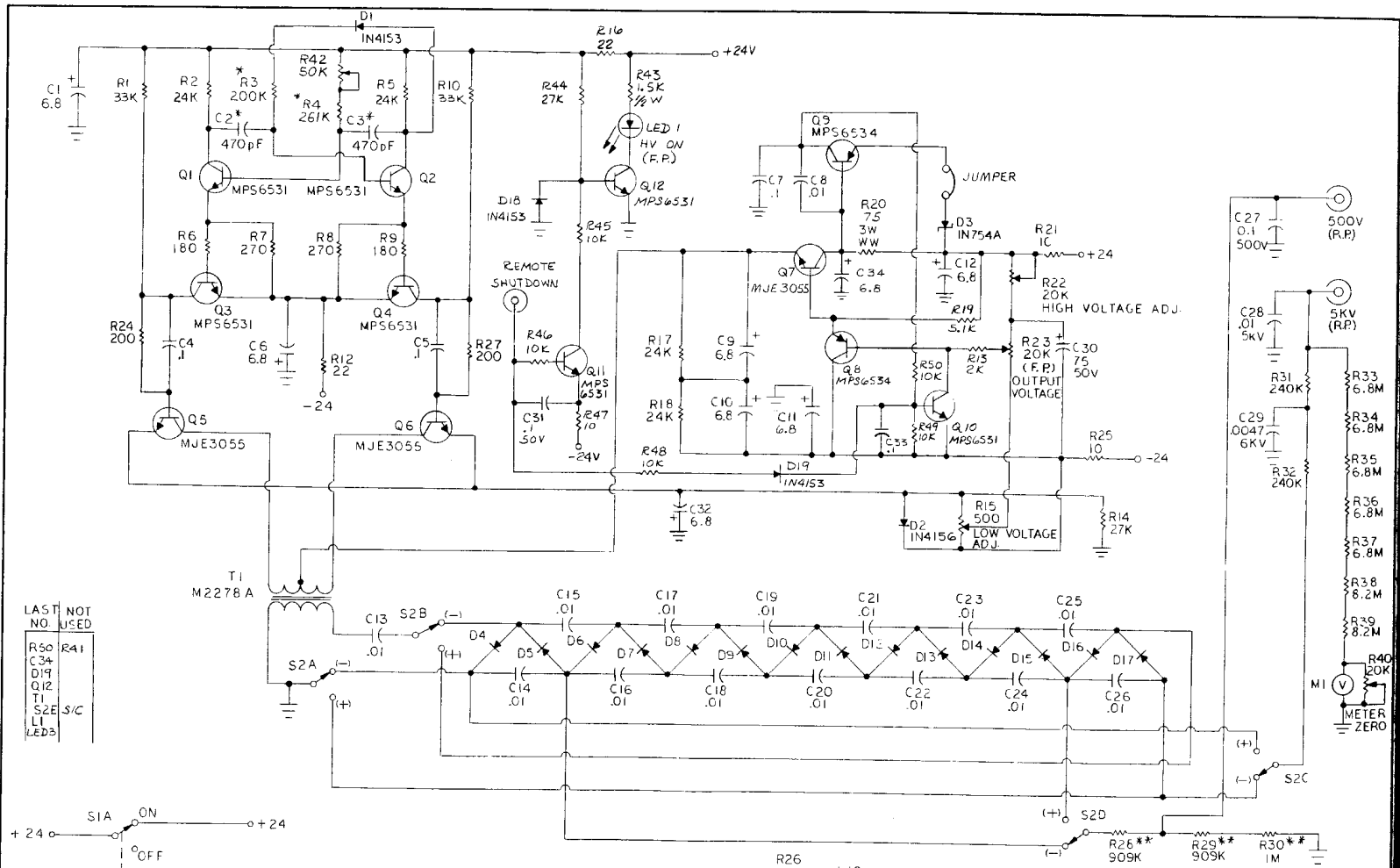
459-0200			459-0200 PC BD ASM			459-0200			459-0200 PC BD ASM		
REFDES	PART NUMBER	DESCRIPTION	REFDES	PART NUMBER	DESCRIPTION	REFDES	PART NUMBER	DESCRIPTION	REFDES	PART NUMBER	DESCRIPTION
R7	9 015 402140	270 OHM CC 1/4W 5% ABC CB	R33	9 019 451480	6.8 M CC 1W 5% ABC GB						
R8	9 015 402140	270 OHM CC 1/4W 5% ABC CB	R34	9 019 451480	6.8 M CC 1W 5% ABC GB						
R9	9 015 402690	180 OHM CC 1/4W 5% ABC CB	R35	9 019 451480	6.8 M CC 1W 5% ABC GB						
R10	9 015 402530	33 KOHM CC 1/4W 5% ABC CB	R36	9 019 451480	6.8 M CC 1W 5% ABC GB						
R12	9 015 402040	22 OHM CC 1/4W 5% ABC CB	R37	9 019 451480	6.8 M CC 1W 5% ABC GB						
R13	9 015 402310	2 KOHM CC 1/4W 5% ABC CB	R38	9 019 451490	8.2 MOHM CC 1W 5% ABC GB						
R14	9 015 402520	27 KOHM CC 1/4W 5% ABC CB	R39	9 019 451490	8.2 MOHM CC 1W 5% ABC GB						
R15	9 051 437610	500 OHM 10-T POT BRN 3006P-1-501	R40	9 051 437430	20 KOHM 10-T POT BRN 3006P-1-203						
R16	9 015 402040	22 OHM CC 1/4W 5% ABC CB	R42	9 051 437820	50 KOHM 10-T POT BRN 3006P-1-503						
R17	9 015 402840	24 KOHM CC 1/4W 5% ABC CB	R43	9 017 403270	1.5 KOHM CC 1/2W 5% ABC EB						
R18	9 015 402840	24 KOHM CC 1/4W 5% ABC CB	R44	9 015 402520	27 KOHM CC 1/4W 5% ABC CB						
R19	9 015 402390	5.1 KOHM CC 1/4W 5% ABC CB	R45	9 015 402450	10 KOHM CC 1/4W 5% ABC CB						
R20	9 036 407240	75 OHM WW 3W 1% DLE RS-2	R46	9 015 402450	10 KOHM CC 1/4W 5% ABC CB						
R21	9 015 402020	10 OHM CC 1/4W 5% ABC CB	R47	9 015 402020	10 OHM CC 1/4W 5% ABC CB						
R22	9 051 437430	20 KOHM 10-T POT BRN 3006P-1-203	R48	9 015 402450	10 KOHM CC 1/4W 5% ABC CB						
R24	9 015 402120	200 OHM CC 1/4W 5% ABC CB	R49	9 015 402450	10 KOHM CC 1/4W 5% ABC CB						
R25	9 015 402020	10 OHM CC 1/4W 5% ABC CB	R50	9 015 402450	10 KOHM CC 1/4W 5% ABC CB						
R26	9 015 402260	1 KOHM CC 1/4W 5% ABC CB	T1	9 090 434710	XFMR KMC M2278H						
R27	9 015 402120	200 OHM CC 1/4W 5% ABC CB									
P28	9 029 406370	909 KOHM MF 1/4W 1% CGW C5 T-0				459-0300	459-0300 PC BD ASM				
R29	9 029 406370	909 KOHM MF 1/4W 1% CGW C5 T-0									
R30	9 029 406380	1 MOHM MF 1/4W 1% CGW C5 T-0									
R31	9 015 402610	240 KOHM CC 1/4W 5% ABC CB				REFDES	PART NUMBER	DESCRIPTION			
R32	9 015 402610	240 KOHM CC 1/4W 5% ABC CB							9 097 447020	PIN GOLD-PLATED PMP MP175-2	

**BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR AEC STANDARD NUCLEAR INSTRUMENT MODULES
PER TID-20893**

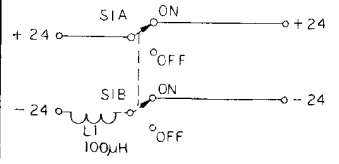
Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	-3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 volts
7	Coaxial	*29	-24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 volts	32	Spare
*11	-6 volts	*33	115 volts ac (Hot)
12	Reserved Bus	*34	Power Return Ground
13	Spare	**35	Reset (Scaler)
14	Spare	**36	Gate
15	Reserved	**37	Reset (Auxiliary)
*16	+12 volts	38	Coaxial
*17	-12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	115 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC 401A and 401B Modular System Bins.

Pins marked (*) and (**) are installed and wired in EG&G/ORTEC-HEP M250/N and M350/N NIMBINS.

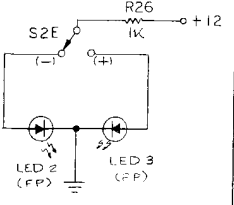


LAST NO.	NOT USED
R50	R41
C34	D19
C19	Q12
Q12	T1
T1	S2E S/C
S2E S/C	L1
L1	LED3



HIGH VOLTAGE

- NOTES: (UNLESS OTHERWISE SPECIFIED)
1. RESISTORS MARKED * ARE 1/8, 1/4W MF.
 2. CAPACITORS ARE IN µF.
 3. D4-D17 ARE 1N4441.
 4. RESISTORS ARE 1/4W, 5% CC.
 5. CAPACITORS MARKED * ARE MICA DIPPED.
 6. RESISTORS MARKED ** ARE 1%, 1/4W, MF.



UNLESS OTHERWISE SPECIFIED		DIMENSIONS IN INCHES		TOLERANCES	
FRACTIONS DECIMALS		FRACTIONS DECIMALS		FRACTIONS DECIMALS	
1/16	0.0625	1/16	0.0625	1/16	0.0625
1/32	0.03125	1/32	0.03125	1/32	0.03125
1/64	0.015625	1/64	0.015625	1/64	0.015625
3/32	0.09375	3/32	0.09375	3/32	0.09375
1/8	0.125	1/8	0.125	1/8	0.125
3/16	0.1875	3/16	0.1875	3/16	0.1875
1/4	0.25	1/4	0.25	1/4	0.25
5/16	0.3125	5/16	0.3125	5/16	0.3125
3/8	0.375	3/8	0.375	3/8	0.375
7/16	0.4375	7/16	0.4375	7/16	0.4375
1/2	0.5	1/2	0.5	1/2	0.5
5/8	0.625	5/8	0.625	5/8	0.625
3/4	0.75	3/4	0.75	3/4	0.75
7/8	0.875	7/8	0.875	7/8	0.875
1	1.0	1	1.0	1	1.0

ORTEC INCORPORATED
100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830

MODEL 459
H.V. SUPPLY C-5KV

DATE: 11-17-70
DESIGNER: R. WILSON
CHECKER: [Signature]
SCALE: [Blank]
MATERIAL: [Blank]
APPROVALS: [Blank]
RELEASED FOR MFG: [Blank]