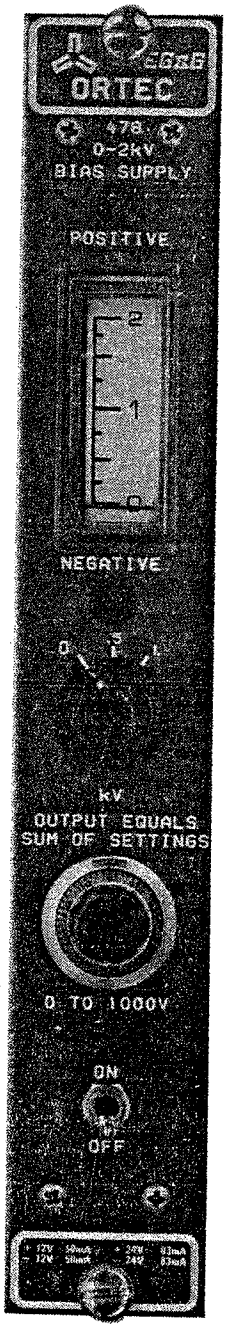
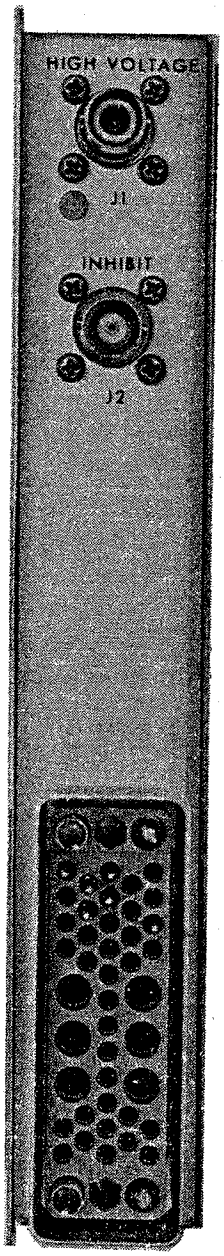
EG&G ORTEC
Subsidiary of EG&G, Inc.

Model 478
2-kV Bias Voltage Supply
Operating and Service Manual

CONTENTS


ORTEC
478
0-2kV
BIAS SUPPLY
POSITIVE
2
1
0
NEGATIVE
kV
OUTPUT EQUALS
SUM OF SETTINGS
0 TO 1000V
ON
OFF


HIGH VOLTAGE
J1
INHIBIT
J2

EG&G ORTEC MODEL 478 2-kV BIAS VOLTAGE SUPPLY

CAUTION

THIS UNIT PRODUCES HAZARDOUS VOLTAGE. DO NOT APPLY INPUT POWER UNLESS ADEQUATE GROUND IS CONNECTED TO THE POWER SUPPLY AND THE HIGH VOLTAGE OUTPUT HAS BEEN PROPERLY CONNECTED.

1. DESCRIPTION

The EG&G ORTEC Model 478 Bias Voltage Supply is an economical, single-width module especially designed to power photomultiplier tubes and electron multipliers requiring ±2000 V dc at 1 mA. This unit incorporates a direct-reading voltage control switch and precision dial to permit a high degree of accuracy and resettability for the output voltage level selections. Polarity LED indicators and a panel meter are provided for rapid and convenient determination of the operating conditions. Polarity is reversible via an internal selector switch.

The unit incorporates a remote shutdown feature where manual control is not desirable or possible.

2. SPECIFICATIONS

2.1. PERFORMANCE

OUTPUT VOLTAGE 0–2000 V.

POLARITY SELECTION Internal.

OUTPUT CURRENT 0–1 mA; 0–2 mA for increased power input.

PEAK-TO-PEAK NOISE AND RIPPLE 2 mV.

REGULATION 0.001%.

TEMPERATURE INSTABILITY (0 to 50° C) <±0.005%/°C.

LONG TERM DRIFT AT AMBIENT TEMPERATURE AND CONSTANT LINE AND LOAD 0.01%/h; 0.02%/8 h.

RESETTABILITY 0.05%.

2.2. CONTROLS

OUTPUT VOLTAGE
Coarse 3-position adjustment switch for 0, 0.5, and 1 kV dc.
Fine 10-turn potentiometer, 0 to 1000 V dc.

HIGH-VOLTAGE ON/OFF Toggle switch to turn the high-voltage output On or Off.

POLARITY +/− Internal switch selects the output voltage polarity.

2.3. INPUT

INHIBIT (J2) Rear panel BNC connector. Output voltage is reduced to zero by shorting the center contact to ground; Z_{max} of ground circuit <30 Ω.

2.4. OUTPUT

HIGH VOLTAGE (J1) Rear panel SHV connector furnishes the adjusted output voltage. Output impedance ~20 Ω.

FRONT PANEL METER Edge-reading meter to monitor output voltage level.

2.5. ELECTRICAL AND MECHANICAL

POWER REQUIRED +12 V, 50 mA; −12 V, 50 mA; +24 V, 83 mA; −24 V, 83 mA. All input power is furnished through the rear panel module connector from the NIM-standard bin and power supply.

WEIGHT
Net 2.72 kg (6.0 lb).
Shipping 3.63 kg (8.0 lb).

DIMENSIONS NIM-standard single-width module 3.43 x 22.13 cm (1.35 x 8.714 in.) per TID-20893 (Rev).

3. INSTALLATION AND OPERATION

The 2-kV Bias Voltage Supply is intended for installation in a standard NIM bin and operates at ±12 and ±24 V dc input power provided through the standard NIM bin power connector. A toggle switch on the front panel is used to turn the unit On. Either the Positive or Negative LED indicator is illuminated when the unit is On.

POLARITY Internal switch selects the output voltage polarity. For reverse polarity, remove the short, left-side-panel cover on the unit and rotate the bracket restraining the polarity selector plug. The polarity selector plug can then be rotated by 180°. The "Output Positive" or "Output Negative" labels will then be visible. It is recommended that the Output Voltage controls be set to 0 and the Output Polarity indicator LEDs observed for indication of the proper output polarity before the unit is reset for high voltage. **The module must be removed from the bin, input turned Off, and the high voltage output fully discharged to ground at the Output connector before reversing polarity.**

HIGH VOLTAGE OUTPUT (J1) Rear panel SHV high voltage output connector furnishes the adjusted output voltage. Output impedance ~20 Ω.

OUTPUT VOLTAGE CONTROL Output voltage is read directly from the sum of the dial settings on the front panel. A continuous 10-turn dial directly reads from 0 to 1000 V with a resolution of 1 V. A 500-V-step selector switch with up to four step positions is provided. Output voltage is the sum of switch and dial settings.

FRONT PANEL METER Edge-reading meter for monitoring the output voltage. This meter provides a coarse indication of the output voltage. Precise output voltage settings should be derived from the calibrated voltage control dials.

INHIBIT (J2) Rear panel BNC connector. Output voltage is reduced to zero by shorting the center contact to ground; Z_{max} of ground circuit <30 Ω. The Inhibit Gate functions at all output voltage settings; can also be used to reset an overload condition which causes the unit to go into automatic shutdown.

AUTOMATIC SHUTDOWN The unit provides automatic protection against sustained overloading which causes the high voltage to shut down completely. This condition is indicated by the zero output reading on the meter, independent of voltage control setting. A short duration arc-over or turn-on charging transient will not cause shutdown. To reset, the unit must be turned Off for ~5 seconds, then turned back On. Gating the unit Off via J2 will also reset the automatic shutdown condition.

4. FUNCTIONAL DESCRIPTION

A schematic and block diagram are included at the back of the manual.

The 2-kV Bias Voltage Supply is basically a dc-dc converter which converts low voltage dc power to high voltage dc output. This output voltage is highly regulated and filtered and can be varied by the front panel voltage controls. The input to the dc-dc converter is obtained from the ±12 and ±24 V dc in the NIM bin.

An oscillator determines the high frequency (~20 kHz) at which all amplification, high voltage transformation, rectification, and filtering occurs. The amplification is a function of a control voltage which performs the functions of control and regulation. A sample of the output voltage is compared with a reference voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed voltage output.

5. MAINTENANCE

5.1. TEST EQUIPMENT REQUIRED

Following is a list of test equipment required for the procedures used to determine that the equipment is operating to specifications.

- Oscilloscope
- Digital Voltmeter
- High impedance, high voltage, 1000:1 precision dc voltage divider
- Capacitive-coupled ac viewing circuit
- High voltage load resistor rated for maximum voltage and current

5.2. PREPARATION FOR MEASUREMENTS

Connect the high voltage output of the power supply to the high voltage terminal of the dc voltage divider and to the capacitor input of the ac viewing circuit. The low voltage terminal of the dc divider should be connected to the digital voltmeter input, and the ac viewing circuit output connected to the oscilloscope input. Make sure that a good ground is connected to all instruments, viewing circuits, and the power supply before applying input power.

5.3. PERFORMANCE TESTS

Check to assure that the procedures in Section 5.2 have been followed. Turn the front panel output voltage controls to maximum output. The digital voltmeter should indicate the maximum rated output of the unit.

Connect one end of the high voltage load resistor to ground and the other end to the shorting stick. Then, with the shorting stick, connect the load resistor across the high voltage output and observe the change in output voltage. During this no-load to full-load test, the digital voltmeter reading should not change by more than 0.001%.

With the load connected as above, observe the ac-ripple voltage on the oscilloscope. The ripple should be less than the specified peak-to-peak ripple under this condition of full load and maximum voltage.

Additional line and load regulation and ripple measurements may be performed at other voltage levels using the same procedure outlined. This should not usually be necessary. Satisfactory test data at maximum output voltage and the full range of voltage control generally indicate that satisfactory test data will be obtained at all voltage levels. However, full range testing is performed at the factory on each unit prior to shipment.

6. TROUBLESHOOTING

Prior to troubleshooting the unit, proper input must be applied and the polarity connector must be attached. Be sure that the output is not being overloaded and that any overload condition causing automatic shutdown has been properly reset.

Removal of the unit's two side covers provides access to all assemblies. No further disassembly is required for troubleshooting purposes. **Once the cover has been removed, extreme caution must be exercised as potentially dangerous voltages are accessible.** Make sure all test instruments are grounded, either to the high voltage connector shield or directly to the chassis, prior to the application of input power to the unit. The following procedures should then be followed.

1. Determine that the ±12 and ±24 V dc obtained from the NIM bin are operating properly.

2. If all of the low voltage power supplies are operating properly and no high voltage output is obtainable, either the control module or the high voltage module is probably defective. To determine which unit is defective, test for ac drive to the base of drive transistors Q101 and Q102 on the control module. If drive is present, the encapsulated high voltage module or transistors Q101 and/or Q102 is probably defective. If there is no drive even when the voltage control is raised, the fault is probably in the control module.

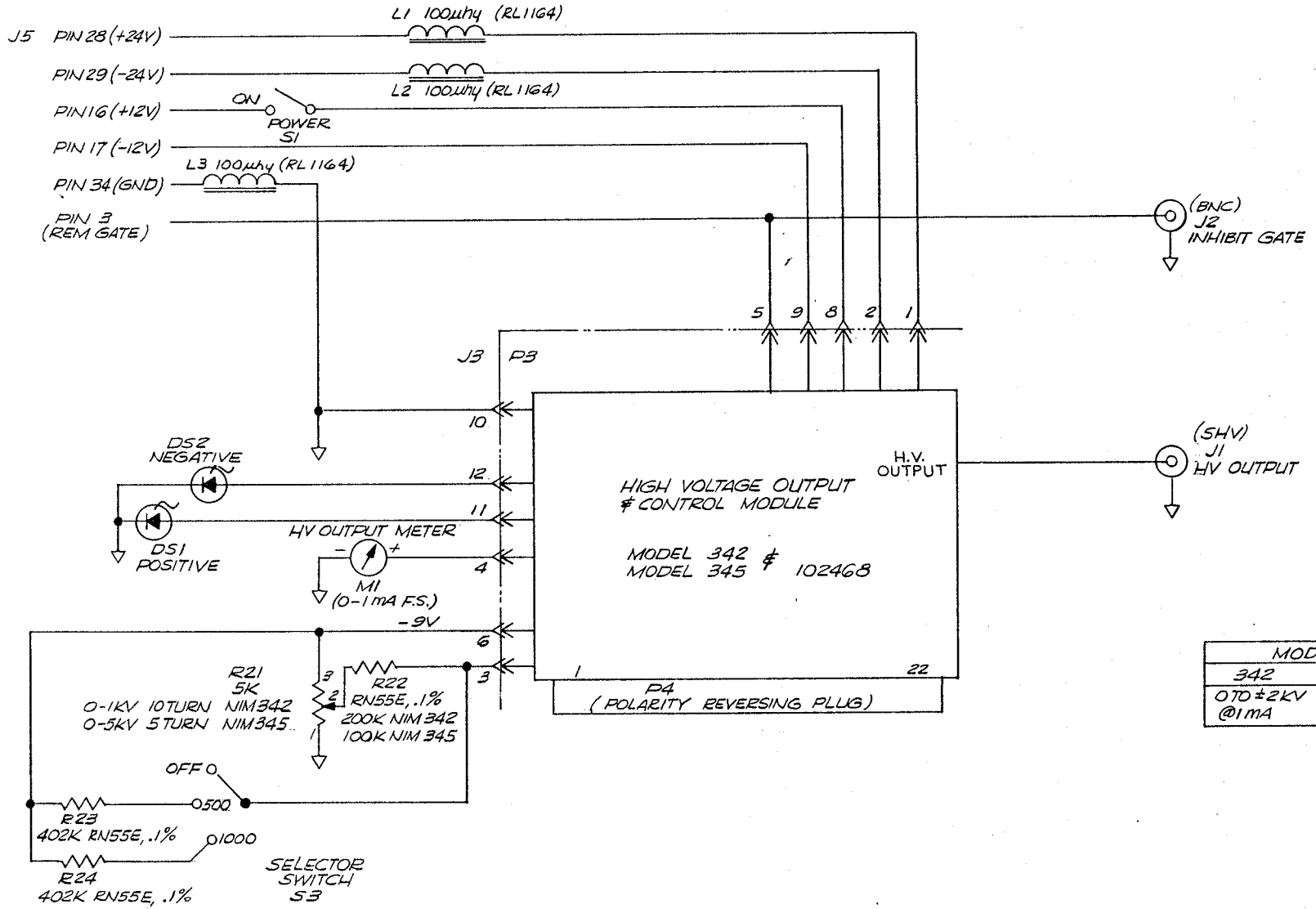
After installation of a new control or high voltage module, it is necessary to readjust the oscillator frequency control, R103, located on the control module. Set the unit for maximum voltage and no load and, observing the waveform at the emitter of Q101 or Q102, adjust R103 for minimum emitter waveform.

Spare assemblies, switches, connectors, voltage controls, meters, etc. can be obtained from the factory. When ordering, specify the Model number, serial number and schematic diagram reference number to assure direct replaceability with the original assemblies.

6.1. FACTORY REPAIR

This instrument can be returned to the EG&G ORTEC factory for service and repair at a nominal cost. The EG&G ORTEC standard procedure for repair ensures that the same quality control and checkout procedures that are used for a new instrument will be used for the repaired unit. Always contact Customer Services at EG&G ORTEC, (615) 482-4411, before sending in an instrument for repair to obtain shipping instructions and so that the required Return Authorization Number can be assigned to the unit. This number should be written on the address label and on the package.

LTR	REVISIONS	DATE	APPROVED
B	REVISED & REDRAWN, L1&2 ADDED	11/9/77	
C	ADDED L3	2/9/78	



MODEL	
342	345
0 TO ±2KV @1mA	0 TO ±5KV @.3mA

SELECTOR SWITCH S3, RESISTORS R23 & R24 ARE OMITTED ON NIM 345.

202163	345
202163	342
NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS·DECIMALS·ANGLES

MATERIAL:

FINISH:

DR CB 11/9/77
CK [illegible] 11/14/77
APVD

BERTAN ASSOCIATES, INC
SYOSSET, NEW YORK

SCHEMATIC DIAGRAM SINGLE WIDTH DC INPUT 'NIM'

SIZE C | CODE IDENT NO 50429 | DRAWING NO 202162

SCALE | SHEET

NEXT ASSY	USED ON
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS DECIMALS ANGLES	

FINISH:

DR CB 11/9/77
CK [illegible] 11/14/77
APVD

SINGLE WIDTH
DC INPUT 'NIM'

SIZE C | CODE IDENT NO 50429 | DRAWING NO 202162

SCALE — | SHEET 1 OF 1

MODEL	V+/V-	B+/B-
342	±12V	±24V
345	±12V	±24V
353	±15V	±15V
355	±15V	±15V

LTR	REVISION	DATE	APPROVED
A	HV PWR SUPPLY SECTION DRAWN AS SEPARATE SCHEMATIC. R127 56.2K WAS 110K	7/9/77	AR
B	SEE ECN 516	9/15/77	JH
C	R137 & 138 WAS 2.2Ω	1/18/78	JH
D	SEE ECN 529	1/24/78	JH
E	R132 - 5K POT WAS 2.5K 1/4 W FIXED RESISTOR, UPDATED NOTES	1/25/78	JH
F	ADDED CHART 1 .015@400 WAS .01@200	1/27/78	JH

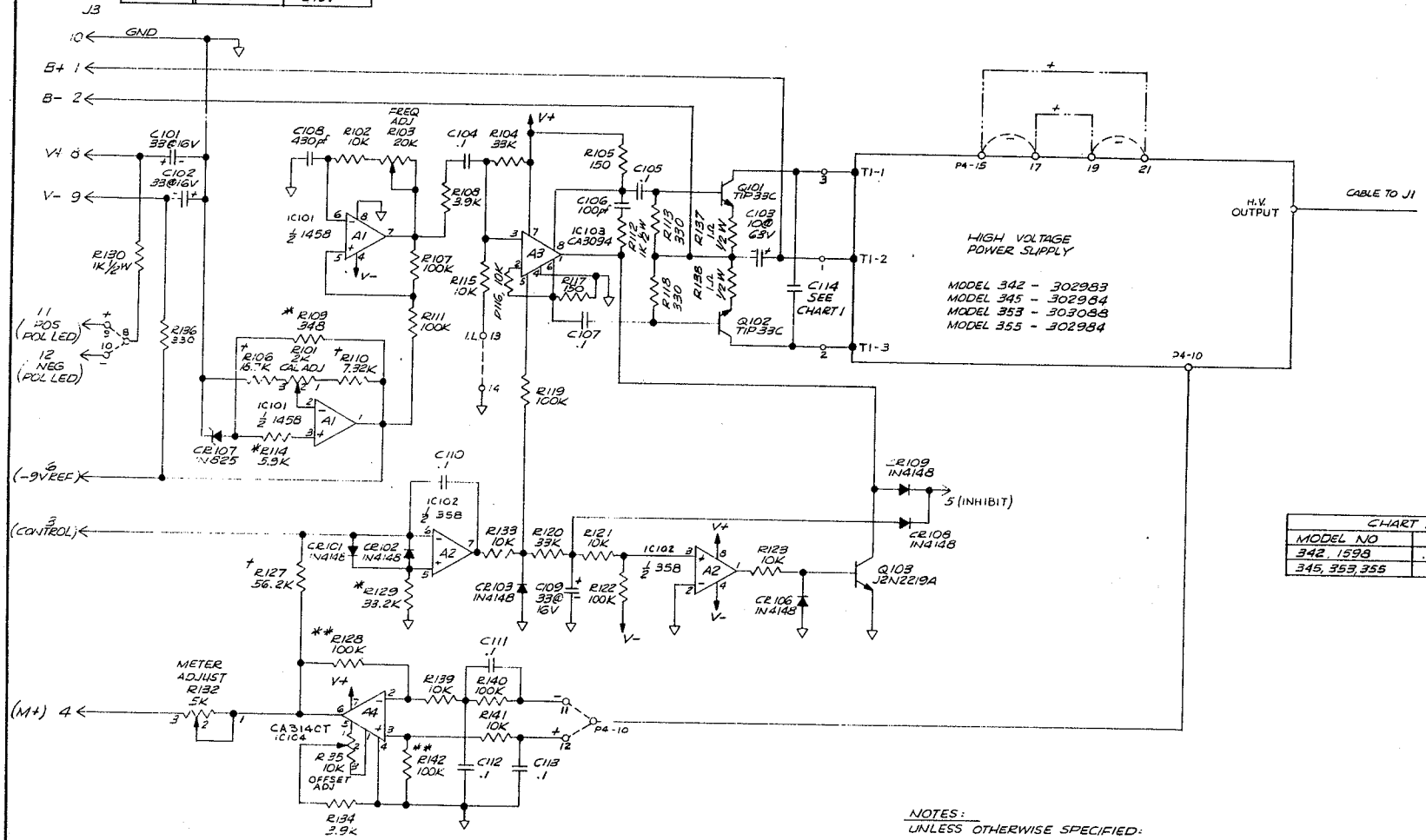


CHART 1	
MODEL NO	C114
342, 1598	.015@400V
345, 353, 355	OMIT

NOTES:
UNLESS OTHERWISE SPECIFIED:

1. ALL CAPACITORS IN MICROFARADS ±10%.
2. ALL RESISTORS 1/4W.
3. ALL RESISTORS IN OHMS ±5%.
4. (*) SYMBOL INDICATES RN55C, ±1%, (**) RN55E, ±.1%, (†) RN55E, ±1%.

LAST COMPONENT NUMBERS USED ARE
R142, CR109, Q103, C114

	355
	353
	345
	342
NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL:

FINISH:

BERTAN ASSOCIATES, INC SYOSSET, NEW YORK

SCHEMATIC 2,3 & 5 KV
SINGLE WIDTH 'NIM'

DR CB 2/23/77
CK [illegible] 6/23/77
APVD

SIZE D | CODE IDENT NO 50429 | DRAWING NO 202468

SCALE — | SHEET 1 OF 1