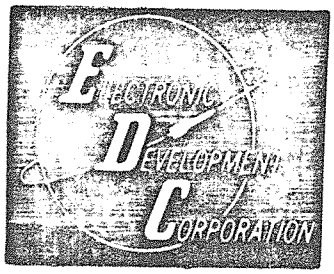
Serial#'s 10016-
Has PA2002, 2P 6 Pos Switch



ELECTRONIC DEVELOPMENT CORPORATION

INSTRUCTION AND MAINTENANCE MANUAL

PRECISION STANDARD

Model 3200 Serial # _____

ELECTRONIC DEVELOPMENT CORPORATION
11 HAMLIN STREET, BOSTON, MASS. 02127, Area Code 617, 268-9696

WARRANTY

The ELECTRONIC DEVELOPMENT CORPORATION (EDC) warrants to the original purchaser each instrument manufactured by them to be free from defects in material and workmanship. This warranty is limited to servicing, repairing and/or replacing any instrument or part thereof returned to the EDC factory for that purpose in accordance with the instructions set forth below; and furthermore to repair or replace all materials, except tubes, fuses, transitors and other semi-condutor devices which shall within one year of shipment to the original purchaser be returned to the EDC factory and upon examination be deemed defective.

EDC instruments may not be returned to the factory under the terms of this warranty without the prior authorization of the EDC Service Department. All instruments returned to EDC for service hereunder should be carefully packed and shipped. All transportation charges shall be paid by the purchaser.

EDC reserves the right to discontinue instruments without notice and to make changes to any instrument at any time without incurring any obligation to so modify instruments previously sold.

This warranty is expressly in lieu of all other obligations or liabilities on the part of EDC. No other person or persons is authorized to assume in the behalf of EDC any liability in the connection with the sale of its instruments.

CAUTION: The instrument you have purchased is a precision instrument manufactured under exacting standards. Any attempts to repair, modify or otherwise tamper with the instrument by anyone other than an EDC employee or authorized representative may result in this warranty becoming void.

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SECTION I

1.1.0 GENERAL DESCRIPTION

1.1.1 The Model 3200 Current Calibrator is a highly accurate voltage to current amplifier. The application of a precise voltage to the input terminals produces a proportional current into any load within the compliance range of the instrument. The input voltage can be DC or AC up to 1 khz.

1.1.2 The unit is laboratory calibrated with instrument and load resistor traceable to N.B.S.

1.1.3 Current Calibrator Controls are on the front panel. Applying power and setting the range prepares the 3200 for operation.

1.1.4 The circuitry is solid state. Derated components are used throughout to minimize temperature effects. Forced air cooling is provided. The air input and output ports are located to facilitate conventional bench or rack mounting. The input is protected against over-voltage and high output impedances.

1.2.0 APPLICATIONS

1.2.1 Direct calibration of Watt Meters (with applicable Voltage Standard), Meter Shunts, AC & DC Current Meters, Current to Voltage Transducers, Current to Pneumatic Transducers, DVMs, DMMs, and relay coil current testing.

GENERAL SPECIFICATIONS

Power Requirement	117 Vac 60 Hz 150 W
Optional	220 Vac 50 Hz
Temperature Coefficient	50 ppm/°C 1 A and 10 A
	10 ppm/°C 1 mA, 10 mA, 100 mA
Operating Temperature	10 to 40° C
Weight	30 lbs. 13.6 kg.
Shipping Weight	(USA) 34 lbs. 15.4 kg.
Rack Mountable	5.22H x 19W x 16D inches
	123 x 483 x 406 mm.
Certification	Certificate of Compliance
	traceability to U.S. Bureau
	of Standards

ELECTRICAL CHARACTERISTICS

Input Voltages	0 to ±10Vdc
	0 to 10 V rms
Input Impedance	10 k All Ranges
AC Band Width	50 Hz to 1 kHz
Ranges	10 A; 1 A; 100 mA; 10 mA; 1 mA
Resolution	Limited by resolution of input source.
Compliance Voltage	1 mA to 1 A, 5 Volts DC or 5 Volts AC Peak
	10 Amps, 1.5 Volts DC or 1.5 Volts AC Peak
Load Regulation	±0.005% from 10% to 90% of full compliance
Line Regulation	±0.0005% for ±10% line change
Distortion (added to input Distortion)	1mA to 1A Range $<$.2%
	10Amp Range $<$ .5%
Accuracy	DC ± .01% setting + .01% R + 10 μA
	AC ± 05% setting + .01% R + 20 μA

SECTION II

2.0.0 The Model 3200 is equipped for rack mounting in a standard 19-inch rack. It is completely enclosed in dust covers and therefore suitable for bench top use. Tilt bale is available on request.

2.1.1 The overall size is 5.22H x 19W x 16D inches. It weighs 30 lbs. A standard 3-prong polarized plug and power cable is attached.

2.1.2 The instrument has been designed to be easily transported from one location to another and will be within operational specifications within one minute after power is applied.

SECTION III

3.0.0 OPERATION OF INSTRUMENT

3.1.0 GENERAL

3.1.1 The Model 3200 is a voltage to current amplifier which requires only a driving source to generate output currents to 10 amperes.

3.1.2 Operation is simple and straight forward with a few reasonable precautions to prevent damage to equipment under test.

3.2.0 INTERCONNECTIONS

3.2.1 The 3200 should be plugged into the AC line with the Power Switch off.

3.2.2 The shorting bar supplied with the unit should be on the Output Terminals.

NOTE: Open Circuit Compliance Voltage is 7.5 Volts.

3.2.3 The load may be connected to the output terminals. The connections should be made to the inside portion of the five-way binding post. This serves two purposes: it permits removal of the shorting bar when desired, or its reinsertion; also, a more

secure, and electricly low ohmic connection may be made, reducing the IR drop at the binding post. This is critical at the high current levels where unnecessary IR drops reduce the available compliance voltage at the load.

3.2.4 Select the desired range with the five-position RANGE switch.

3.2.5 Connect suitable AC or DC voltage source to the input terminals. Select the desired input voltage to deliver the required output current.

The output current and input voltage required may be derived as follows:

$$I_{out} = \frac{Vin \times Range}{10} \qquad (1)$$

$$Vin = \frac{10 \times I_{out}}{RANGE} \qquad (2)$$

NOTE: The maximum input voltage is 10 Vdc or rms AC

3.2.6 Turn on 3200. When overload light extinguishes, the shorting plug on the output terminals may be removed. If the overload light comes on again, check load and output connections. The load may be wrong for the current being called for:

$$R_{L\ max} = \frac{E\ compliance}{I_{out}} \qquad (3)$$

3.3.0 SPECIAL OPERATING CONSIDERATIONS

3.3.1 Reasonable care should be exercised in the selection of wire size used to connect high current loads to the 3200. A choice of size, with a high IR drop, or a poor connection at the 3200 or the load will limit the compliance voltage available at the load.

3.3.2 Accurate measurements of the current through the load should be made at the load, not at the 3200 terminals, i.e. as in determining resistance values of shunts, etc.

3.3.3 The Model 3200 is factory tested and calibrated with 1kΩ, 100Ω, 10Ω, 1Ω, and .1Ω on the 1mA, 10mA, 100mA, 1 Amp, and 10 Amp Ranges, respectively.

3.3.4 Although all precautions have been made to minimize the effects of thermals, it is a good practice to allow, when time permits, 15 minutes between high current usage (1 or 10 Amps) and milliamp range measurements. The unit does not exceed its basic accuracy specifications for the low ranges. However, some drift does occur in the sensing circuits due to high current operation which may affect critical milliamp measurements.

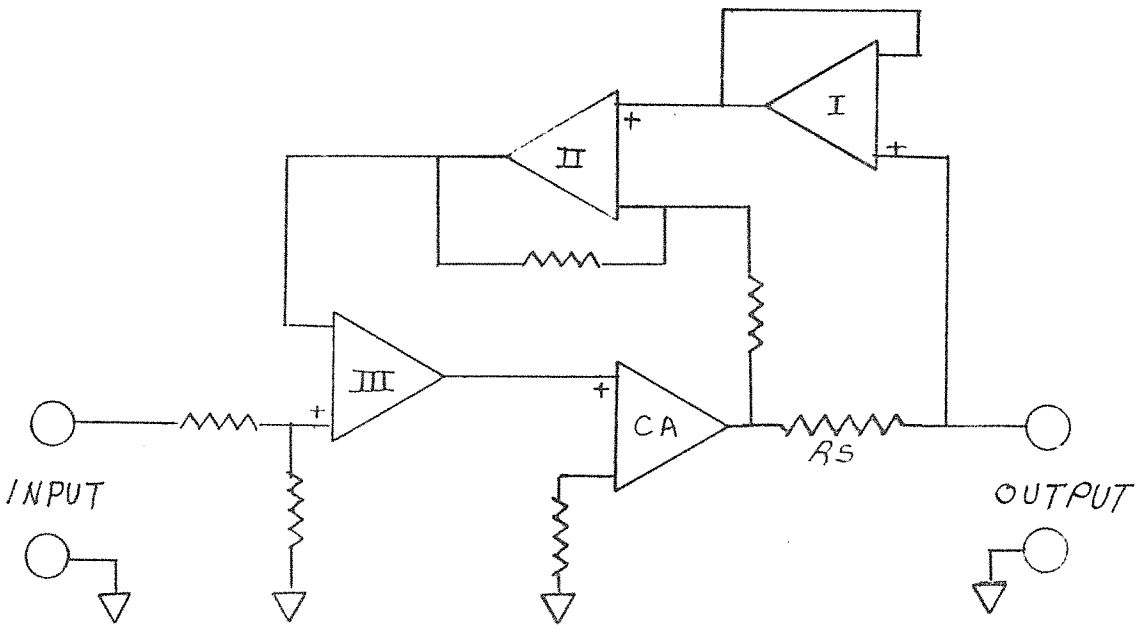
SECTION IV

4.0.0 THEORY OF OPERATION

4.1.1 A Non inverting 3 stage amplifier driving a current boost stage.

Range selection

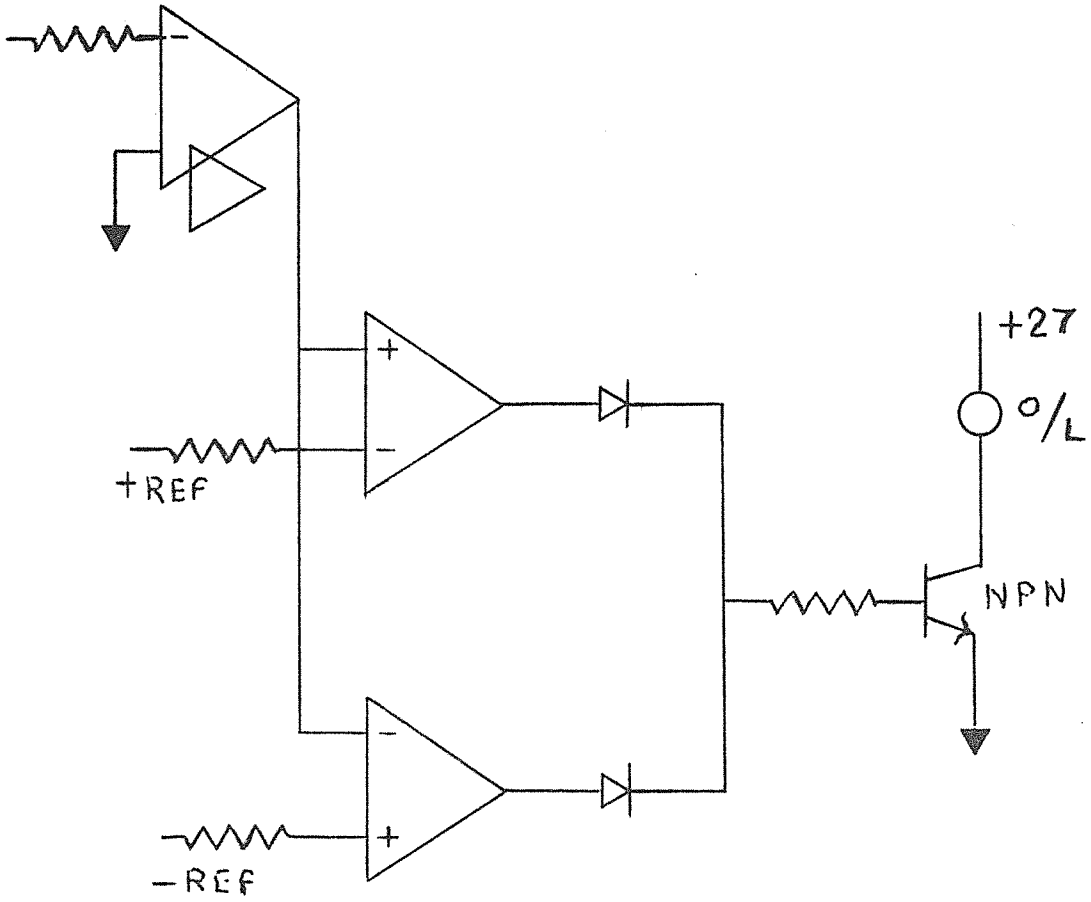
$$I_{OUT} = .1\left(\frac{E_{IN}}{R_S}\right) \quad (4)$$



is accomplished by switching Rs (see diagram above). A high current power supply and adequate wire size makes available the high compliance with a minimum of internal heat generation.

4.1.2 Range selection is accomplished by selecting Rs values in accordance with Eq. 4. Though a fixed 9 k input resistor is used, each range has a trim resistor to compensate for the tolerance of the sense resistor Rs.

4.1.3 The overload indicator circuit senses a malfunction mode of the 3200 by monitoring the output of the voltage amplifier. An extreme negative or positive voltage triggers a comparator circuit which turns on the light driver transistor.



SECTION V

5.0.0 MAINTENANCE

5.1.0 The Model 3200 is designed to be trouble-free. Maintenance is scheduled for once a year.

5.1.1 Switches and Relay

5.1.2 Dirty or mechanically misaligned contacts can cause excessive IR drops which will take away from the compliance voltage at the load.

5.1.3 The switch is lubricated at the factory, and it is recommended that it is not serviced during the first year.

NOTE: Over-zealous cleaning may damage the switch. Clean and lubricate only when necessary.

5.1.4 Apply once a year, EDC 2008 lubricant, in small amounts to the switch contacts. Rotate the switch several times to disperse the lubricant.

5.1.5 If inspection or faulty 10 Amp operation reveals a defective relay, do not attempt to clean. Replace relay, using the old relay as a wiring guide.

5.2.0 CALIBRATION

5.2.1 Calibration of the 3200 consists of trimming the input resistor. This trimming may affect the input inpedance by as much as 1%, but this should not present a problem for most voltage sources.

5.2.2 Fixed resistor trims have been installed at the factory which sould permit final tweaking with the five (5) range pots on the range switch. In the event a sense resistor should have to be replaced, the fixed resistor trim may have to be replaced.

5.3.0 IDLING CURRENT

5.3.1 The output stages must be biased to minimize cross-over distortion in AC operation. This is done by setting the bias while monitoring the collector current.

5.3.2 With a short on both the input and output terminals, select the 10 amp range. Locate the two 8.3 mF power supply capacitors joined plus to minus and grounded at that point. Place a DVM from the negative ungrounded capacitor terminal to the top MJ 4030 transistor collector on the heat sink. This will be from one end of A #18 lead wire to the other end. The voltage drop across this wire should not exceed the value written on a tag on the heat sink. Adjust R2 for that value.

Too low a reading will result in distortion. An excessive reading would result in high idling current and could damage the output stages. This wire length represents approximately 6 milliohms, so it can be seen that the ideal idling current is 40 mA.

5.3.5.0 AMPLIFIER OFFSET ADJUSTMENT (FIG A-3499)

5.3.5.1 Set range switch to 100 MA. Place short on input terminals. Place 100Ω resistor on output terminals.

5.3.5.2 Place DVM across 100Ω resistor. If voltage is less than 50 μv then proceed to common mode adj.

5.3.5.3 Place jumper from pin 5 to point "G" on amplifier board.

5.3.5.4 Place DVM between point "A" and "G" on amplifier board.

5.3.5.5 Place standby-operate switch in standby. Adjust RB for a reading of less than 10 μv.

5.3.5.6 Place DVM across 100 Ω load resistor connected to the output terminals. Adjust RA for a reading of less than 10 μv.

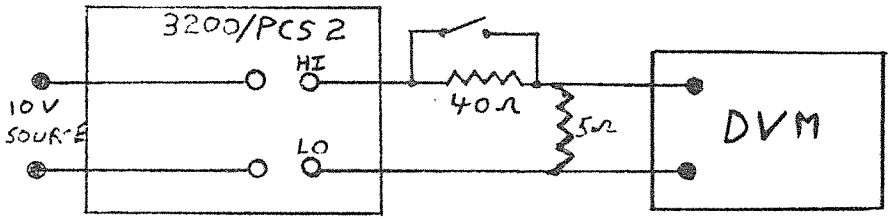
5.3.5.7 Place standby-operate switch in operate, remove jumper wire from points "5" and "G". Adj R1 for a reading of less than 10 μv.

5.3.5.8 Zero is now complete.

5.3.6.0 LOAD REGULATION CALIBRATION (FIG A3499)

5.3.6.1 A 5Ω precision resistor, A 40Ω resistor and a switch or cliplead are needed for this procedure.

5.3.6.2 Set the 3200 to the 100 MA range. Connect the 40Ω and 5Ω resistors in series across the output terminals.



5.3.6.3 Connect DVM across 50Ω resistor. Input 10V to the 3200/PCS2.

5.3.6.4 Short out the 40Ω resistor, observe reading on DVM.

5.3.6.5 Remove short from 40 Ω. If necessary adjust Rx until DVM reads the same as in step 5.3.6.4.

5.3.6.6 Repeat 5.3.6.4 and 5.3.6.5 as necessary until the two readings are within 25 μv of each other.

5.3.6.7 This completes the load regulation calibration.

5.4.0 OUTPUT CURRENT CALIBRATION

5.4.1 The factory calibration is done using an EDC Precision Voltage Standard; 1kΩ, 100Ω, 10Ω, 1Ω, and .1Ω calibrated load resistors.

5.4.2 Zero Adjustment

5.4.2.1 Place a short on the input terminal, and 10Ω on the output terminal. Select the 100 mA range. adjust R1 for zero as read across the 100Ω resistor.

5.4.3 The 1 mA range is adjusted first after a one-hour warm-up period. 10 V is applied to the input terminals, and a 1kΩ resistor to the output terminals.

Measuring directly at the resistor terminals adjust R3 for 1.00000 Volt.

5.4.4 Switch to the 10 mA range; using the 100 Ω resistor adjust R4 for 1.000000 Volt.

5.4.5 Replace the 100 Ω resistor with 10Ω; place the range switch in the 100 mA position. Adjust R5 for 1.00000 Volt.

5.4.6 Switch to the 1 Amp range; using the 1Ω resistor, adjust R6 for 1.000000 Volt.

5.4.7 Replace the 1Ω resistor with a .1Ω resistor. Allow a 15-minute stabilization period, adjust R7 for 1.000000 V across the .1Ω.

SUPPLEMENT TO MANUAL
3200 - PCS2 Model

General:

The Model PCS2 is a 3200 Current Calibrator, adapted for remote control. The control is TTL compatible, positive logic

Four bits of range information, is required to select the five ranges.
One line is available and must be used for "Standby-Operate" Command.

Operation:

Standby:- A logical "1" on the standby line places the PCS2 in the standby mode when the remote light is on.

The manual Standby switch on the front panel overrides the remote Standby Operate Command, and will keep the PCS2 in standby.

Range Lines:- Four lines of BCD data must be used to program the PCS2. The Range Logic Table below:

1 Ma	0001
10 Ma	0010
100 Ma	0011
1 Amp	0100
10 Amp	0101

All other codes appearing on these lines will force a standby condition.

These range codes may be changed to make the unit system compatible. Consult with factory for information.

Connector Wiring:-

Pin	Line
A	1
B	2
C	4
D	gnd (Wire to Stby toggle switch)
E	8
F	Stby (Wire to Stby toggle switch)

501 - PCS-2 SYSTEM
RANGE ASSIGNMENTS
IEEE STD 488 BUS
(See Para. 6.5.3.1 of 501 MANUAL)

b1	b2	b3	b4	501 RANGE	PCS-2 RANGE	ASCII CHAR
0	0	0	0	100mV	STBY	0
1	0	0	0	10V	STBY	1
0	1	0	0	10V	STBY	2
1	1	0	0	10V	STBY	3
0	0	1	0	10V	STBY	4
1	0	1	0	10V	STBY	5
0	1	1	0	10V	STBY	6
1	1	1	0	10V	STBY	7
0	0	0	1	10V	1 mA	8
1	0	0	1	10V	10 mA	9
0	1	0	1	10V	100 mA	:
1	1	0	1	10V	1 A	;
0	0	1	1	10V	10 A	<

501 - PCS-2 LOGIC INTERCONNECTION

		501 EDGE CONNECTOR	PCS-2 AMPHENOL 6 PIN MALE
Black	GND	A8	D & E
Brown	B2	A3	A
Red	B4	A4	B
Orange	B8	A1	C
Yellow	$\overline{B1}$	A2	F

Manual Operation:-By pressing the Local-Remote switch the PCS2 may be operated at the front panel.

The range lights indicate the operating range, in either Local or Remote.

7.0.0 RECOMMENDED SPARE PARTS LIST
for
EDC Model 3200

QTY	DESCRIPTION	PART NUMBER
1	Fan	PAM Model 8500C
1	Regulator	RC-4194 TK
1	Rectifier Bridge	MDA 3501
1	Rectifier Bridge	MDA 200
1	Capacitor 83,000/15V	36DX833G01
1	Capacitor 470/40-50V	
1	Switch Assembly	12-2
1	Switch	12-E
3	Resistor 1Ω 50W	850F 1RO
1	Resistor 10Ω 50W	850F 10R
1	Resistor 100Ω 0.1%	RCL
1	Resistor 1kΩ 0.1%	RCL
1	Resistor 10kΩ 0.1%	RCL
1	Resistor 9kΩ 0.1%	RCL
5	Light bulbs	327
1	Diode 24V	1N5359 B
2	Diode	1N 4005
1	Relay	GP 3R 231AD
3	Diode	1N914
1	Amplifier	OP-07
1	Amplifier	741
1	Amplifier	EDC 225

ELECTRONIC DEVELOPMENT CORPORATION

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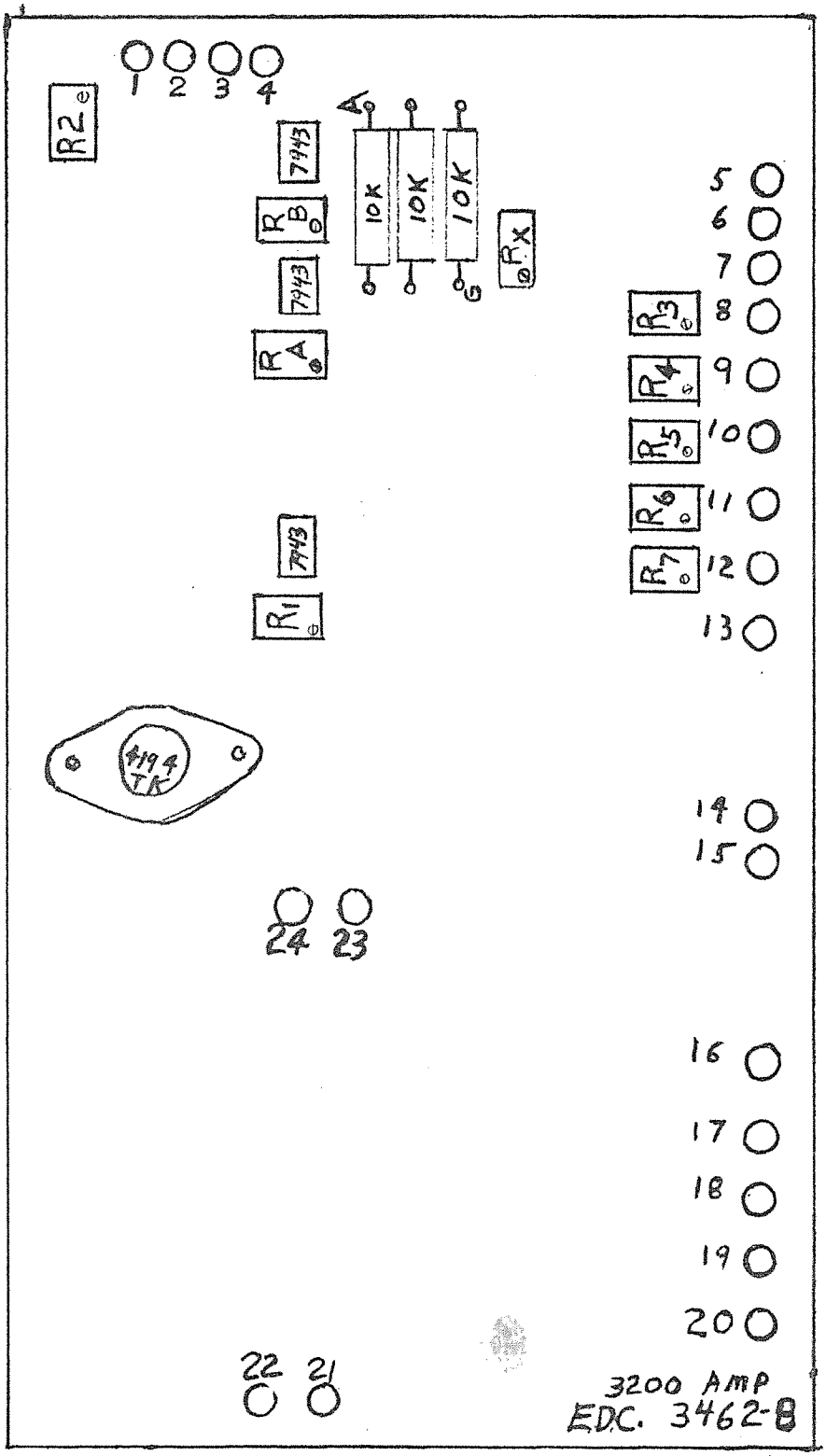


1980/81

ENG BOB L.	3200 CALIBRATION LAYOUT
DRN BY PAUL L.	
DATE 2-20-80	A-3499 REV 1
MODEL 3200	

ISOL Vcc

330Ω 10K → 1 (Z13) 2 (Z14) 4 (Z15) 8 (Z16) PROG STBY (Z17)

+5

+12V

K1 K2 K7 K3 K8 K4 K5 K9 K10

Z3 - 7430
Z9, Z5 - 7400
Z6 - 7404
Z10, Z11 - 7407
Z12 - 7406

6.8K PULLUP ON ALL INPUTS

+27

14-6 13-6 9-6

7442 Z2

7452 Z1

Z6-1

STBY

1MA 10MA .1A 1A 10A

LOCAL

SPR

6.8K

Z3 Z4 Z5 Z6 Z10 Z11 Z12

Q36 MJE800

Q37 800

Q39 800

Q38 MJE800

680Ω

Kb

Bob Lo	PCS-2
R.V.B	Logic Diagram
3-27-79	B-3453

ELECTRONIC DEVELOPMENT CORPORATION
11 HAMLIN STREET, BOSTON, MASS. 02127

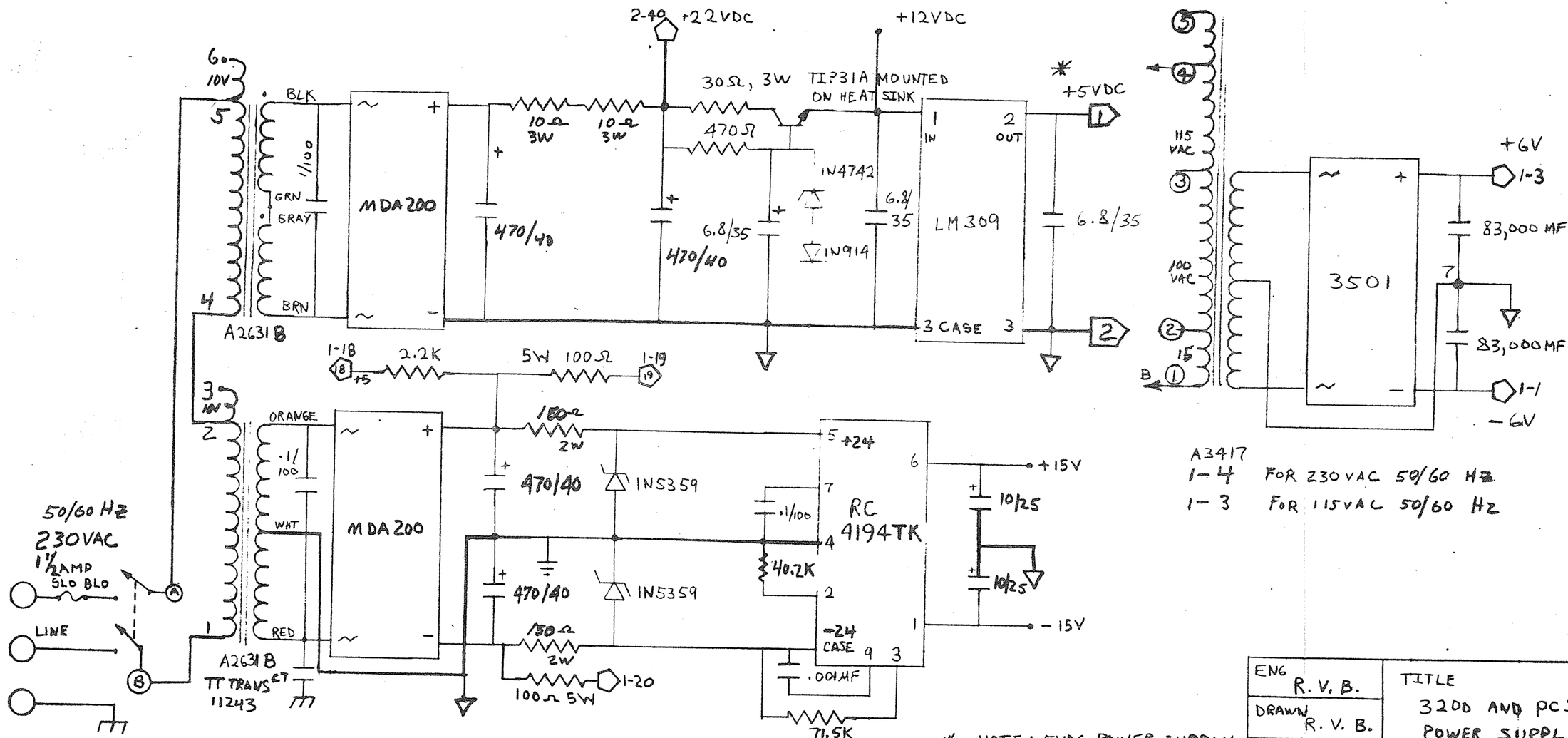
TRANSFORMER A2631B

FOR 115 VAC

Connect 1 to 4

" 2 to 5

NO JUMPER 4 to 2



A3417

1-4 FOR 230 VAC 50/60 Hz

1-3 FOR 115 VAC 50/60 Hz

* NOTE: 5VDC POWER SUPPLY CIRCUIT IS USED IN PCS-2 UNIT ONLY.

ENG R. V. B.	TITLE 3200 AND PCS-2 POWER SUPPLY SCHEMATIC
DRAWN R. V. B.	
DATE REV 10-1-80	
MODEL 3200, PCS-2	DRW # B-3[illegible]2-1

ELECTRONIC DEVELOPMENT CORPORATION

11 HAMLIN STREET, BOSTON, MASS. 02127, Area Code 617, 268[illegible]

TYPICAL CURCUIT IN EACH RANGE

+5V

.1mA
1mA
10mA
1A
10A

INPUT 0-10V

20Ω
5K 1%
100Ω 1%
5K 1%
TRIM

1K
STNBY/OPERATE
IN4741
IN4741
IN914
CT
1K
200 PF

1K 1%

+27
AMB
GREEN
STNDBY/OPER.

+15
-15

2X IN914

-IN
EDC 225
COM
OUT
INPUT COM
+V
-V
TRIM
47K
50K

+15V
3.3K
MJE 243
100Ω
.1
680Ω
680Ω
MJE 253
100Ω
39K
3.3K
+27V
OVERLOAD
-15V

6.8/35
OP-07-2
9K .01%
9K .01%
9K .01%
10K .01%
22PF
OP-07-1
+15V
-15V
+6V

1.8K
2N 5088
IN 4005's MOUNTED ON HEAT SINK
20K
1K
100Ω
MJ 4033
20 AMP
20 AMP
100Ω
MJ 4030
-6V

1K
10A
1A
100 mA
10 mA
1mA
0-10 AMP OUT
3PDT
(101Ω)
100Ω 1% (50W)
10Ω 1% (50W)
.1Ω 1% (50W)
1Ω 1% (50W)
IN 4005
27V

1AMP SLO BLO
LINE

IN914
160 K
75uF 50V
330 K
160K
330K
741
741
IN914
IN914
10K
MJE 800
27K

+6V
83,000 MFD
83,000 MFD
-6V
115 VAC
3501
F29U OR A3417

ALL 1% RESISTORS
RN60's EXCEPT 50W

115 VAC LINE
A2631A
1uF -100V
1530

+5V
2.2K
100Ω
+27V
330Ω
+470uF 40V
470uF 40V
330Ω
270Ω
-27V
IN5359
IN5359
.001 uF
37.4K
.001 uF
71.5K
RC 4194
GAIN
+15V
10uF 16V
10uF 16V
-15V

TITLE:	AMPLIFIER SCHEMATIC
ELECTRONIC DEVELOPMENT CORPORATION	DRAWING NO.: B-3321B
	DATE:
	MODEL: 3200