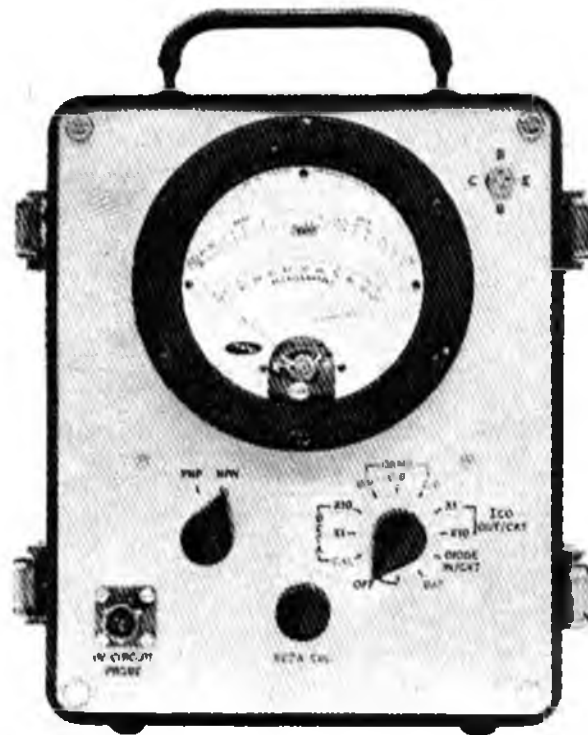


# IN-CIRCUIT SEMICONDUCTOR TESTER

MODEL 245MA

## TECHNICAL MANUAL



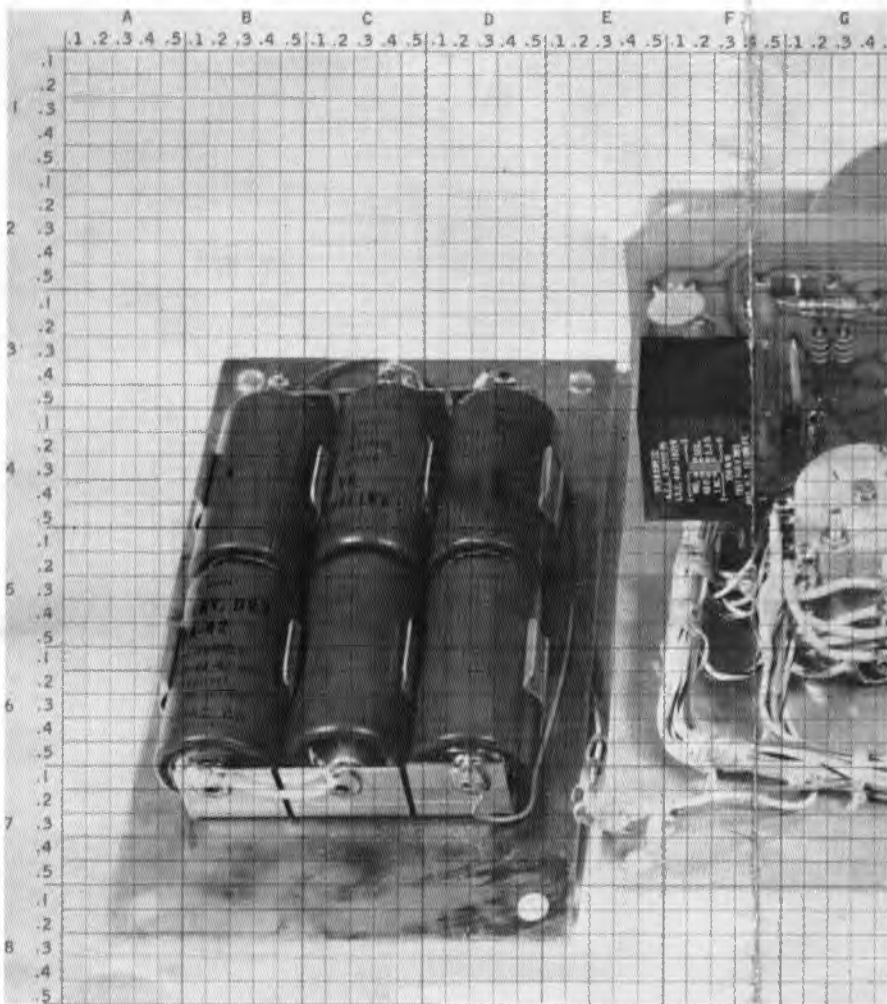
AMERICAN **E**LECTRONIC **L**ABORATORIES, INC.

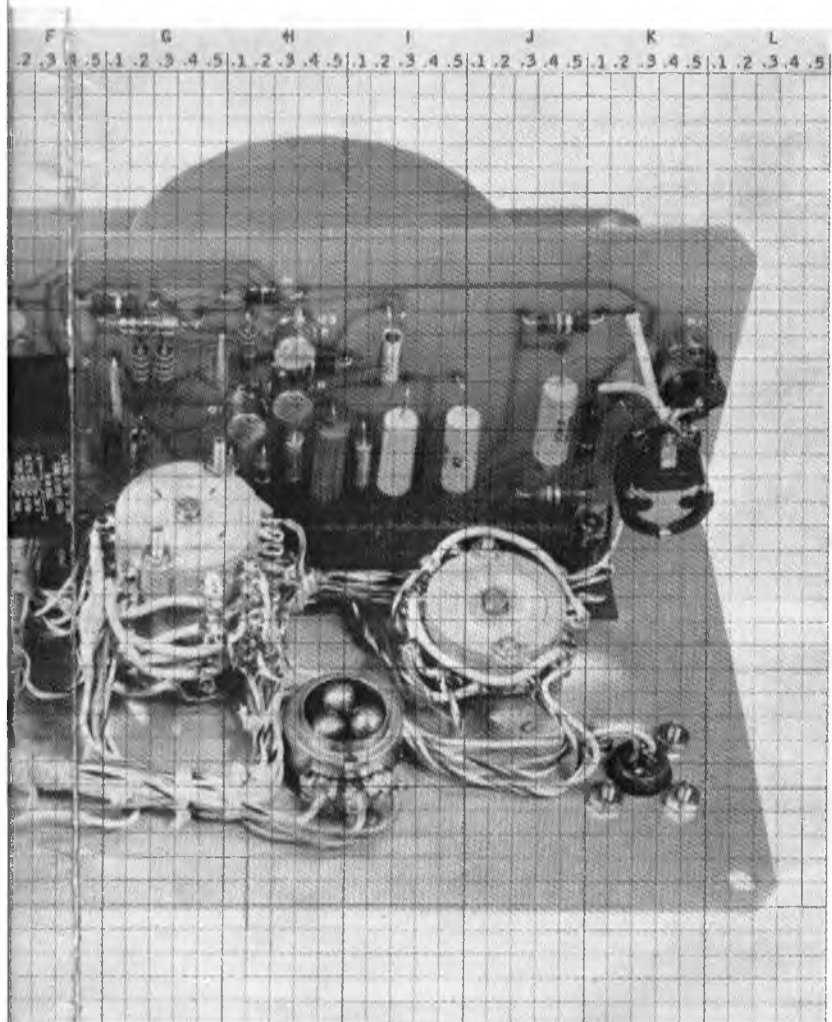
OPERATING INSTRUCTIONS				
S2 PNP/NPN SWITCH	S1 FUNCTION POS.	ACTIONS AND INDICATIONS	EQUIVALENT CIRCUITS	
—	OFF	1	METER POINTER INDICATES EXACTLY ZERO (A) WHEN METER IS NOT IN USE, S1 SHOULD ALWAYS BE 'OFF' TO AVOID UNNECESSARY DRAIN ON METER BATTERIES.	
BETA MEASUREMENTS (IN/OUT OF CIRCUIT)				
CORRESPONDS TO TYPE OF DEVICE UNDER TEST (OUT)	BETA CAL	2	PLUG TRANSISTOR IN TEST JACK, CBE (TRANSISTOR SOCKET J2); OR CONNECT TEST LEADS TO TRANSISTOR WITH YELLOW TO EMITTER, BLACK TO BASE AND RED TO COLLECTOR. ADJUST 'BETA CAL' CONTROL, R5, SO THAT METER INDICATES FULL SCALE.	
	BETA X1	3	METER INDICATES BETA DIRECTLY ON TOP SCALE. IF METER INDICATES BETA IS GREATER THAN 10, PLACE FUNCTION SWITCH S1 IN THE 'BETA X 10' POSITION. (SEE NOTE)	
	BETA X 10	4	MULTIPLY THE METER INDICATION OF BETA BY 10 TO OBTAIN BETA. (SEE NOTE)	
ELECTRODE RESISTANCE MEASUREMENTS (IN CIRCUIT)				
—	OHMS E-B	5	CONNECT TEST LEADS TO TRANSISTOR IN CIRCUIT WITH YELLOW TO EMITTER, BLACK TO BASE, AND RED TO COLLECTOR. RESISTANCE APPEARING BETWEEN EMITTER AND BASE ELECTRODES IS INDICATED ON THE CENTER (RED) SCALE OF THE METER.	
—	OHMS C-B	6	RESISTANCE APPEARING BETWEEN COLLECTOR AND BASE ELECTRODES IS INDICATED ON THE CENTER (RED) SCALE OF THE METER.	
—	OHMS C-E	7	RESISTANCE APPEARING BETWEEN COLLECTOR AND EMITTER ELECTRODES IS INDICATED ON THE CENTER (RED) SCALE OF THE METER.	
I <sub>CO</sub> MEASUREMENTS (OUT OF CIRCUIT)				
CORRESPONDS TO TYPE OF DEVICE UNDER TEST (OUT)	I <sub>CO</sub> OUT/CKT X1	8	PLUG TRANSISTOR IN TEST JACK, J2. METER INDICATES I <sub>CO</sub> DIRECTLY IN MICROAMPERES ON LOWEST SCALE. IF METER INDICATES OFF SCALE, PLACE FUNCTION SWITCH, S1, IN THE X 10 POSITION.	
	I <sub>CO</sub> OUT/CKT X 10	9	MULTIPLY THE METER INDICATION OF I <sub>CO</sub> BY 10 TO OBTAIN I <sub>CO</sub> . IF METER INDICATES OFF SCALE, REVERSE PNP/NPN SWITCH AND REPEAT POS. 8 TEST.	
DIODE I <sub>r</sub> MEASUREMENTS (OUT OF CIRCUIT)				
PNP	I <sub>CO</sub> OUT/CKT X1	8	CONNECT CATHODE OF DIODE TO RED TEST LEAD, AND ANODE OF DIODE TO BLACK TEST LEAD. METER INDICATES I <sub>r</sub> DIRECTLY IN MICROAMPERES ON LOWEST SCALE. IF METER INDICATES OFF SCALE, PLACE FUNCTION SWITCH, S1, IN THE X10 POSITION.	
	I <sub>CO</sub> OUT/CKT X10	9	MULTIPLY THE METER INDICATION OF I <sub>r</sub> BY 10 TO OBTAIN I <sub>r</sub> . IF METER INDICATES OFF SCALE, REVERSE PNP/NPN SWITCH AND REPEAT POS. 8 TEST.	
DIODE IN CIRCUIT MEASUREMENTS				
PNP	DIODE IN/CKT	10	CONNECT CATHODE OF DIODE TO RED TEST LEAD, AND ANODE OF DIODE TO YELLOW TEST LEAD, INCREASE 'BETA CAL' CONTROL UNTIL METER DEFLECTS DOWNSCALE. REVERSE PNP/NPN SWITCH IF METER DEFLECTS DOWNSCALE. NO DEFLECTION OF METER INDICATES THAT THE DIODE IS EITHER OPENED OR SHORTED, OR THAT THE RELATED CIRCUIT IMPEDANCE IS LESS THAN 20 OHMS.	
BATTERY CHECK				
—	BAT	11	IF BATTERIES ARE GOOD, METER INDICATES IN THE RED BOX LABELED 'BAT'.	
(A) ALIGNMENT PROCEDURE				

NOTE: POSITIONS 5, 6 AND 7 ARE USED TO PRECLUDE FALSE INTERPRETATIONS OF IN-CIRCUIT BETA MEASUREMENTS, SINCE ACCURACY OF THE BETA X 1 RANGE IS  $\pm 10\%$  ONLY WHEN E TO B LOADING IS EQUAL TO OR GREATER THAN 50 OHMS. BETA X 10 IS  $\pm 10\%$  ONLY WHEN E TO B LOADING IS EQUAL TO OR GREATER THAN 500 OHMS.

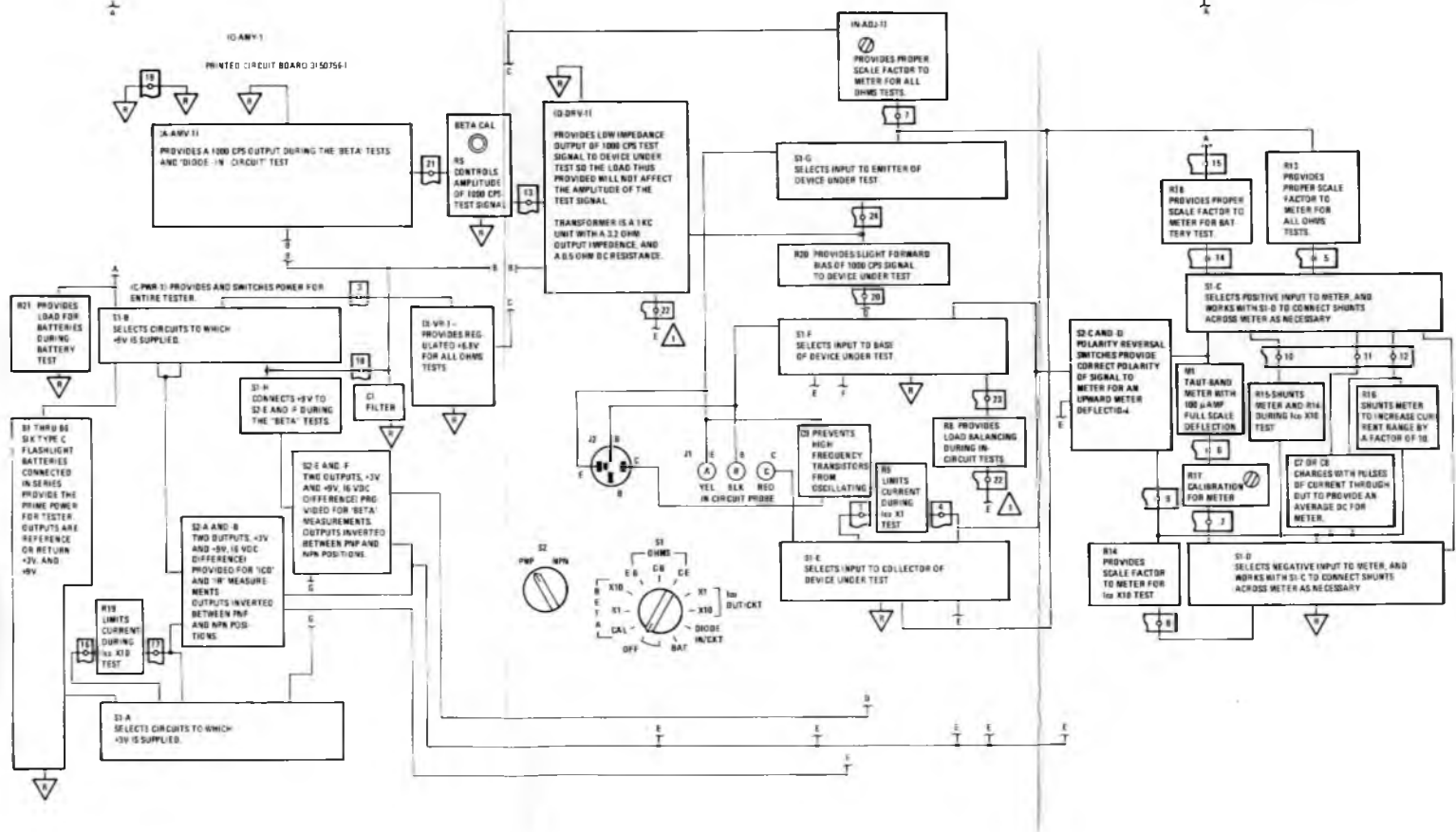
ALIGNMENT PROCEDURE		
STEP 1	FUNCTION SWITCH S1 IN 'OFF' POSITION	ADJUST METER ADJUST SCREW ON FRONT OF METER SO THAT METER POINTER INDICATES EXACTLY ZERO.
STEP 2	————	INSERT A 100 OHM +1% RESISTOR BETWEEN THE C-B SOCKETS OF TRANSISTOR TEST JACK ON FRONT PANEL.
STEP 3	FUNCTION SWITCH S1 IN 'OHMS E-B' POSITION	ADJUST R11 SO THAT METER INDICATES EXACTLY FULL SCALE. (INFINITY OHMS).
STEP 4	FUNCTION SWITCH S1 IN 'OHMS C-B' POSITION	ADJUST R17 SO THAT METER INDICATES EXACTLY 100 OHMS.
STEP 5	————	REPEAT STEPS 3 AND 4 UNTIL NO FURTHER ADJUSTMENT IS REQUIRED TO SATISFY BOTH CONDITIONS; THEN REMOVE THE RESISTOR INSTALLED IN STEP 2, AND PLACE FUNCTION SWITCH S1 IN THE 'OFF' POSITION

BATTERY REPLACEMENT	
STEP 1	REMOVE THE FOUR (4) SCREWS ON FRONT PANEL.
STEP 2	LIFT OUT FRONT PANEL ASSEMBLY.
STEP 3	REMOVE THE FOUR (4) SCREWS ON BATTERY COVER.
STEP 4	LIFT OUT BATTERY COVER WITH BATTERIES.
STEP 5	EXCHANGE BATTERIES AND RE-ASSEMBLE.
	(MAINTAIN CORRECT BATTERY POLARITY.)





REF DESIG	LOCATION	PART NO.	DESCRIPTION
RT1	B.4/4.3		TYPE C DRYCELL
RT2	B.2/8.1		TYPE C DRYCELL
RT3	C.3/6.1		TYPE C DRYCELL
RT4	C.3/4.3		TYPE C DRYCELL
RT5	D.3/4.3		TYPE C DRYCELL
RT6	D.3/6.1		TYPE C DRYCELL
C1	G.2/4.1	CS12A0220K	CAPACITOR, FXD, T <sub>6</sub> 22UF, 15 VDC, ±10% MIL-C-18855
C2	G.1/3.4	55C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VDC, ±20% SPRAGUE #121A
C3	B.5/3.3	55C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VDC, ±20% SPRAGUE #121A
C4	1.2/3.2	CS12A0220K	CAPACITOR, FXD, T <sub>6</sub> 22 UF, 15 VDC, ±10% MIL-C-28655
C5	G.2/3.1	CS12A0220K	CAPACITOR, FXD, T <sub>6</sub> 22 UF, 15 VDC, ±10% MIL-C-28655
C6	F.1/3.1	55C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VDC, ±20% SPRAGUE #5121A
C7	1.1/4.2	CS12A0220K	CAPACITOR, FXD, T <sub>6</sub> 22 UF, 15 VDC, ±10% MIL-C-28655
C8	H.3/4.2	CS12A0220K	CAPACITOR, FXD, T <sub>6</sub> 22 UF, 15 VDC, ±10% MIL-C-28655
C9	F.2/2.3(H)	CK13AK47K	CAPACITOR, FXD, 0047 UF, 100 VDC, ±10%
CR1	H.2/2.6	1N754A	SEMICOND DEVICE, REF 0100E EZ-8.8V, ±10% MIL-S-13500/127
J1	K.3/6.4	MS3112EB-38	CONN, ELEC, CIR, MINAT, QUICK DISC 3 CONT MIL-C-28482
J2	F.2/2.3(H)	09-3313	90C, T8RT, SUB MIN 4 CONT FURN. WITH 55-47202 RING (ELCO CORR)
J3	1.2/4.6	SD6246	RECEPTACLE, CARD, 24 CONTACTS (METHODE)
M1	H.4/2.1	4100393.1	METER
PCB1	J.1/3.1	3190756.1	BOARD, PRINTED WIRING
Q1	H.1/3.8	2N404	SEMICONDUCTOR DEVICE TRANSISTOR MIL-T-19500C
Q2	H.3/3.4	2N404	SEMICONDUCTOR DEVICE TRANSISTOR MIL-T-19500C
Q3	H.3/3.2	2N404	SEMICONDUCTOR DEVICE TRANSISTOR MIL-T-19500C
R1	G.1/4.1	RC20GF222K	RESISTOR, FXD, COMP 2.2K, ±10% MIL-R-11
R2	G.2/3.3	RC20GF333K	RESISTOR, FXD, COMP 33K, ±10% MIL-R-12
R3	G.3/3.3	RC20GF333K	RESISTOR, FXD, COMP 33K, ±10% MIL-R-11
R4	G.1/2.5	RC20GF222K	RESISTOR, FXD, COMP 2.2K, ±10% MIL-R-11
R5	H.5/8.2	2152303.1	RESISTOR VARIABLE VERNIER 5K
R6	H.4/3.3	RC20GF273K	RESISTOR, FXD, COMP 27K, ±10% MIL-R-11
R7	H.1/3.2	RC20GF331K	RESISTOR, FXD, COMP 330 OHM, ±10% MIL-R-11
R8	F.5/4.4	RC20GF4R7K	RESISTOR, FXD, COMP 4.7 OHM, ±10% MIL-R-11
R9	J.4/4.3	RC20GF863K	RESISTOR, FXD, COMP 86K, ±10% MIL-R-11
R10	K.1/4.1	RC20GF122K	RESISTOR, FXD, COMP 12K, ±10% MIL-R-11
R11	K.5/3.4	RV6LYSA253A	RESISTOR, VAR, COMP, 25K, ±10% MIL-R-34
R12	J.5/3.1	RC20GF503K	RESISTOR, FXD, COMP, 50K, ±10% MIL-R-11
R13	J.4/3.5	RN70B51R1F	RESISTOR, FXD, FILM 51.1 OHM, ±1% MIL-R-10608
R14	1.5/4.1	RN70B1001F	RESISTOR, FXD, FILM 10K, ±1% MIL-R-10608
R18	1.3/4.1	RN70C1170D	RESISTOR, FXD, FILM 117 OHM, ±1% MIL-R-10608
R16	H.8/4.2	R894CE8R010F	RESISTOR, FXD, WIRE WOUND 5.81 OHM, ±1% MIL-R-33
R17	K.4/4.3	RA10LASM150A	RESISTOR, VAR, WIRE WOUND 15 OHM 1W, ±15% MIL-R-19
R18	H.2/4.2	RC20GF184J	RESISTOR, FXD, COMP 180K, ±5% MIL-R-11
R19	H.1/4.2(H)	RC20GF472K	RESISTOR, FXD, COMP 4.7K, ±10% MIL-R-11
R20	G.2/4.4(H)	RC20GF392K	RESISTOR, FXD, COMP 3.9K, ±10% MIL-R-11
R21	G.1/5.2(H)	RC20GF580	RESISTOR, FXD, COMP 580 OHMS, ±10% MIL-R-11
S1	G.4/4.5	2142282-1	SWITCH
S2	J.3/6.3	2152283-1	SWITCH
T1	F.2/4.2	3450135-1	TRANSFORMER, COUPLING







**VOLTAGE DATA**  
**TEST CONDITIONS AND EQUIPMENT**

1. NO DEVICE UNDER TEST
2. PNP/PN SWITCH S2 IN PNP POSITION
3. BETA CAL CONTROL R5 FULLY CLOCKWISE
4. FUNCTION SWITCH S1 POSITIONED AS INDICATED
5. TEST INSTRUMENT
  - D.C. VOLTS: SIMPSON 260
  - A.C. VOLTS: TEKTRONIX 544 OSCILLOSCOPE OR RMS VOLTMETER HP410B
6. DC VOLTAGES ARE  $\pm 20\%$  AND REFERENCED TO POSITIVE TERMINAL OF BATTERY EXCEPT AS NOTED
7. AC VOLTAGES ARE SINE WAVE, 1000 CPS, PEAK-TO-PEAK,  $\pm 20\%$ 
  - \* REFERENCED TO NEGATIVE TERMINAL OF BATTERY.

**VOLTAGE TEST POINTS (ALL VOLTAGES  $\pm 20\%$ )**

TEST POINT	POS. 1 AND 12 OFF	POS. 2 BETA CAL	POS. 3 BETA X1	POS. 4 BETA X10	POS. 5 OHMS E-B	POS. 6 OHMS C-B	POS. 7 OHMS C-E	POS. 8 I <sub>CO</sub> X1	POS. 9 I <sub>CO</sub> X10	POS. 10 DIODE IN/CKT	POS. 11 BATT
END OF JACK NEAR R17 J3 PIN 1								-6V	-6V		
J3 PIN 2		-6V	-6V	-6V	9V	-9V	-8V	-8V	-6V		-9V
J3 PIN 3					0V	0V	0V				
J3 PIN 4								-6V	-6V		
J3 PIN 5					-9V	-9V	-9V				
J3 PIN 6		-6V	-6V	-6V	-9V	-9V	-9V	6V	6V		-9V
J3 PIN 7					9V	9V	-9V				
J3 PIN 8								-8V	-8V		
J3 PIN 9		-6V	-6V	-6V							
J3 PIN 10								-6V	-6V		
J3 PIN 11		0V	-6V	-6V							
J3 PIN 12		6V	6V	-6V							
J3 PIN 13		4V 8 VAC	4V 8 VAC	4V 8 VAC						4V 8 VAC	
J3 PIN 14											-9V
J3 PIN 15											0V
J3 PIN 16								-6V	-6V		
J3 PIN 17								-8V	-6V		
J3 PIN 18		0V	0V	0V						0V	
J3 PIN 19		-9V	-9V	-9V							-9V
J3 PIN 20		0V	0V	0V							
J3 PIN 21		4V 8 VAC	4V 8 VAC	4V 8 VAC						4V 8 VAC	
J3 PIN 22		-6V	-6V	-6V							
J3 PIN 23		-6V	-6V	-6V							
END OF JACK NEAR T1. 13 PIN 24		-6V	-6V	-6V							
J3 PIN 22 to J3 PIN 24		2 VAC	2 VAC	2 VAC							
CR-1 CATHODE	*				+6.8V	+6.8V	+6.8V				
S1-D-11											-9V
S1-B-11											0V

**AMERICAN ELECTRONIC LABORATORIES, Inc.**

*Subsidiary of AEL Industries, Inc.*

**P.O. Box 552, Lansdale, Pa. 19446 (215) 822-2929**