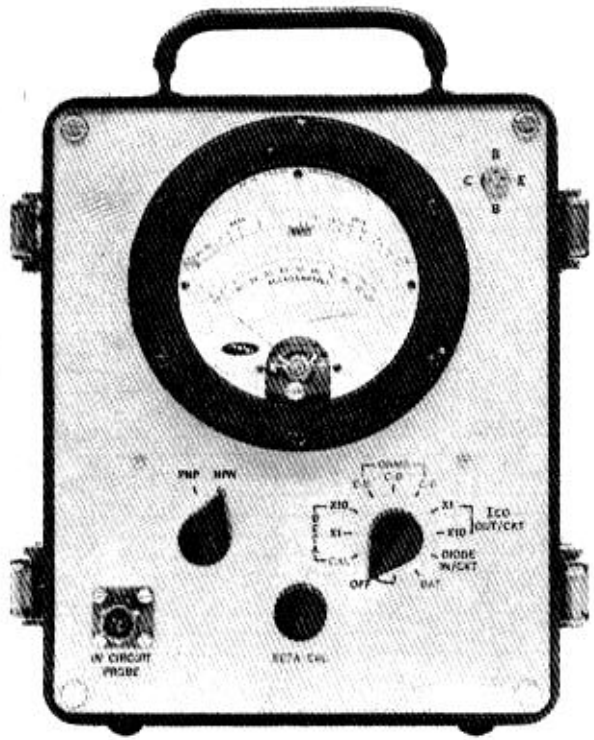
IN-CIRCUIT SEMICONDUCTOR TESTER

MODEL 245MA

TECHNICAL MANUAL

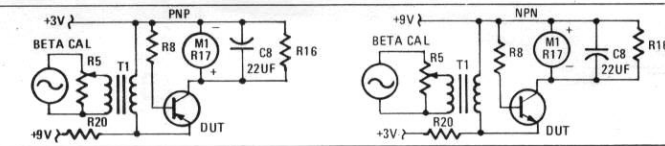
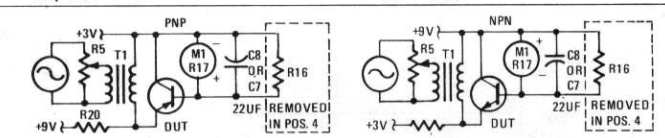
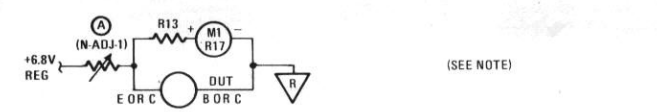
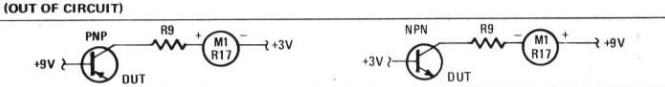
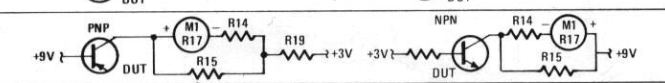
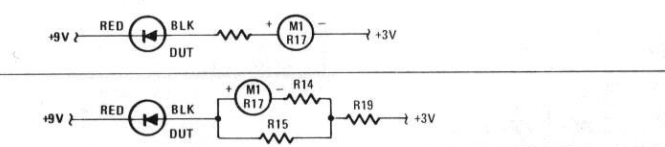
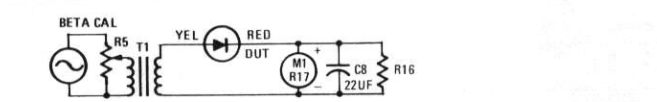
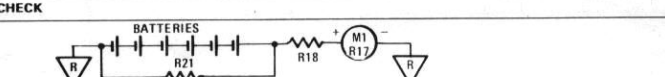


AMERICAN ELECTRONIC LABORATORIES, INC.

CAUTION: DE-ENERGIZE EQUIPMENT BEFORE PERFORMING IN-CIRCUIT TESTS

4416-000-1003

OPERATING INSTRUCTIONS

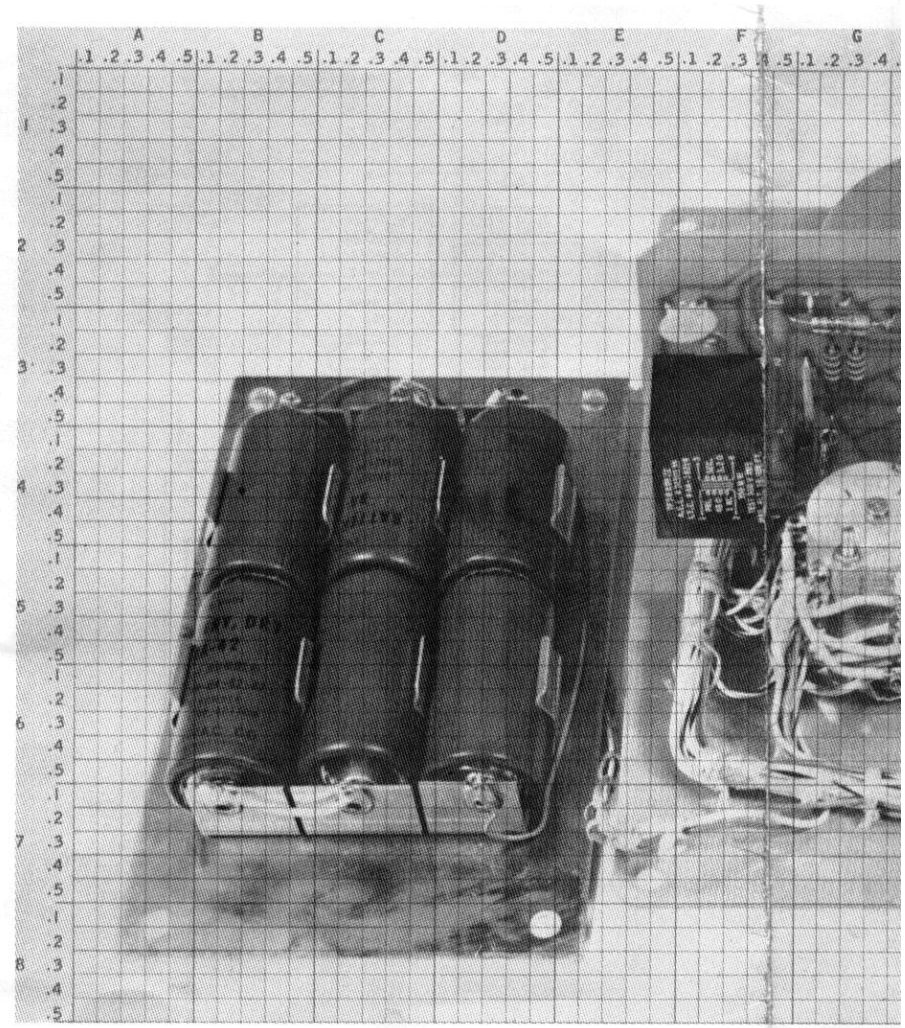
S2 PNP/NPN SWITCH	S1 FUNCTION POS.		ACTIONS AND INDICATIONS	EQUIVALENT CIRCUITS
——	OFF	1	METER POINTER INDICATES EXACTLY ZERO Ⓐ. WHEN METER IS NOT IN USE, S1 SHOULD ALWAYS BE 'OFF' TO AVOID UNNECESSARY DRAIN ON METER BATTERIES.	
BETA MEASUREMENTS (IN/OUT OF CIRCUIT)				
CORRESPONDS TO TYPE OF DEVICE 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.	 (SEE NOTE)
	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.	
Ico MEASUREMENTS (OUT OF CIRCUIT)				
CORRESPONDS TO TYPE OF DEVICE UNDER TEST (OUT)	Ico OUT/CKT X1	8	PLUG TRANSISTOR IN TEST JACK, J2. METER INDICATES Ico DIRECTLY IN MICROAMPERES ON LOWEST SCALE. IF METER INDICATES OFF SCALE, PLACE FUNCTION SWITCH, S1, IN THE X 10 POSITION.	
	Ico OUT/CKT X 10	9	MULTIPLY THE METER INDICATION OF Ico BY 10 TO OBTAIN Ico. IF METER INDICATES OFF SCALE, REVERSE PNP/NPN SWITCH AND REPEAT POS. 8 TEST.	
DIODE Ir MEASUREMENTS (OUT OF CIRCUIT)				
PNP	Ico OUT/CKT X1	8	CONNECT CATHODE OF DIODE TO RED TEST LEAD, AND ANODE OF DIODE TO BLACK TEST LEAD. METER INDICATES Ir DIRECTLY IN MICROAMPERES ON LOWEST SCALE. IF METER INDICATES OFF SCALE, PLACE FUNCTION SWITCH, S1, IN THE X10 POSITION.	
	Ico OUT/CKT X10	9	MULTIPLY THE METER INDICATION OF Ir BY 10 TO OBTAIN Ir. 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 UPSCALE. 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'.	

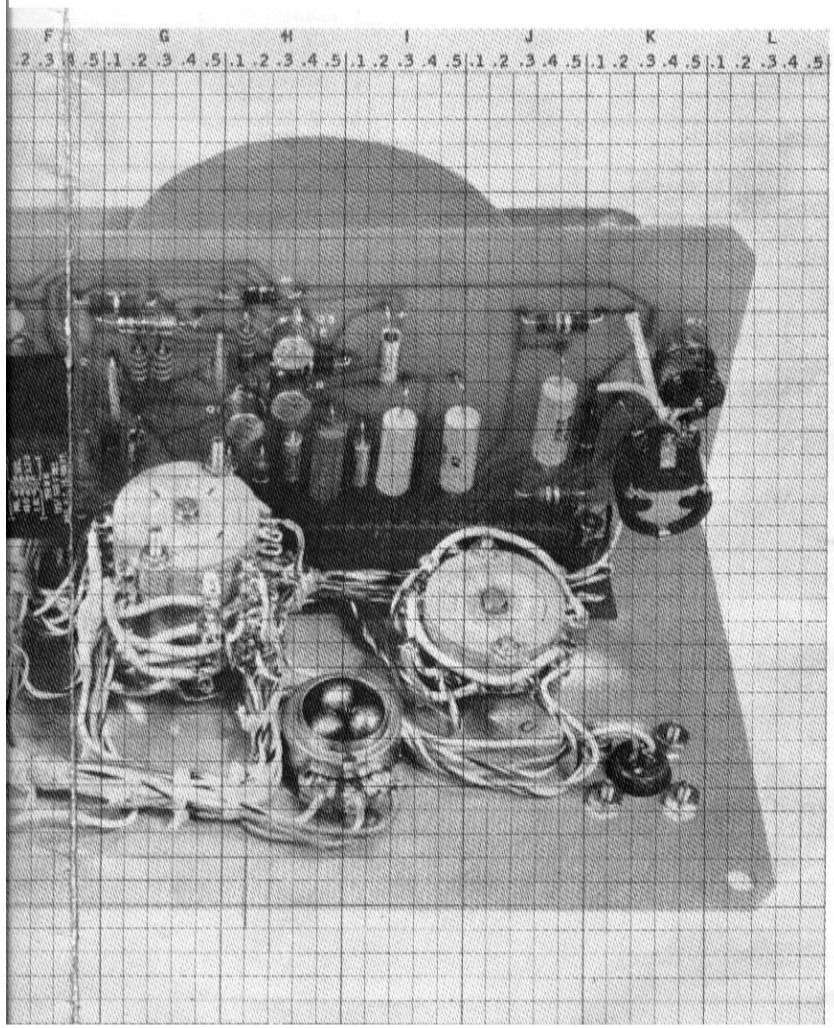
Ⓐ ALIGNMENT PROCEDURE

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 ±10% ONLY WHEN E TO B LOADING IS EQUAL TO OR GREATER THAN 50 OHMS; BETA X 10 IS ±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.)

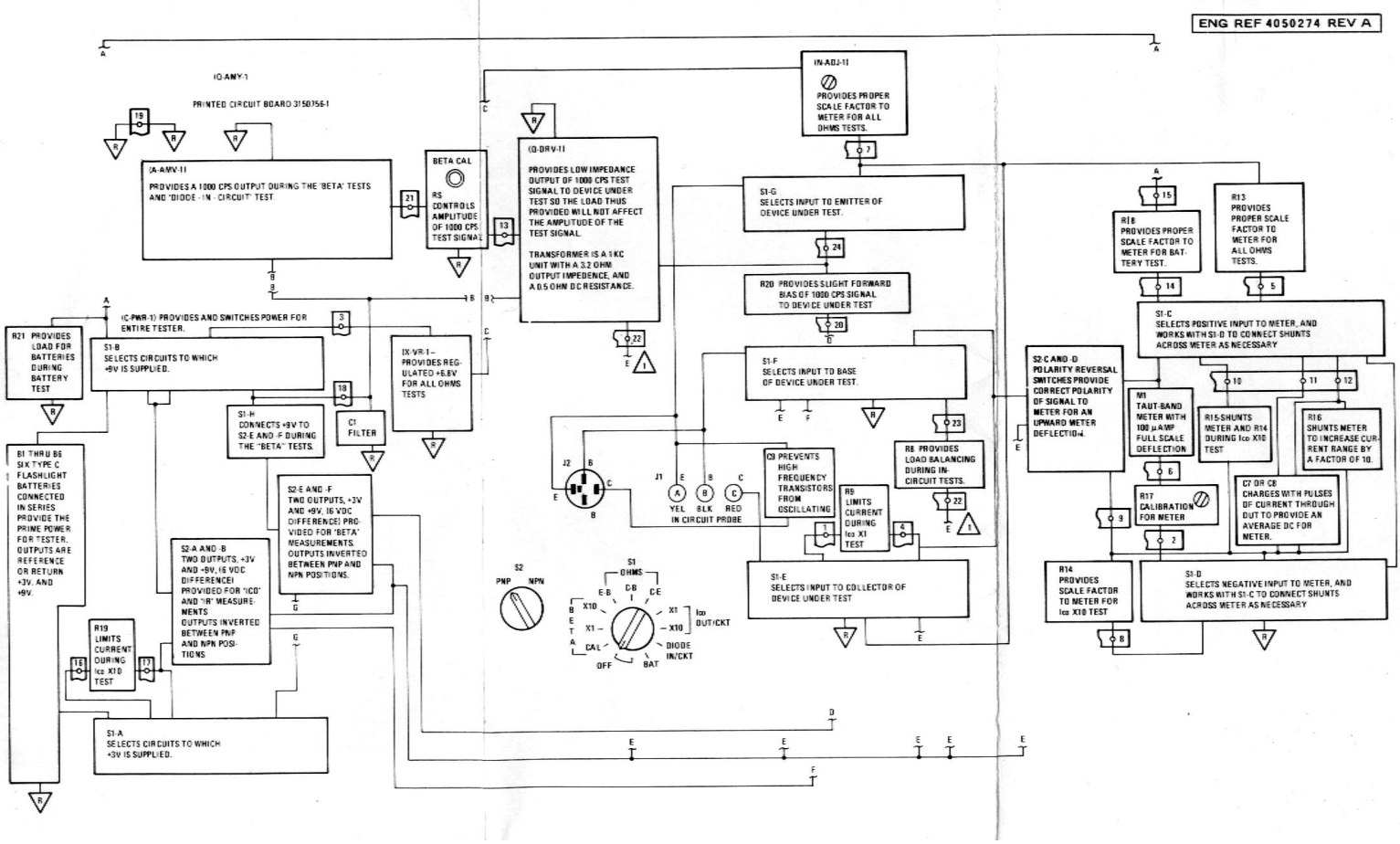




ENG REF 3250902 B 4251057 C

REF DESIG	LOCATION	PART NO.	DESCRIPTION
BT1	B.4/4.3		TYPE C DRYCELL
BT2	B.2/6.1		TYPE C DRYCELL
BT3	C.3/6.1		TYPE C DRYCELL
BT4	C.3/4.3		TYPE C DRYCELL
BT5	D.3/4.3		TYPE C DRYCELL
BT6	D.3/6.1		TYPE C DRYCELL
C1	G.2/4.1	CS12AD220K	CAPACITOR, FXD, Ta 22UF, 15 VDC ±10% MIL-C-16655
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	CS12AD220K	CAPACITOR, FXD, Ta, 22 UF, 15 VDC ±10% MIL-C-26655
C5	G.2/3.1	CS12AD220K	CAPACITOR, FXD, Ta, 22 UF, 15 VDC ±10% MIL-C-26655
C6	F.1/3.1	55C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VDC ±20% SPRAGUE #6121A
C7	1.1/4.2	CS12AD220K	CAPACITOR, FXD, Ta 22 UF, 15 FCD ±10% MIL-C-26655
C8	H.3/4.2	CS12AD220K	CAPACITOR, FXD, Ta, 22 UF, 15 VDC ±10% MIL-C-26655
C9	F.2/2.3(H)	CK13AX472K	CAPACITOR, FXD .0047 UF 100 VDC ±10%
CR1	H.2/2.5	1N754A	SEMICOND DEVICE, REF DIODE EZ=6.8V ±10% MIL-S-19500/127
J1	K.3/6.4	MS3112E8-3S	CONN, ELEC, CIR, MINAT, QUICK-DISC 3 CONT MIL-C-26482
J2	F.2/2.3(H)	05-3313	SOC, TSRT, SUB-MIN 4 CONT FURN. WITH 55-47202 RING (ELCO CORP)
J3	1.2/4.5	SD6245	RECEPTACLE, CARD, 24 CONTACTS (METHODE)
M1	H.4/2.1	4150393-1	METER
PCB1	J.1/3.1	3150756-1	BOARD, PRINTED WIRING
Q1	H.1/3.5	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, ½W, ±10% MIL-R-11
R2	G.2/3.3	RC20GF333K	RESISTOR, FXD, COMP 33K, ½W, ±10% MIL-R-12
R3	G.3/3.3	RC20GF333K	RESISTOR, FXD, COMP 33K, ½W, ±10% MIL-R-11
R4	G.1/2.5	RC20GF222K	RESISTOR, FXD, COMP 2.2K, ½W ±10% MIL-R-11
R5	H.5/6.2	2152303-1	RESISTOR VARIABLE VERNIER 5K
R6	H.4/3.3	RC20GF273K	RESISTOR, FXD, COMP 27K, ½W, ±10% MIL-R-11
R7	H.1/3.2	RC20GF331K	RESISTOR, FXD, COMP 330 OHM ½W, ±10% MIL-R-11
R8	F.5/4.4	RC20GF4R7K	RESISTOR, FXD, COMP 4.7 OHM ½W, ±10% MIL-R-11
R9	J.4/4.3	RC20GF563K	RESISTOR, FXD, COMP 56K, ½W, ±10% MIL-R-11
R10	K.1/4.1	RC20GF122K	RESISTOR, FXD, COMP 1.2K, ½W, ±10% MIL-R-11
R11	K.5/3.4	RV6LAYSA253A	RESISTOR, VAR, COMP, 25K, ½W, ±10% MIL-R-94
R12	J.5/3.1	RC20GF563K	RESISTOR, FXD, COMP, 56K, ½W, ±10% MIL-R-11
R13	J.4/3.5	RN70B51R1F	RESISTOR, FXD, FILM 51.1 OHM ½W, ±1% MIL-R-10509
R14	1.5/4.1	RN70B1001F	RESISTOR, FXD, FILM 1.0K ½W, ±1% MIL-R-10509
R15	1.3/4.1	RN70C1170D	RESISTOR, FXD, FILM 117 OHM ½W, ±1% MIL-R-10509
R16	H.5/4.2	RB54C5R510F	RESISTOR, FXD, WIRE WOUND 5.51 OHM, ¼W, ±1% MIL-R-93
R17	K.4/4.3	RA10LA5M150A	RESISTOR, VAR, WIRE WOUND 15 OHM 1W, ±10% MIL-R-19
R18	H.2/4.2	RC20GF184J	RESISTOR, FXD, COMP 180K, ½W, ±5% MIL-R-11
R19	H.1/4.2(H)	RC20GF472K	RESISTOR, FXD, COMP 4.7K, ½W, ±10% MIL-R-11
R20	G.2/4.4(H)	RC20GF392K	RESISTOR, FXD, COMP, 3.9K, ½W, ±10% MIL-R-11
R21	G.1/5.2(H)	RC20GF560	RESISTOR, FXD, COMP 560 OHMS ½W, ±10% MIL-R-11
S1	G.4/4.5	2142282-1	SWITCH
S2	J.2/5.3	2152283-1	SWITCH
T1	F.2/4.2	3450135-1	TRANSFORMER, COUPLING

ENG REF 4050274 REV A



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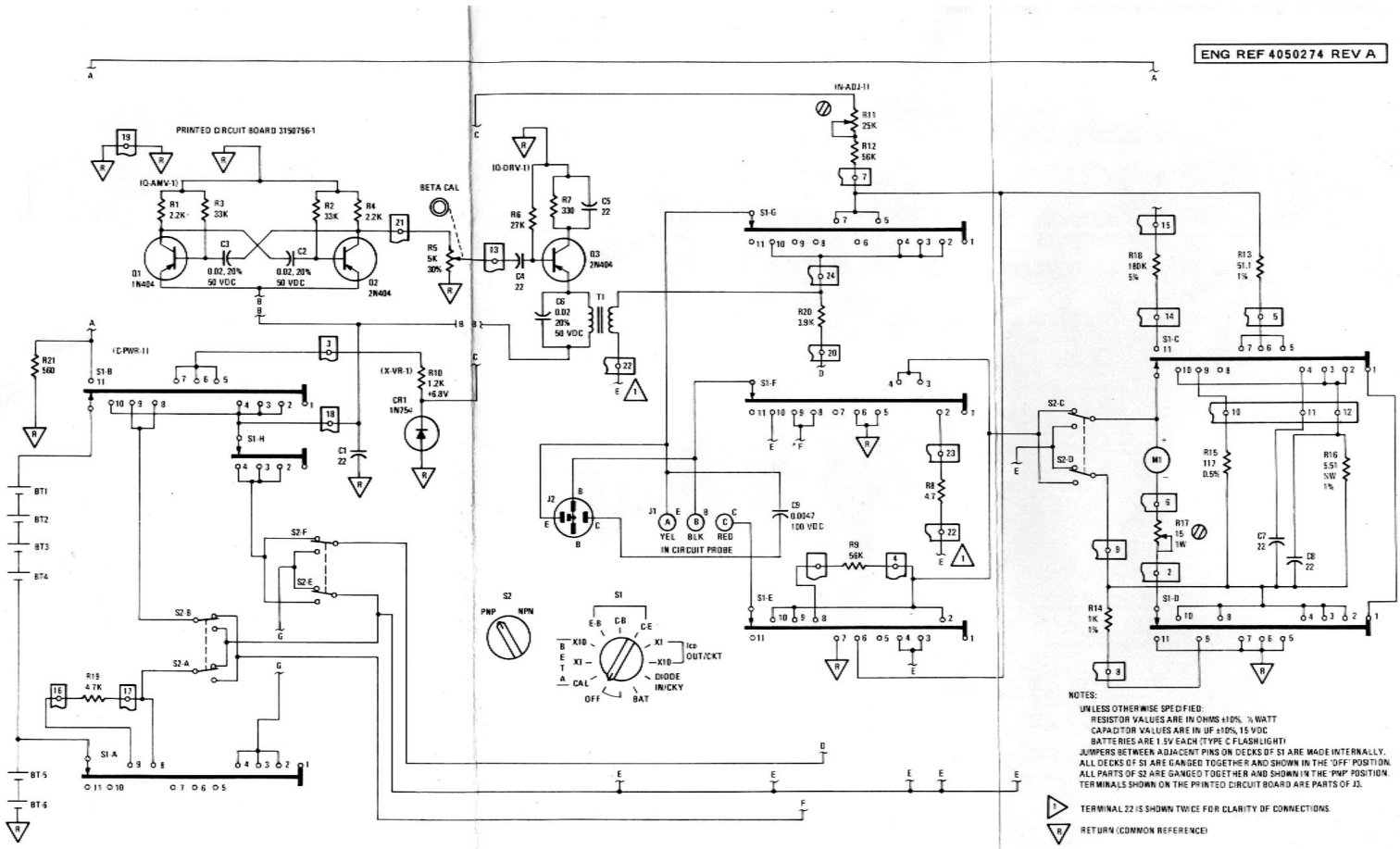

NOTES:
UNLESS OTHERWISE SPECIFIED:
RESISTOR VALUES ARE IN OHMS ±10%, ¼ WATT
CAPACITOR VALUES ARE IN UF ±10%, 15 VDC
BATTERIES ARE 1.5V EACH (TYPE C FLASHLIGHT)
JUMPERS BETWEEN ADJACENT PINS ON DECKS OF S1 ARE MADE INTERNALLY.
ALL DECKS OF S1 ARE GANGED TOGETHER AND SHOWN IN THE 'OFF' POSITION.
ALL PARTS OF S2 ARE GANGED TOGETHER AND SHOWN IN THE 'PNP' POSITION.
TERMINALS SHOWN ON THE PRINTED CIRCUIT BOARD ARE PARTS OF J3.

1 TERMINAL 22 IS SHOWN TWICE FOR CLARITY OF CONNECTIONS.

R RETURN (COMMON REFERENCE)

VOLTAGE DATA
TEST CONDITIONS AND EQUIPMENT

1. NO DEVICE UNDER TEST
2. PNP/NPN 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 HP-410B
6. DC VOLTAGES ARE ±20% AND REFERENCED TO POSITIVE TERMINAL OF BATTERY EXCEPT AS NOTED.
7. AC VOLTAGES ARE SQAURE WAVE, 1000 CPS, PEAK-TO-PEAK, ±20%

* REFERENCED TO NEGATIVE TERMINAL OF BATTERY.

VOLTAGE TEST POINTS (ALL VOLTAGES ±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 Ico X1	POS. 9 Ico 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	-9V	-6V	-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									-6V	-6V		
J3 PIN 9			-6V	-6V	-6V							
J3 PIN 10									-6V	-6V		
J3 PIN 11			-6V	-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									-6V	-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

441-6-000-1001

AMERICAN ELECTRONIC LABORATORIES, Inc.
Subsidiary of AEL Industries, Inc.
P.O. Box 552, Lansdale, Pa. 19446 (215) 822-2929