845A/845AB

High Impedence Voltmeter Null Detector

Instruction Manual

P/N 294173
November 1967

CHANGE/ERRATA INFORMATION

ISSUE NO: 3 7/93

This change/errata contains information necessary to ensure the accuracy of the following manual:

MANUAL

Title: 845A & 845AB
Print Date: Nov. 1967
Rev.- Date: ---

C/E PAGE EFFECTIVITY

Page No.	Print Date
1	2/90
2	2/90
3	2/90
4	2/90
5	2/90
6	2/90
7	2/90
8	2/90
9	2/90
10	2/90

NOTE

A major circuit modification has been made to the Fluke Model 845AB. This change entails the complete redesign of the Photo Modulator, previously based on photo-conductive resistors. The new circuit now employs optically-isolated Bilateral Analog FETs, and is fabricated on an additional circuit board.

Updates to the relevant sections of this manual are now in process and will be available for shipment approximately December 1993. This manual is completely accurate with regard to specifications and operating instructions. The circuit modifications are totally internal and are completely transparent to the user.

If you have any questions regarding repair and/or service of your 845AB please contact your nearest Fluke Service Center (see the list attached to this change/errata.)

CHANGE #1 - 6282

On page 1-1,

Change paragraph 1-2,

FROM: ...the input impedance is 10 megohms...
TO: ...the input impedance is 1 megohms....

Under Paragraph 1-4, under INPUT RESISTANCE,

ADD:
10 Megohms on the 3 millivolt through 100 millivolt range

CHANGE: 10 Megohms on 100 millivolt range and below
TO: 1 Megohms on 1 millivolt range and below

On page 2-5,

Change paragraph 2-36,

FROM: In the 1 microvolt to 1 millivolt ranges, a 10...
TO: In the 1 microvolt to 1 millivolt ranges, a 1....

FROM: ....creased on these ranges by disconnecting the 10 megohm..
TO: ....creased on these ranges by disconnecting the 1 megohm...

FROM: ....Typical input resistances with the 10 megohm resistor...
TO: ....Typical input resistances with the 1 megohm resistor....

On page 3-2, change paragraph 3-14,

FROM: ...volt and below, a 10 megohm resistor, R104 is con-...
TO: ...volt and below, a 1 megohm resistor, R104 is con-....

On the functional schematic, change R104,

FROM: 10M
TO: 1M.

ERRATA #1

On page 3-1, change all occurrences,

FROM: "dc signal"
TO: "ac signal"

In Section 5, replace all the tables with the following:

Table 5-1. 845AB Final Assembly
(See Figure 5-1.)

REFERENCE DESIGNATOR -A>-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
A 2		FRONT PANEL ASSEMBLY	194548	89536	194548	1	
A 3	*	AMPLIFIER PCB ASSEMBLY	194399	89536	194399	1	
A 4	*	POWER SUPPLY PCB ASSEMBLY	194555	89536	194555	1	
BT 1		BATTERY PACK ASSY	256966	89536	256966	1	
C 4, 5		CAP,MICA,1000PF,+-5%,500V	148387	09023	CD15FD102J0	2	
E 1		TERM,RING 5/64 & .144,SOLDR	101055	79963	9.074.020,BR,ELEC-TIN	1	
E 2, 3		TERM,RING .120 & .187,SOLDR	169409	79963	29A.120.016COPR,ELC-TN	2	
F 1		FUSE,.25X1.25,0.063A,250V,SLOW	163030	71400	MDL-1-16 250V	1	
H 1		SCREW,MACH,PH,P,SEMS,STL,6-32X.375	177022	COMMERCIAL		10	
H 2		SCREW,THD FORM,FHP,S.STL,6-20X1/2	176172	COMMERCIAL		12	
H 3		NUT,SPEED,J TYPE,STL,6Z	156364	COMMERCIAL		16	
H 4		SCREW,MACH,FH,P,STL,8-32X.375	114116	COMMERCIAL		6	
H 5		SCREW,MACH,PH,P,STL,6-32,.500	152173	COMMERCIAL		14	
H 8		SCREW,MACH,PH,P,STL,8-32X0.375	114124	COMMERCIAL		4	
H 9		WASHER,FLAT,STL,.149,.375,.031	110270	COMMERCIAL		7	
H 10		NUT,CAP EXT LW,STL,6-32X.109	152819	COMMERCIAL		6	
H 11		SCREW,SET,SCKT,STL,8-32,.187	114991	COMMERCIAL		4	
H 12		WASHER,FLAT,STL,.160,.281,.010	111005	COMMERCIAL		2	
H 13		WASHER,LOCK,INTRNL,STEEL,#10	110312	COMMERCIAL		2	
H 14		SCREW,MACH,PH,P,SEMS,STL,6-32X.250	178533	COMMERCIAL		8	
M 1		METER,+-100UA,FS,LINEAR,CENTER ZERO	192294	1A791	502	1	
MP 1		DECAL,VOLTAGE,115VAC	117259	89536	117259	1	
MP 2		DECAL DECAL, REAR	194506	89536	194506	1	
MP 3		COVER BOTTOM	455162	89536	455162	1	
MP 4		METL,SHT TILT STAND	194282	89536	194282	1	
MP 5		COVER,SIDE	455188	89536	455188	2	
MP 6		SIDE CASTING, FINISHED,	194308	89536	194308	2	
MP 7		METL,SHT REAR,	194241	89536	194241	1	
MP 8		ASSEMBLY GUARD,	194258	89536	194258	1	
MP 9		METL,SHT COVER, TOP GUARD,	194266	89536	194266	1	
MP 10		METL,SHT COVER, BOTTOM GUARD,	194274	89536	194274	1	
MP 11		BRACKET F/TILT STAND,	196907	89536	196907	2	
MP 12		METL,SHT SHAFT, ZERO,	194365	89536	194365	1	
MP 13		GROMMET CLEANED, 3/8 IN	171876	89536	171876	4	
MP 14		GROMMET,SLOT,RUBBER,.313,.438	100065	88786	505	1	
MP 15		SPACER,RND,AL,.156IDX.250	153155	55566	1124-.156-A-22	4	
MP 16		ASSY, PUTTY POINTER KNOB-GREEN DECAL	341339	89536	341339	1	
MP 17		ASSY,P.GREY POINTER KNOB-P.GREY DECAL	434183	89536	434183	1	
MP 18		ASSY,PUTTY KNURLED KNOB-PUTTY DECAL	341396	89536	341396	2	
MP 19		COUPLING 1/8 -1/4 IN	193557	89536	193557	1	
MP 20		RUBBER, 1 IN DIA, TYPE 9102-W, BLACK	103309	83478	9102-W	4	
MP 21		CABLE TIE,CLAMP,8"L,1.75 DIA,#10SCREW	104638	06383	SSC2S-S10	1	
MP 22		X-2092-1/4 X 7/8 BRASS COLLAR	103838	89536	103838	1	
MP 23		SHAFT,SWITCH	203299	89536	203299	1	
MP 24		SPACER,RND,AL,.156IDX.125	215210	55566	1122-6-A-22	4	
MP 25		COVER TOP	455352	89536	455352	1	
MP 26		COVER SIDE	455170	89536	455170	2	
MP 27		HANDLE,5-3/4",FLEXIBLE VINYL	166280	12136	919-415-173	1	
MP 28		INSULATION SHIELD	284323	89536	284323	4	
TM 1		MANUAL,INSTRUCTION	294173	89536	294173	1	
W 1		CORD,LINE,5-15/IEC,3-18AWG,SVT	284174	70903	17239	1	
XF 1		HLDR,FUSE,1/4 X 1-1/4, PNL MT	160846	75915	342004	1	

An * in 'S' column indicates a static-sensitive part.

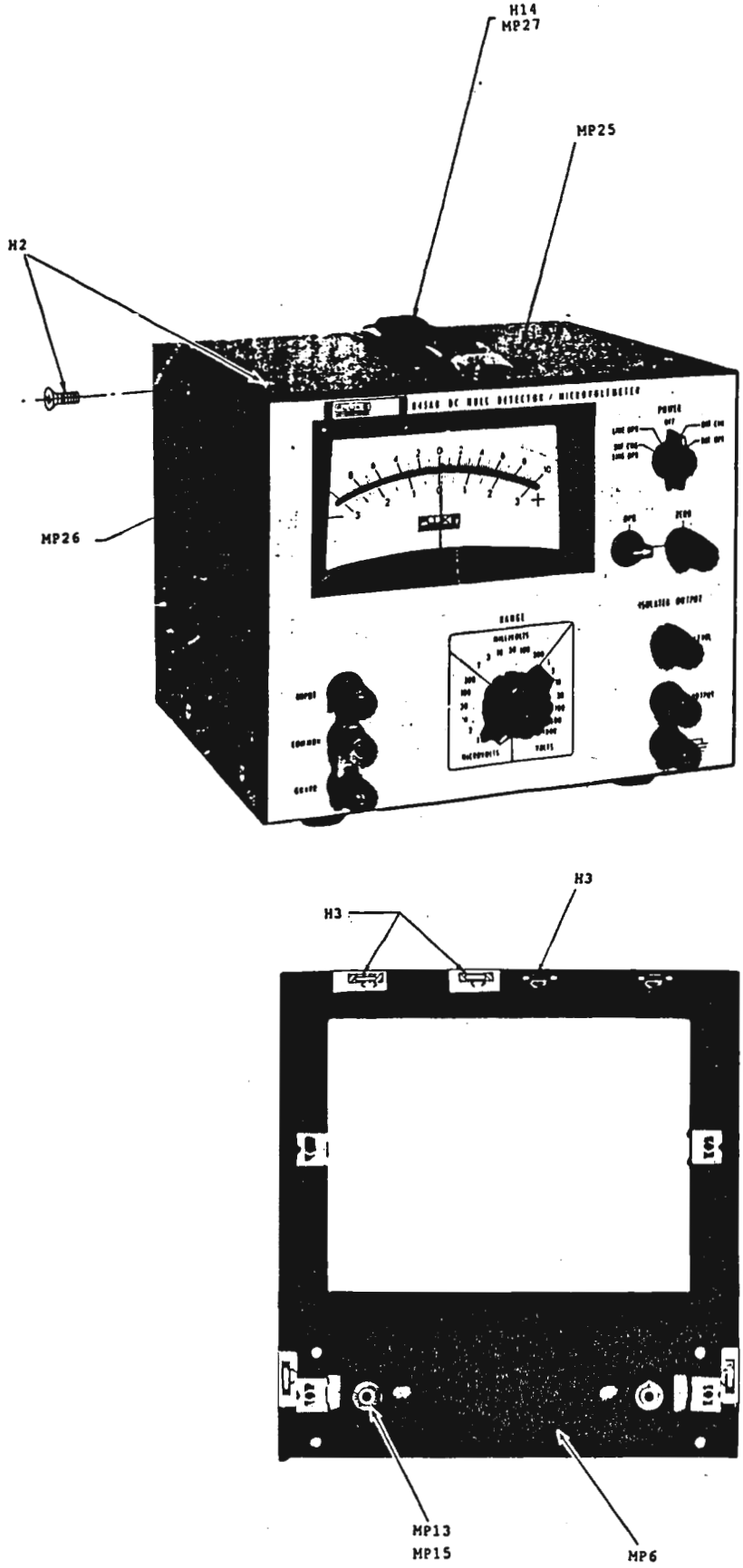


Figure 5-1. 845AB Final Assembly

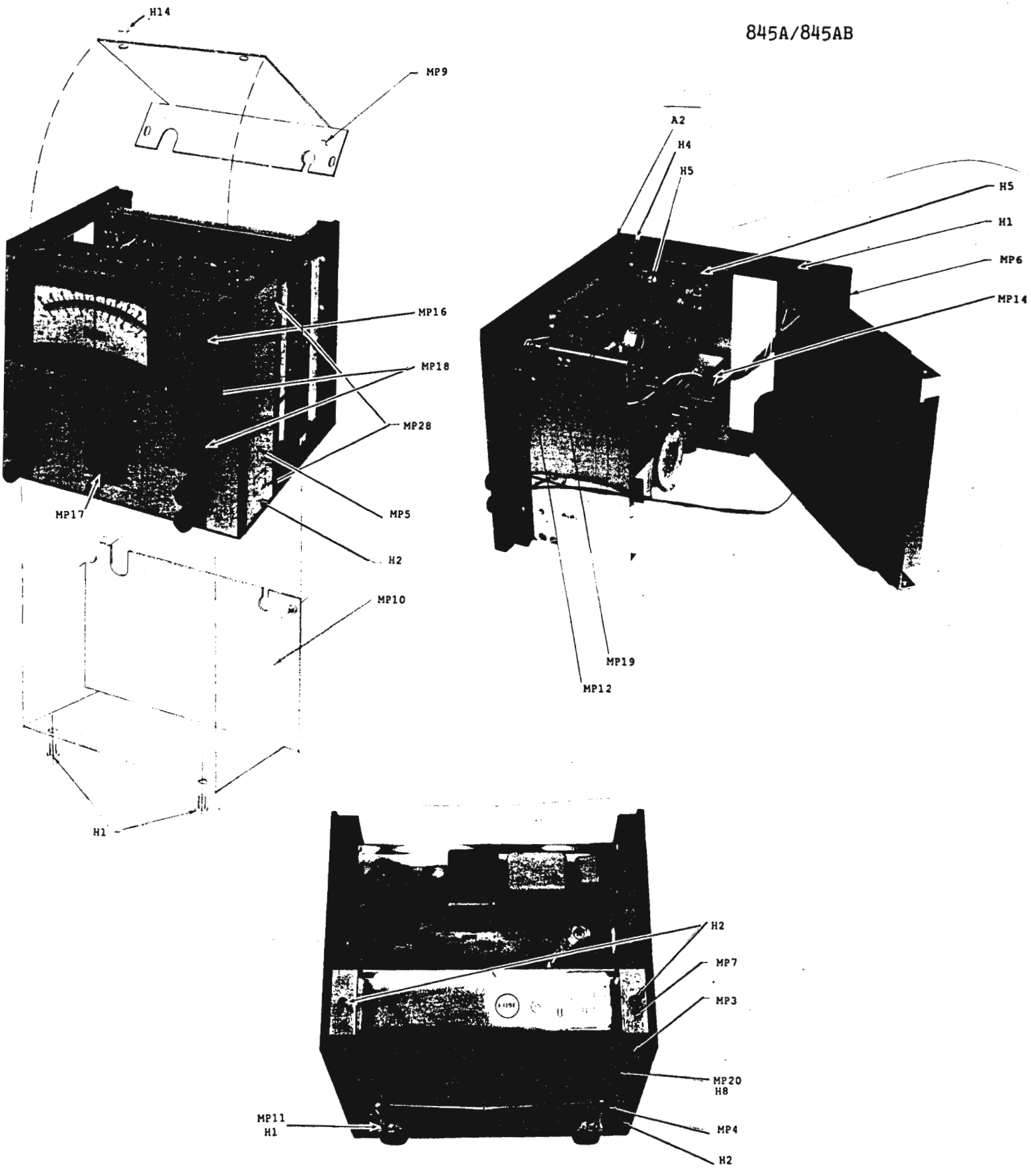
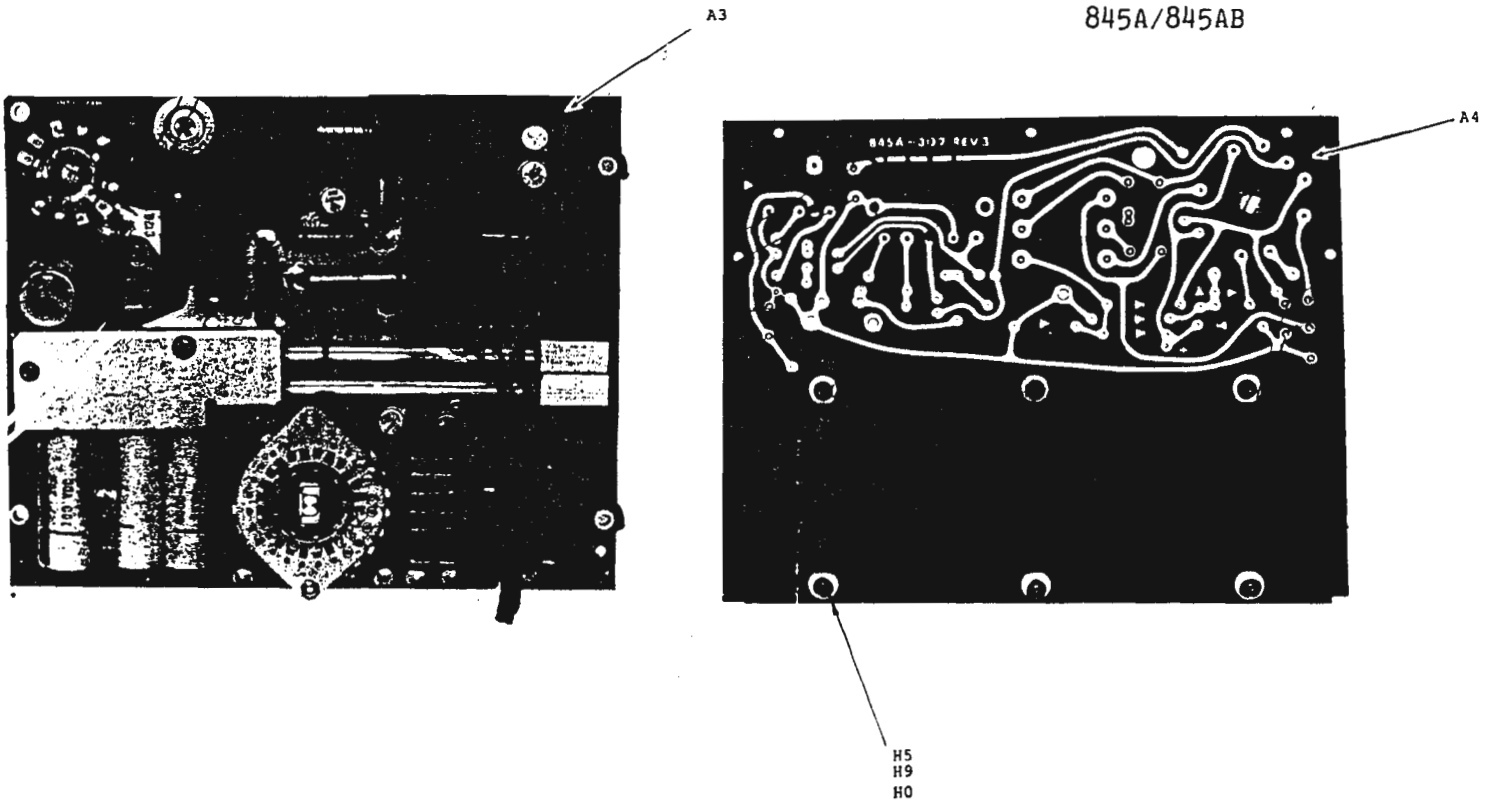


Figure 5-1. 845AB Final Assembly (cont.)



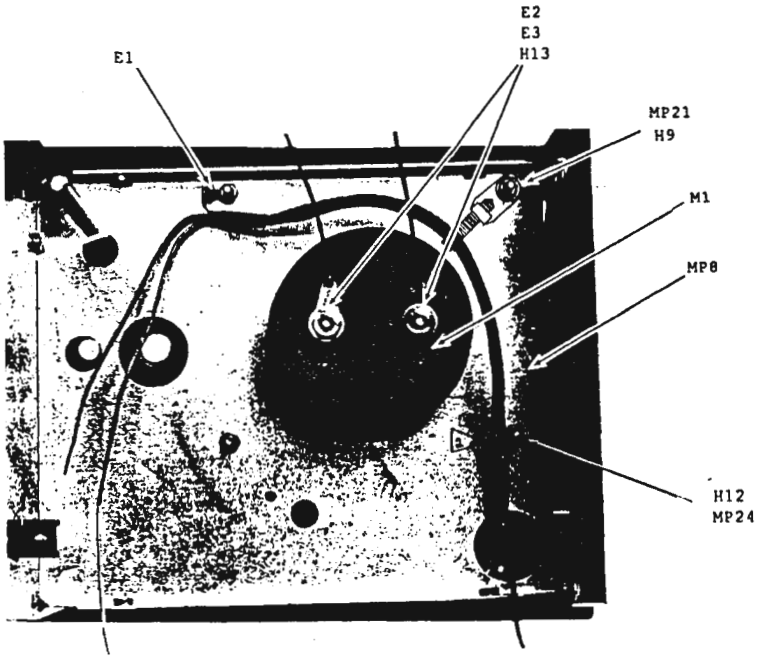


Figure 5-1. 845AB Final Assembly (cont.)

Table 5-2. A2 Front Panel Assembly
(See Figure 5-2.)

REFERENCE DESIGNATOR -A->-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
C 1		CAP,POLYES,0.047UF,+-20%,1200V	182683	84411	663UW.47320%1200V	1	
C 2		CAP,POLYST,0.047UF,+-20%,1200V	190561	84411	1263UW.04720%1200V	1	
C 3		CAP,AL,10UF,+50-10%,25V	170266	62643	SM25 T-100	1	
E 1		JUMPER,LINK,BINDING POST	190728	83330	21171	1	
E 2- 6		TERM,RING .120 & .187,SOLDR	169409	79963	29A.120.016COPR,ELC-TN	5	
H 1		NUT,MACH,HEX,STL,3/8-32	110510	COMMERCIAL		1	
H 2		WASHER,LOCK,INTRNL,STEEL,0.387 ID	129957	COMMERCIAL		1	
H 3		WASHER,LOCK,INTRNL,STEEL,#10	110312	COMMERCIAL		9	
H 4		SCREW,MACH,PH,P,STL,4-40X0.500	152132	COMMERCIAL		2	
H 5		WASHER,LOCK,INTRNL,STEEL,#4	110403	COMMERCIAL		2	
J 1, 2		ASSY,RED 10-32 BINDING POST CU	794438	89536	794438	2	
J 3, 5		ASSY,BLK 10-32 BINDING POST BR	794412	89536	794412	2	
J 4		ASSY,RED 10-32 BINDING POST BR	794404	89536	794404	1	
MP 1		CASTING FINISHED,	194217	89536	194217	1	
MP 2		PANEL SCREENED	455121	89536	455121	1	
MP 3		SWITCH,PART,INDEX,ROTARY	193565	29238	4-8243-348	1	
MP 4		BUSHING,SNAP-IN,NYLON,0.251 ID	160499	96881	7-4L2-FF	1	
MP 5		NAMEPLATE, .250X1.3, SERIAL NUMBER	393975	89536	393975	1	
MP 6		BUSHING,SWITCH,LEXAN,0.435 ID	193540	20584	193540	1	
MP 7		SPACER	127761	89536	127761	2	
R 1		RES,VAR,CP,10K,+-30%,0.25W	192344	12697	CM46140	1	
R 2		RES,CC,4.7K,+-10%,0.5W	108381	01121	EB4721	1	
W 1		CORD,LINE INPUT CABLE,	195917	89536	195917	1	

An * in 'S' column indicates a static-sensitive part.

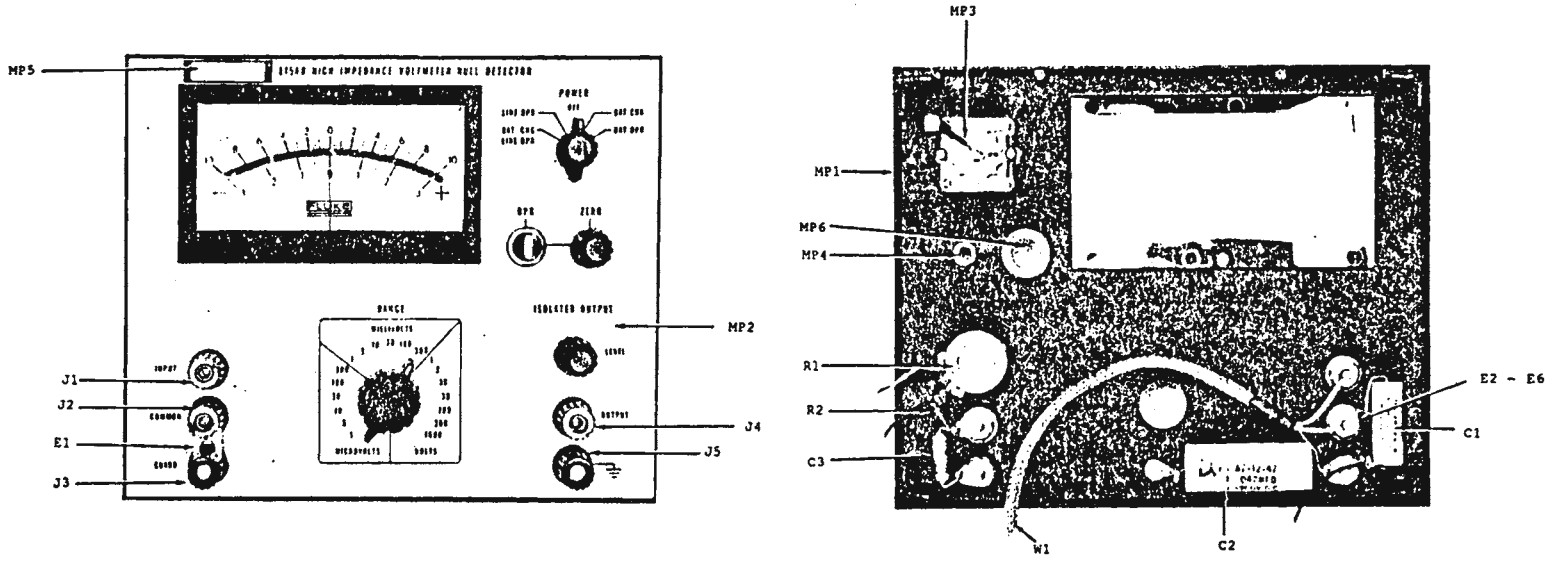


Figure 5-2. A2 Front Panel Assembly

Table 5-3. A3 Amplifier PCB Assembly
(See Figure 5-3.)

REFERENCE DESIGNATOR -A->-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
C 101-103		CAP,POLYST,0.47UF,+-20%,120V	190553	84411	1263UW474 20% 120V	3	
C 104,109,115		CAP,POLYES,0.1UF,+-10%,250V	271973	84411	X603.1-10-250V	3	
C 105,108		CAP,CER,300PF,+-10%,500V,X7W	105734	60705	562CX7WCK501AE301K	2	
C 106		CAP,AL,1500UF,+50-10%,6.3V	166330	62643	SM6.3T-1500	1	
C 107		CAP,AL,330UF,+50-10%,16V	187765	62643	SM16T-331	1	
C 110,112		CAP,AL,10UF,+50-10%,25V	170266	62643	SM25 T-100	2	
C 111		CAP,POLYES,0.0047UF,+-20%,200V	106054	56289	10304	1	
C 113		CAP,AL,470UF,+50-10%,6.3V	187773	62643	SM6.3T-470	1	
C 114		CAP,TA,6.8UF,+-10%,35V	182782	56289	150D685X9035B3	1	
C 116		CAP,TA,15UF,+-10%,20V	153056	56289	150D156X0020B3	1	
C 117,118		CAP,AL,470UF,+50-10%,25V	168153	62643	SM25T-470	2	
C 119		CAP,POLYES,0.22UF,+-10%,250V	194803	80031	719A1GG223L251SB	1	
C 120		CA;,AL,150UF,+75-10%,15V	150292	56289	30D150-10%-15V	1	
CR 101,102	*	DIODE,SI,BV= 90.0V,IO= 75MA,SELCTD IR	260554	14552	CD55105	2	
CR 104-107		DIODE,SI,600 PIV,1.5 AMP	112383	04713	1N5397	4	
CR 108	*	DIODE,SI,2 PELLET,BV= 20.0V,400 MW	375477	09214	MPD200	1	
DS 101,102		LAMP,NEON,105-125V,0.7MA,WIRE LEADS	100347	53944	A9A-1	2	
FL 1		CORE,TOROID,FERRITE,.079X.185X.291	219535	25088	B62110-A503-0X025-C	1	
H 1		SCREW,MACH,PH,P,SEMS,STL,6-32X.250	178533	COMMERCIAL		4	
H 2		WASHER,FLAT,STL,.149,.375,.031	110270	COMMERCIAL		1	
H 3		NUT,MACH,HEX,BR,SIZE-THDS PER IN	110601	COMMERCIAL		1	
H 4		WASHER,FLAT,BRASS,#6,0.012 THK	111054	COMMERCIAL		3	
H 5		WASHER,LOCK,SPLIT,STEEL,#6	110692	COMMERCIAL		1	
H 6		SCREW,MACH,PH,P,STL,6-32X0.375	152165	COMMERCIAL		1	
H 7		NUT,MINI,HEX,SS,6-32	110569	COMMERCIAL		1	
MP 1		METL,SHT SHIELD, INPUT	194316	89536	194316	1	
MP 2		METL,MACH BLOCK, PHOTOCHOPPER	167569	89536	167569	2	
MP 3		INSUL ROD,ROUND,ACRYLIC,3.50X0.250	168047	9S171	3200180-3.50	2	
MP 4		GROMMET CLEANED, 3/8 IN	171876	89536	171876	4	
MP 5		SPACER,RND,AL,.156IDX.250	153155	55566	1124-.156-A-22	4	
MP 6		SPACER,SWAGED,HEX,BR,6-32,.750	194076	89536	194076	2	
MP 7		SUPPORT,PHOTOCELL,MODIFIED	656124	89536	656124	1	
Q 101	*	TRANSISTOR,SI,NPN,SMALL SIGNAL	242065	04713	2N5089	1	
Q 102	*	TRANSISTOR,SI,NPN,SMALL SIGNAL	168716	27014	STO7154	1	
Q 103,107,108	*	TRANSISTOR,SI,NPN,SMALL SIGNAL	168708	09214	2N3391	3	
Q 104,105	*	TRANSISTOR,SI,NPN,SM SIGNAL,HI-BETA	177105	27014	PN3565	2	
Q 106,114	*	TRANSISTOR,SI,PNP,SWITCHING	321398	04713	2N2945A	2	
Q 109,110	*	TRANSISTOR,SI,PNP,SMALL SIGNAL	169375	04713	MPS-3638	2	
Q 111	*	TRANSISTOR,SI,NPN,SMALL SIGNAL	218081	04713	MPS-6520	1	
Q 112	*	TRANSISTOR,SI,PNP,SMALL SIGNAL	229898	07263	MPS-6522	1	
Q 113	*	TRANSISTOR,SI,NPN,SELECTED,SMALL SIG	454843	04713	SPS7940	1	
R 101-103,105-		RES, ASSY NULL INPUT DIVIDER	227132	89536	227132	1	1
R 109			227132				
R 104		RES,MF,1M,+-1%,1W,100PPM	177188	64537	PME751004F T-1	1	
R 110	*	RES,MF,150K,+-0.5%,1W,25PPM	393397	64537	PME75150.5% T-9	4	
R 111,120		RES,CC,47K,+-5%,0.25W	148163	01121	CB4735	2	
R 112,128,130,		RES,CC,100K,+-5%,0.25W	148189	01121	CB1045	4	
R 146			148189				
R 113		RES,CC,470,+-5%,0.25W	147983	01121	CB4715	1	
R 114		RES,WW CARD, 1/2W, 10<,	193946	89536	193946	1	
R 115		RES,CC,1.2M,+-10%,0.5W	108407	01121	EB1251	1	
R 116		RES,CC,680K,+-5%,0.25W	188433	01121	CB6845	1	
R 117		RES,VAR,CP,5M,+-30%,1W	193086	12697	CM46141	1	
R 118		RES,CC,10M,+-10%,0.5W	108142	01121	EB1061	1	
R 119		RES,CC,2.2M,+-5%,0.25W	198390	01121	CB2255	1	
R 121		RES,CC,10,+-5%,0.25W	147868	01121	CB1035	1	
R 122,150		RES,CC,68K,+-5%,0.25W	148171	01121	CB6835	2	
R 123		RES,CC,82K,+-5%,0.25W	188458	01121	CB8235	1	
R 124		RES,CC,22,+-5%,0.25W	147884	01121	CB2205	1	
R 125		RES,CC,68,+-5%,0.25W	147918	01121	CBR685	1	
R 126		RES,CC,220,+-5%,0.25W	147959	01121	CB2215	1	
R 127,133		RES,CC,10K,+-5%,0.25W	148106	01121	CB1035	2	
R 129,135,148,		RES,CC,22K,+-5%,0.25W	148130	01121	CB2235	5	
R 155,156			148130				
R 131		RES,CC,100,+-5%,0.25W	147926	01121	CB1015	1	
R 132		RES,CC,39K,+-5%,0.25W	188466	01121	CB3935	1	
R 134,147		RES,CC,15K,+-5%,0.25W	148114	01121	CB1535	2	
R 136		RES,MF,1.07K,+-1%,0.5W,100PPM	187930	91637	CMF651071F T-1	1	
R 137		RES,MF,3.16K,+-1%,0.5W,100PPM	187781	91637	CMF653161F T-1	1	

An * in 'S' column indicates a static-sensitive part.

Table 5-3. A3 Amplifier PCB Assembly (cont)

REFERENCE DESIGNATOR -A>-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
R 138-142		RES,ASSY BETA SET	194423	89536	194423	1	2
R 143-145		RES,CC,150K,+-5%,0.25W	182212	01121	CB1545	3	
R 149		RES,CC,3.9M,+-5%,0.25W	188417	01121	CB3955	1	
R 151		RES,VAR,WW,2K,+-5%,1.25W,PWB MTG	160705	71450	110-202-1.25W-5%	1	
R 152		RES,MF,7.5K,+-1%,0.5W,100PPM	192161	91637	CMF657501F T-1	1	
R 153,158,159		RES,CC,1K,+-5%,0.25W	148023	01121	CB1025	3	
R 154		RES,CC,47K,+-5%,0.5W	108738	01121	EB4735	1	
R 157		RES,MF,825,+-1%,0.5W,100PPM	155119	91637	CMF658250F T-1	1	
S 101		SW,ROTARY RANGE, 845A-804	194589	89536	194589	1	
S 102		SWITCH,WAFER,SPECIAL CUT	194027	29238	4-2512-665	1	
S 103		SW,ROTARY ZERO, 845A-809	194936	89536	194936	1	
V 101		PHOTOCELL PHOTOCELL ASMBLY,	194449	89536	194449	1	
VR 103	*	ZENER,UNCOMP,10.0V,10%,12.5MA,0.4W	113324	04713	1N961A	1	
XQ 104-106,109-		SOCKET,TRANS,TO-5	104315	95354	133-400-01	9	
XQ 114			104315				

An * in 'S' column indicates a static-sensitive part.

NOTE 1 = These resistors are factory matched. If any replacement is required, an entire set, part number 227132, must be replaced.

NOTE 2 = These resistors are factory matched. If any replacement is required, an entire set, part number 194423, must be replaced.

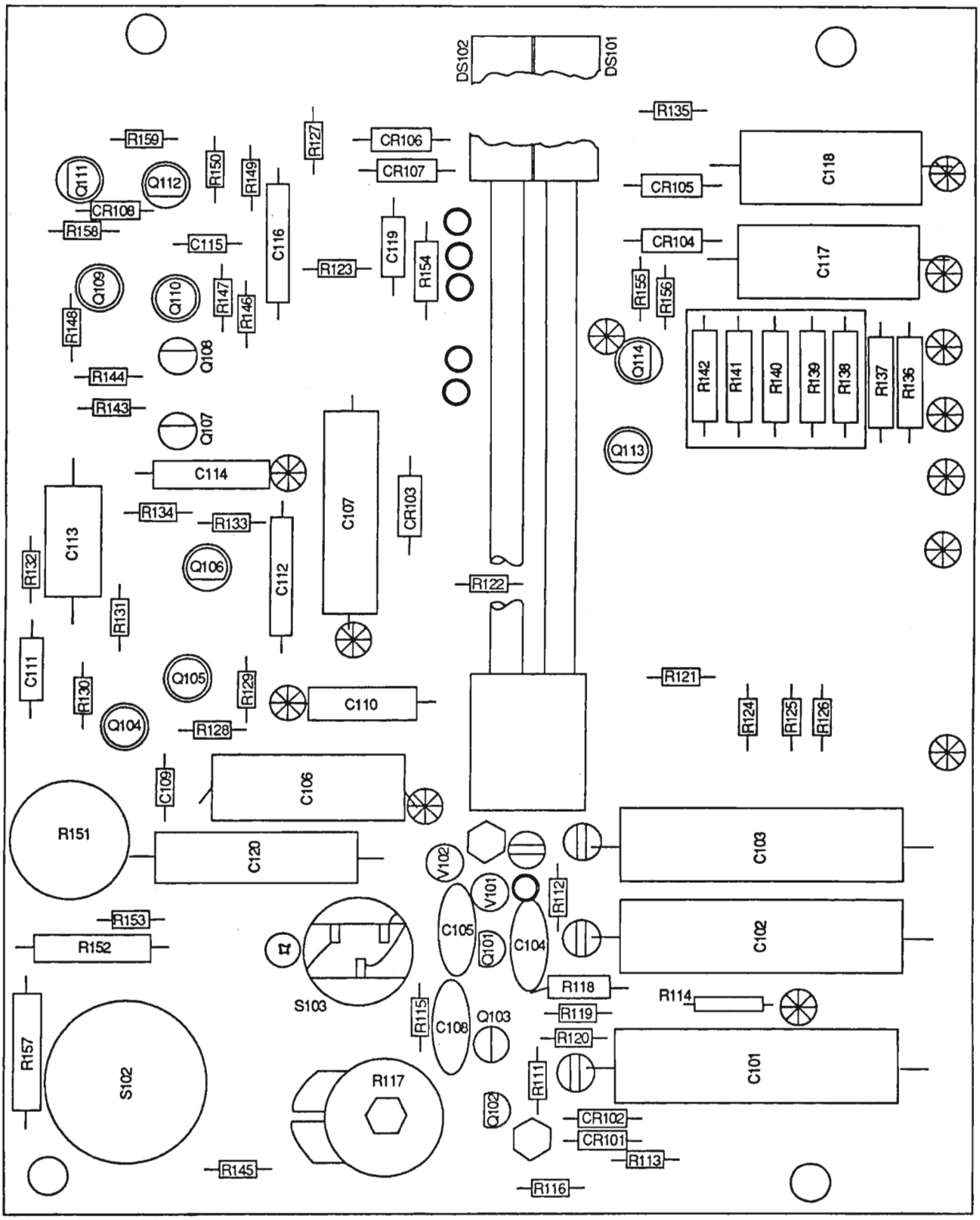


Figure 5-3. A3 Amplifier PCB Assembly

Table 5-4. A4 Power Supply PCB Assembly
(See Figure 5-4.)

REFERENCE DESIGNATOR -A>-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY--	NOT -E---
C 201		CAP,AL,470UF,+50-10%,25V	168153	62643	SM25T-470	1	
C 203		CAP,POLYES,1UF,+-20%,200V	106450	12673	33M1004M-2	1	
C 204		CAP,AL,470UF,+50-10%,6.3V	187773	62643	SM6.3T-470	1	
CR 201-206		DIODE,SI,600 PIV,1.5 AMP	112383	04713	1N5397	6	
H 1		RIVET,S-TUB,OVAL,STL,.118,.218	103606	12014	R3647X7-32	8	
MP 1		METL,SHT REAR BULKHEAD	194357	89536	194357	1	
Q 201,202	*	TRANSISTOR,SI,NPN,SELECTED,SMALL SIG	454843	04713	SPS7940	2	
Q 203,204	*	TRANSISTOR,SI,PNP,SMALL SIG,SELECTED	380394	56289	T-6506	2	
R 201		RES,CC,39,+-10%,2W	144378	01121	HB3901	1	
R 202		RES,CC,150,+-5%,1W	178566	01121	GB1515	1	
R 205		RES,MF,9.53K,+-1%,0.5W,100PPM	159442	91637	CMF659531F T-1	1	
R 206		RES,VAR,WW,3K,+-10%,1.25W	112458	11236	110-302-1.25-10%	1	
R 207,208		RES,CC,5.1K,+-5%,0.5W	109108	01121	EB5125	2	
R 209,210		RES,CC,22K,+-5%,0.25W	148130	01121	CB2235	2	
S 201		SWITCH,WAFER,SPECIAL CUT	194019	29238	4-2435-469	1	
T 201		XFORMER POWER	192724	89536	192724	1	
T 202		XFORMER DRIVER	192708	89536	192708	1	
T 203		XFORMER ISOLATION	192716	89536	192716	1	
XQ 201-204		SOCKET,TRANS,TO-5	104315	95354	133-400-01	4	

An * in 'S' column indicates a static-sensitive part.

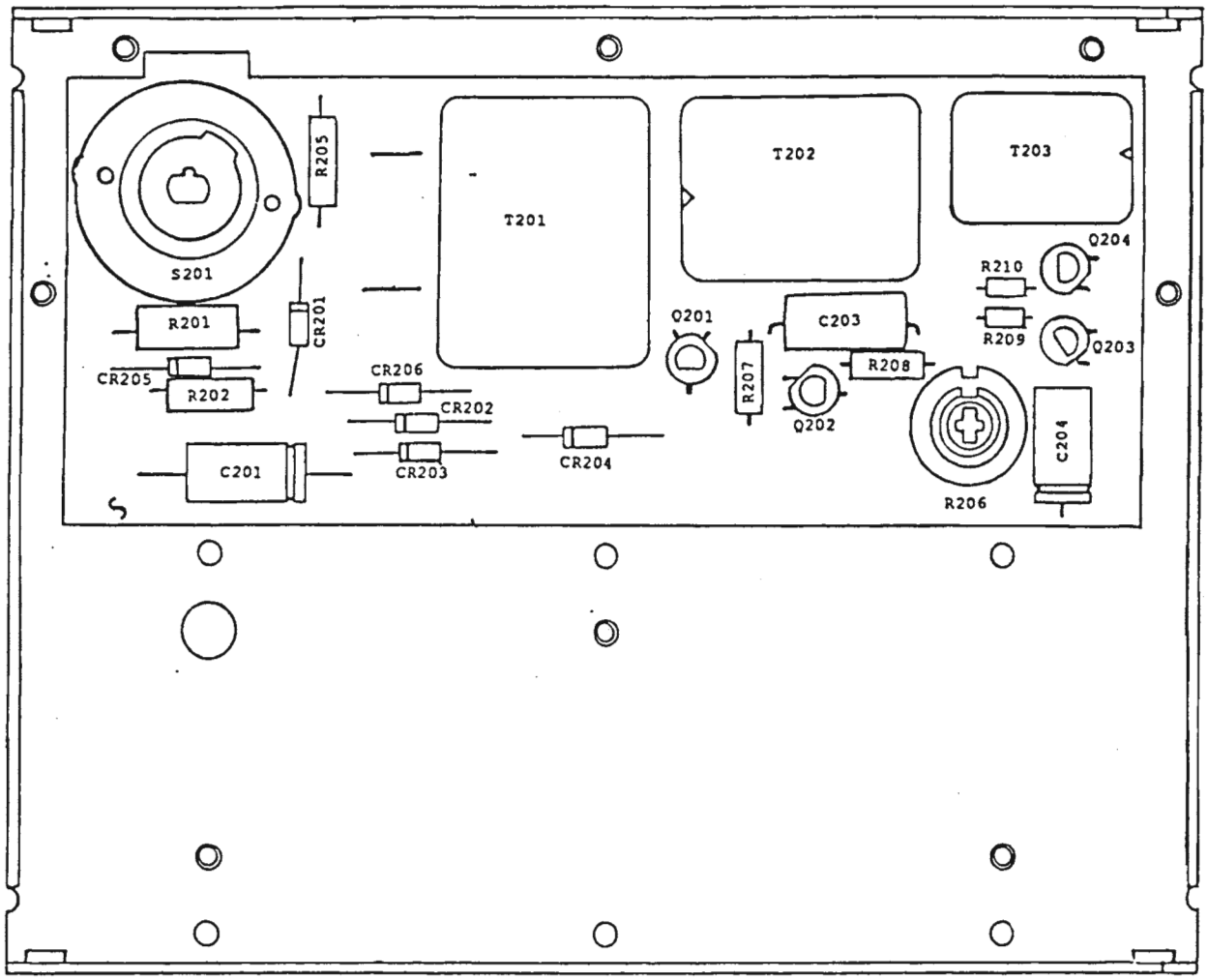


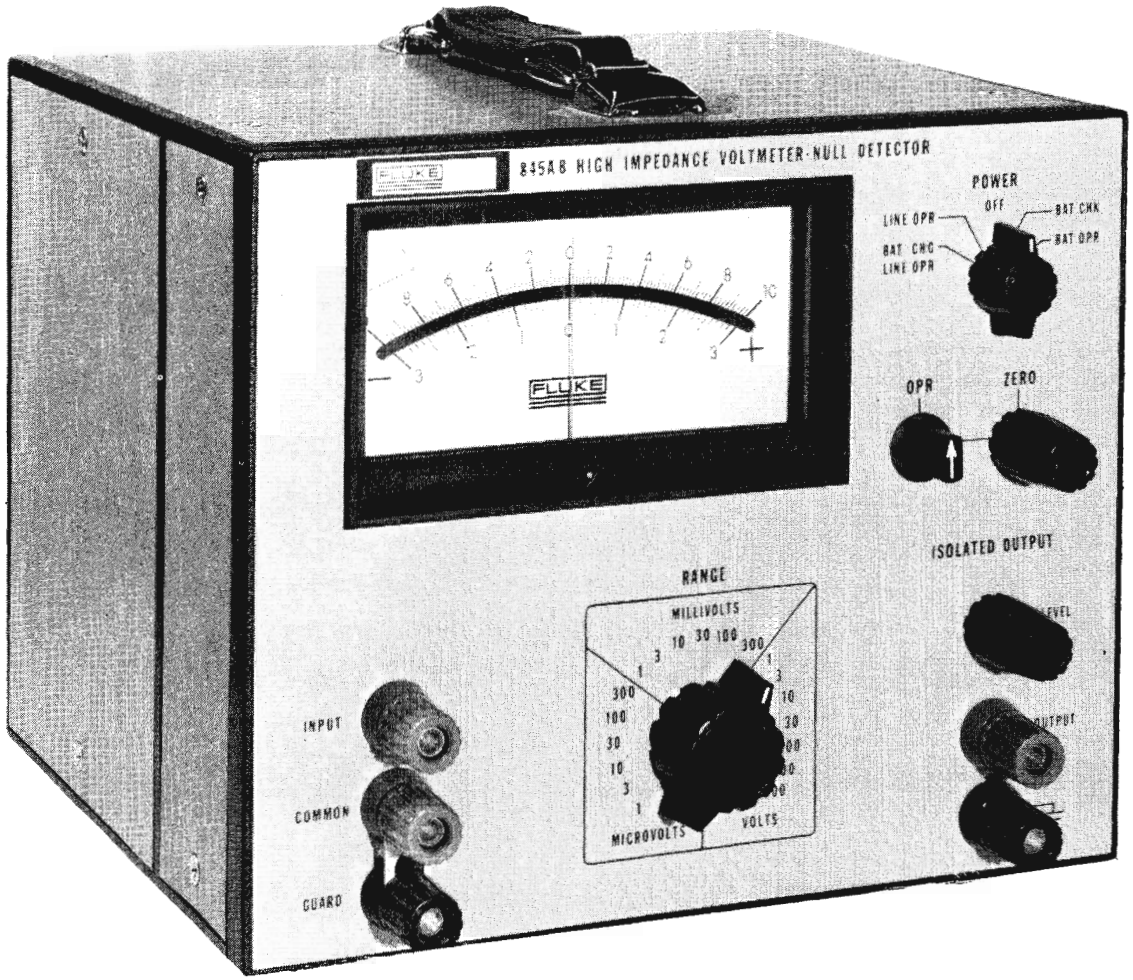
Figure 5-4. A4 Power Supply PCB Assembly

TABLE OF CONTENTS

Section	Title	Page
I	INTRODUCTION AND SPECIFICATIONS	1-1
	1-1. Introduction	1-1
	1-4. Electrical Specifications	1-1
	1-5. Environmental Specifications	1-2
	1-6. Mechanical Specifications	1-2
II	OPERATING INSTRUCTIONS	2-1
	2-1. Introduction	2-1
	2-3. Controls, Terminals, and Indicator	2-1
	2-5. Preliminary Operation	2-1
	2-7. Model 845AB Battery Check	2-1
	2-9. Model 845AB Battery Charging	2-1
	2-11. Mechanical Zeroing	2-3
	2-13. Operation as a High Impedance Voltmeter	2-3
	2-15. Operation as a Null Detector	2-3
	2-17. Measuring Voltages With a Standard Cell	2-4
	2-19. Use of the Isolated Output	2-4
	2-24. Operating Notes	2-5
III	THEORY OF OPERATION	3-1
	3-1. Introduction	3-1
	3-3. Block Diagram Analysis	3-1
	3-8. Circuit Description	3-2
IV	MAINTENANCE	
	4-1. Introduction	4-1
	4-3. Test Equipment	4-1
	4-5. Battery Replacement	4-1
	4-8. 230 Volt AC Power-Line Conversion	4-1
	4-11. Disassembly Instructions	4-2
	4-13. Corrective Maintenance	4-3
	4-23. Calibration Procedures	4-5
V	LIST OF REPLACEABLE PARTS	5-1
	5-1. Introduction	5-1
	5-3. Columnar Information	5-1
	5-4. How to Obtain Parts	5-1
	5-7. List of Abbreviations	5-2
	5-8. Serial Number Effectivity	5-15
	APPENDIX	
	WARRANTY	
	LIST OF SALES REPRESENTATIVES	
	SCHEMATIC DIAGRAM	

LIST OF ILLUSTRATIONS

Figure	Title	Page
Frontispiece	Model 845AB High Impedance Voltmeter-Null Detector . .	iii
1-1.	Outline Drawing.	1-2
2-1.	Controls, Terminals, and Indicator	2-2
2-2.	Bridge Detector - Floating Supply.	2-3
2-3.	Bridge Detector - High Resistance	2-3
2-4.	Bridge Detector - Floating Null Detector	2-4
2-5.	Standard Cell Voltage Measurements	2-4
2-6.	Chassis Ground - Wire Location	2-4
3-1.	Model 845 Block Diagram	3-1
4-1.	Test Equipment Requirements	4-1
4-2.	Battery Polarity Connections	4-2
4-3.	T201 115/230 Volt AC Power Terminals	4-2
4-4.	Troubleshooting Chart (Sheet 1 of 2)	4-3
4-4.	Troubleshooting Chart (Sheet 2 of 2)	4-4
4-5.	Waveform at TP10	4-5
4-6.	Waveforms at TP6	4-5
4-7.	Waveform at TP7	4-5
4-8.	Waveform at TP2 -Q104 Removed	4-5
4-9.	Waveform at TP2	4-5
4-10.	Waveform at TP1	4-5
4-11.	Leakage Resistance Test - Equipment Connections	4-6
4-12.	Test and Alignment Points	4-6
4-13.	Calibration Equipment Connections	4-6
5-1.	Final Assembly	5-3
5-2.	Chassis Assembly	5-4
5-3.	Front Panel Assembly	5-6
5-4.	Amplifier P/C Assembly (Sheet 1 of 2)	5-8
5-4.	Amplifier P/C Assembly (Sheet 2 of 2)	5-9
5-5.	Power Supply P/C Assembly	5-14



MODEL 845AB HIGH IMPEDANCE VOLTMETER-NULL DETECTOR

SECTION I

INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

1-2. The Fluke Model 845 High Impedance Voltmeter-Null Detector allows measurement of dc voltages from one microvolt to 1000 volts dc in 19 ranges. When used as a null detector on the 100 millivolt range and below, the input impedance is 10 megohms. A linear recorder output allows the instrument to be used for production testing and also as a dc amplifier with a maximum gain of 120 db.

1-3. The instrument consists of the line powered Model 845A, and the line-battery-powered Model 845AB. The instruments are half-rack in size, and are equipped with resilient feet and a tilt-up bail for field or bench use. A single instrument may be mounted in a standard 19 inch rack by means of metal handle rack adapter kit 881A-102. Two instruments may be mounted side-by-side in a standard 19 inch rack by means of metal handle rack adapter kit 881A-103.

1-4. ELECTRICAL SPECIFICATIONS

INPUT VOLTAGE RANGE
1 microvolt to 1000 volt dc end scale in nineteen ranges, using X1 and X3 progression.

INPUT RESISTANCE
100 megohms on 300 millivolt range and above.
10 megohms on 100 millivolt range and below.

ACCURACY
±(2% end scale + 0.1 microvolt).

MAXIMUM METER NOISE (Input Shorted)

RANGE	NOISE (peak-to-peak)
1 microvolt	0.20 microvolt
3 microvolt	0.25 microvolt
10 microvolt - 1000 volt	0.30 microvolt

METER RESPONSE TIME (to 90% of reading)

RANGE	TIME
1 microvolt	5 seconds
3 microvolt	3 seconds
10 microvolt - 1000 volt	1-1/2 seconds

INPUT ISOLATION
Better than 10^{12} ohms at less than 50% relative humidity and 25° C regardless of line, chassis, or recorder grounding. Better than 10^{10} ohms up to 80% relative humidity and 35° C. With driven guard, isolation improves by at least one order of magnitude up to 10^{13} ohms. Any input terminal may be floated 1100 volts off chassis ground.

DC COMMON MODE REJECTION
Better than 160 db, input short-circuited, 80% relative humidity.
Better than 140 db, open-circuited, 50% relative humidity.
Better than 120 db, open-circuited, 80% relative humidity.

AC COMMON MODE REJECTION (below 100 kHz)
100 volts rms or 120 db greater than end scale, whichever is less, will effect reading less than 2% of end scale. Input open-circuited.

AC NORMAL MODE REJECTION (60 Hz and above)
AC voltages 60 db above end scale will effect reading less than 2% of end scale. Maximum ac voltage not to exceed 750 volts rms.

RECORDER OUTPUT
0-1 volt, one side at chassis ground; linear to 0.5% of end scale. Source impedance, 5k to 7.5k. Response time is approximately half that of the meter, therefore noise may exceed meter noise by 6 db.

STABILITY OF ZERO
Better than 0.15 microvolt/hour.
Better than 0.3 microvolt/day.

TEMPERATURE COEFFICIENT OF ZERO
Less than 0.1 microvolt/° C from 15° C to 35° C.
Less than 0.2 microvolt/° C from 0° C to 50° C.

ZERO CONTROL RANGE
±5 microvolt minimum.

OVERLOAD PROTECTION
Up to 1100 volts dc may be applied on any range. Typical recovery time is 4 seconds.

INPUT POWER
Model 845A
115/230 volts ac ±10%, 50 to 440 Hz, approximately 3 watts.
Model 845AB
Rechargeable battery or 115/230 volts ac ±10%, 50 to 440 Hz, approximately 6 watts during recharge (40 hours operation on full charge, batteries trickle-charged while instrument operates from line power).

1-5. ENVIRONMENTAL SPECIFICATIONS

OPERATING TEMPERATURE RANGE
Within all specifications from 15° C to 35° C.
Within all specifications from 0° C to 50° C except:
Maximum noise and meter response time - derated by a factor of two.
DC Common Mode Rejection - derated by 20 db.

STORAGE TEMPERATURE RANGE
Model 845A -40° C to +70° C.
Model 845AB -40° C to +60° C.

RELATIVE HUMIDITY RANGE
0 to 80%.

SHOCK
Meets hammer blow requirements of MIL-T-945A and MIL-S-901B.

VIBRATION
Meets 10 Hz to 55 Hz tests of MIL-T-945A.

1-6 MECHANICAL SPECIFICATIONS

MOUNTING
Resilient feet provide for bench and portable use. For side-by-side EIA rack mounting of two units, add Adapter Kit 881A-103 (includes handle-brackets and key plate). For EIA rack mounting of a single unit, add Adapter Kit 881A-102.

WEIGHT
Model 845A 9 pounds.
Model 845AB 10-1/4 pounds.

SIZE
8 inches high by 8-1/2 inches wide by 9 inches deep.

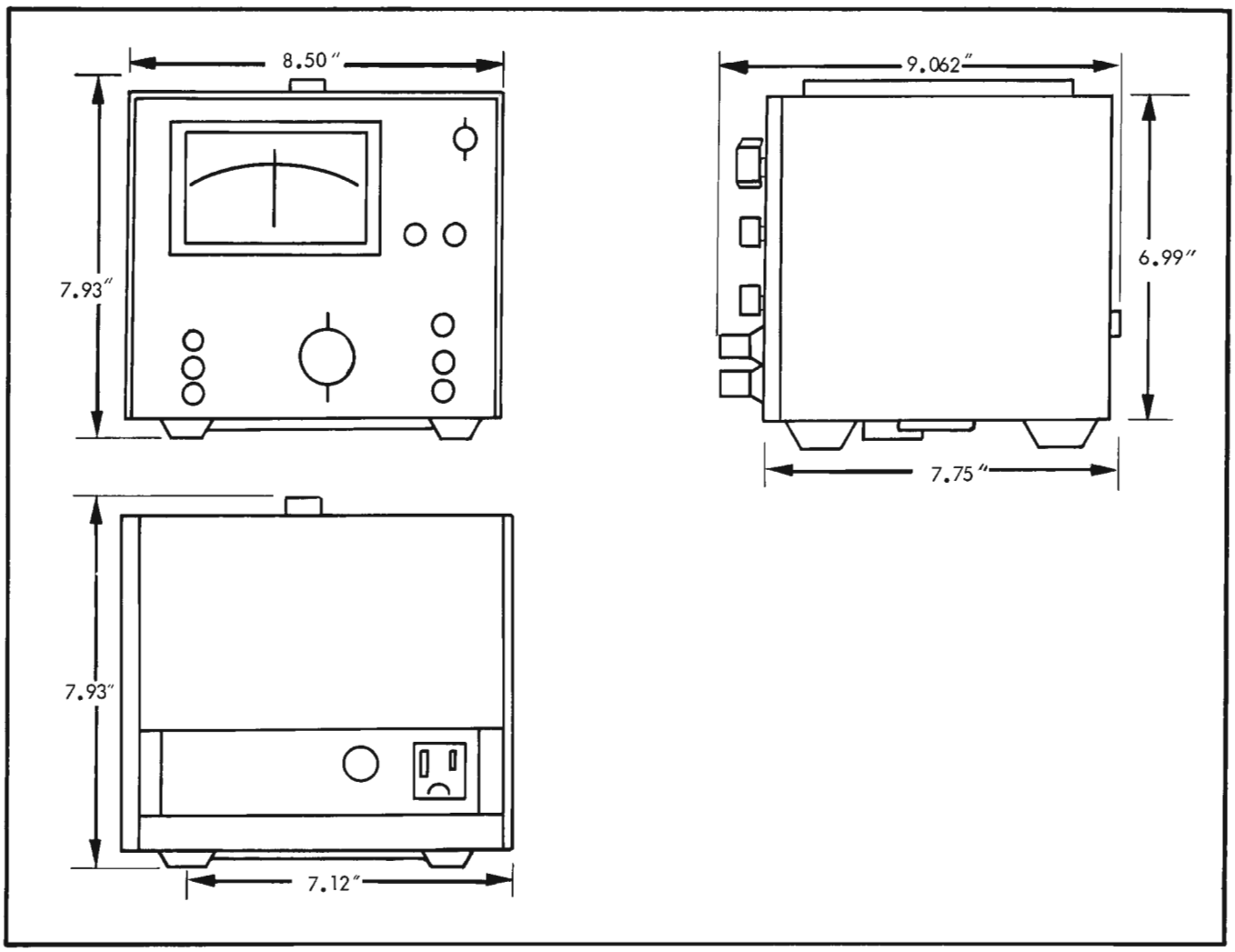


Figure 1-1. MODEL 845 OUTLINE DRAWING

SECTION II

OPERATING INSTRUCTIONS

2-1. INTRODUCTION

2-2. This section of the manual contains information necessary to operate the Model 845 High Impedance Voltmeter-Null Detector. Should any difficulties be encountered during operation of your instrument, feel free to contact your nearest John Fluke Sales Representative or write directly to the John Fluke Mfg. Co. Inc.

2-3. CONTROLS, TERMINALS, AND INDICATOR

2-4. The location and function of the front-panel controls are described in Figure 2-1. Detailed operating descriptions are given in the following paragraphs.

2-5. PRELIMINARY OPERATION

2-6. Connect the Model 845 line plug to a 115 volt ac power outlet or to 230 volts ac, if the instrument is so wired. If your instrument is a Model 845A, proceed with steps a and b. If your instrument is a Model 845AB, check the batteries as outlined in paragraph 2-7. Upon completion of a satisfactory battery check, proceed with steps c and d.

WARNING!

The round pin on the polarized three-prong plug connects the instrument case to power system ground. Use a three-to-two pin adapter when connecting to a two-contact outlet. For personnel safety, connect the short lead from the adapter to a high-quality earth ground.

a. Place the Model 845A controls as follows:

POWER	ON
RANGE	10 MICROVOLTS
OPR	ZERO

b. Adjust the ZERO control for an initial zero meter deflection. Place the RANGE switch to the 1 MICROVOLT RANGE and re-zero with the ZERO control.

c. Place the Model 845AB controls as follows:

POWER	LINE OPR or BAT OPR
RANGE	10 MICROVOLTS
OPR	ZERO

d. Adjust the ZERO control for an initial zero meter deflection. Place the RANGE switch to the 1 MICROVOLT RANGE and re-zero with the ZERO control.

2-7. MODEL 845AB BATTERY CHECK

2-8. The Model 845AB batteries must be in the proper charge state for the instrument to operate properly in the BAT OPR mode. To check the batteries proceed as follows:

a. Place the POWER switch to BAT CHK position.

b. The Model 845AB meter needle should deflect within the BATTERY OK region. If the meter needle does not stay within the BATTERY OK region for at least 10 seconds, charge the batteries as indicated in paragraph 2-9. If the batteries are adequately charged, refer to paragraph 2-5.

2-9. MODEL 845AB BATTERY CHARGING

2-10. If the Model 845AB is left in the BAT OPR mode for an extended period of time, the batteries will become discharged. If the batteries are fully discharged, the instrument will not operate properly in the LINE OPR mode until the battery voltage can be brought up to 3/4 of full voltage. This will require about 15 minutes of charging. To charge the Model 845AB batteries proceed as follows:

a. Connect the line plug to a 115 volt ac power outlet or to 230 volts ac, if the instrument is so wired.

b. Place the POWER switch to BAT-CHG LINE OPR. After 16 hours the batteries will be fully charged and capable of operating the instrument for at least 40 hours.

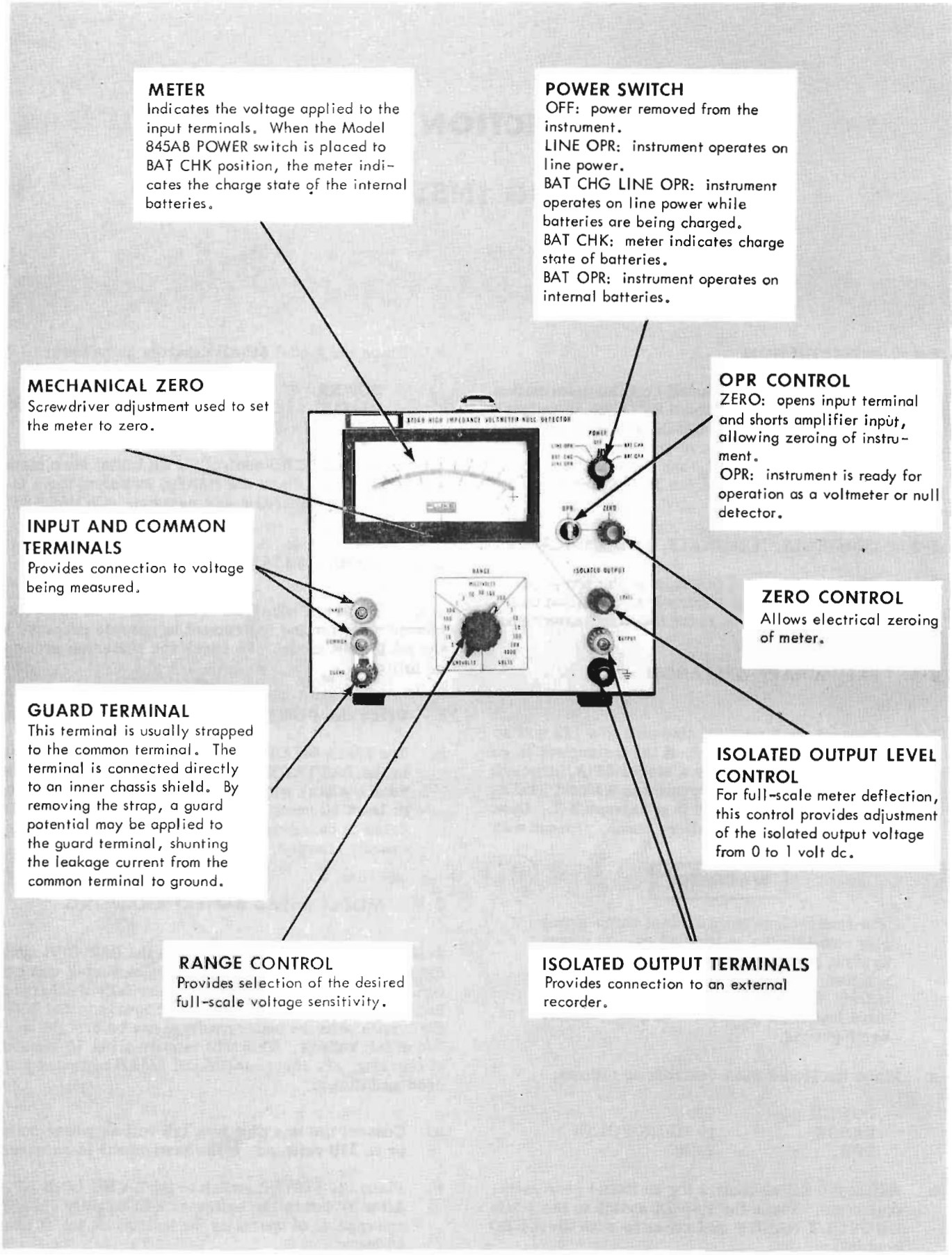


Figure 2-1. CONTROLS, TERMINALS, AND INDICATORS

2-11. MECHANICAL ZEROING

2-12. It may be necessary to adjust the mechanical zero control of the Model 845 at more frequent intervals than complete calibration. To mechanically zero the instrument proceed as follows:

a. Place the RANGE switch to 1000 VOLTS and the POWER switch to ON or to LINE OPR.

b. Adjust the mechanical zero adjustment screw for zero meter deflection.

c. Place the RANGE switch to 10 MICROVOLTS and electrically zero the instrument as outlined in paragraph 2-5.

d. Repeat steps a through c until the meter is mechanically and electrically zeroed.

2-13. OPERATION AS A HIGH IMPEDANCE VOLTMETER

2-14. To operate the Model 845 as a High Impedance Voltmeter, perform the preliminary operations according to paragraph 2-5 and proceed as follows:

a. Place the controls as follows:

POWER	ON/LINE OPR or BAT OPR
OPR	OPR
RANGE	1000 VOLTS

Note!

When measuring voltages in the microvolt ranges, use copper wire having low thermal EMF's.

b. Connect the voltage to be measured to the Model 845 INPUT terminal and connect the common point of the voltage being measured to the Model 845 COMMON terminal.

c. Deflection of the meter indicates the polarity and magnitude of the measured voltage. Increase the sensitivity of the Model 845 for maximum on-scale deflection.

2-15 OPERATION AS A NULL DETECTOR

2-16. The Model 845 may be used to monitor small voltage differences in bridge circuits, potentiometers, and other measuring apparatus. In most of these applications the circuits are adjusted for zero deflection or a null on the Model 845. Equipment connections for various types of null detector configurations are illustrated by Figure 2-2 through 2-4. To operate the Model 845 as a Null Detector perform the preliminary operations according to paragraph 2-5 and proceed as follows:

a. Select the desired equipment application as illustrated by Figure 2-2 through 2-4 and make the appropriate equipment connections.

b. Place the Model 845 controls as follows:

POWER	ON/LINE OPR or BAT OPR
OPR	OPR
RANGE	as desired

c. Adjust the circuit being measured for zero or a null deflection on the Model 845 meter.

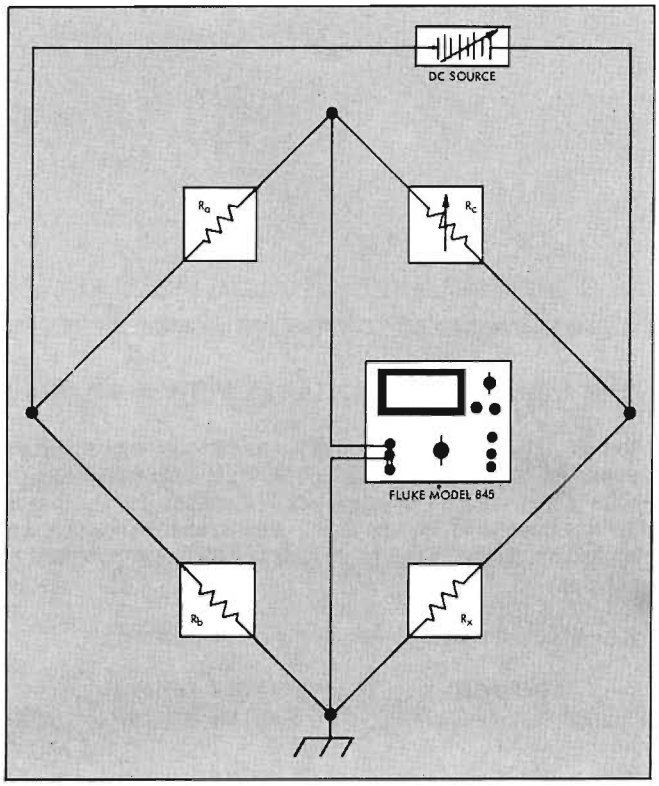


Figure 2-2. BRIDGE DETECTOR-FLOATING SUPPLY

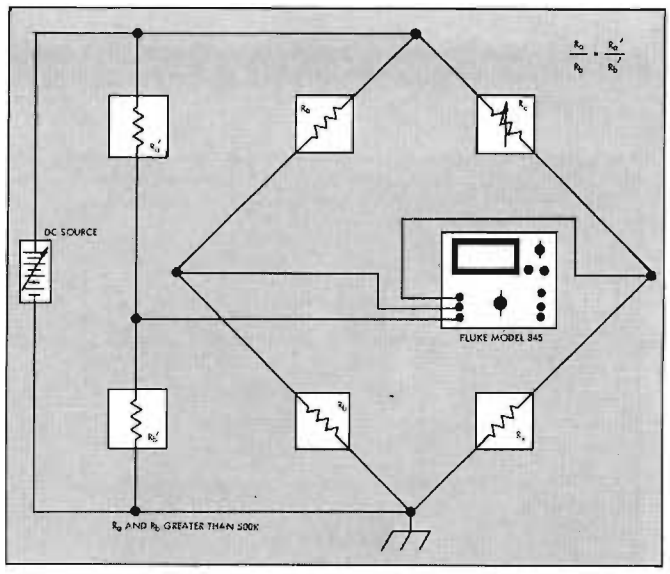


Figure 2-3. BRIDGE DETECTOR-HIGH RESISTANCE

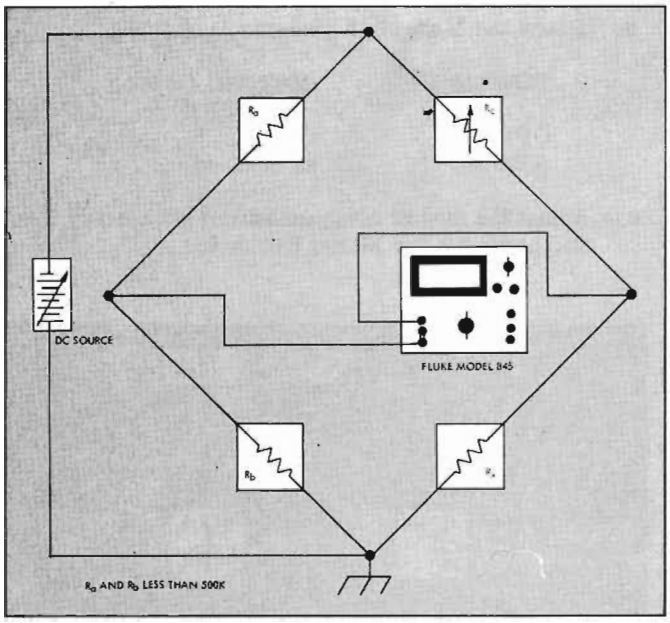


Figure 2-4. BRIDGE DETECTOR-FLOATING NULL DETECTOR

2-17. MEASURING VOLTAGES WITH A STANDARD CELL

2-18. The Model 845 may be used with a voltage divider and a standard cell to calculate unknown voltages with a high degree of accuracy. Connect the equipment as illustrated in Figure 2-5. Perform the preliminary operation as outlined in paragraph 2-5 and proceed as follows:

a. Place the Model 845 controls as follows:

POWER	ON/LINE OPR or BAT OPR
OPR	OPR
RANGE	as desired

b. Adjust the voltage divider for zero or null deflection on the Model 845 meter while placing the RANGE switch to successively more sensitive ranges.

c. Calculate the unknown voltage by dividing the standard cell voltage by the final division ratio of the divider.

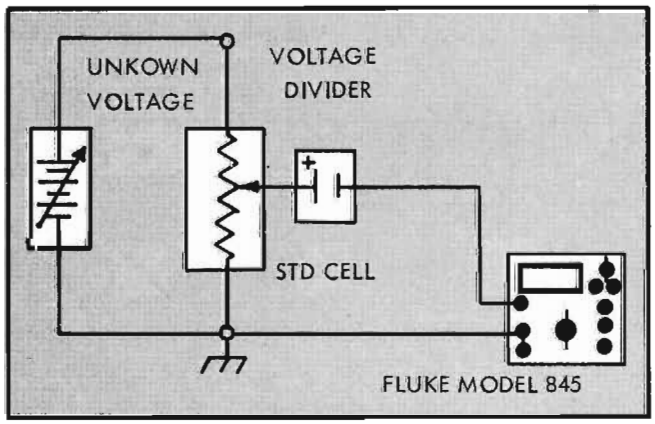


Figure 2-5. STANDARD CELL VOLTAGE MEASUREMENTS

2-19. USE OF ISOLATED OUTPUT

2-20. DC ISOLATION AMPLIFIER

2-21. The Model 845 may be used as a dc isolation amplifier having a voltage gain of up to 120 db, depending on the settings of the RANGE switch and the OUTPUT LEVEL control. To compute the maximum voltage gain on any range of the Model 845, use the following formula:

$$\text{Voltage gain in db} = 20 \log_{10} \frac{1 \text{ volt (maximum isolated output)}}{\text{RANGE (in volts)}}$$

2-22. RECORDER OUTPUT

2-23. The Model 845 ISOLATED OUTPUT may be used to provide an output voltage, adjustable from zero to one volt for a full-scale meter deflection for use with a recorder. Since the output is isolated from the input, floating measurments can be made without the use of a floating recorder. To use the adjustable recorder output, proceed as follows:

a. Connect the recorder to the ISOLATED OUTPUT terminals.

Note!

The lower ISOLATED OUTPUT terminal is connected to chassis ground. If a ground reference is undesirable, disconnect the green wire between the power supply circuit board and the grounding pin on the ac line plug. Refer to Figure 2-6 for wire location.

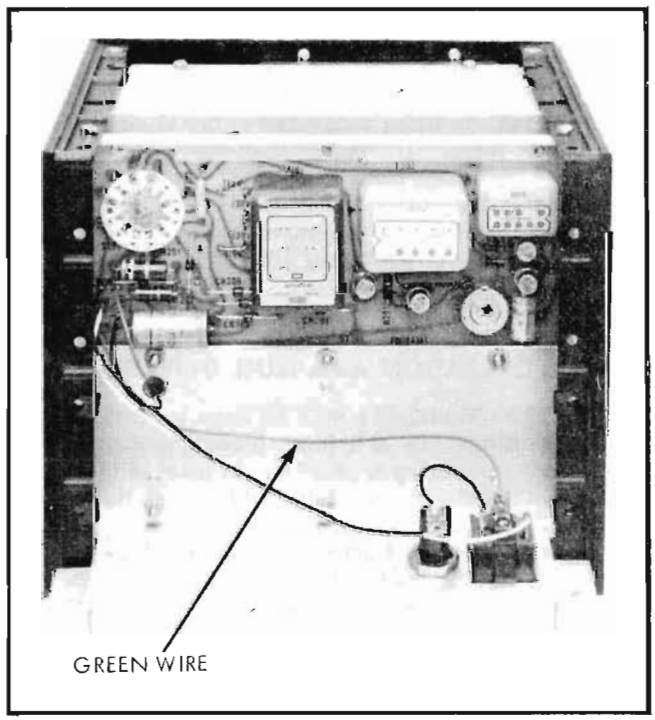


Figure 2-6. CHASSIS GROUND-WIRE LOCATION

b. Turn the recorder on.

c. Proceed as outlined in paragraph 2-13 or 2-15, as desired.

d. Adjust the ISOLATED OUTPUT LEVEL control for the desired output to the recorder. This control has a log taper so that smooth control is possible at both high and low settings.

Note!

The ISOLATED OUTPUT current capability is 100 microamperes with a 5 kilohm source impedance.

2-24. OPERATING NOTES

2-25. SPURIOUS VOLTAGES AND CURRENTS

2-26. Voltage measurements at the microvolt level involve the persistant problems of thermoelectric effects. These effects may be compensated for by temporarily disconnecting the voltage from the circuit under measurement and noting the meter deflection of the Model 845 on the desired range. This reading must then be subtracted from all subsequent voltage measurements. A thorough understanding of these effects can lead to reducing or eliminating them completely.

2-27. THERMOELECTRIC VOLTAGES

2-28. If a circuit is composed of two dissimilar metals, a net voltage will result if the two dissimilar junctions are maintained at different temperatures. These thermoelectric voltages, also known as thermals, thermocouple voltages, or Seebeck voltages, can be reduced by using metals having low thermoelectric potentials and keeping all junctions at the same temperature. The terminals of the Model 845 are made of pure copper, gold-flashed to prevent tarnish. For lowest thermal voltages, all connections to the Model 845 should be made with pure copper wire. Silver plated copper or solder coated copper also produce satisfactory results. Tinned copper is less satisfactory than silver plated or solder coated copper . Nickel and nickel-based alloys are not suitable for connections to the instrument. Excellent results can be obtained using ordinary TV twin lead, or even lamp cord if high insulation resistance is not required. If shielding is necessary, use a length of flat braid over the cable.

2-29. HIGH SOURCE IMPEDANCE

2-30. Due to the very high input resistance and extreme sensitivity of the Model 845, it is charge sensitive. Thus, a person's body potential, an electrostatic voltage, can cause charge redistribution at the input to the instrument and result in meter needle deflection as a hand approaches the input terminals. Careful shielding will eliminate this problem. Also, due to charges that may be deposited on the input terminals when the OPR switch is set to ZERO, an appreciable transient will result when the switch is set to OPR if nothing is connected to the input terminals. Turning the switch back and forth will dissipate this charge, eliminating the problem. With a high source impedance, the response of the instrument is unavoidably slow due to the low pass filter used to suppress superimposed noise. However, the design of the low pass filter is such that common mode rejection is extremely high while the response time for the normally encountered low source impedances is very fast.

2-31. OVERLOAD VOLTAGES

2-32. The instrument is designed to withstand up to 1100 volts dc or 1100 volts peak ac continuously applied between any two of the three input terminals, or between cabinet ground and any of the three input terminals, regardless of the setting of the RANGE or OPR switch. However, repeated or continuous overloads above 200 volts in the ranges below 3 millivolts will result in excessive dissipation in the protective, low-pass-filter resistor R110. This will result in thermal voltages which may take several minutes to subside after the overload is removed.

2-33. GUARDING

2-34. The instrument has an inner chassis connected to the GUARD terminal on the front panel. Ordinarily, this GUARD terminal is strapped to the COMMON terminal. When connected in this way, the inner chassis serves as a shield. This greatly improves the leakage resistance to ground and the common mode rejection. However, since the inner chassis is available at the GUARD terminal, it may be driven at the same voltage as the COMMON terminal. This further increases the leakage resistance and common mode rejection by about ten times. The voltage used to drive the GUARD terminal should be obtained from a separate source or by means of a voltage divider connected directly across the source so that the leakage currents do not cause voltage drops across impedances in the circuit under measurement.

2-35. INCREASING INPUT RESISTANCE

2-36. In the 1 microvolt to 1 millivolt ranges, a 10 megohm resistor is connected directly across the input of the instrument. The input resistance may be increased on these ranges by disconnecting the 10 megohm resistor where it attaches to the RANGE switch. However, the input resistance will no longer be well defined. Typical input resistances with the 10 megohm resistor removed, are as follows:

RANGE	INPUT RESISTANCE
1 microvolt	300 megohms
3 microvolt	1000 megohms
10 microvolt	3000 megohms
30 microvolt to 1 millivolt	10,000 megohms

SECTION III

THEORY OF OPERATION

3-1. INTRODUCTION

3-2. The Model 845 High Impedance Voltmeter-Null Detector theory of operation is contained in this section of the manual. A block diagram is illustrated in Figure 3-1, and a functional schematic diagram is located at the end of Section V. The block diagram and functional schematic diagram are to be used as an aid in understanding circuit theory, and in troubleshooting.

3-3. BLOCK DIAGRAM ANALYSIS

3-4. The Model 845 is a photo-chopper stabilized amplifier with the overall gain of the amplifier being precisely controlled by negative feedback. The instrument's main circuits are an input range divider, a photocell modulator, an ac amplifier, a synchronous demodulator, a dc amplifier, a meter, an isolation converter, a neon drive, an 84 Hz multivibrator, a supply rectifier, and a rectifier filter.

3-5. The input range divider provides a fixed input impedance to signals of less than 1 millivolt and allows reduction of input signals above 1 millivolt. Photo-choppers modulate the input signal to the ac amplifier at 84 Hz. The drive signal for the photo modulator is provided by the neon drive which is composed of neon lamps driven alternately at 84 Hz by the 84 Hz multivibrator. The 84 Hz signal provides the Model 845 with an operating frequency asynchronous with the power line frequency and power line harmonics. The 84 Hz multivibrator also drives the following circuits; (1) the supply rectifiers which provide operating voltages for the amplifiers, (2) the isolation converter which provides the isolated recorder output, (3) the synchronous demodulator which demodulates the amplified dc signal. The entire amplifier and the secondaries of both transformers are surrounded by a guard shield which permits the use of external guard voltages.

3-6. The ac amplifier is a high impedance amplifier whose gain is controlled by the resistance selected by the RANGE control. The amplified dc signal is then detected by the synchronous demodulator.

3-7. Demodulation of the output signal of the ac amplifier is accomplished by a synchronous demodulator. The synchronous demodulator is driven by the 84 Hz reference signal and detects the amplified dc signal. The detected dc signal is then amplified by a dc amplifier whose gain is controlled by fixed feedback. The output signal of the dc amplifier drives the meter which indicates the polarity and magnitude of the measured voltage, and the isolation converter which drives the isolated recorder output. This same dc signal is also fed back to the input of the ac amplifier to control overall amplifier gain. The feedback ratio is determined by the setting of the RANGE control and allows overall amplifier gain to be precisely controlled.

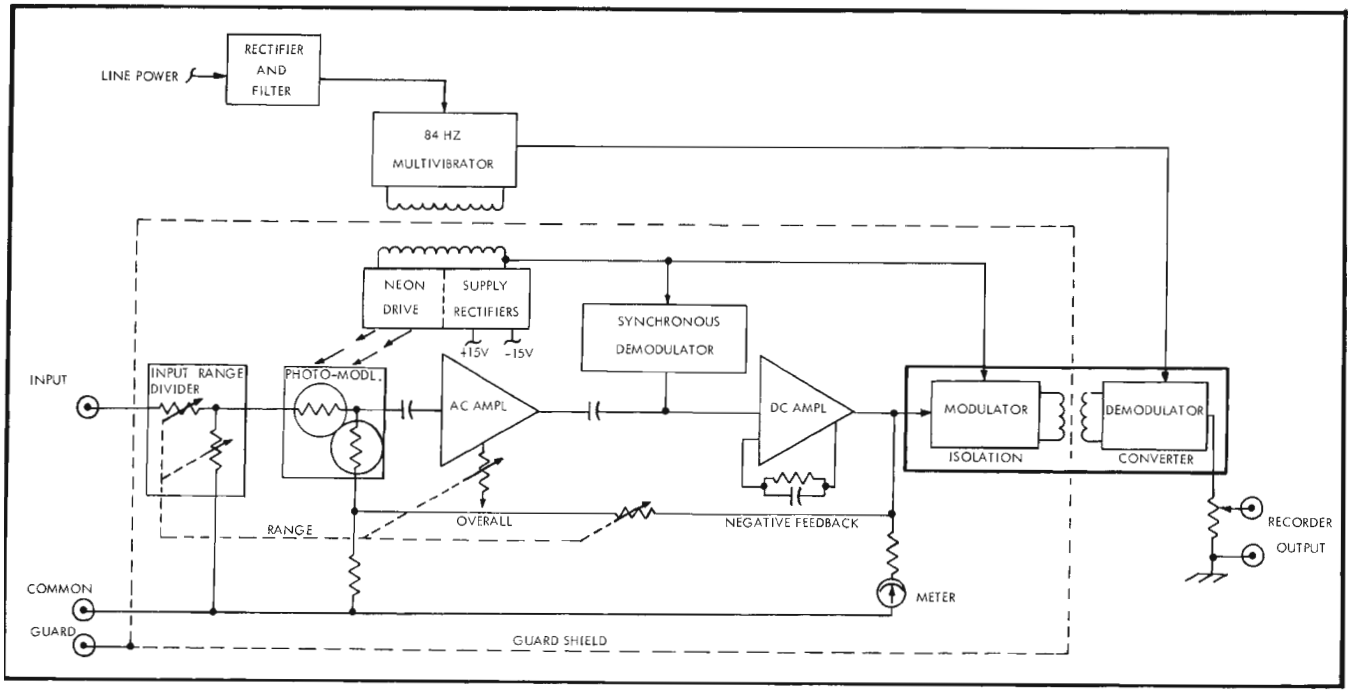


Figure 3-1. MODEL 845 BLOCK DIAGRAM

3-8. CIRCUIT DESCRPTION

3-9. THE POWER SUPPLY

3-10. Input power transformer T201 receives 115 volts ac, or 230 volts ac if the instrument is so wired, through the power switch, S201. The primary winding of T201 is constructed in such a manner as to utilize either 115 volts ac input, windings parallel, or 230 volts ac, windings in series. Fuse, F1, protects the Model 845 circuitry from overloads.

3-11. The secondary voltage of T201 is rectified by bridge rectifier CR201 through CR204. An additional bridge leg composed of CR205 and CR206, is used on the Model 845AB for charging of the batteries. This additional leg allows charging of the batteries while using the instrument on line power and also references the bridge rectifier to the battery voltage, providing regulation of the dc output voltage. When the POWER switch S201 is placed to the BAT CHK position, meter multiplier resistor R205, and meter shunt resistor R157, are selected. The output dc voltage of the batteries under an actual load condition is then indicated by the meter of the Model 845AB. The Model 845A bridge rectifier output voltage is regulated by zener CR207. Capacitor C201 filters the output dc voltage on both Model 845 instruments. This regulated output is used as the operating voltage for the 84 Hz multivibrator.

3-12. The 84 Hz multivibrator is used to provide synchronous drive voltages and dc operating voltages for the Model 845 amplifier circuits free from any power line frequency variations and harmonics. The multivibrator is a transformer-coupled free running multivibrator composed of transistors Q201 and Q202, transformer T202, and frequency determing components C203 and R206 through R208. Variable resistor R206 is used to adjust the frequency of the multivibrator to 84 Hz. The voltage at the secondary of T202 is rectified by CR104 and CR105 to produce the positive and negative 15 volt dc operating voltages for the amplifier circuits. The same winding furnishes the synchronous demodulator and isolation converter drive signals and is tapped at a higher voltage level to drive the neon lamps DS101 and DS102. The neon lamps provide the drive signals for the photocell modulators V101 and V102.

3-13. THE INPUT DIVIDER

3-14. The basic full-scale sensitivity of the Model 845 is limited to a maximum of 1 millivolt. Therefore, input signals above this value must be reduced. The input divider consists of R101 through R109 and RANGE switch S101A. On ranges being a multiple of 1, input voltages above 1 millivolt are divided down to 1 millivolt or less, upon selection of the proper range. On ranges being a multiple of 3, input voltages above 1 millivolt are divided down to 300 microvolts or less, upon selection of the proper range. On ranges of 1 millivolt and below, a 10 megohm resistor, R104, is connected across the input to provide a fixed value of input impedance.

3-15. THE AC AMPLIFIER

3-16. The input signal from the input divider is filtered by a three stage, low-pass filter composed of R110, C101, R111, C102, R112, and C103. This filter reduces any ac voltage having a frequency above 1 Hz. The filtered dc voltage is then square-wave modulated by photochoppers V101 and V102, which are driven by DS101 and DS102. The resulting square-wave signal is coupled through C104 and the Ferrite Bead FL1 and amplified by Q101, Q102, and Q103 which form a three stage ac amplifier having a high input impedance. The gain of the ac amplifier is controlled by the common emitter resistance selected by the RANGE switch S101B. Maximum gain is used on the 1, 3, 10, and 30 microvolt ranges and is gradually reduced by the selection of R124 through R126 as the range is increased. The output of Q103 is capacitively coupled to a two stage current amplifier composed of Q104 and Q105. The current amplifiers have a constant gain controlled by fixed negative feedback through R130 and C111.

3-17. THE SYNCHRONOUS DEMODULATOR

3-18. The synchronous demodulator detects the magnitude and phase of the amplified signal. The 84 Hz drive signal is applied to the base of transistor Q106 which references the synchronous demodulator to the same phase as the photo modulator. The demodulated signal is filtered by R134 and C114 before being applied to the dc amplifier.

3-19. THE DC AMPLIFIER

3-20. The dc amplifier amplifies the detected dc signal from the synchronous demodulator. Transistors Q107 through Q112 comprise a two-stage differential amplifier with a complementary emitter-follower output. Negative feedback through R149 and C116 is applied to the base of Q108 and controls the dc amplifier gain. The output from the common emitter of Q111 and Q112 is 1 volt dc for a full range input on any range, which drives the meter and isolation converter. Overall negative feedback through the resistive network of R138 through R142 and R114 is controlled by the position of the RANGE switch S101C. This negative feedback allows precise control of the overall gain of the Model 845 amplifiers.

3-21. THE ISOLATION CONVERTER

3-22. The isolation converter drives the recorder output and provides isolation from the Model 845 amplifier circuitry. The output signal from the dc amplifier is applied to the transistors Q113 and Q114. An 84 Hz reference drive signal is applied to the bases of transistors Q113 and Q114 which causes modulation of the dc input signal to occur. The resulting modulated signal is coupled to the secondary of T203 where transistors Q203 and Q204 demodulate secondary signals occuring at their 84 Hz base signal rate. Capacitor C204 charges to the peak of the demodulated signal and discharges through the OUTPUT LEVEL control R1. C3 and R2 filter the resulting dc output voltage for the recorder output.

SECTION IV

MAINTENANCE

4-1 INTRODUCTION

4-2. The Model 845A and 845AB instruments should be checked for calibration annually. Without extreme abuse all that should be required is periodic cleaning and calibration as specified in this section. If a problem arises, refer to the information on corrective maintenance in this section.

4-3. TEST EQUIPMENT

4-4. Figure 4-1 lists the recommended equipment and their specifications which are required for maintenance and calibration.

4-5. BATTERY REPLACEMENT

4-6. Batteries in the Model 845AB need to be replaced when 16 hours of charging will no longer bring the meter to the minimum BATTERY OK region.

4-7. To replace the batteries proceed as follows:

a. Remove upper and lower dust covers of the Model 845AB.

b. Locate the battery pack which is mounted below the power supply printed circuit assembly and unsolder the black and red leads that electrically connect the battery pack to the power supply printed circuit assembly.

c. Remove the six nuts and screws that attach the battery pack to the power supply printed circuit assembly.

d. Remove the battery pack from the Model 845AB and replace the defective batteries observing the connections and polarities as illustrated in Figure 4-2.

e. Replace the battery pack in the Model 845AB, securing it to the power supply printed circuit assembly and chassis assembly with the six screws and nuts removed in step c.

f. Replace the battery pack black and red leads removed in step b, and replace the upper and lower dust covers.

g. Check the batteries as outlined in paragraph 2-7. If the batteries show a discharge, recharge them as outlined in paragraph 2-9.

4-8 230 VOLT AC POWER-LINE CONVERSION

4-9. All versions of the Model 845 may be converted for operation on 230 volt ac line power by modifying the power supply printed circuit assembly wiring. Factory modified versions will have a decal on the rear panel indicating a 230 volt ac input requirement.

4-10. To convert the Model 845 to 230 volt ac operation proceed as follows:

a. Remove the top-back dust cover.

b. Locate T201 on the power supply printed circuit assembly and remove the two jumper wires labeled 115V. Refer to Figure 4-3, for location.

EQUIPMENT NOMENCLATURE	SPECIFICATIONS	RECOMMENDED INSTRUMENT
DC POWER SUPPLY	Output voltage of 0 to 1000 volts dc. Accuracy of ±0.25% or 100 microvolts.	Fluke Model 332A
Oscilloscope	Voltage sensitivity of 200 uv/cm. Sweep speed of 2 ms/cm.	Hewlett-Packard Model 130C
Battery	10 volt	

Figure 4-1. TEST EQUIPMENT REQUIREMENTS

c. Place the jumpers removed in step b across the 230V labeled terminals, refer to Figure 4-3 for location, and solder the connections.

d. Replace the top-back dust cover and install a 3AG 1/32 ampere fuse in place of F1.

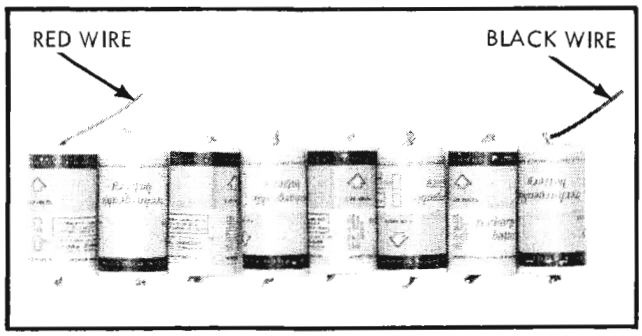


Figure 4-2. BATTERY POLARITY CONNECTIONS

4-11. DISASSEMBLY INSTRUCTION

4-12. The following procedure can be used to gain access to the inside of the Model 845:

a. Remove the top-back cover by removing four screws that fasten it to side castings. This allows access to the parts on the power supply board (parts with 200 series reference designations.)

b. Remove the bottom cover by removing two screws that fasten it to side castings. This allows access to capacitors C1 and C2 on the front panel.

c. Remove the large side cover on both sides of instrument by removing two screws that fasten each of them to side castings.

d. Remove the top cover of the guard chassis by removing four screws; two screws on the top of the guard and two on the back. This allows access to the dc amplifier Q107 through Q112, and the last two stages of the ac amplifier, Q104 through Q106. The instrument will still operate properly with the top of guard chassis removed. When the instrument is turned on, a red neon glow from the two lucite rods on the amplifier board is an indication that the photo-modulator drive circuit is working.

e. Remove the bottom-back cover of guard chassis by removing two screws on bottom. This allows access to; the input divider R101 to R110, the +15 and -15 volt dc supply filter capacitors C117 and C118, and the recorder output modulator Q113 and Q114. The instrument will still operate but will have a meter offset, especially with high source impedances.

f. Remove the screw that fastens the right side casting to the front panel at the top of the instrument.

g. Remove the small right side cover by removing the two screws that attach it to the chassis.

h. Loosen the four screws located below the removed small right side cover, by two turns only.

CAUTION!

Avoid touching polyethelene grommets. Contamination will cause excessive electrical leakage.

i. Remove the top and bottom screws that fasten the right side casting to the power supply board bracket.

j. Loosen the top and bottom screws that fasten the left side casting to the power supply board bracket by two turns.

k. Take off the power plug bracket at the rear of the instrument by removing two screws that fasten it to the side castings.

l. Pull the rear of the right side casting out far enough to swing the power supply board bracket out from the back of the instrument. This will allow access to the entire component side of the amplifier board.

m. Remove the input shield located at the end of the Lucite rods by removing the two attaching screws. This will allow access to the first three amplifier stages Q101 to Q103, and the chopper drive photocells V101 and V102.

n. If it is necessary to gain access to the land side of amplifier board, proceed as follows:

(1) Place the RANGE control to 1 MICROVOLTS and loosen the RANGE switch set screw that points toward the bottom of the instrument.

(2) Place the RANGE switch to 1000 VOLTS and loosen the other set screw that now points down, and take off the RANGE knob.

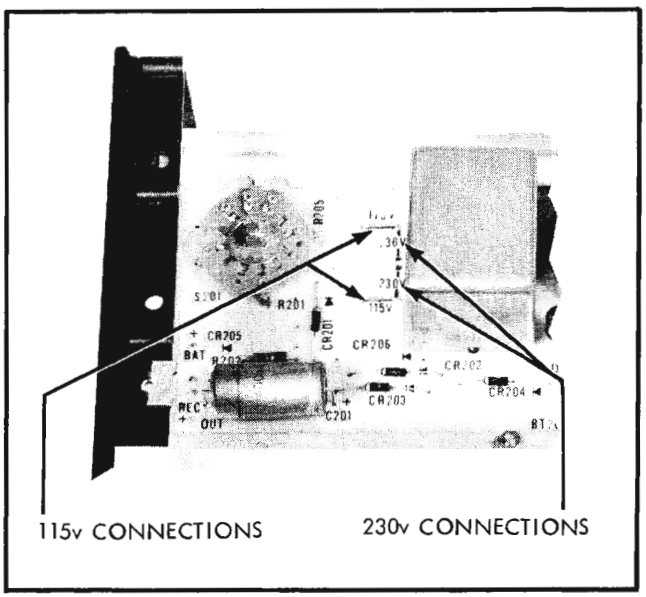


Figure 4-3. T201 115/230 VOLT AC POWER TERMINALS

(3) Loosen the set screw on the ZERO control shaft coupler where it connects to the potentiometer.

(4) Using a 1/2" socket wrench, remove the nut that holds the range switch to the guard chassis.

(5) Remove the four screws that hold the amplifier board to the guard chassis.

(6) Slide the amplifier board toward the rear of the instrument. This will allow access to the land side of the amplifier board.

4-13. CORRECTIVE MAINTENANCE

4-14. TROUBLESHOOTING

4-15. The purpose of troubleshooting is to locate and replace as quickly as possible any malfunctioning component or components that are causing improper operation. The causes and remedies of the more common troubles that may occur are listed in the troubleshooting chart, Figure 4-4. Waveforms useful for troubleshooting are given in Figures 4-5 through 4-10. A complete understanding of the theory of operation and familiarity with the schematic diagram is the best way to locate and correct the cause of any malfunction.

4-16. VISUAL INSPECTION

4-17. Troubles may sometimes be located by a thorough visual inspection. This may be accomplished by looking for the following symptoms:

a. Accumulations of dirt, dust, moisture, or grease. Remove contamination as outlined in paragraph 4-18.

b. Scorched or burned parts. Damage of this type is usually caused by other defective components. Determine the cuase of damage before replacing the components.

SYMPTOM	PROBABLE CAUSE	FAULT ISOLATION PROCEDURE
Blows fuses	Short circuit across secondary of T201	Test for short circuit between pins 3 and 6.
	Shorted turn in T201	Unsolder R202 in secondary of T201. A shorted turn will require almost as much current as normal operation.
	Defective CR201 through CR206	Measure voltage of C201. Should be 10.5 volts. If near zero, replace CR201 thru CR206, as necessary.
Photo Modulator inoperative (Neon lights out)	Low battery voltage	Charge batteries.
	Defective Q201 or Q202	If voltage of C201 is less than 7 volts, and batteries are charged, replace Q201 and/or Q202.
	Open winding on T202, or open C203	Waveform on TP10 should agree with Figure 4-5. If square wave is absent, T202 or C203 is defective.
	No drive to neon lamps DS101 and DS102	A square wave of over 200 volts peak-to-peak should be present between pin 9 of T202 and the GUARD terminal. If not, T202 may be defective.
Meter movement inoperative	Dead meter	Check meter with an ohmmeter. Panel meter should peg. (Model 845AB in LINE OPR, line cord disconnected).
	Defective auxiliary supply	Test points 3 and 4 voltage is near zero, check the associated diode and capacitor. If both voltages are zero, T202 is defective.

Figure 4-4. TROUBLESHOOTING CHART (Sheet 1 of 2)

SYMPTOM	PROBABLE CAUSE	FAULT ISOLATION PROCEDURE
Meter pegs or wanders	Meter mechanically stuck Defective amplifier	Using an oscilloscope with dc coupling, measure waveforms at TP6. If waveforms agree with Figure 4-6 check Q111, Q112, Q109, Q110, Q107, and Q108 by replacement. If waveforms are not correct, then: (a) Waveform at TP6 looks more like waveform at TP7, Figure 4-7, Q106 is open. (b) No change in waveform at TP6 as ZERO control is rotated. R114 is shorted, base of Q101 is shorted, V101 or V102 is shorted. (c) Waveform at TP6 looks like a square wave. Measure waveform at TP7. If square wave disappears and waveform at TP7 is correct, C112 is shorted. If waveform is not correct, remove Q104 and measure waveform at TP2, Figure 4-8. If square wave persists, short junction of R115, C104, C105, and base of Q101 to common. If square wave disappears, remove short and transfer short to R112, C103, and V101 junction. If square wave returns, a photocell is defective, or C104 is shorted. If square wave does not return move the short to the end of R110 that connects to RANGE switch. If square reappears, CR101 or CR102 is defective. If square wave does not reappear, the RANGE switch is defective. (d) No signal at TP6. If there is also no signal at TP7, Q106 is probably shorted. If Q106 is satisfactory, measure waveform at TP2. If there is still no signal, C107, CR103, Q101, Q102, or Q103 is defective.
ISOLATED OUTPUT operates on one polarity only	Open winding on T203 defective Q113, Q114, Q203, or Q204	Check and replace as necessary.
Slower response in negative direction	Leaky C120	Test and replace if necessary.
Measurements are low on high-sensitivity ranges	Shorted C116	Test and replace if necessary.
Poor stability	Defective CR207 Batteries not charged	Replace if necessary. Charge batteries as in paragraph 2-9.
Noise on 1, 3, and 10 uv ranges	Dirty or defective Q101, or defective Q102 Defective Chopper	Measure waveform at TP2. Figure 4-9 waveform shown in normal. Additional noise at TP2 is due to dirty Q101 or defective Q102. Remove Q111 and Q112, and apply an input of 1 mv. Observe waveform at TP1 for waveform shown in Figure 4-10: (a) Excessive noise can be caused by poor positioning of neon lamps. (b) Smaller waveform can be caused by slow response of photocells; if so, replace cells.
Unguarded leakage poor	Dirty grommets Leakage in T202 or T203	Clean according to paragraph 4-18. Test and replace if necessary.
Guarded leakage poor	Leakage in T202 or T203, or pins touching circuit board Contaminated binding posts	Test and repair as necessary. Clean according to paragraph 4-18.
Poor overload recovery	Defective C101, C102, C103, C120, CR101, CR102, or R110	Test and replace as necessary.

Figure 4-4. TROUBLESHOOTING CHART (Sheet 2 of 2)

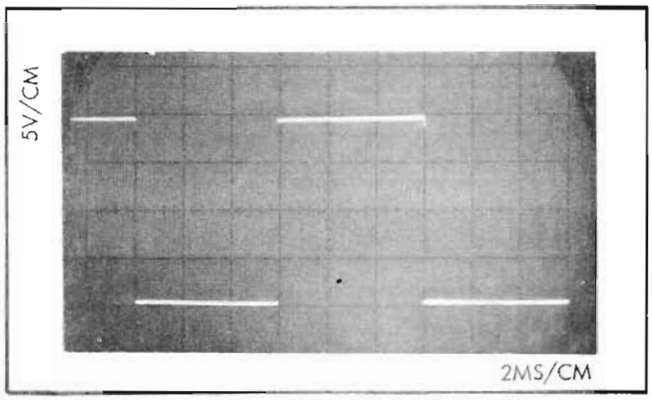


Figure 4-5. WAVEFORM AT TP10

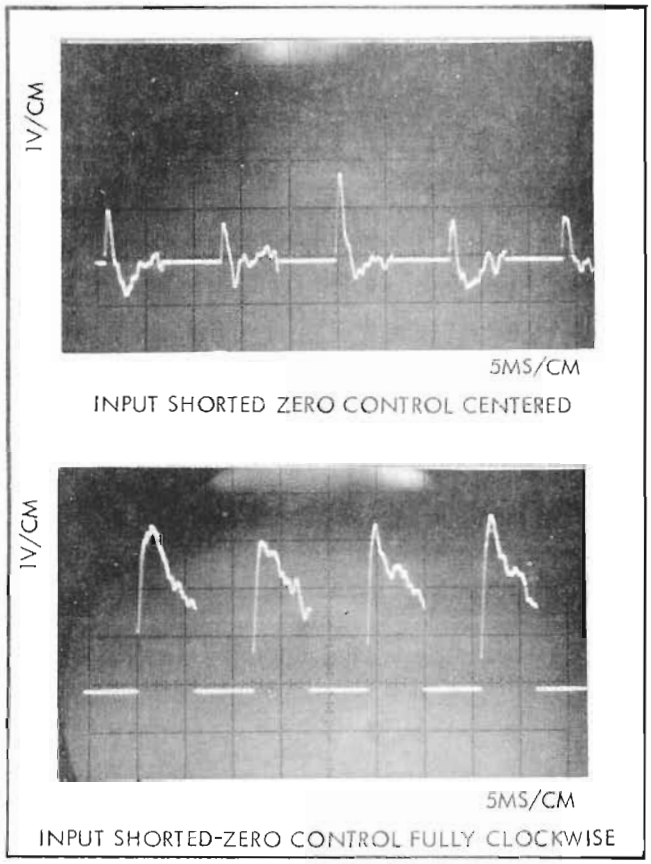


Figure 4-6. WAVEFORMS AT TP6

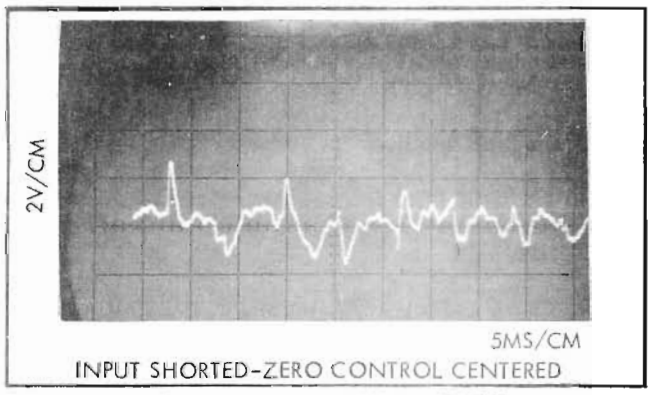


Figure 4-7. WAVEFORM AT TP7

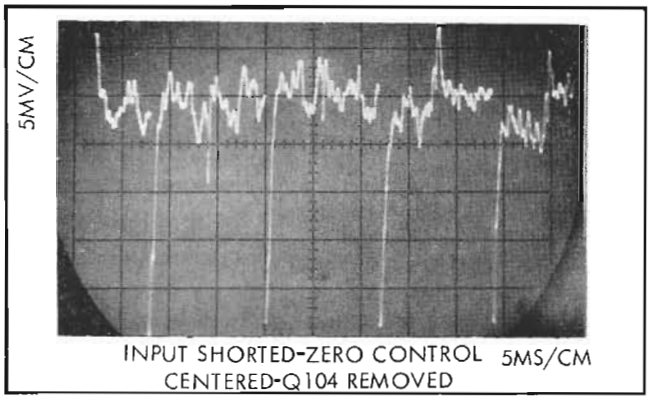


Figure 4-8. WAVEFORM AT TP2-Q104 REMOVED

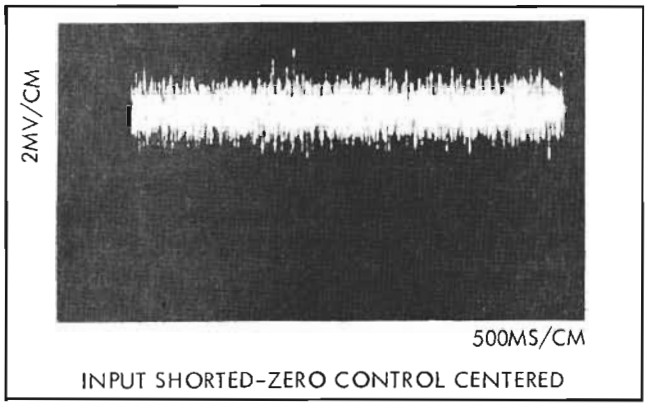


Figure 4-9. WAVEFORM AT TP2

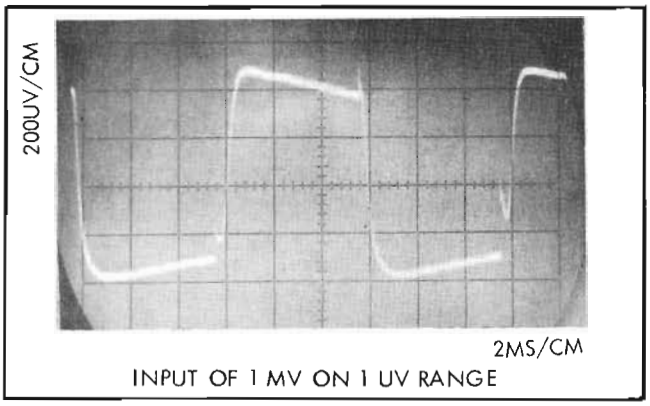


Figure 4-10. WAVEFORM AT TP1

c. Cracks, cuts, and other damage to the polyethelene grommets or to the circuit boards.

CAUTION!

Do not touch the polyethelene grommets. Contamination will cause excessive electrical leakage.

4-18. PERIODIC MAINTENANCE

4-19. Periodic maintenance consists of occasional cleaning to remove dust, grease, and other contaminations.

4-20. To clean the instrument proceed as follows:

a. Remove accumulations of dust and other foreign matter with low-pressure, clean dry air.

b. Clean binding posts and front panel with denatured alcohol, using a clean cloth or cotton swab. Do not attempt to clean switches.

4-21. LEAKAGE RESISTANCE TEST

4-22. The following leakage test is to be used to check the leakage resistance of the Model 845. Failure of the instrument to meet the test indicates the need of cleaning or troubleshooting.

a. Connect the equipment as illustrated in Figure 4-11.

b. Place the Model 845 controls as follows:

POWER	ON/LINE OPR or BAT OPR
OPR	OPR
RANGE	300 MICROVOLTS

c. For a leakage resistance of 10^{12} ohms, the panel meter must not indicate more than 100 microvolts. Allow sufficient time for the meter deflection to stabilize.

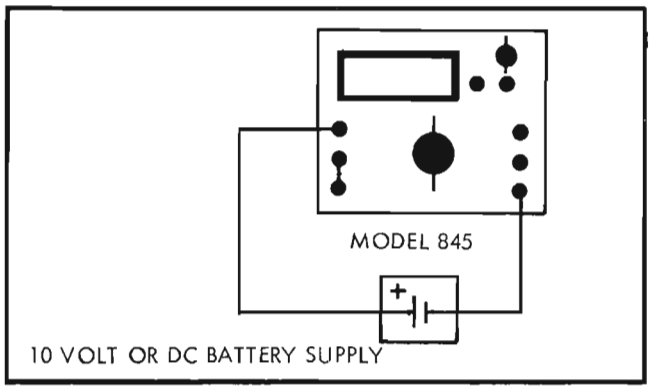


Figure 4-11. LEAKAGE RESISTANCE TEST EQUIPMENT CONNECTIONS

4-23. CALIBRATION PROCEDURES

4-24. The Model 845 should be calibrated once every year. It is recommended that if component replacement is performed, the Model 845 should be re-calibrated. Test and alignment points are illustrated by Figure 4-12.

4-25. METER CALIBRATION

4-26. Connect the equipment as illustrated in Figure 4-13 and proceed as follows:

Note!

Allow equipment to warm up for at least 5 minutes.

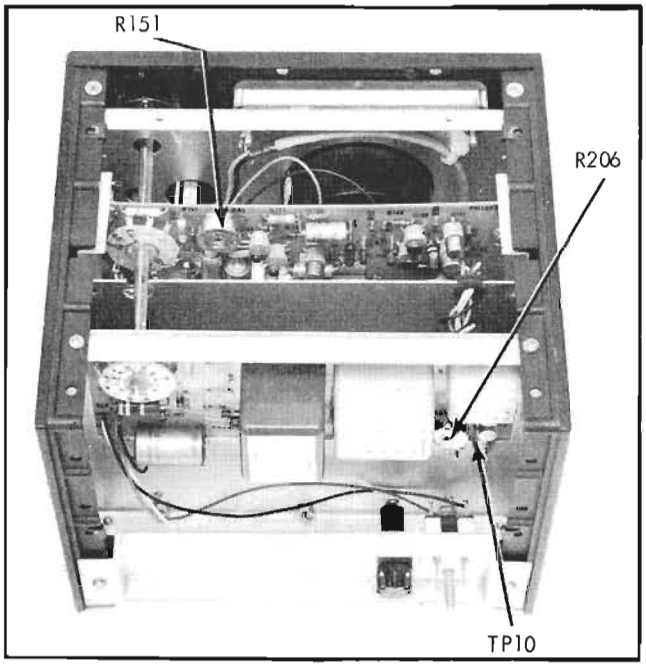


Figure 4-12. TEST AND ALIGNMENT POINTS

a. Place the Model 845 controls as follows:

POWER	ON/LINE OPR or BAT OPR
OPR	OPR
RANGE	10 VOLTS

b. Adjust the Model 332A output for 10 volts dc.

c. Adjust R151 for a full-scale deflection (+10) on the Model 845 meter.

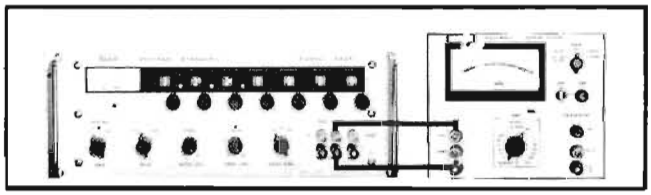


Figure 4-13. CALIBRATION EQUIPMENT CONNECTIONS

4-27. CHOPPER FREQUENCY

4-28. To adjust the 84 Hz multivibrator frequency, proceed as follows:

a. Place the Model 845 POWER switch to ON/LINE OPR or BAT OPR.

b. Connect an oscilloscope between TP10 and ground.

c. Adjust R206 until the oscilloscope waveform has a time period of 12 milliseconds, as illustrated in Figure 4-5.

Note!

A frequency counter may be used in lieu of the oscilloscope for adjustment of the 84 Hz multivibrator frequency.

SECTION V

LIST OF REPLACEABLE PARTS

5-1. INTRODUCTION

5-2. This section contains complete descriptions of those parts one might normally expect to replace during the life of the instrument. The first listing is a breakdown of all of the major assemblies in the instrument. Subsequent listings itemize the components in each assembly. Every listing where possible, is accompanied by an illustration identifying each component in the listing. Assemblies and subassemblies are identified by a reference designation beginning with the letter A, (e.g., A1, A2, A3, etc.). Components are identified by the schematic diagram reference designation (e.g. R1, C107, DS1). Parts not appearing on the schematic diagram are identified by only a location index number. Flagnotes are used throughout the parts list and refer to ordering explanations. The flagnote explanations appear at the end of the parts list.

5-3. COLUMNAR INFORMATION

a. The REF DESIG column indexes the item description to the associated illustration. In general the reference designations are listed in alpha-numeric order. Subassemblies of minor proportions are sometimes listed with the assembly of which they are a part. In this case, the reference designations for the components of the subassembly may appear out of order.

b. The INDEX NO. column lists coordinates which locate the designated part on the associated illustration.

c. The DESCRIPTION column describes the salient characteristics of the component. Indention of the item description indicates the relationship to other assemblies, components, etc. In many cases it is necessary to abbreviate in this column. For abbreviations and symbols used, see paragraph 5-7.

d. The ten-digit part number by which the item is identified at the John Fluke Mfg. Co. is listed in the STOCK NO column. Use this number when ordering parts from the factory or authorized representatives.

e. The Federal Supply Code for the item manufacturer is listed in the MFR column. An abbreviated list of Federal Supply Codes is included in the Appendix.

f. The part number which uniquely identifies the item to the original manufacturer is listed in the MFR PART NO column. If a component must be ordered by description, the type number is listed.

g. The TOT QTY column lists the total quantity of the item used in the instrument. Second and subsequent listing of the same item are referenced to the first listing with the abbreviation REF. In the case of optional subassemblies, plug ins, etc. that are not always part of the instrument, the TOT QTY column lists the total quantity of the item in that particular assembly.

h. Entries in the REC QTY column indicate the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of every part in the instrument be stocked.

i. The USE CODE column identifies certain parts which have been added, deleted or modified throughout the life of the instrument. Each part for which a Use Code has been assigned may be identified with a particular instrument serial number by consulting the Serial Number Effectivity List at the end of the parts list. As Use Codes are added to the list, the TOT QTY column listings are changed to reflect the most current information. Sometimes when a part is changed, the new part can and should be used as a replacement for the original part. In this event a parenthetical note is added in the DESCRIPTION column.

5-4. HOW TO OBTAIN PARTS

5-5. Standard components have been used wherever possible. Standard components may be ordered directly from the manufacturer by using the manufacturer's part number, or parts may be ordered from the John Fluke Mfg. Co. factory or authorized representative by using the Fluke part number. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. You can insure prompt and efficient handling of your order to the John Fluke Mfg. Co. if you include the following information:

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation.

e. Instrument model and serial number.

Example: 2 each, 4805-177105, Transistors, 2N3565, Q107-108 for 845AR, s/n 168.

If you must order structural parts not listed in the parts list, describe the part as completely as possible. A sketch of the part showing its location to other parts of the instrument is usually most helpful.

5-7. LIST OF ABBREVIATIONS

ac	alternating current
Al	Aluminum
amp	ampere
assy	assembly
cap	capacitor
car flm	carbon film
C	centigrade
cer	ceramic
comp	composition
conn	connector
db	decibel
dc	direct current
dpdt	double-pole, double-throw
dpst	double-pole, single-throw
elect	electrolytic
F	fahrenheit
Ge	germanium
gmv	guaranteed minimum value
h	henry
Hz	hertz
hf	high frequency
IC	integrated circuit
if	intermediate frequency
k	kilohm
kHz	kilohertz
kv	kilovolt
lf	low frequency
MHz	megahertz
M	megohm
met flm	metal film
ua	microampere
uf	microfarad
uh	microhenry
usec	microsecond
uv	microvolt
ma	milliampere
mh	millihenry
m	millohms
msec	millisecond
mv	millivolt
mw	milliwatt
na	nanoampere
nsec	nanosecond
nv	nanovolt
Ω	ohm
ppm	parts per million
piv	peak inverse voltage
p-p	peak to peak
pf	picofarad
plstc	plastic
p	pole
pos	position
P/C	printed circuit
rf	radio frequency
rfi	radio frequency interference
res	resistor
rms	root mean square
rtry	rotary
sec	second
sect	section
S/N	serial number
Si	silicon
scr	silcon controlled rectifier
spdt	single-pole, double-throw
spst	single-pole, single-throw
sw	switch
Ta	tantalum
tstr	transistor
tvm	transistor voltmeter
uhf	ultr high frequency
vtvm	vacuum tube voltmeter
var	variable
vhf	very high frequency
vlf	very low frequency
v	volt
va	voltampere
vac	volts, alternating current
vdc	volts, direct current
w	watt
ww	wire wound

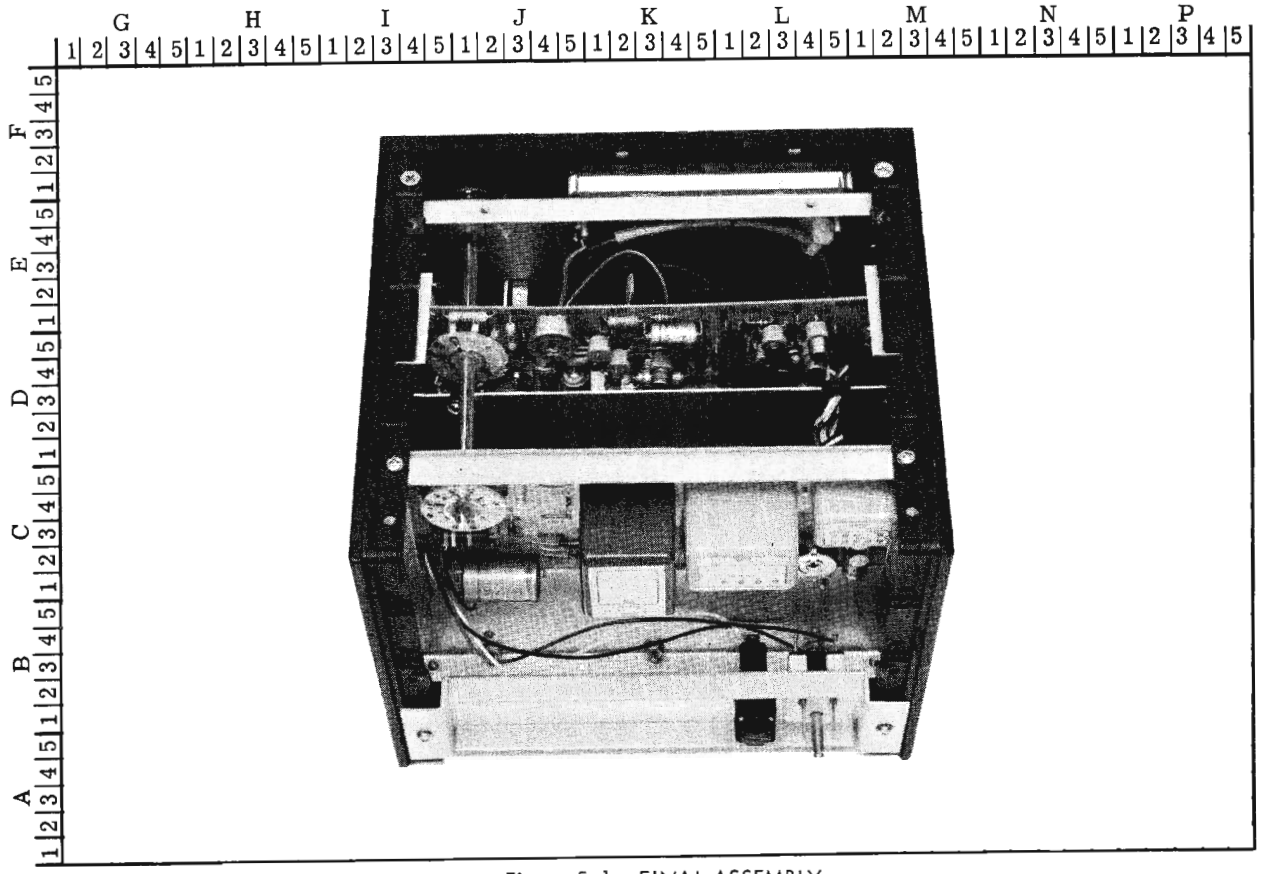


Figure 5-1. FINAL ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
		FINAL ASSEMBLY - Figure 5 - 1						
		Line-powered model	845A					
		Battery/line-powered model	845AB					
A1	D3-M3	Chassis Assembly (See Figure 5-2)						
A2	F1-J4	Front Panel Assembly (See Figure 5-3)						
A3	D5-L1	Amplifier P/C Assembly (See Figure 5-4)	1702-194399 (845A-401)	89536	1702-194399	1		
A4	C4-J4	Power Supply P/C Assembly (See Figure 5-5)						
		Model 845A	1702-194407 (845A-402)	89536	1702-194407	1		
		Model 845AB	1702-194555 (845AB-402)	89536	1702-194555	1		

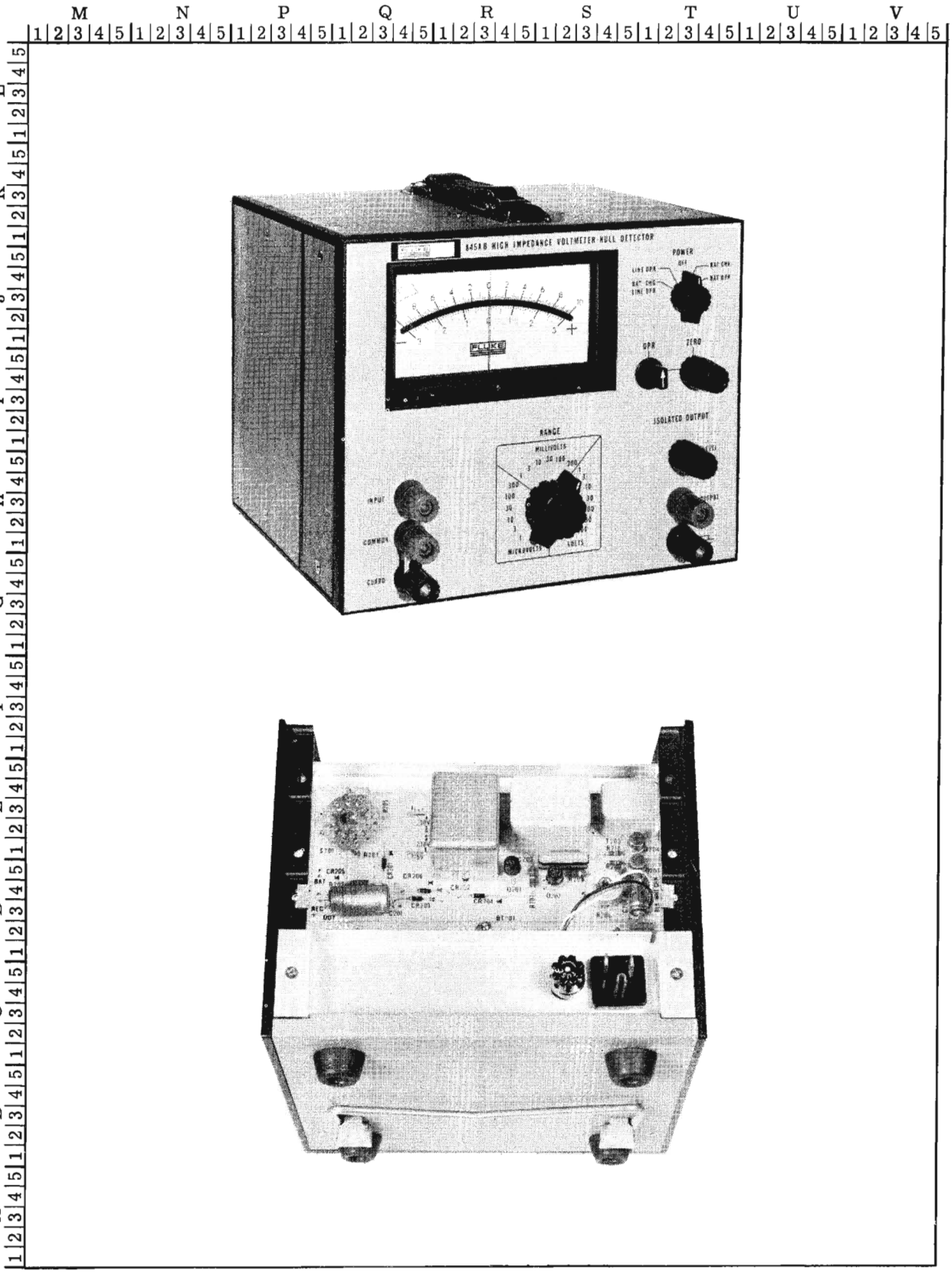


Figure 5-2. CHASSIS ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A1		CHASSIS ASSEMBLY - Figure 5-2						
BT201		Battery, 1.2v, Ni-Cad, (not illustrated)	4002-160390	05397	C1.2J	8		
C4, C5		Cap, mica, 0.001 uf ±5%, 500v (not illustrated)	1504-148387	88419	CD19F102J	2		B
F1		Fuse, Type MDL, slow blow, 1/16 amp, 250v (for 115v operation) (not illustrated)	5101-163030	71400	Type MDL	1	5	
F1		Fuse, Type MDL, slow blow, 1/32 amp, 250v (for 230v operation) (not illustrated)	5101-163022	71400	Type MDL	1	5	
P1	C5-S5	Connector, male, 3 prong chassis mount	2109-160275	73586	M-1548-GS	1		
XBT201		Holder, battery (not illustrated)	3155-194530	89536	3155-194530	1		
XF1	C5-S2	Holder, fuse	2102-160846	75915	342004	1		
		Coupler, 1/4 to 1/4 (not illustrated)	2402-104505	89536	2402-104505	1		
		Coupler, 1/8 to 1/4 (not illustrated)	2402-193557	89536	2402-193557	1		
	C1-R3	Cover, bottom	3156-194233	89536	3156-194233	1		
	I2-P2	Cover, side	3156-194290	89536	3156-194290	2		
		Cover, side (not illustrated)	3156-194290	89536	3156-194290	REF		
	I2-P5	Cover, side front	3156-162164	89536	3156-162164	2		
		Cover, side front (not illustrated)	3156-162164	89536	3156-162164	REF		
	K2-Q2	Cover, top	3156-194225	89536	3156-194225	1		
	B5-Q1	Foot, rubber	2819-103309	77969	9102-W	4		
	B1-Q2	Foot, rubber	2819-103309	77969	9102-W	REF		
	B5-S5	Foot, rubber	2819-103309	77969	9102-W	REF		
	B1-S4	Foot, rubber	2819-103309	77969	9102-W	REF		
	K3-R2	Handle, black vinyl	2404-166280	12136	919-415-173	1		
		Line cord (not illustrated)	6005-161638	91934	107-1, SVT	1		
		Shaft, zero (not illustrated)	3156-194365	89536	3156-194365	1		
		Shaft, range switch (not illustrated)	2814-203299	89536	2814-203299	1		
	B3-R3	Tilt stand	3156-194282	89536	3156-194282	1		

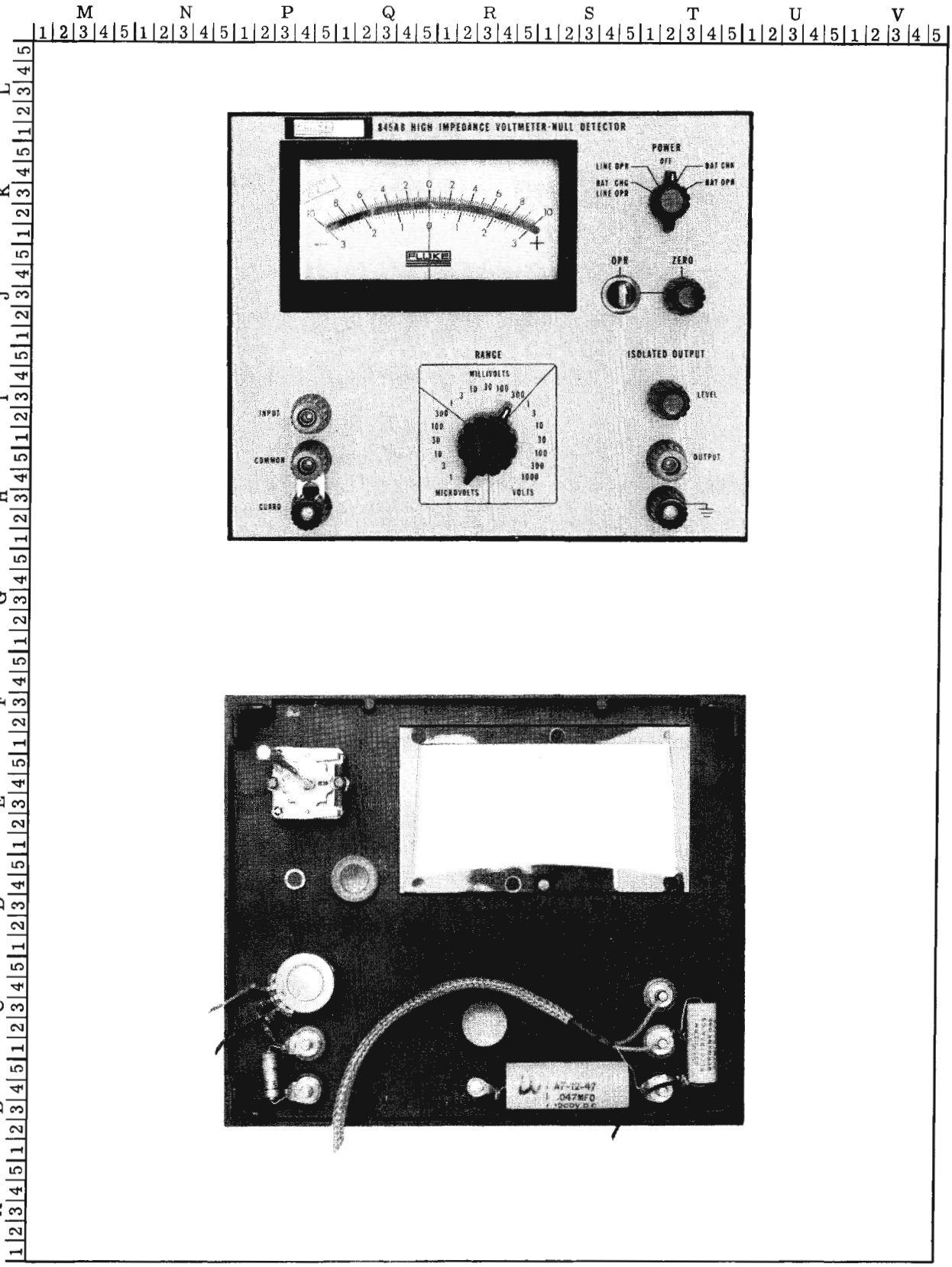


Figure 5-3. FRONT PANEL ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A2		**FRONT PANEL ASSEMBLY** **Figure 5-3**						
C1	C1-T4	Cap, mylar, 0.047 uf ±20%, 1200v	1507-182683	72928	343-087M	1		
C2	B4-S3	Cap, poly, 0.047 uf ±20%, 1200v	1507-190561	84411	JF-7	1		
C3	B5-P3	Cap, elect, 10 uf +50/-10%, 25v	1502-170266	73445	C426ARF10	1	1	A
J1	I2-P4	Binding post, red	2811-149856	58474	BHB-10208-G22	2		
J2	H5-P4	Binding post, red	2811-149856	58474	BHB-10208-G22	REF		
J3	H2-P4	Binding post, black	2811-142984	58474	DF31BC	2		
J4	H5-T2	Binding post, red	2811-142976	58474	DF31RC	1		
J5	H3-T2	Binding post, black	2811-142984	58474	DF31BC	REF		
M1	K2-Q2	Meter, 100-0-100 ua, 650Ω (845A only)	2901-192310	89536	2901-192310	1		
	K2-Q2	Meter, 100-0-100 ua, 650Ω (845AB only)	2901-192294	89536	2901-192294	1		
R1	C4-P4	Res, var, comp, 10k ±30%, 1/3w	4701-192344	71450	WF-45	1		
R2	C2-P2	Res, comp, 4.7k ±10%, 1/2w	4704-108381	01121	EB4721	1		
S201	E3-P3	Switch, detent, dual index ball (845A only)	5108-193573	76854	Type F	1		
S201	E3-P3	Switch, detent, dual index ball (845AB only)	5108-193565	76854	Tyep F	1		
	I3-T2	Knob, LEVEL	2405-158949	89536	2405-158949	2		
	K3-T2	Knob, POWER	2405-158956	89536	2405-158956	1		
	I1-R3	Knob, RANGE	2405-170035	89536	2405-170035	1		
	J3-T3	Knob, ZERO	2405-158949	89536	2405-158949	REF		
	I5-P4	Panel, front (845A only)	1406-194209	89536	1406-194209	1		
	I5-P4	Panel, front (845AB only)	1406-194522	89536	1406-194522	1		
	H4-P5	Shorting link	2811-190728	24655	938LG	1		

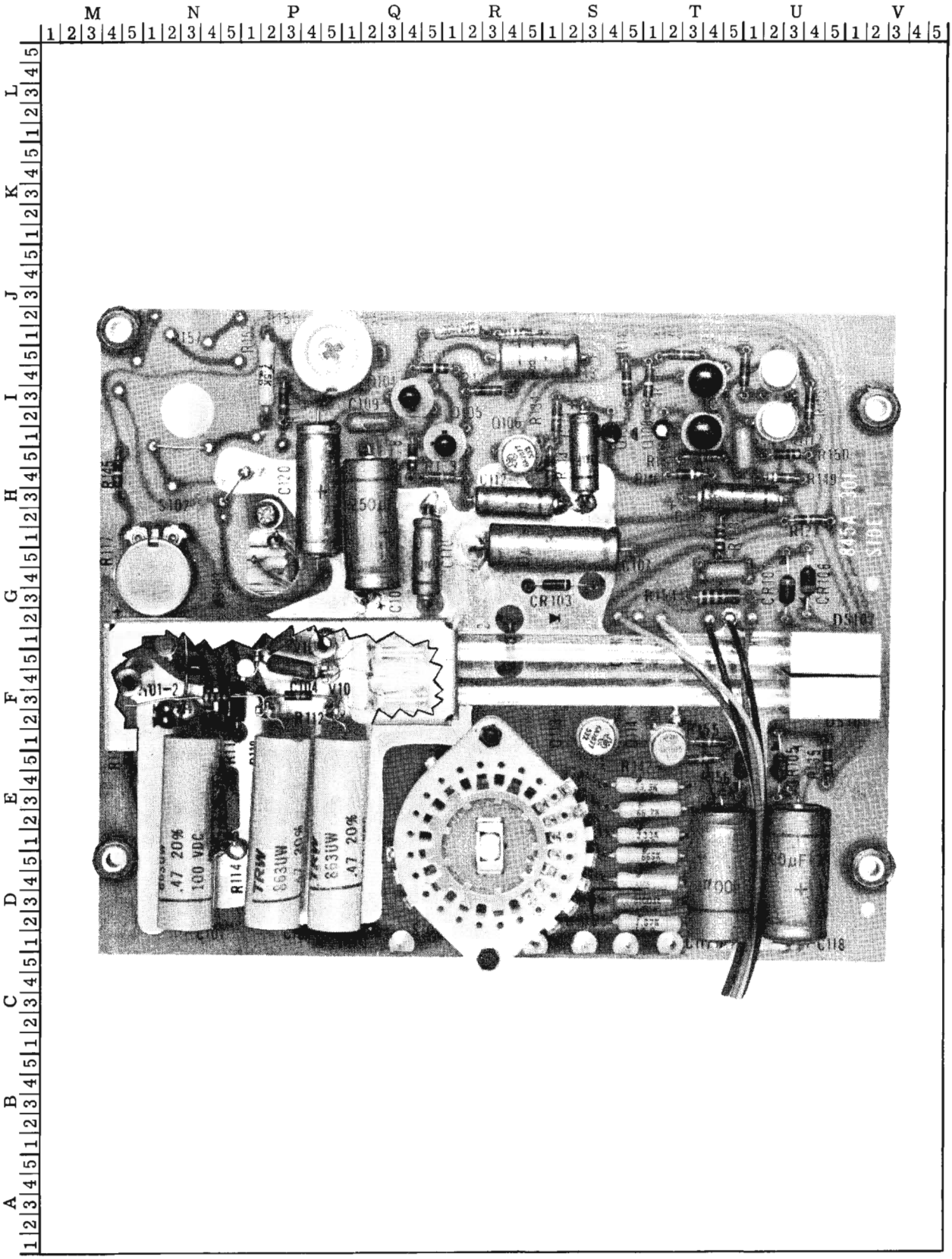


Figure 5-4. AMPLIFIER P/C ASSEMBLY (SHEET 1 OF 2)

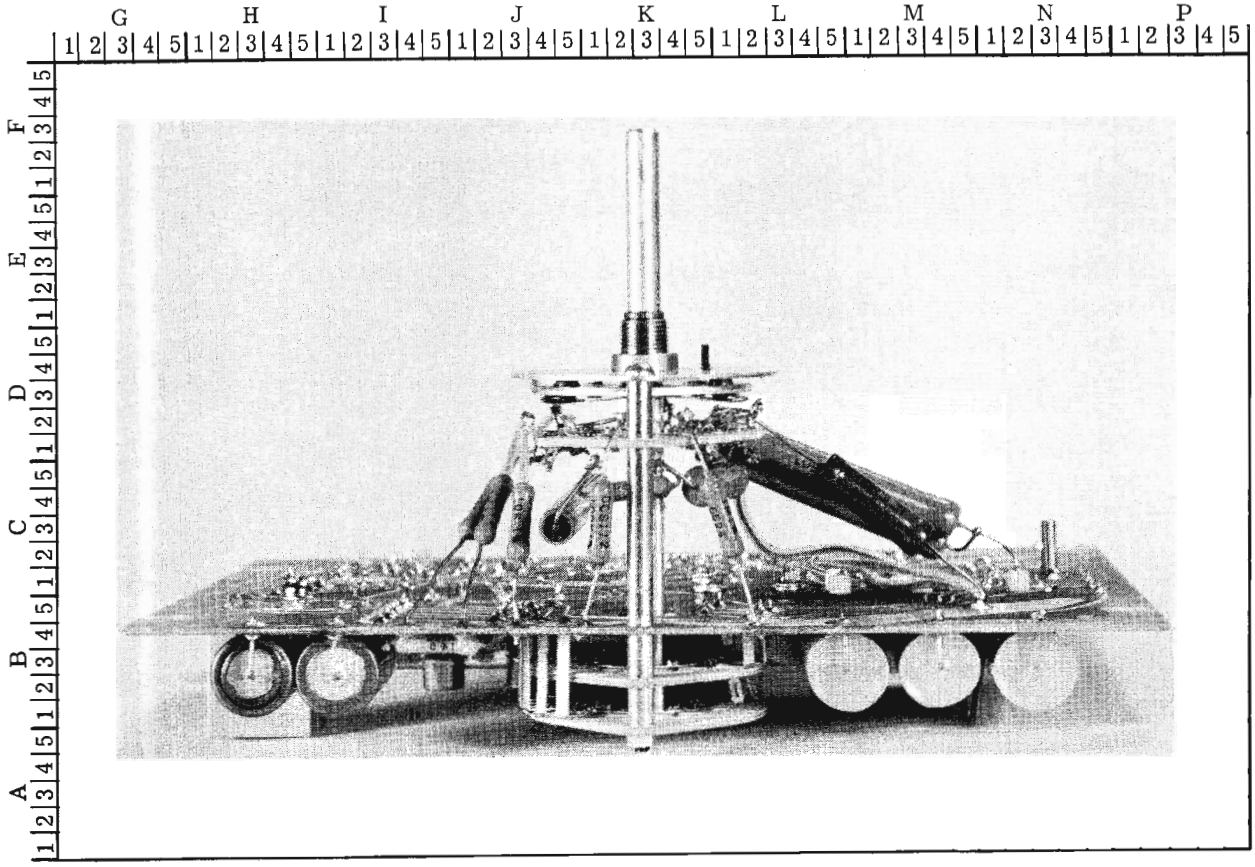


Figure 5-4. AMPLIFIER P/C ASSEMBLY (Sheet 2 of 2)

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A3		**AMPLIFIER P/C ASSEMBLY** **Figure 5-4**	1702-194399 (845A-401)	89536	1702-194399	REF		
C101	E1-N3	Cap, plstc, 0.47 uf ±20%, 100v	1507-190553	84411	JF-36	3		
C102	E1-P2	Cap, plstc, 0.47 uf ±20%, 100v	1507-190553	84411	JF-36	REF		
C103	E1-P5	Cap, plstc, 0.47 uf ±20%, 100v	1507-190553	84411	JF-36	REF		
C104	F5-P3	Cap, plstc, 0.1 uf ±20%, 250v	1507-161992	73445	C280AE/P100K	3		
C105	G1-P3	Cap, cer, 300 pf ±10%, 500v	1501-105734	71590	BB60301KW7W	2		
C106	H1-Q2	Cap, elect, 1250 uf +50/-10%, 4v	1502-166330	73445	C437ARB1250	1	1	
C107	G5-S1	Cap, elect, 250 uf +50/-10%, 16	1502-187765	73445	C437ARE250	2	1	A
C108	G1-N4	Cap, cer, 300 pf ±10%, 500v (underneath cover)	1501-105734	71590	BB60301KW7W	REF		
C109	I2-Q2	Cap, plstc 0.1 uf ±20%, 250v	1507-161992	73445	C280AE/P100K	REF		
C110	G5-Q5	Cap, elect, 10 uf +50/-10%, 25v	1502-170266	73445	C426ARF10	2	1	
C111	J1-R1	Cap, mylar, 0.0047 uf ±20%, 200v	1507-106054	72928	C472M	1		
C112	H3-R4	Cap, elect, 10 uf +50/-10%, 25v	1502-170266	73445	C426ARF10	REF		
C113	I5-S1	Cap, elect, 400 uf +50/-10%, 4v	1502-187773	73445	C426ARE400	2	1	
C114	H5-S3	Cap, Ta, 10 uf ±10%, 20v	1508-160259	05397	K10C20K	1		A
C114	H5-S3	Cap, Ta, 6.8 uf ±10%, 35v	1508-182782	88411	Type 901	1		B
C115	H5-U1	Cap, plstc, 0.1 uf ±20%, 250v	1507-161992	73445	C280AE/P100K	REF		
C116	H3-T5	Cap, Ta, 22 uf ±10%, 15v	1508-182816	05397	K22C15K	1		A
C116	H3-T5	Cap, Ta, 15 uf ±10%, 20v	1508-153056	05397	K15C20K	1		B
C117	D5-T5	Cap, elect, 400 uf +50/-10%, 25v	1502-168153	73445	C437ARF400	3	1	
C118	D5-U3	Cap, elect, 400 uf +50/-10%, 25v	1502-168153	73445	C437ARF400	REF		
C119	G4-T5	Cap, plstc, 0.22 uf ±20%, 230v	1507-194803	73445	C280AE/P220K	1		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
C120	H4-P4	Cap, elect, 250 uf +50/-10%, 16v	1502-187765	73445	C437ARE250	REF		A
C120	H4-P4	Cap, elect, 150 uf +75/-10%, 15v	1502-150292	80183	TE 1163	1	1	B
CR101		Diode, C.D. Type CD12599 treated (not illustrated)	4802-180885	89536	4802-180885	2	1	
CR102		Diode, C.D. Type CD12599 treated (not illustrated)	4802-180885	89536	4802-180885	REF		
CR103	G4-S1	Diode, zener, 10v Type 1N961A	4803-113324	07910	1N961A	1	1	
CR104	E5-T5	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	8	2	
CR105	E5-U3	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	REF		
CR106	G4-U4	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	REF		
CR107	G3-U3	Diode, IRC,Type 4D4	4802-180240	81483	Type 4D4	REF		
DS101		Lamp, neon, NE-2U (not illustrated)	3902-162602	89730	NE-2U	2	5	
DS102		Lamp, neon, NE-2U (not illustrated)	3902-162602	89730	NE-2U	REF		
FL1	F5-P3	Bead, Ferrite choke	2503-219535	02214	56-060-85-3B	1		B
Q101	F5-P1	Tstr, selected Transitron Type ST-1750T	4805-194456	89536	4805-194456	1	1	
Q102	G1-N2	Tstr, selected Transitron Type ST-1750T	4805-198812	89536	4805-198812	1	1	
Q103	F5-N3	Tstr, Type 2N3391	4805-168708	89730	2N3391	3	1	
Q104	I3-Q4	Tstr, Type 2N3565	4805-177105	07263	2N3565	2	1	
Q105	I1-R1	Tstr, Type 2N3565	4805-177105	07263	2N3565	REF		
Q106	H5-R4	Tstr, T.I. Type GA2877	4805-182709	01295	GA2877	2	1	
Q107	I1-S4	Tstr, Type 2N3391	4805-168708	89730	2N3391	REF		
Q108	I1-T2	Tstr, Type 2N3391	4805-168708	89730	2N3391	REF		
Q109	I4-T4	Tstr, Motorola Type MPS3638	4805-169375	04713	MPS3638	2	1	
Q110	I1-T4	Tstr, Motorola Type MPS3638	4805-169375	04713	MPS3638	REF		
Q111	I4-U2	Tstr, Type 2N1304	4805-117127	01295	2N1304	1	1	
Q112	I2-U2	Tstr, Type 2N1305	4805-190298	95303	2N1305	1	1	
Q113	F1-S3	Tstr, T.I. Type GA2875	4805-182691	01295	GA2875	3	1	
Q114	F1-T2	Tstr, T.I. Type GA2877	4805-182709	01295	GA2877	REF		
R101	C5-L1	Res, car flm, matched set (sheet 2 of 2)	1					
R102	C4-K2	Res, car flm, 900k ±1/2%, 1/2w (sheet 2 of 2)	4703-107391	19701	DC1/2A	1		
R103	C3-J5	Res, car flm, matched set (sheet 2 of 2)	1					
R104	C3-M2	Res, car flm, 10M ±1/2%, 1w (sheet 2 of 2)	4703-107748	19701	DC1	1		
R105	C3-L1	Res, car flm, matched set (sheet 2 of 2)	1					
R106	C2-K1	Res, car flm, matched set (sheet 2 of 2)	1					
R107	C3-J3	Res, car flm, matched set (sheet 2 of 2)	1					
R108	C3-J2	Res, car flm, matched set (sheet 2 of 2)	1					
R109	C3-J1	Res, car flm, matched set (sheet 2 of 2)	1					
R110	C5-L3	Res, car flm, 300k ±1%, 2w (sheet 2 of 2)	4703-107425	12400	Type C30	2		
R111	F3-N4	Res, comp, 47k ±5%, 1/4w	4704-148163	01121	CB4735	2		
R112	F3-P3	Res, comp, 100k ±5%, 1/4w	4704-148189	01121	CB1045	4		
R113	E5-M5	Res, comp, 470Ω ±5%, 1/4w	4704-147983	01121	CB4715	1		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R114	E1-N5	Res, ww, 10Ω ±1%, 1/2w	4707-193946	19429	4707-193946	1	1	
R115	G1-P1	Res, comp, 1.2M ±10%, 1/2w (underneath cover)	4704-108407	01121	EB1251	1		
R116	F3-M4	Res, comp, 680k ±5%, 1/4w (underneath cover)	4704-188433	01121	CB6845	1		
R117	G4-N1	Res, var, comp, 5M ±30%, 0.2w	4701-193086	71450	U-70	1		
R118	F3-P1	Res, comp, 10M ±10%, 1/2w	4704-108142	01121	EB1061	1		
R119	F3-N5	Res, comp, 2.2M ±10%, 1/4w	4704-198390	01121	CB2255	1		
R120	F2-N4	Res, comp 47k ±5%, 1/4w	4704-148163	01121	CB4735	REF		
R121	E4-R1	Res, comp, 10Ω ±5%, 1/4w (underneath switch wafers)	4704-147868	01121	CB1005	1		
R122	G1-R4	Res, comp, 68k ±5%, 1/4w	4704-148171	01121	CB6835	2		
R123	H1-T4	Res, comp, 82k ±5%, 1/4w	4704-188458	01121	CB8235	1		
R124	E2-Q5	Res, comp, 22Ω ±5%, 1/4w (underneath switch wafers)	4704-147884	01121	CB2205	1		
R125	E1-Q4	Res, comp, 68Ω ±5%, 1/4w (underneath switch wafers)	4704-147918	01121	CB6805	1		
R126	D5-Q4	Res, comp, 220Ω ±5%, 1/4w (underneath switch wafers)	4704-147959	01121	CB2215	1		
R127	H2-U4	Res, comp, 10k ±5%, 1/4w	4704-148106	01121	CB1035	2		
R128	H5-Q4	Res, comp, 100k ±5%, 1/4w	4704-148189	01121	CB1045	REF		
R129	H4-R1	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	7		
R130	I4-Q5	Res, comp, 100k ±5%, 1/4w	4704-148189	01121	CB1045	REF		
R131	I3-R3	Res, comp, 100Ω ±5%, 1/4w	4704-147926	01121	CB1015	1		
R132	J1-R4	Res, comp, 39k ±5%, 1/4w	4704-188466	01121	CB3935	1		
R133	H5-S1	Res, comp, 10k ±5%, 1/4w	4704-148106	01121	CB1035	REF		
R134	I2-S1	Res, comp, 15k ±5%, 1/4w	4704-148114	01121	CB1535	2		
R135	E5-U5	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R136	D2-T1	Res, met flm, 1.07k ±1%, 1/2w	4705-187930	12400	Type CEC-TO	1		
R137	D3-T1	Res, met flm, 3.16k ±1%, 1/2w	4705-187781	12400	Type CEC-TO	1		
R138	D4-T1	Res, met flm, matched set	2					
R139	D5-T1	Res, met flm, matched set	2					
R140	E1-T1	Res, met flm, matched set	2					
R141	E2-T1	Res, met flm, matched set	2					
R142	E4-T1	Res, met flm, matched set	2					
R143	I4-S5	Res, comp, 150k ±5%, 1/4w	4704-182212	01121	CB1545	3		
R144	I4-T1	Res, comp, 150k ±5%, 1/4w	4704-182212	01121	CB1545	REF		
R145	H4-M4	Res, comp, 150k ±5%, 1/4w	4704-182212	01121	CB1545	REF		
R146	H4-T3	Res, comp, 100k ±5%, 1/4w	4704-148189	01121	CB1045	REF		
R147	H5-T4	Res, comp, 15k ±5%, 1/4w	4704-148114	01121	CB1535	REF		
R148	I5-T3	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R149	H4-U3	Res, comp, 3.9M ±5%, 1/4w	4704-188417	01121	CB3955	1		
R150	H5-U3	Res, comp, 68k ±5%, 1/4w	4704-148171	01121	CB6835	REF		
R151	J1-P5	Res, var, ww, 2k ±5%, 1-1/4w	4702-160705	11237	Type 110	2		
R152	I4-P2	Res, met flm, 7.5k ±1%, 1/2w	4705-192161	12400	Type CEC-TO	1		
R153	I3-P3	Res, comp, 1k ±5%, 1/4w	4704-148073	01121	CB1025	3		
R154	G3-T4	Res, comp, 33k ±5%, 1/2w	4704-108761	01121	EB3335	1		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R155	F1-T4	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R156	E5-T4	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R157		Res, met flm, 825Ω ±1%, 1/2w (not illustrated)	4705-155119	19701	MF7C-TO	1		
R158	I4-U1	Res, comp, 1k ±5%, 1/4w	4704-148023	01121	CB1025	REF		
R159	I3-U4	Res, comp, 1k ±5%, 1/4w	4704-148023	01121	CB1025	REF		
S101	D4-K3	Switch, rotary, 4p, 19 pos, 3 sect (sheet 2 of 2)	5105-194589	89536	5105-194589	1		
S102		Switch, section (not illustrated)	5107-194027	76854	Type FV	1		
S103	G5-P2	Switch, twist, spdt	5105-194936	89536	5105-194936	1		
V101, V102	F4-Q3	Photocell assembly	3700-194449	89536	3700-194449	1		
	J2-M4	Grommet, 3/8"	2807-171876	89536	2807-171876	4	1	
	E1-M4	Grommet, 3/8"	2807-171876	89536	2807-171876	REF		
	I3-V3	Grommet, 3/8"	2807-171876	89536	2807-171876	REF		
	D5-V3	Grommet, 3/8"	2807-171876	89536	2807-171876	REF		
	F3-S1	Rod, optical	3800-168047	89536	3800-168047	2		
	F5-S1	Rod, optical	3800-168047	89536	3800-168047	REF		

These resistors are factory matched. If any replacement is required, an entire set, part number 4710-194415, must be ordered.

These resistors are factory matched. If any replacement is required, an entire set, part number 4710-194423, must be ordered.

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A4		**POWER SUPPLY P/C ASSEMBLY**						
		Figure 5-5						
		Model 845A	1702-194407 (845A-402)	89536	1702-194407	REF		
		Model 845AB	1702-194555 (845AB-402)	89536	1702-194555	REF		
C201	G2-N5	Cap, elect, 400 uf +50/-10%, 25v	1502-168153	73445	C437ARF400	REF		
C203	H2-T1	Cap, plstc, 1 uf ±20%, 250v	1507-190330	73445	C280AE/P1M	1		
C204	G4-U3	Cap, elect, 400 uf +50/-10%, 4v	1502-187773	73445	C426ARE400	REF		
CR201	H2-P3	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	REF		
CR202	G3-Q1	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	REF		
CR203	G4-Q2	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	REF		
CR204	G4-R3	Diode, IRC Type 4D4	4802-180240	81483	Type 4D4	REF		
CR205	H1-N4	Diode, IRC Type 4D4 (845AB only)	4802-180240	81483	Type 4D4	2		
CR206	G5-Q1	Diode, IRC Type 4D4 (845AB only)	4802-180240	81483	Type 4D4	REF		
CR207		Diode, Type 1N961A (845A only) (not illustrated)	4803-113324	07910	1N961A	1	1	
Q201	H1-S1	Tstr, T.I. Type GA2817	4805-182600	01295	GA2817	2	1	
Q202	G5-S5	Tstr, T.I. Type GA2817	4805-182600	01295	GA2817	REF		
Q203	H2-U4	Tstr, T.I. Type GA2875	4805-182691	01295	GA2875	REF		
Q204	H4-U3	Tstr, T.I. Type GA2875	4805-182691	01295	GA2875	REF		
R201	H2-N4	Res, comp, 39Ω ±10%, 2w (845AB only)	4704-144378	01121	HB3901	1		
R202	G5-N5	Res, comp, 150Ω ±5%, 1w	4704-178566	01121	GB1515	1		
R205	I3-P4	Res, met flm, 9.53k ±1%, 1/2w (845AB only)	4705-159442	12400	Type CEC-TO	1		
R206	G4-T5	Res, var, ww, 2k ±5%, 1-1/4w	4702-160705	11237	Type 110	REF		
R207	H1-S3	Res, comp, 5.1k ±5%, 1/2w	4704-109108	01121	EB5125	2		
R208	H1-T2	Res, comp, 5.1k ±5%, 1/2w	4704-109108	01121	EB5125	REF		
R209	H3-U1	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R210	H4-U1	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
S201	H5-N3	Switch section (845A only)	5107-194035	76854	Type F	1		
S201	H5-N3	Switch section (845AB only)	5107-194019	76854	Type FE	1		
T201	H5-R1	Transformer, power	5600-192724	89536	5600-192724	1		
T202	I2-S4	Transformer, drive	5600-192708	89536	5600-192708	1		
T203	I3-U3	Transformer, isolation	5600-192716	89536	5600-192716	1		

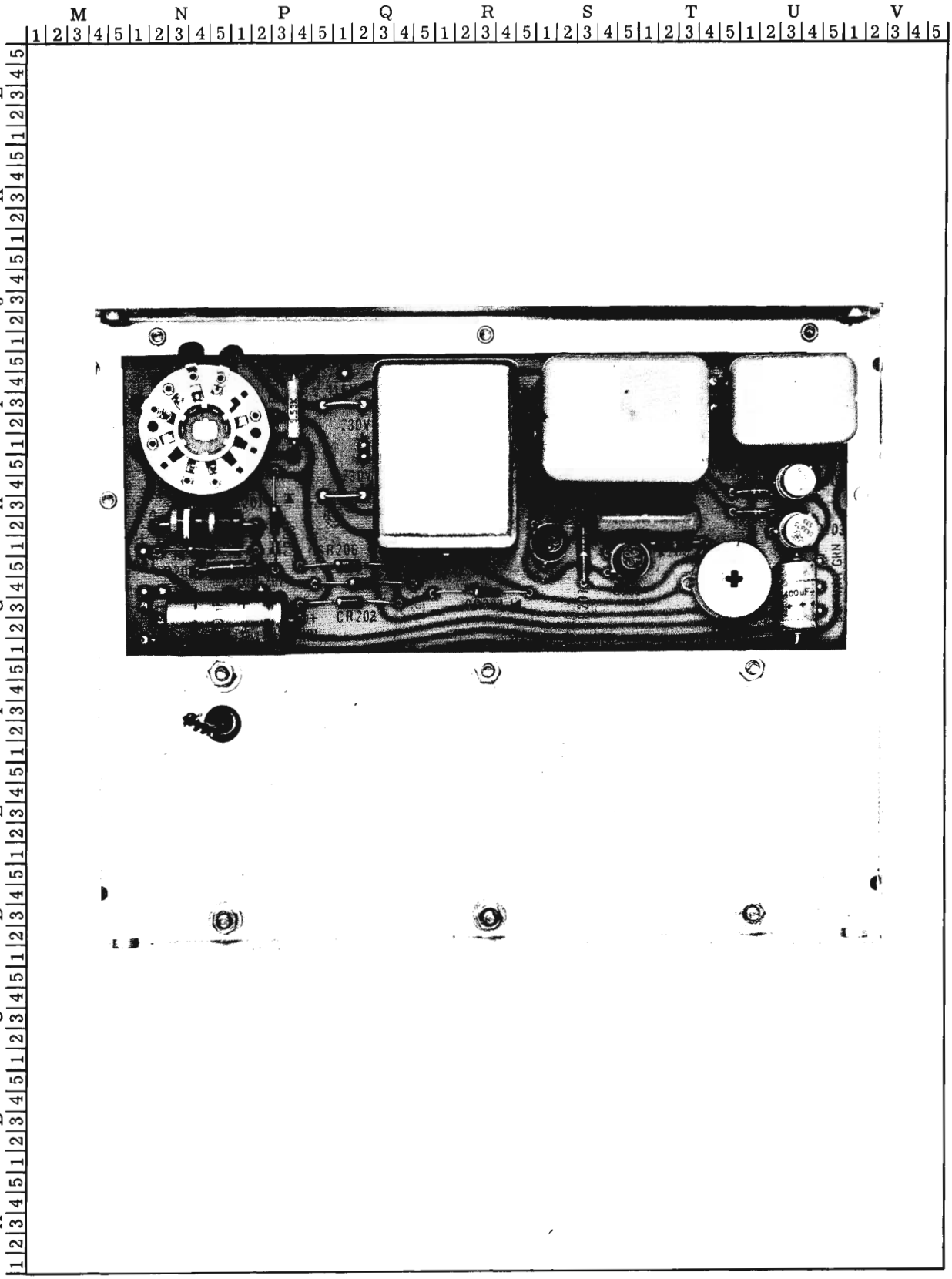


Figure 5-5. POWER SUPPLY P/C ASSEMBLY

5-8. SERIAL NUMBER EFFECTIVITY

5-9. A Use Code column is provided to identify certain parts that have been added, deleted, or modified during production of the Model 845. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity List below. All parts with no code are used on all instruments with serial numbers above 123. New codes will be added as required by instrument changes.

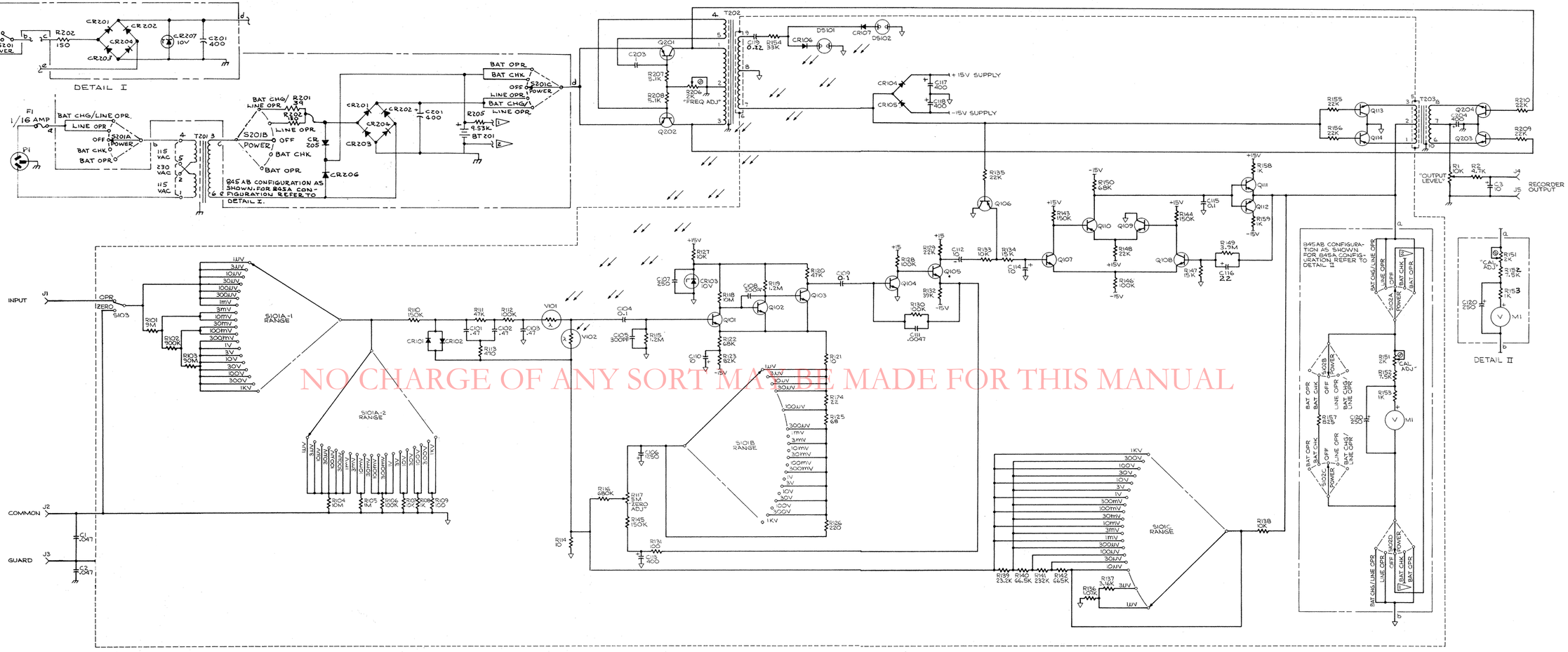
USE CODE	EFFECTIVITY
A	Model 845A and 845AB, serial number 123 to 1011.
B	Model 845A and 845AB, serial number 1012 and on.

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5.

List of Abbreviations and Symbols

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
°C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
°F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^9)
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^3)
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^6)
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(-) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmablle read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})



REFERENCE DESIGNATIONS:
BT 201
C-3, -101-120, 201, 203, 204
CR101-107, 201, 207
DS101-102
J-5
P-1
Q101-114, 201-204
R-2, -101-159, 201, 202, 205-210
S101-103, 201
T201-203
V101-102

NOTES:

- ALL FLAGNOTES WITH THE SAME NUMBER ARE CONNECTED.
- INDICATES NULL DETECTOR COMMON.
- INDICATES CHASSIS GROUND.
- INDICATES INTERNAL ADJUSTMENT.

UNLESS OTHERWISE INDICATED RESISTANCE IS IN OHMS AND CAPACITANCE IS IN MICROFARADS.

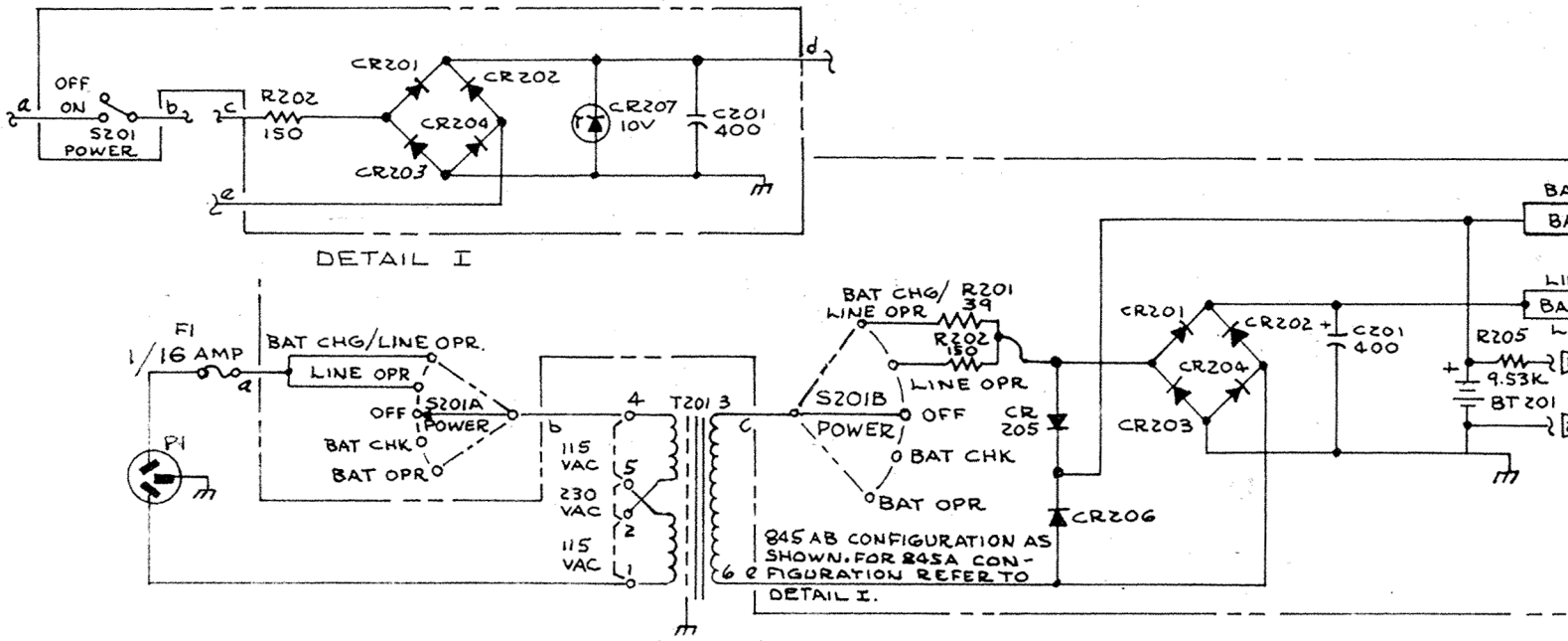
FUNCTIONAL SCHEMATIC a

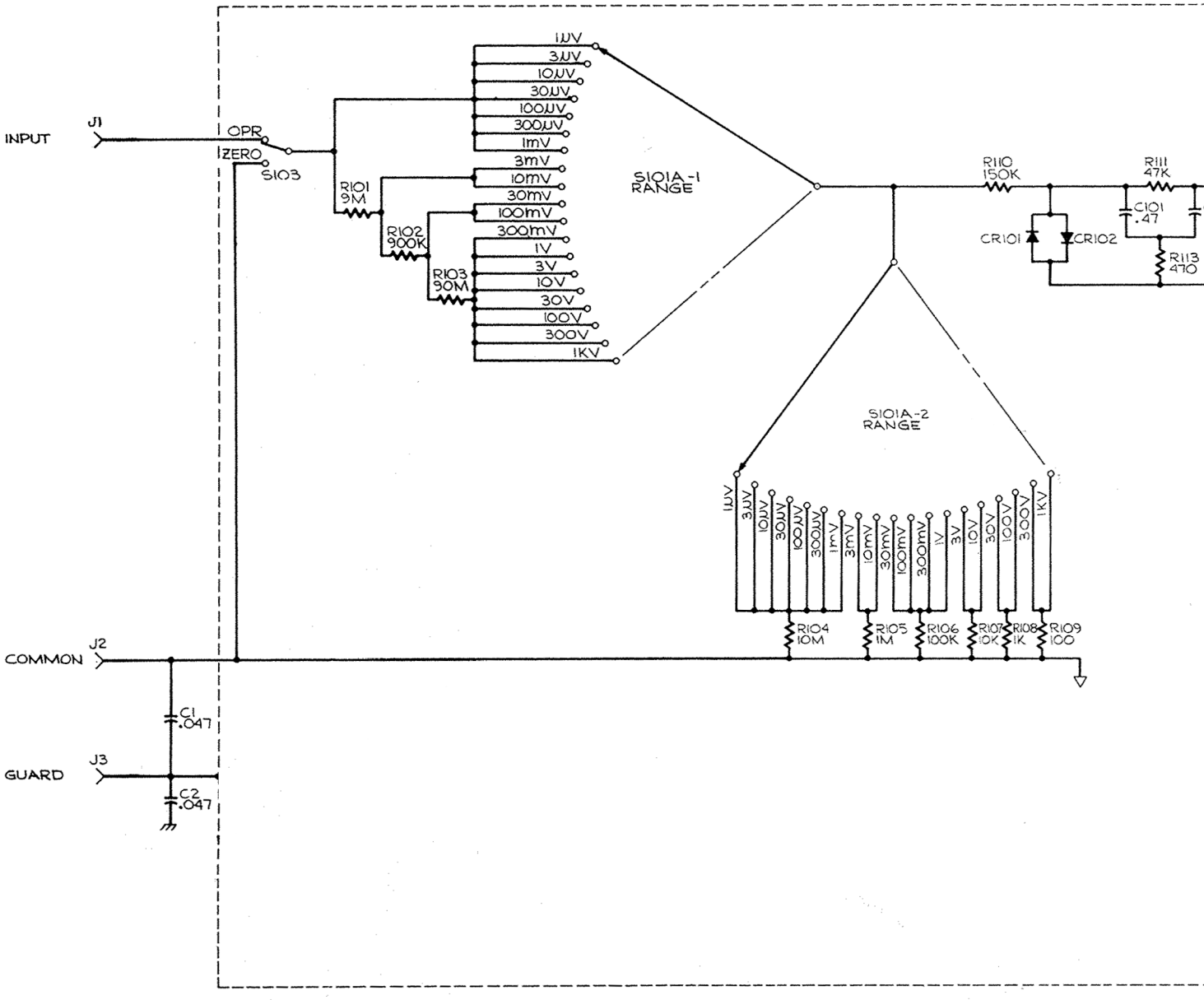
NULL DETECTOR / MICROVOLTMETER

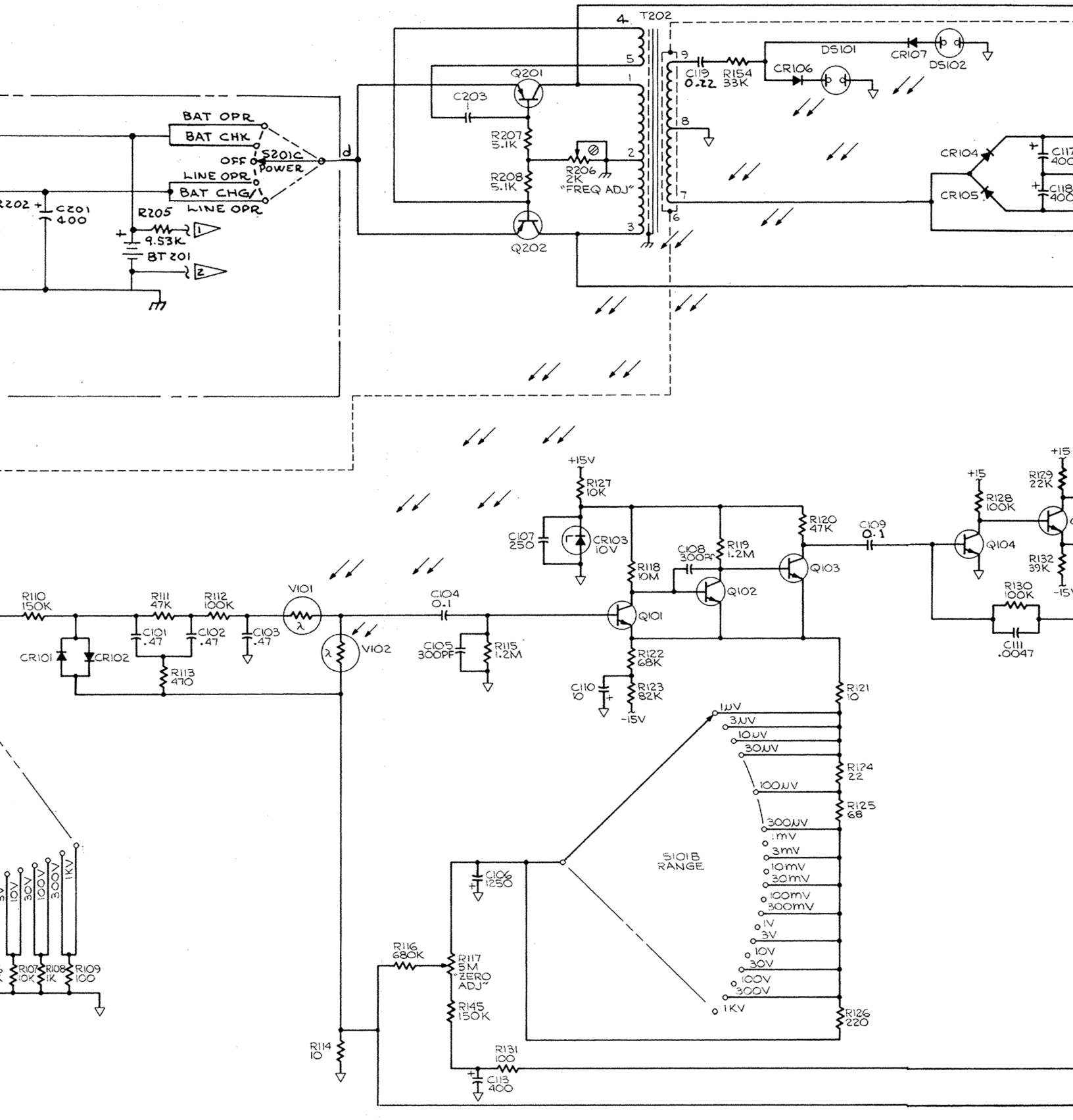
MODEL 845A & 845AB

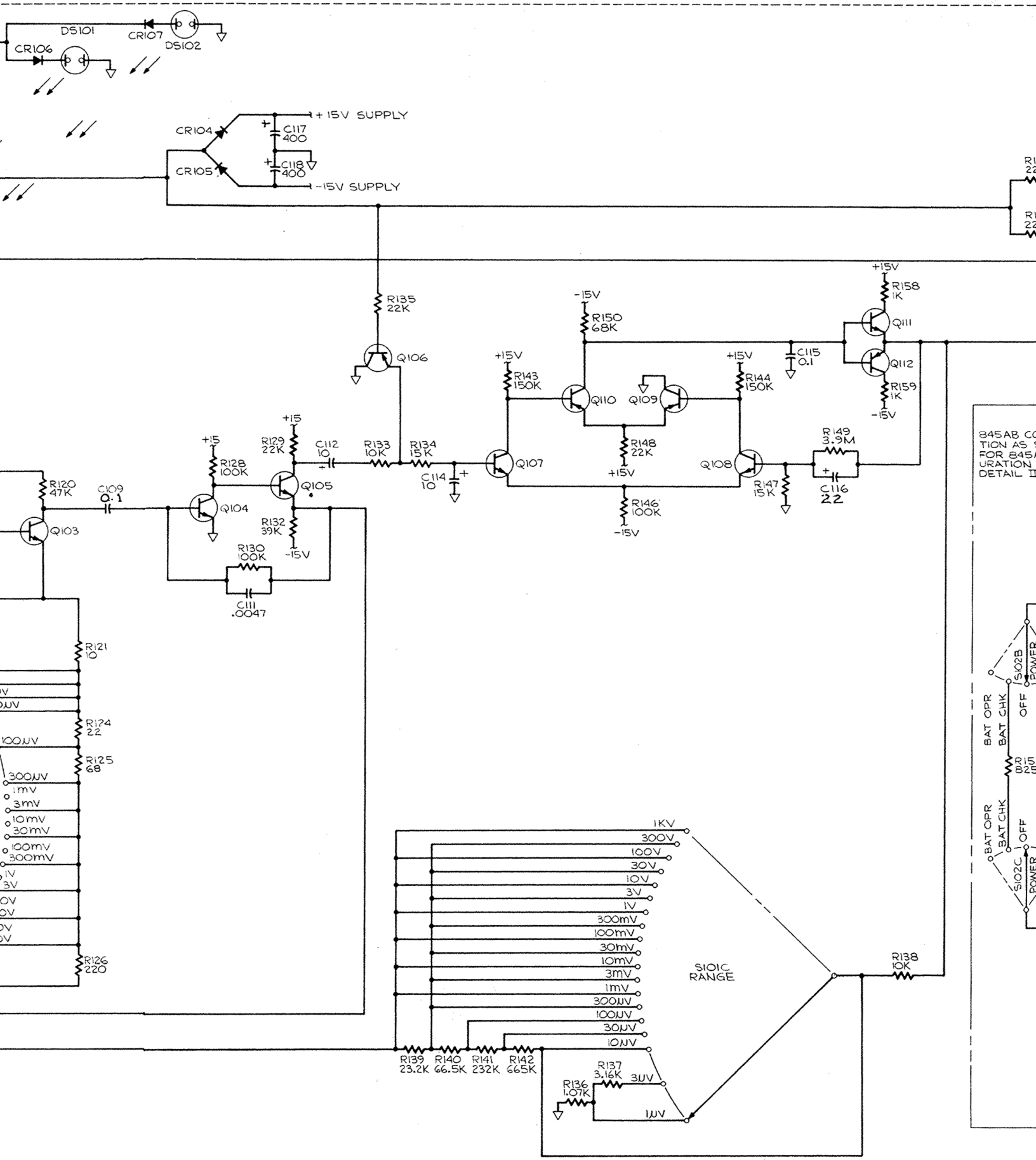
MODEL 845A & 845AB SER. NO. 123 & ON

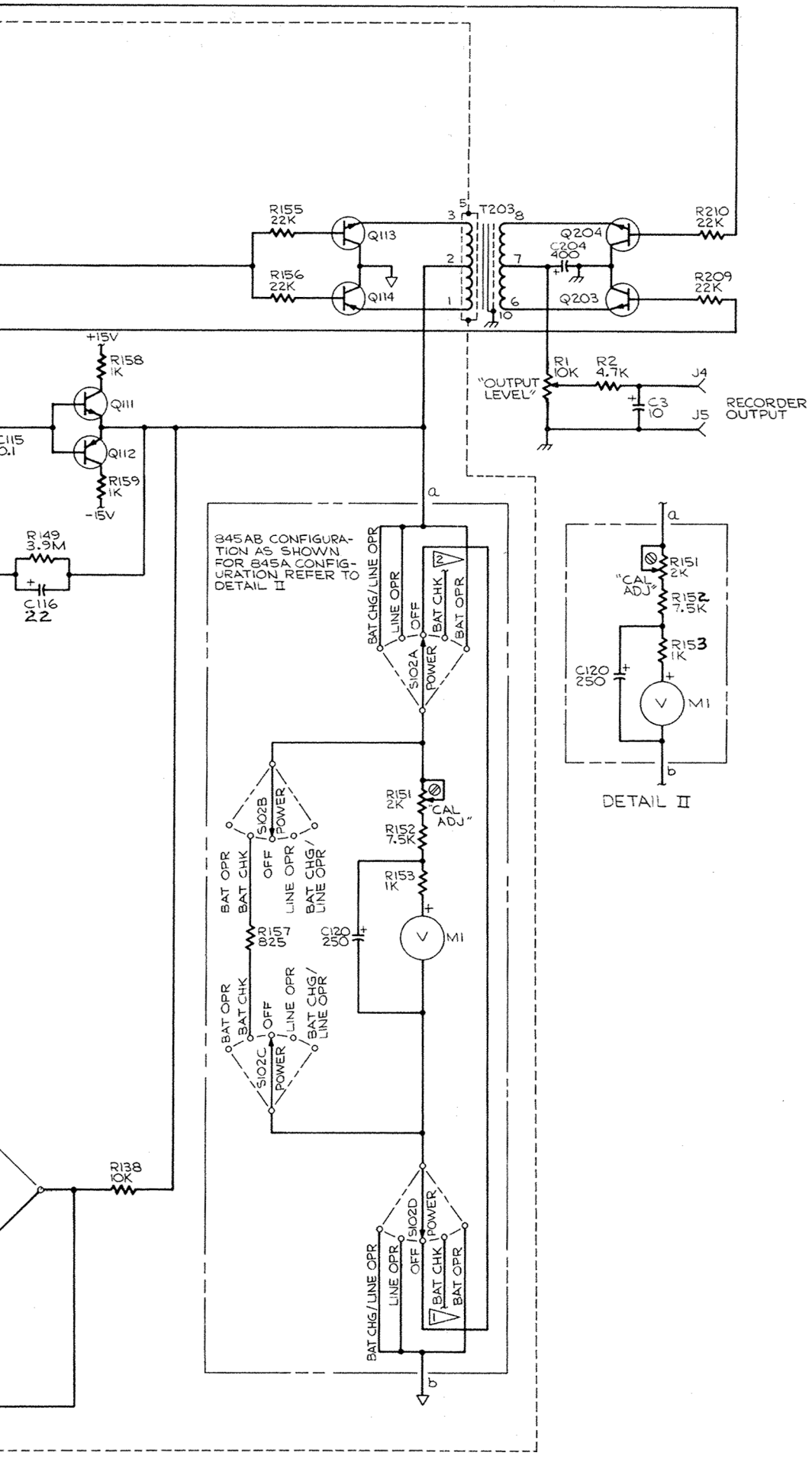
FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133


OFF
ON
S201
POWER
R202
150
CR201
CR202
CR203
CR204
CR207
10V
C201
400
DETAIL I
F1
1/16 AMP
BAT CHG/LINE OPR.
LINE OPR
OFF
POWER
BAT CHK
BAT OPR
S201A
P1
T201
115 VAC
230 VAC
115 VAC
BAT CHG/ LINE OPR
R201
39
R202
150
S201B
CR 205
CR206
845 AB CONFIGURATION AS SHOWN. FOR 845A CONFIGURATION REFER TO DETAIL I.
R205
9.53K
BT 201


INPUT
J1
OPR
ZERO
S103
R101
9M
R102
900K
R103
90M
1μV
3μV
10μV
30μV
100μV
300μV
1mV
3mV
10mV
30mV
100mV
300mV
1V
3V
10V
30V
100V
300V
1KV
S101A-1
RANGE
S101A-2
RANGE
R104
10M
R105
1M
R106
100K
R107
10K
R108
1K
R109
100
R110
150K
R111
47K
C101
.47
CR101
CR102
R113
470
COMMON
J2
C1
.047
GUARD
J3
C2
.047


T202
Q201
Q202
C203
R207 5.1K
R208 5.1K
R206 2K "FREQ ADJ"
C119 0.22
R154 33K
CR106
DS101
CR107
DS102
CR104
CR105
C117 400
C118 400
BAT OPR
BAT CHK
OFF
LINE OPR
BAT CHG
LINE OPR
S201C POWER
C201 400
R205 9.53K
BT 201
+15V
R127 10K
C107 250
CR103 10V
R118 10M
C108 300PF
R119 1.2M
R120 47K
C109 0.1
Q103
Q102
Q101
Q104
R128 100K
R129 22K
R132 39K
R130 100K
C111 .0047
-15V
R110 150K
R111 47K
R112 100K
C101 .47
C102 .47
C103 .47
R113 470
CR101
CR102
V101
V102
C104 0.1
C105 300PF
R115 1.2M
R122 68K
C110 10
R123 82K
R121 10
S101B RANGE
1UV
3UV
10UV
30UV
100UV
300UV
1MV
3MV
10MV
30MV
100MV
300MV
1V
3V
10V
30V
100V
300V
1KV
R124 22
R125 68
R126 220
C106 1250
R116 680K
R117 5M "ZERO ADJ"
R145 150K
R114 10
R131 100
C113 400
R107 10K
R108 1K
R109 100


DS101
CR107
DS102
CR106
+15V SUPPLY
CR104
C117 400
CR105
C118 400
-15V SUPPLY
R135 22K
Q106
-15V
R150 68K
+15V
R158 1K
Q111
C115 0.1
Q112
R159 1K
-15V
+15V
R143 150K
Q110
Q109
+15V
R144 150K
R148 22K
+15V
R149 3.9M
C116 22
Q108
R147 15K
R146 100K
-15V
+15
R129 22K
C112 10
R133 10K
R134 15K
Q107
C114 10
+15
R128 100K
Q105
R132 39K
-15V
R130 100K
C111 .0047
R120 47K
C109 0.1
Q104
Q103
R121 10
R124 22
R125 68
300μV
1mV
3mV
10mV
30mV
100mV
300mV
1V
3V
10V
R126 220
1KV
300V
100V
30V
10V
3V
1V
300mV
100mV
30mV
10mV
3mV
1mV
300μV
100μV
30μV
10μV
S101C RANGE
R138 10K
R139 23.2K
R140 66.5K
R141 232K
R142 665K
R137 3.16K
3μV
R136 1.07K
1μV
BAT OPR
BAT CHK
OFF
S102B
POWER
BAT OPR
BAT CHK
OFF
S102C
POWER



REFERENCE DESIGNATIONS:

BT 201
C1-3, 101-120, 201, 203, 204
CR101-107, 201, 207
DS101-102
F1
J1-5
M1
P1
Q101-114, 201-204
R1-2, 101-159, 201, 202, 205-210
S101-103, 201
T201-203
V101-102

NOTES:

▷ ALL FLAGNOTES WITH THE SAME NUMBER ARE CONNECTED.

INDICATES NULL DETECTOR COMMON.

INDICATES CHASSIS GROUND.

⊘ INDICATES INTERNAL ADJUSTMENT.

UNLESS OTHERWISE INDICATED RESISTANCE IS IN OHMS AND CAPACITANCE IS IN MICROFARADS.

FUNCTIONAL SCHEMATIC a

NULL DETECTOR / MICROVOLTMETER

MODEL 845A & 845AB

MODEL 845A & 845AB SER. NO. 123 & ON

FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133