Service – Unterlagen

Röhrennetzteil

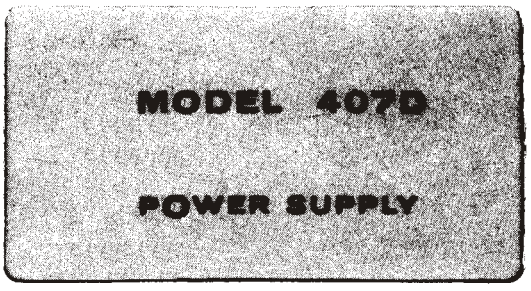
FLUKE 407 D

Diese Unterlagen wurden mir von Herrn Wolfgang Gis-despki und Herrn Ingo Schmitz zur Verfügung gestellt.

Vielen Dank!

Dipl. – Ing. H. R. Fredel

Instruction Manual



FLUKE

ELECTRONICS FOR INDUSTRY
INSTRUMENTS / COMPONENTS

JOHN FLUKE MFG. CO. INC.
P. O. Box 7428 Seattle 33, Washington

February 1, 1964

MODEL 407D

WER SUPPLY

Serial no._____and above.

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MODEL 407D

MODEL 407DR

SECTION I

INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

The Model 407D is an extremely stable, highly regulated source of DC voltage in the 0 to 555 volt, 0 to 300 milliampere range. The power transformer is a specially designed, conservatively rated unit, provided with a dual primary for operation from either 115 or 230 volts. Precision wirewound resistors using Evanohm alloy are used in all voltage sampling resistors and at other critical points in the circuit. This permits the use of calibrated output voltage controls and insures excellent long term stability. This stability plus the high degree of isolation of the output from variations of either line voltage or load current enhance the use of the power supply. Two auxiliary outputs are also provided: a dual-range, negative-bias output with excellent resolution, and dual 6.3 VAC, 5 ampere output which can be operated in series or parallel. These features make the Model 407D an ideal laboratory or general purpose power supply.

1-2. RECEIVING INSPECTION

This instrument has been thoroughly checked and tested before being shipped from the factory. Immediately after receiving the instrument, carefully inspect for damage which may have occurred in transit. If any damage is noted, follow the instructions outlined on the warranty page in the back of this manual.

1-3. SPECIFICATIONS

a. ELECTRICAL

AUXILIARY OUTPUTS:
(DC) 0 to minus 250 VDC. Maximum auxiliary output is 5 milliamperes at -250 volts. Line regulation of 0.005% at maximum output. Maximum ripple is 500 microvolts. Output impedance 0 to 50,000 ohms, depending on setting of BIAS control. At 250 volts, load regulation is 0.01% for 5 ma load change.

(AC) Two independent 6.3 VAC, 5 ampere outputs. May be series or parallel connected. Each insulated for 1500 volts RMS.

CALIBRATION ACCURACY: ±0.5% from 50 to 500 volts when selected by the 0-500 volt control.

INPUT POWER: Approximately 425 watts at full load, 100 watts standby.

INPUT VOLTAGE: 115 or 230 VAC ±10%, 50/60 cycles, single phase.

LINE REGULATION: 0.005% or 10mv, whichever is greater, for ±10% change in line voltage.

LOAD REGULATION: 0.01% or 20mv, whichever is greater, for full load change.

METER: 4-1/2 inch, 0-600 volts, 0-300 milliamperes.

MAIN OUTPUT CURRENT: 0 to 300 milliamperes.

MAIN OUTPUT VOLTAGE: 0 to 555 volts.

OUTPUT IMPEDANCE: Less than 0.5 ohm at 300 milliamperes load. (DC to 100KC).

OUTPUT POLARITY: Plus or minus relative to ground, or floating.

OUTPUT CONNECTORS: Binding posts on 3/4 inch centers. Also terminal strip at rear on rack model.

RIPPLE: 500 microvolts RMS maximum.

STABILITY: 0.01% per hour and 0.05% per day.

VOLTAGE CONTROLS:
Ten 50 volt increments
0 to 55 volt vernier
0 to 0.55 volt vernier

VOLTAGE RESOLUTION: ±2.0 millivolts.

b. MECHANICAL

SIZE:
Cabinet model; 9-3/4" W x 13" H x 14" D
Rack model; 19" W x 8-3/4" H x 16" D

WEIGHT:
Cabinet model; 39 lbs.
Rack model; 48 lbs.

SECTION II

OPERATING INSTRUCTIONS

2-1. CONTROLS, TERMINALS, AND INDICATORS

The location, circuit symbol, and functional description of external controls, terminals, and indicators on the Model 407D are given in Figure 2-1.

CONTROLS TERMINALS AND INDICATORS	LOCATION	CIRCUIT SYMBOL	FUNCTIONAL DESCRIPTION
Meter	Front Panel	M1	Indicates magnitude of output current, and output voltages.
MTR CKT	Front Panel	S3	Used to select the circuit monitered by M1, also used to remove voltage from output connectors.
BIAS	Front Panel	R68	Used to vary the auxiliary output DC voltages.
500V switch	Front Panel	S2	Used to select magnitude of main output voltage.
0-55V vernier	Front Panel	R62	Used to select magnitude of main output voltage.
0-0.55V vernier	Front Panel	R63	Used to select magnitude of main output voltage.
Toggle switch	Front Panel	S1	Applies AC line power to the instrument.
Binding posts	Front Panel (Middle and right side)	J1 thru J6	Output connectors for main and auxiliary DC output voltages.
Binding posts	Front Panel (Left side)	J7 thru J10	Output connectors for two 6.3 VAC sources.

Figure 2-1. CONTROLS, TERMINALS, AND INDICATORS

2-2. OPERATION

a. Connect the instrument to a single phase 50 or 60 cycle source of proper line voltage. The power transformer T1 in the Model 407D has a dual primary. For operation from 115 volt power line, the two primaries are connected in parallel; for operation from 230 volt power line the two primaries are connected in series. A label is attached to the outside of the back panel which states the voltage for which the transformer has been connected. To change the connection of the primaries, remove the instrument from its case and refer to the schematic diagram in the back of this manual. When operating from 230 volts, change the 5 ampere slo-blo fuse to a 2 ampere slow blow fuse.

b. Select desired output voltage on the three calibrated voltage controls.

c. Set MTR CKT switch to HV OFF position and turn PWR switch ON. The pilot light should illuminate. After approximately 30 seconds, turn the MTR CKT switch to HV position and the desired voltage will appear at the 0 to 555 volt output posts. The 30 second delay before turning on the high voltage is highly desirable to permit the tubes to warm to operating temperature before applying high voltage to the tube plates. This permits better control of output voltage during turn-on, and prolongs the life of the tubes.

d. The first calibrated output voltage control on the front panel of the instrument is accurate to better than ±0.5% of its reading, whereas the panel meter is accurate to ±3% of full scale. Consequently, the voltage controls are approximately 6 times as accurate as the meter, and should be relied upon in preference to the meter to indicate the magnitude of the output voltage. Should a large discrepancy between meter reading and dial position appear, refer to Section IV, paragraph 4-2, Troubleshooting for correction procedure.

e. When turning the power supply on or off, always turn the MTR CKT switch to the HV OFF position before turning the PWR switch off. This is a precautionary measure to prevent the possibility of damage to a sensitive load from overshoot in the output voltage.

2-3. USE AS A GENERAL PURPOSE LABORATORY SUPPLY

Four different voltages are available at four sets of binding posts on the Model 407D. All four may be used simultaneously at maximum output current with no derating required under any conditions.

a. Main Output Voltage. This is 0 to 555 volts, 0 to 300 milliamperes, available at the right hand binding posts. This voltage is adjusted via the three calibrated controls. Regulation is 0.01% or 20 millivolts for full load change, or 0.005% or 10 mv for ±10% line voltage change. Output voltage may be monitored on the panel meter by setting the MTR CKT switch to the HV position. Output current may be monitored on the 300 ma meter scale by turning the MTR CKT switch to I_{HV}. Output voltage may be removed from the binding posts by turning the MTR CKT switch to HV OFF. This opens the circuit between the regulator and the positive binding post. An anti-arcing circuit biases the output tubes to cut-off before the output circuit is interrupted, thus preventing switch arcing.

b. Auxiliary Output. 0 to minus 250 volts at 5 ma maximum, available at center three binding posts. This control is not calibrated, since the output voltage is derived from a 50,000 ohm potentiometer and is therefore sensitive to load current. Line regulation is 0.005% or 10 millivolts for ±10% line change. With control turned to maximum (250 volts), the output is regulated to 0.01% for a load change of 5 ma. This bias voltage may be monitored on the panel meter by setting the MTR CKT switch to BIAS. There is a 10-to-1 voltage divider across this minus 250 volt output, which provides a 0-to-25 volt source. Since this is derived from a voltage divider, it is also sensitive to to load current. To determine the output voltage at this tap, divide meter reading by 10. The main output, when used with the 250 volt auxiliary output, provides a positive, negative, or floating output of 250 to 805 volts at 0 to 5 milliamperes, with no change in line, load, or ripple specifications. The plus side of the 250 VDC output is connected to the minus side of the main output.

c. Two 6.3 VAC sources at 5 amperes, unregulated, are available at the two pairs of binding posts on the left side of the panel. These windings are insulated for 1500 volts RMS between chassis and between each other. They are balanced and may be series or parallel connected to provide 12.6 volts at 5 amperes or 6.3 volts at 10 amperes.

2-4. CALIBRATION OF VOLTMETERS

a. The Model 407D may be used for the direct calibration of DC voltmeters to an accuracy of better than 0.5% at 10 cardinal points from 50 through 500 volts. An additional 55 volts is available from one of the verniers. The Model 407D may be used in combination with the John Fluke Model 801B Differential Voltmeter to calibrate DC instruments to an accuracy of 0.05% over the range of 0.1 volt to 500 volts.

b. Select the desired voltage on the calibrated voltage controls and connect the instrument to be calibrated to the 555 volt binding posts. Of course, a Model 801B, or equivalent, must also be connected to monitor the voltage.

c. The accuracy of the Model 407D is dependent almost entirely upon the accuracy of the precision resistors used in the output voltage sampling network (assuming the proper sampling network current, proper reference voltage and adequate amplifier gain). Consequently, since 0.25% resistors are used in the sampling network, the calibration accuracy should be well within the specified 0.5%. Internal calibration controls are provided for occasional adjustment to compensate for the effects of aging. Refer to paragraph 4-3.

SECTION III

THEORY OF OPERATION

3-1. CIRCUIT DESCRIPTION

The Model 407D consists of the following nine main elements:

a. The high voltage transformer, rectifier, and filter consist of silicon rectifiers CR1 through CR8, capacitors C2 thru C11, and transformer T1. Taps of the high voltage transformer winding which furnish power to the full wave bridge rectifier are switched by a section of the 0-500 volt control. This requires less voltage drop and less power dissipation by the series regulating tubes at low output voltages.

b. The series regulating tubes are tetrodes V1, V2, and V3. The grids of these tubes are driven by the error signal amplifier, which causes the tubes to regulate output voltage to prevent fluctuations. The regulated output appears at the cathodes of the tubes.

c. The precision, wirewound, constant-current voltage sampling network is composed of S2B, R14 through R23, and R62 through R66. This network determines the magnitude of the output voltage, a sample of which is compared to the reference voltage.

d. The reference voltage sources are V12 and R52. V12 is operated at a constant current of 2.2 ma, and produces the reference voltage of 85.5 volts, which should drift less than 0.45 mv per hour after the first 300 hours of operation.

e. The error detector is composed of V13 and associated components. Any difference between the reference voltage and the output voltage is detected by this differential amplifier, and a signal is produced which tends to correct the difference.

f. The error signal amplifier is composed of V14 and associated components. This tube amplifies the error signal produced by "e."; the amplified signal is then applied to the grids of element "b.".

g. The AC feedback loop is composed of capacitors C13, C31 and resistor R72. This reduces ripple voltage and AC output impedance.

h. The 250 volt auxiliary supply consists of CR11, CR12, V8, V9, and associated components. V9 is the differential amplifier for the auxiliary supply. The heater current for V9 and V13 is obtained from a filtered, half-wave rectifier (CR13 and C36) which is regulated by a transistor network (Q1, Q2, CR14 and associated components). This improves the regulation of the supply against large fluctuations in line voltage, and stabilizes the operation of V9 and V13.

i. The screen grid supply includes CR9, CR10, R28, and C15. This supply provides 340 volts for bias of the screen grids of V1, V2, and V3.

SECTION IV

MAINTENANCE

4-1. INTRODUCTION

Very little maintenance, consisting primarily of occasional cleaning, tube replacement, and calibration, is necessary for this power supply. A discussion of troubleshooting and a tube voltage chart are presented in paragraph 4-2. Calibration procedure and the equipment necessary are presented in paragraph 4-3.

4-2. TROUBLESHOOTING

The chart on the following pages lists various failures and their possible causes and remedies. Tubes fail more often than any other component, and should be checked first. If tubes are known to be good, voltage and resistance measurements should be made.

SYMPTOM	POSSIBLE CAUSE	REMEDY
No output.	Open heater on tube or tubes.	Check all tubes to verify operation of heaters.
	No high-voltage from supply.	Measure high voltage using a well insulated probe.
	Open R11, R12, R13, R65 or R66.	Measure and replace if necessary.
	Shorted C31	Check and replace if necessary.
Incorrect output voltage over entire range.	250V auxiliary supply out-of-tolerance.	Turn BIAS control fully clockwise and measure 250V output. If not within ±1% replace R39 and/or R41. Also check C22, C31, R45, and R46.
	Out-of-calibration.	See paragraph 4-3.
Incorrect output over part of range.	Out-of-tolerance resistor in sampling network.	Turn output to 500 volts and decrease one position at a time. The defective resistor is in the last position in which the error was noted.
Small percentage error over entire range.	Reference voltage drift.	Recalibrate per paragraph 4-3.
Output rises and follows line voltage variations.	Defective V1, V2, V3, V13, or V14.	Replace if defective.

Figure 4-1. TROUBLESHOOTING (sheet 1 of 2)

SYMPTOM	POSSIBLE CAUSE	REMEDY
Oscillation.	Open C13, C22, C31, or C33.	Check and replace if necessary.
Poor load regulation.	Weak V14.	Check and replace if necessary.
Poor line regulation.	Defective differential amplifier(s)	Check differential amplifier circuits, beginning with tubes, and replace defective component.
Excessive ripple.	Defective C10, C11, C33, or V14. Defective component in 250V auxiliary supply.	Check and replace if necessary. Replace if defective.
Main output erratic over entire range.	Defective R64 or R66.	Replace if defective.
Main output erratic over part of range.	Same as incorrect output over part of range.	See page 4-1.
Main and auxiliary output erratic.	Defective R39 or R41.	Measure and replace if necessary.
Poor stability.	Defective V12, V14. Bias supply drift.	Replace if defective. Check V5, C31, and C22. Replace if necessary.
No screen supply voltage.	Open R28.	Before replacing R28, check C15. This resistor is designed to open in case of capacitor short to protect the transformer winding and rectifiers.
No 250 VDC output voltage.	Open R34.	Before replacing R34, check C20. This resistor, also, is designed to open in case of capacitor short to protect transformer winding and rectifiers.
Fuse blows repeatedly.	Shorted C10 or C11.	Check R3 and R4. If these resistors fail, it will cause C10 and C11 to fail also. Replace components as necessary.

Figure 4-1. TROUBLESHOOTING (sheet 2 of 2)

4-3. CALIBRATION

a. In order to calibrate the Model 407D, a voltmeter having a minimum accuracy of 0.1% should be used. Any Fluke 800 series differential voltmeter is suitable.

b. Allow the instrument to operate for one-half hour minimum before calibration.

c. Turn BIAS control fully clockwise and slide the instrument out of its case to gain access to the calibration adjustments.

d. Connect the differential voltmeter to the BIAS output terminals.

e. Adjust R40 so that voltmeter indicates -250 volts.

f. Set the output voltage to zero volts.

g. Connect the differential voltmeter to the 0-555 volt output terminals.

h. Set the MTR CKT switch to HV.

i. Set S-2 to 500 volts.

j. Adjust R65 for 500 (±1.0) volts as indicated by the differential voltmeter.

k. Set S2 to 0 volts.

l. Readjust R40 for 0 (±0.050) volts as indicated by the differential voltmeter.

m. Repeat steps j thru l until both conditions can be met.

4-4. TUBE VOLTAGE CHART

This chart is to be used under the following conditions:

a. Line voltage is 115/230 volts, 50 - 60 cycles.

b. No load is connected to the 407D.

c. 0-500 switch is set to 500.

d. All measurements are made with a VTVM from negative 0-500 output post to specified terminal.

e. All voltages are DC unless otherwise noted.

Symbol & Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Plate Cap
V1, 807	6.3V AC at 500	850	443	505	6.3V AC at 500	No Pin	No Pin	No Pin	No Pin	845
V2, 807	6.3V AC at 500	850	443	505	6.3V AC at 500	No Pin	No Pin	No Pin	No Pin	845
V3, 807	6.3V AC at 500	850	443	505	6.3V AC at -500	No Pin	No Pin	No Pin	No Pin	845
V8, 6AQ5	-13	0	6.3 VAC		188	188	-13	No Pin	No Pin	No Cap
V9, 12AX7	-96	-146	-159	12V DC at -150		-96	-161	-157	See Pin 4&5	No Cap
V10, 6AU8	-98	-96	0	6.3V AC at -150		-98	-96	-68	-12	No Cap
V12, 5651	-163	-250	IC	-250	-163	IC	-250	No Pin	No Pin	No Cap
V13, 12AX7	-94	-162	-157	12V DC at -150		-94	-161	-157	See Pin 4&5	No Cap
V14, 6AU8	-96	-94	0	6.3V AC at -150		-96	-94	-68	-61	No Cap

Figure 4-2. TUBE VOLTAGE CHART

SECTION V

LIST OF REPLACEABLE PARTS

5-1. INTRODUCTION

The following list describes all normally replaceable parts in the Model 407D and 407DR DC Power Supply. Parts are identified on the list and on corresponding illustrations by reference designations from the schematic diagram. Those parts which have no reference designation are identified by Fluke stock numbers. The 407DR is assembled differently from the 407D, and a separate parts list is provided to show the difference.

5-2. HOW TO OBTAIN PARTS

a. Most parts are standard components and can be obtained locally. All parts manufactured, altered, or designed by Fluke are designated by an asterisk preceding the Fluke stock number. All structural parts and special parts should be purchased from your local Fluke representative or from the factory.

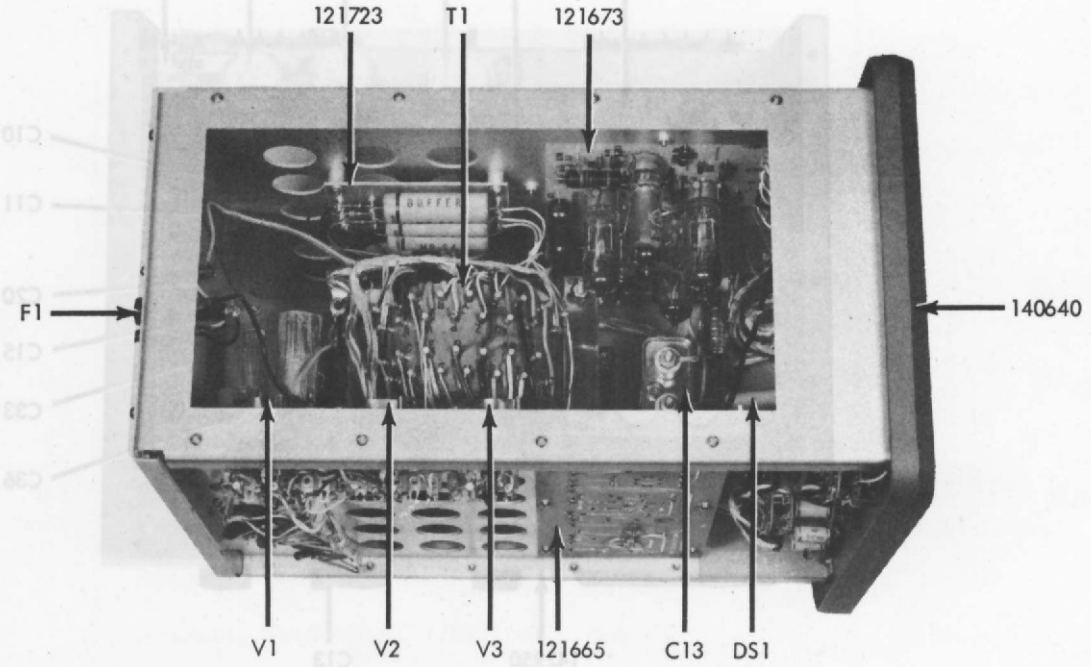
b. When ordering parts, always include:

(1) Reference designation, description and Fluke stock number.
(2) Instrument model and serial number.

c. Most structural parts are not listed in the following chart. To order these, give complete description, function, and location of part.

REFERENCE DESIGNATION	DESCRIPTION	FLUKE STOCK NO.	USE CODE
	Final Assembly	*199158	
	(Cabinet model 407D) (See Figure 5-1)	*142968	
	(Rack model 407DR) (See Figure 5-2)	*142968	
	Rectifier Printed Circuit Board Assembly (See Figure 5-3	*121665	
	Front Panel Assembly (407D)	*140640	
	(See Figure 5-4) (407DR)	*142950	
	Amplifier Printed Circuit Board Assembly (See Figure 5-5)	*121673	
	Capacitor Board Assembly (See Figure 5-6)	*121723	
C10, C11	Capacitor, Electrolytic, 125 uf, -10/+50%, 450V	105098	K
	Capacitor, Electrolytic, 90 uf, -10/+50%, 500V	105114	L
C12	Capacitor, ceramic, 680 pf, 10%, 500V	105544	
C13	Capacitor, Oil, 4 uf, 20%, 600V	104893	
C15	Capacitor, Electrolytic, 125 uf, -10/50%, 450V	105098 105114	
C20	Capacitor, Electrolytic, 20 uf, -10/+50%, 500V	105106	
C33	Capacitor, Electrolytic, 16 uf, -10/+50%, 450V	105049	

REFERENCE DESIGNATION	DESCRIPTION	FLUKE STOCK NO.	USE CODE
C36	Capacitor, Electrolytic, 2000 uf, -10/+100%, 25V	105171	
C38	Capacitor, Electrolytic, 1250 uf, +50/-10%, 4V (Use with Honeywell Meters only)	166330	
DS1	Lamp, Type 47	102855	
F1	Fuse, Slo-Blo, 5A (407D only)	109215	
	Fuse Holder (407D only)	103887	D
	Fuse Holder (407D only)	100107	A
R3, R4	Resistor, wirewound, 50K, 5%, 10W	112763	
R5, R6, R7	Resistor, composition, 220Ω, 10%, 1/2W	108191	
R8, R9, R10	Resistor, composition, 1.5K, 10%, 1/2W	108159	
R11, R12, R13	Resistor, composition, 33Ω, 10%, 1W	109660	
R35	Resistor, composition, 1M, 10%, 1W	109793	
R67	Resistor, composition, 4.7Ω, 5%, 1W	109785	
T1	Transformer, Power (407D) Transformer, Power (407DR)	*121731 *142935	
V1, V2, V3	Electron Tube Type 807 Case Assembly Foot, nylon Foot, rubber Handle	116574 *120386 *102921 101253 101857	
	Line cord	102822	



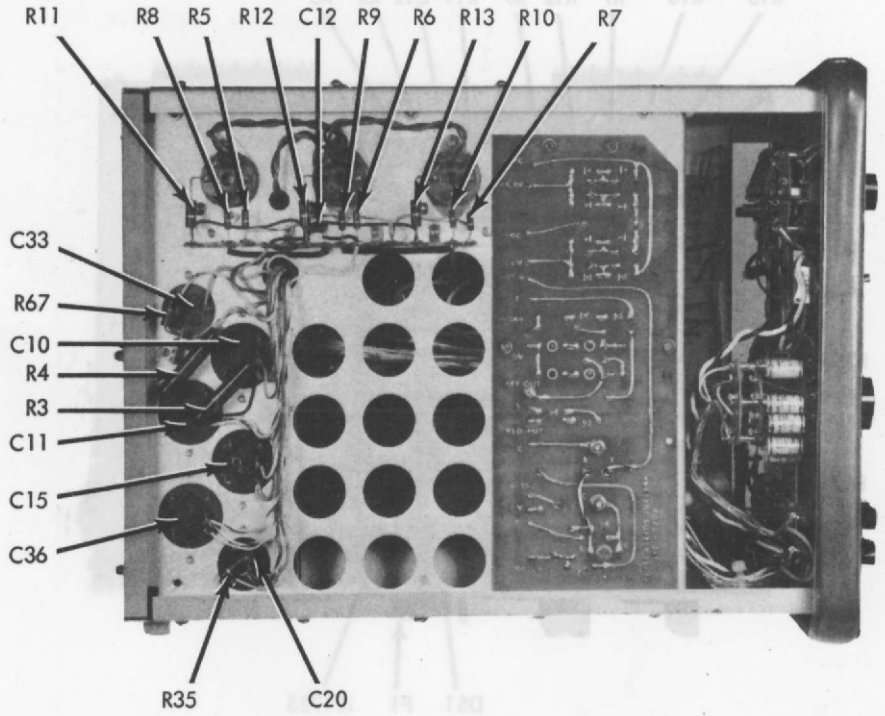


Figure 5-1. FINAL ASSEMBLY (Cabinet Model)

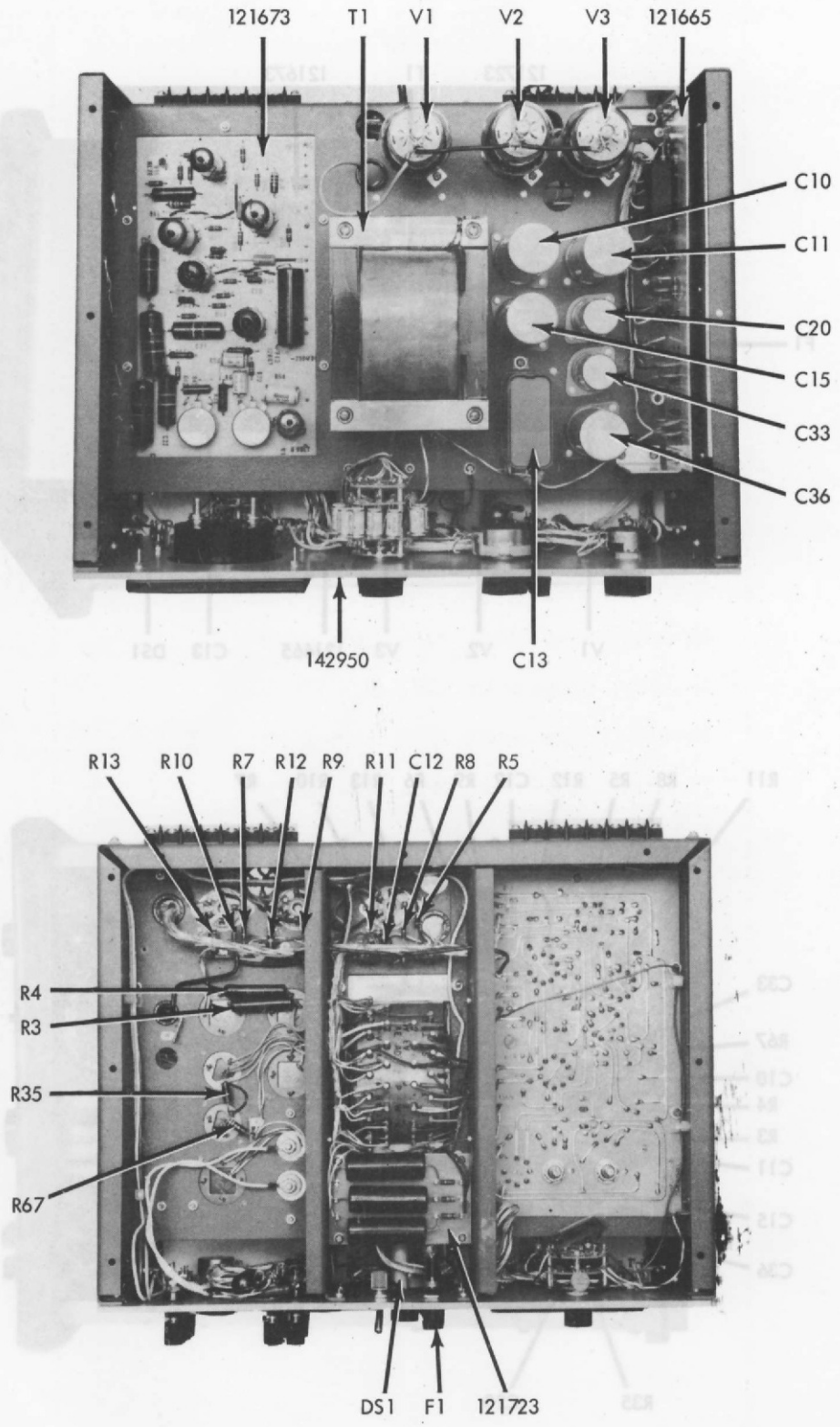


Figure 5-2. FINAL ASSEMBLY (Rack Model)

REFERENCE DESIGNATION	DESCRIPTION	FLUKE STOCK NO.	USE CODE
	Rectifier Printed Circuit Board Assembly (See Figure 5-3)	*121665	
C2 thru C9, C17	Capacitor, ceramic, 1000 pf, 20%, 3000V	105635	
C16	Capacitor, paper, 3300 pf, 20%, 600V	106559	
CR1 Thru CR13	Diode, silicon, 1N4822, 600 PIV, 1.0 Amp	112383	
CR14	Diode, Zener, 13V at 12 ma	110726	
Q1	Transistor, germanium, 2N1372	116129	
Q2	Transistor, germanium, RCA type 35487	116707	
R2	Resistor, wirewound, 4Ω, 5%, 5W	112276	
R28, R34	Resistor, composition, 10Ω, 10%, 1/2W	108092	
R29	Resistor, composition, 220K, 10%, 1W	109652	Z
	Resistor, composition, 56K, 10%, 2W	109991	AA
R30	Resistor, composition, 82K, 10%, 1/2W	108498	
R31	Resistor, composition, 47K, 10%, 1/2W	108480	
R32	Resistor, composition, 470K, 10%, 1/2W	108290	
R36	Resistor, composition, 22K, 10%, 1W	109470	
R37	Resistor, composition, 2.2K, 10%, 1/2W	108605	
R71	Resistor, composition, 39K, 10%, 2W	109983	
V4, V5	Lamp, Neon, Type NE2E	100347	O
	Lamp, Neon, Type NE83	170167	P
V6, V7	Lamp, Neon, Type NE2E	100347	
	Heat sink	*121863	

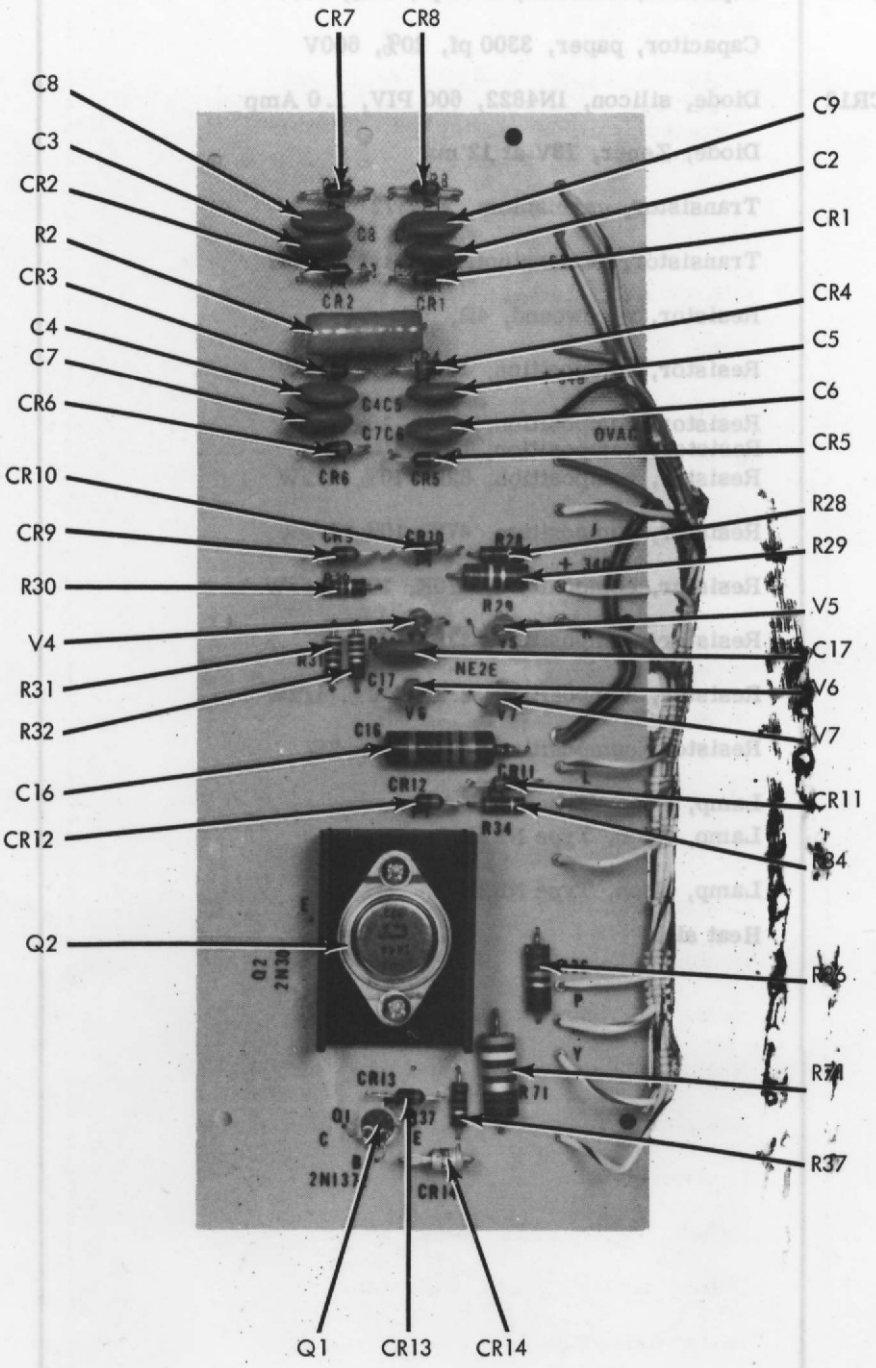


Figure 5-3. RECTIFIER PRINTED CIRCUIT BOARD ASSEMBLY

REFERENCE DESIGNATION		FLUKE STOCK NO.	USE CODE
	Front Panel Assembly (See Figure 5-4)		
	(Model 407D)	*140640	
	(Model 407DR)	*142950	
C18	Capacitor, paper, 0.047 uf, 20%, 1000V	105387	
	Capacitor, paper mylar, 0.1 uf, 20%, 1000V	105866	Y
	Capacitor, plastic, 0.25 uf, ±10%, 1200V	183616	AB
C34	Capacitor, paper, 0.22 uf, 20%, 400V	105304	
C35	Capacitor, paper, 0.022 uf, 20%, 600V	105411	
C37	Capacitor, ceramic, 0.005 uf, 20%, 1000V	105650	G
F1	Fuse, 5A, Slo-Blo (407DR only)	109215	
	Fuse Holder (407DR only)	103887	D
	Fuse Holder (407DR only)	100107	A
J1, J4	Binding Post, Red	142976	
J2, J3, J5 thru J10	Binding Post, Black	142984	
	Knob, 1 inch, w/pointer	101287	R
	Knob, 13/16 inch, w/bar	*170050	S
	Knob, 1-1/2 inch, w/pointer	101311	R
	Knob, 1 inch, w/bar	*170035	S
M1	Meter, DC, 1 milliampere	*111179	
R24	Resistor, wirewound, 0.47Ω, 10%, 1/2W	112888	
R25	Resistor, wire	*115535	
R26, R73	Resistor, carbon film, 600K, 1%, 2W	107417	
R62, R68	Resistor, variable, wirewound, 50K, 10%, 3W	111690	
R63	Resistor, variable, wirewound, 500Ω, 10%, 2W	111773	
R69	Resistor, carbon film, 10K, 1%, 1/2W	107128	
R70	Resistor, carbon film, 90K, 1%, 1W	107300	
S1	Switch, toggle, SPST, 250V, 10 Amp	114850	
S3	Switch, rotary, 2 pole, 5 position	*114728	
	Switch Assembly	*121889	
S2	Switch, rotary, 3 pole, 11 position	*114736	
R14 thru R23	Resistor, wirewound, 45K, 0.25%, 1/2	*112078	
	Panel, front	*121558	

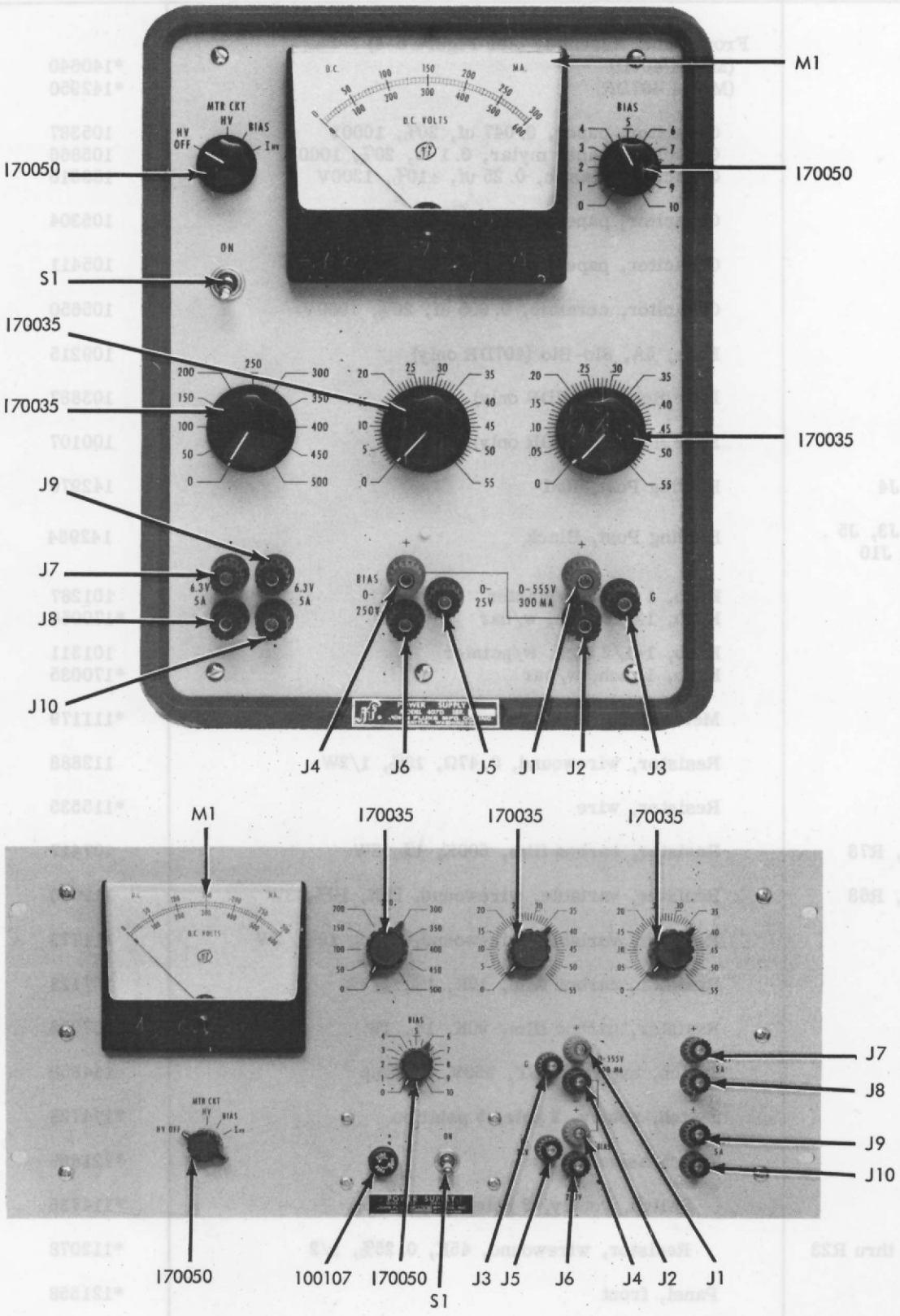


Figure 5-4. FRONT PANEL ASSEMBLY (sheet 1 of 2)

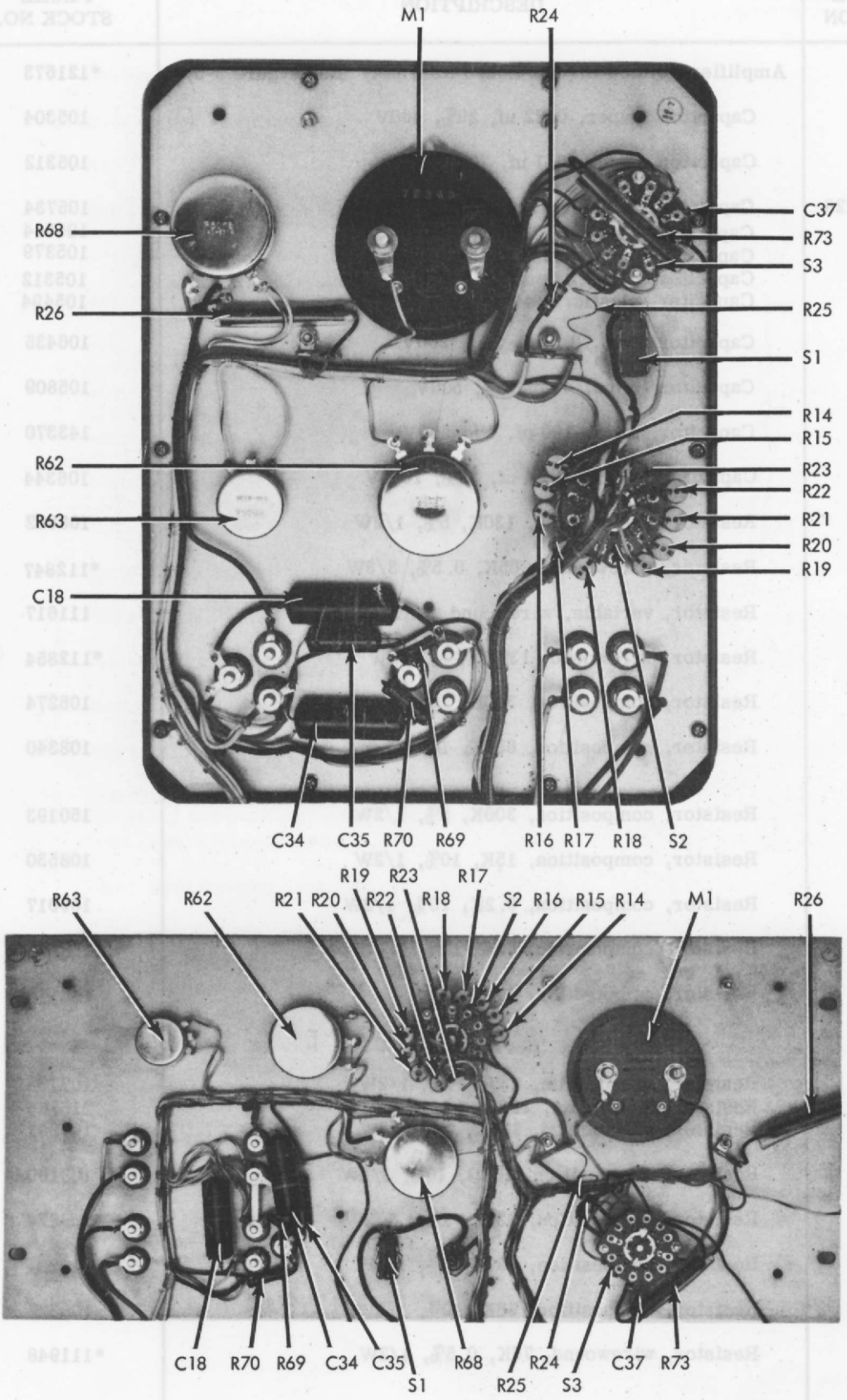


Figure 5-4. FRONT PANEL ASSEMBLY (sheet 2 of 2)

REFERENCE DESIGNATION	DESCRIPTION	FLUKE STOCK NO.	USE CODE
	Amplifier Printed Circuit Board Assembly (See Figure 5-5)	*121673	
C21, C32	Capacitor, paper, 0.22 uf, 20%, 400V	105304	
C22, C27	Capacitor, paper, 0.1 uf, 20%, 400V	105312	
C23, C25, C28	Capacitor, ceramic, 300 pf, 10%, 500V	105734	C
	Capacitor, ceramic, 680 pf, 10% 500V	105544	B
C24	Capacitor, paper, 2200 pf, 20% 1600V	105379	
C26	Capacitor, paper 0.1 uf, 20% 400V	105312	W
	Capacitor, plastic, 0.47 uf, 20% 600V	105494	X
C29	Capacitor, film, 0.1 uf, 20%, 200V	106435	
C30	Capacitor, mica, 47 pf, 5%, 500V	105809	C
	Capacitor, mica, 100 pf, 1%, 500V	143370	B
C31	Capacitor, plastic, 0.04 uf, 20%, 1600V	106344	
R38	Resistor, composition, 130K, 5%, 1/2W	108852	
R39	Resistor, wirewound, 265K, 0.5%, 3/8W	*112847	
R40	Resistor, variable, wirewound, 10K, 10%, 2W	111617	
R41	Resistor, wirewound, 137K, 1%, 1/2W	*112854	
R42	Resistor, composition, 330K, 10%, 1/2W	108274	
R43, R50, R54	Resistor, composition, 680K, 10%, 1/2W	108340	C
R43, R50	Resistor, composition, 300K, 5%, 1/2W	150193	B
R44	Resistor, composition, 15K, 10%, 1/2W	108530	C
	Resistor, composition, 8.2K, 10%, 1/2W	109017	B
R45	Resistor, composition, 82K, 10%, 1/2W	108498	
R46	Resistor, composition, 47K, 5%, 1W	150219	
R47	Resistor, carbon film, 287K, 1%, 1/2W	107763	C
	Resistor, metal film, 133K, 1%, 1/2W	216168	Y
	Resistor, carbon film, 135K, 1%, 1/2W	107201	B
R48	Resistor, composition, 100Ω, 10%, 1/2W	108100	
R49	Resistor, composition, 330K, 10%, 1/2W	108274	C
	Resistor, composition, 330K, 5%, 1/2W	150201	B
R51, R53	Resistor, composition, 68K, 10%, 1/2W	108332	
R52	Resistor, wirewound, 76K, 0.5%, 1/2W	*111948	

REFERENCE DESIGNATION	DESCRIPTION	FLUKE STOCK NO.	USE CODE
R54	Resistor, composition, 270K, 5%, 1/2W	150185	B
R55	Resistor, composition, 150K, 10%, 1/2W	108167	
R56	Resistor, composition, 56K, 10%, 1/2W	108472	C
	Resistor, composition, 47K, 5%, 1/2W	108738	B
R57	Resistor, composition, 150K, 10%, 1W	109801	C
	Resistor, composition, 150K, 5%, 1W	153122	B
R58	Resistor, composition, 47K, 5%, 1W	150219	T
	Resistor, composition, 68K, 10% 1W	109629	U
R59	Resistor, deposited carbon, 287K, 1%, 1/2W	107763	C
	Resistor, metal film, 133K, 1%, 1/2W	216168	Y
	Resistor, deposited carbon, 135K, 1%, 1/2W	107201	B
R60	Resistor, composition, 680K, 10%, 1/2W	108340	C
	Resistor, composition, 300K, 5%, 1/2W	150193	B
R61	Resistor, composition, 82K, 10%, 1/2W	108498	C
	Resistor, composition, 39K, 10%, 1/2W	108555	V
	Resistor, composition, 18K, 10%, 1/2W	108183	U
R64	Resistor, wirewound, 146.5K, 0.25%, 1W	*112243	
R65	Resistor, variable, wirewound, 5K, 10%, 2W	111583	
R66	Resistor, wirewound, 73.5K, 0.25%, 1/2W	*112094	
R72	Resistor, composition, 330K ±10%, 1/2W	108274	
V8	Tube, Beam Power, Type 6AQ5	116400	
V9, V13	Tube, Dual Triode, Type 12AX7	115956	
V10, V14	Tube, Triode-Pentode, Type 6AU8	116426	H
	Tube, Triode-Pentode, Type 6AW8	116434	J
V11	Lamp, Neon Glow, Type NE2E	100347	O
	Lamp, Neon Glow, Type NE83	170167	P
V12	Tube, Voltage Reference, Type 5651-2	*117119	

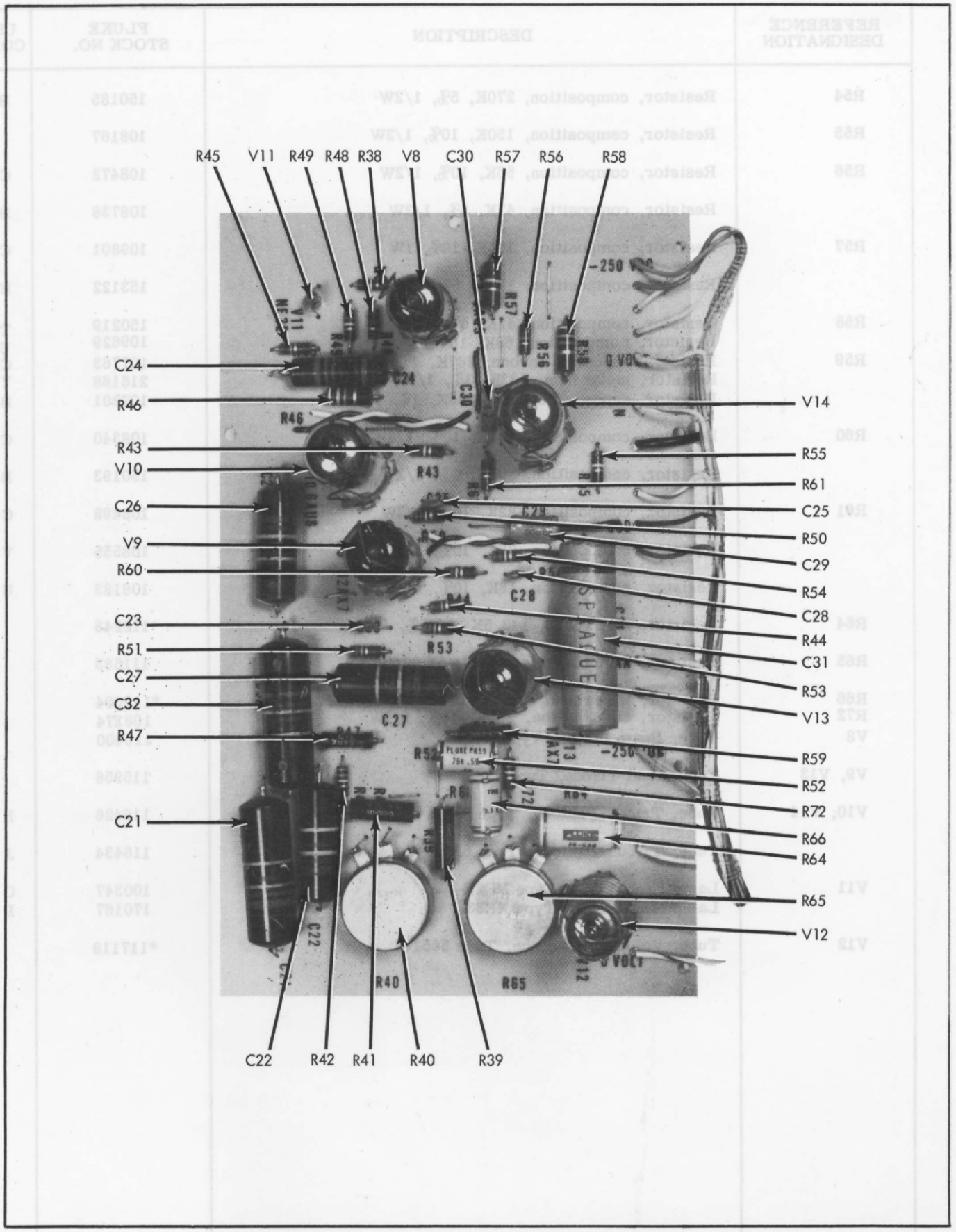


Figure 5-5. AMPLIFIER PRINTED CIRCUIT BOARD ASSEMBLY

REFERENCE DESIGNATION	DESCRIPTION	FLUKE STOCK NO.	USE CODE
	Capacitor Board Assembly (See Figure 5-6)	*121723	G
C1, C14, C19	Capacitor, plastic, 0.047 uf, 20%, 1600V	106344	
R1	Resistor, composition, 100Ω, 10%, 1/2W	108100	
R27	Resistor, composition, 330Ω, 10%, 1/2W	108589	
R33	Resistor, composition, 120Ω, 10%, 1/2W	108696	

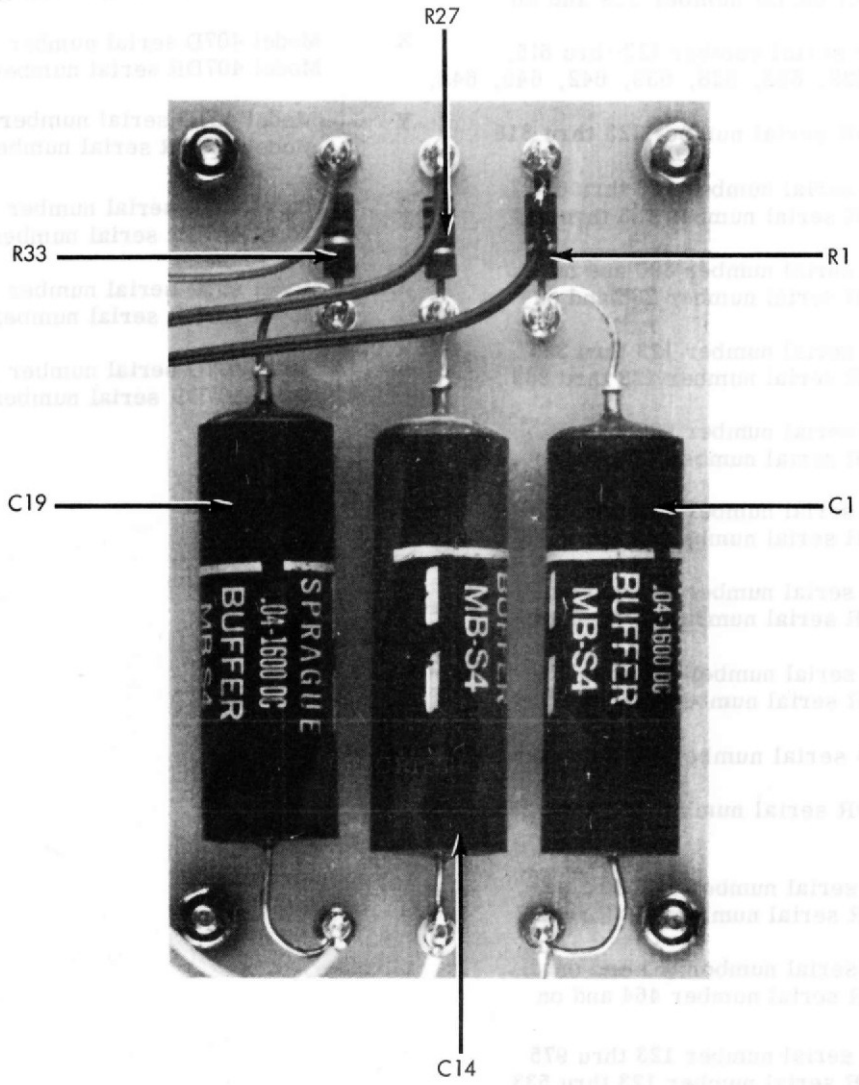


Figure 5-6. CAPACITOR BOARD ASSEMBLY

5-3. USE CODE EFFECTIVITY

The customer can determine the effectivity of all replaceable parts by use of the following use code effectivity list. All parts with no code are used on all instruments with serial numbers 123 and on.

USE CODE	EFFECTIVITY
No Code	Model 407D serial number 123 and on Model 407DR serial number 123 and on
A	Model 407D serial number 651 and on Model 407DR serial number 319 and on
B	Model 407D serial number 616 thru 624, 626, 628, 630, 631, 633 thru 637, 640, 641, 643, 644, 648, 650 and on Model 407DR serial number 319 and on
C	Model 407D serial number 123 thru 615, 625, 627, 629, 632, 638, 639, 642, 645, 646, 647, 649 Model 407DR serial number 123 thru 318
D	Model 407D serial number 123 thru 650 Model 407DR serial number 123 thru 318
E	Model 407D serial number 396 and on Model 407DR serial number 286 and on
F	Model 407D serial number 123 thru 395 Model 407DR serial number 123 thru 285
G	Model 407D serial number 186 and on Model 407DR serial number 191 and on
H	Model 407D serial number 123 thru 770 Model 407DR serial number 123 thru 373
J	Model 407D serial number 771 and on Model 407DR serial number 374 and on
K	Model 407D serial number 396 thru 936 Model 407DR serial number 286 thru 534
L	Model 407D serial number 123 thru 395, 937 and on Model 407DR serial number 123 thru 285, 535 and on
M	Model 407D serial number 123 thru 830 Model 407DR serial number 123 thru 463
N	Model 407D serial number 831 and on Model 407DR serial number 464 and on
O	Model 407D serial number 123 thru 975 Model 407DR serial number 123 thru 533
P	Model 407D serial number 976 and on Model 407DR serial number 534 and on
R	Model 407D serial number 123 thru 1005 Model 407DR serial number 123 thru 559
S	Model 407D serial number 1006 and on Model 407DR serial number 560 and on
T	Model 407D serial number 123 thru 975 Model 407DR serial number 123 thru 559
U	Model 407D serial number 976 and on Model 407DR serial number 560 and on
V	Model 407D serial number 616 thru 624, 626, 628, 630, 631, 633 thru 637, 640, 641, 643, 644, 648, 650 thru 975. Model 407DR serial number 319 thru 559
W	Model 407D serial number 123 thru 1035 Model 407DR serial number 123 thru 584
X	Model 407D serial number 1036 and on Model 407DR serial number 585 and on
Y	Model 407D serial number 1279 and on Model 407DR serial number 892 and on
Z	Model 407D serial number 396 thru 1348 Model 407DR serial number 286 thru 1011
AA	Model 407D serial number 1349 and on Model 407DR serial number 1012 and on
AB	Model 407D serial number 1379 and on Model 407DR serial number 1032 and on

List of Factory Authorized Service Centers

ARIZONA

PHOENIX

Arizona Standards Laboratory
4430 N. 19th Ave.
Tel. (602) 264-9351

CALIFORNIA

LOS ANGELES

Instrument Specialists, Inc.
P. O. Box 39908
2870 Los Feliz Place
Tel. (213) 665-5181
TWX: 910-321-3914

COLORADO

BOULDER

Ball Brothers Research Corp.
Standardization Laboratory
Tel. (303) 444-5300
TWX: 910-940-3241

FLORIDA

ORLANDO

BCS Associates, Inc.
P. O. Box 6578
940 N. Fern Creek Ave.
Tel. (305) 425-2764
TWX. 810-850-0185

HAWAII

HONOLULU

Industrial Electronics
P. O. Box 135
646 Queen Street
Tel. (808) 506-095
TWX. 63238

MARYLAND

KENSINGTON

Electronic Marketing Associates
11501 Huff Court
Tel. (301) 946-0300
TWX. 710-825-9645

MASSACHUSETTS

ARLINGTON

Instrument Representatives, Inc.
1046 Massachusetts Ave.
Tel. (617) 646-1034

NEW MEXICO

ALBUQUERQUE

EG & G Standards and Calibration Laboratory
P. O. Box 4339, Station A
933 Bradbury Drive S. E.
Tel. (505) 842-4084

NEW YORK

PLEASANTVILLE

SBM Associates
28 Hobby Street
Tel. (914) 769-1811
TWX. 710-572-2193

ROCHESTER

SBM Associates
800 Linden Ave.
Tel. (716) 381-8330
TWX. 510-253-6145

OHIO

CLEVELAND

Honeywell Metrology Service
1001 E. 55th St.
Tel. (216) 881-0300

FAIRBORN

Honeywell Metrology Service
600 East Dayton Dr.
Tel. (513) 878-2551

TEXAS

GARLAND

Tucker Electronics Company
326 Kirby Street
Tel. (214) 272-3404

HOUSTON

Linear Standards Laboratory
8207 Millet
Tel. (713) 923-2796

UTAH

SALT LAKE CITY

Stabro Laboratory
23 Kensington Ave.
Tel. (801) 467-8011

CANADA

TORONTO

Allen Crawford Associates Ltd.
65 Martin Ross Ave.
Downsview, Ontario
Tel. (416) 636-4910
TWX. 610-492-2119

INTERNATIONAL

THE NETHERLANDS

Fluke Netherland N. V.
P. O. Box 5053
Tilburg, The Netherlands

UNITED KINGDOM

Fluke International Corp
P. O. Box 102
Watford-Herts, England

For information regarding service centers in other foreign locations, contact the nearest Sales and Service Representative in your area.

WARRANTY

The JOHN FLUKE MFG. CO., INC. warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken.

1. Notify the John Fluke Mfg. Co., Inc., giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

SHIPPING

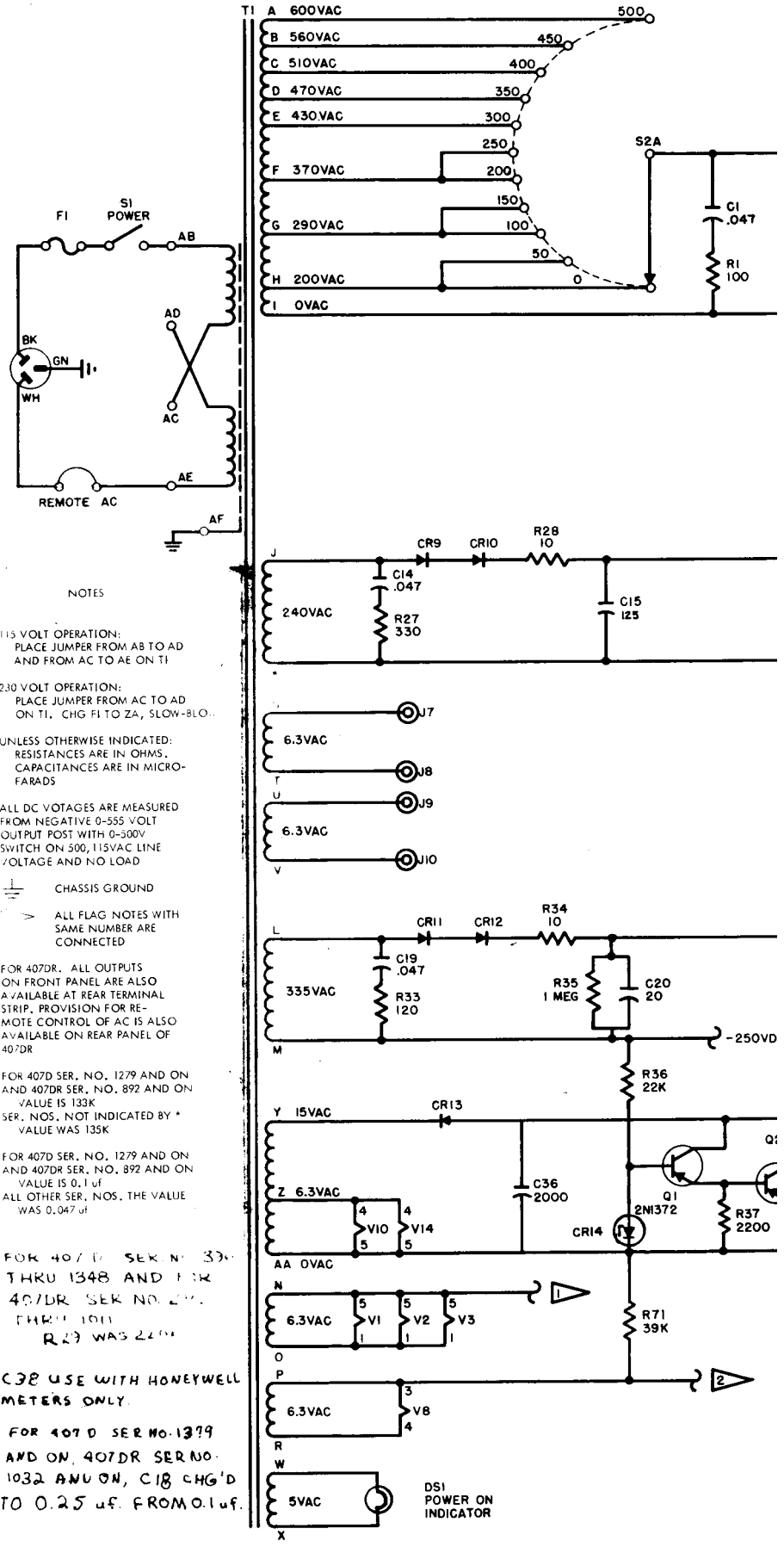
All shipments of John Fluke Mfg. Co., Inc. instruments should be made via Railway Express prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc. Upon receipt of this report you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc. will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to:

JOHN FLUKE MFG. CO., INC., P. O. BOX 7428, SEATTLE 33, WASHINGTON



*
For 407D ser 396 to 615 plus 625, 627, 629, 632 638, 642, 645, 646, 647 & 649
407DR ser 286 to 318

C23, C25, & C28	were 300pf
C30	was 47pf
R43, R50, R54 & R60	were 680K
R44	was 15K
R47, & R59	were 287K
R56	was 56K
R61	was 82K

407D ser 123 thru 770
407DR ser 286 thru 534

V10 & V14	were 6AU8

407D ser 396 thru 936
407DR ser 286 thru 534

C10 & C11	were 125uf

407D ser 396 thru 975
407DR ser 286 thru 533

V4 & V5	were NE2E

407D ser 396 thru 1035
407DR ser 286 thru 584

C26	was 0.1uf

407D ser 123 thru 975
407DR ser 123 thru 559

R58	was 47K

407D ser 616 thru 624, 626, 628, 629 thru 631, 633 thru 637, 639 thru 641, 643, 644, 648 & 650 thru 975
407DR ser 319 thru 559

R61	was 39K

NUMBERS USED

R1-R73	F1
C1-C38	T1
CR1-CR14	Q1-Q2
V1-V14	DS1
	M1

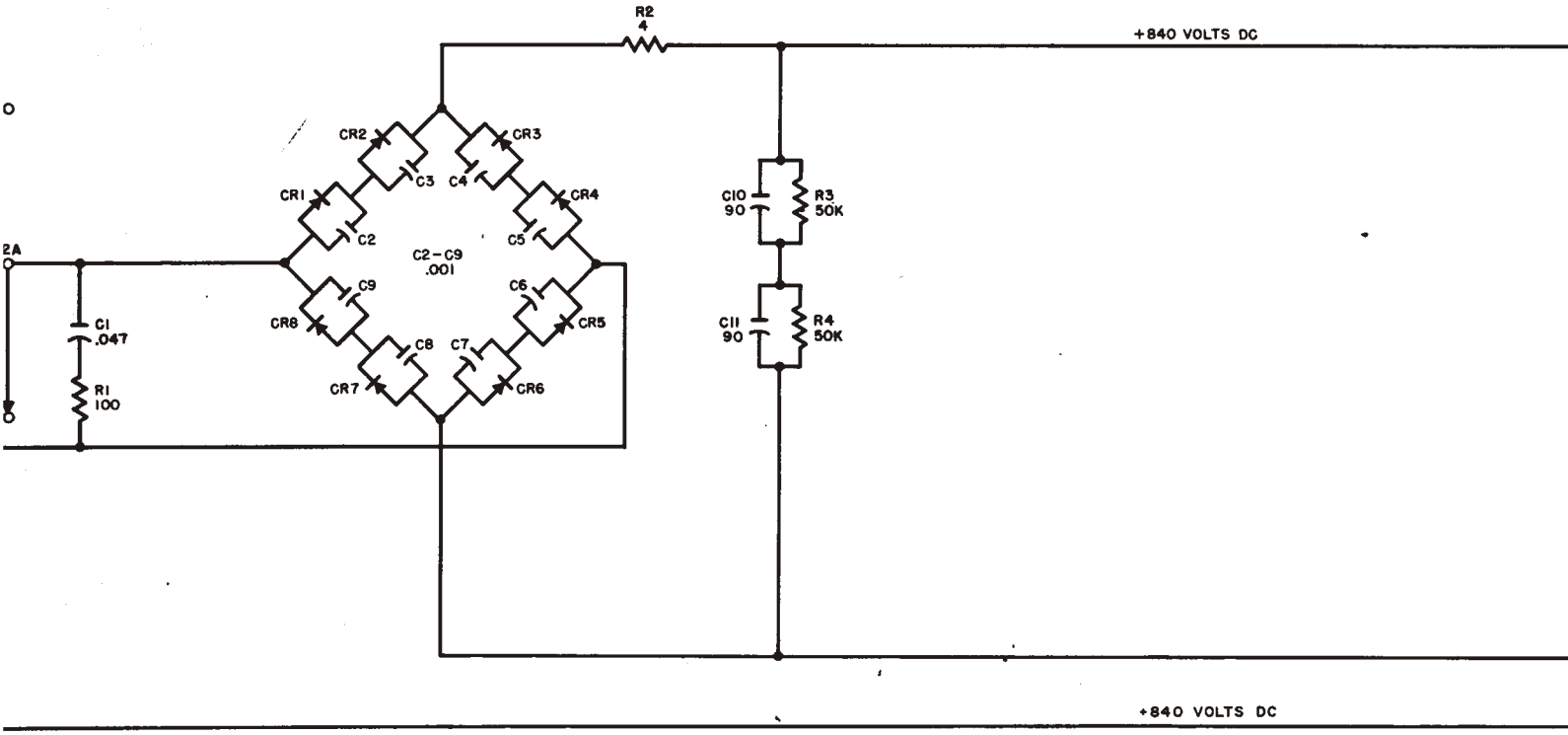
NOTES

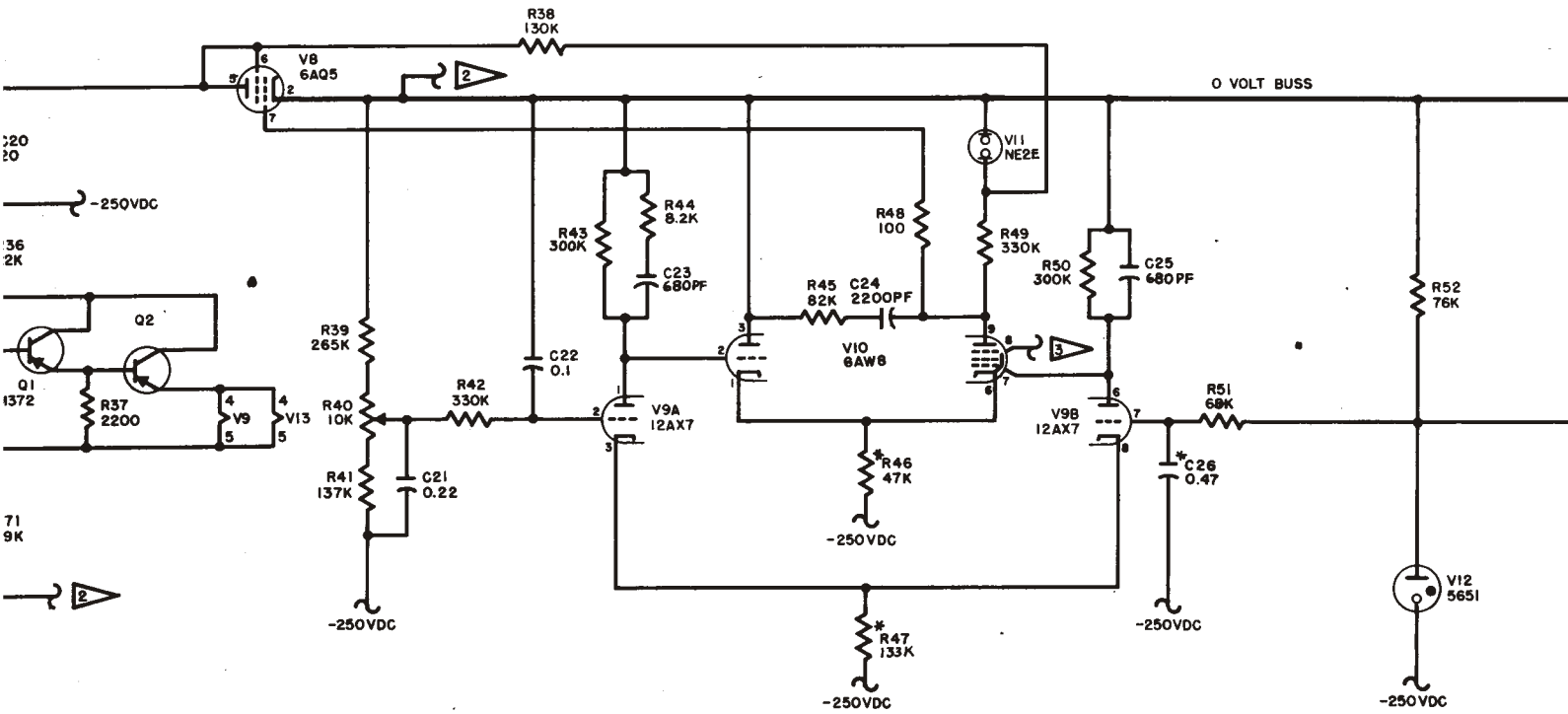
1. 115 VOLT OPERATION: PLACE JUMPER FROM AB TO AD AND FROM AC TO AE ON T1
2. 230 VOLT OPERATION: PLACE JUMPER FROM AC TO AD ON T1. CHG F1 TO 2A, SLOW-BLO.
3. UNLESS OTHERWISE INDICATED: RESISTANCES ARE IN OHMS. CAPACITANCES ARE IN MICRO-FARADS
4. ALL DC VOTAGES ARE MEASURED FROM NEGATIVE 0-555 VOLT OUTPUT POST WITH 0-500V SWITCH ON 500, 115VAC LINE VOLTAGE AND NO LOAD
5. ⏚ CHASSIS GROUND
6. > ALL FLAG NOTES WITH SAME NUMBER ARE CONNECTED
7. FOR 407DR. ALL OUTPUTS ON FRONT PANEL ARE ALSO AVAILABLE AT REAR TERMINAL STRIP. PROVISION FOR REMOTE CONTROL OF AC IS ALSO AVAILABLE ON REAR PANEL OF 407DR
8. FOR 407D SER. NO. 1279 AND ON AND 407DR SER. NO. 892 AND ON VALUE IS 133K
   SER. NOS. NOT INDICATED BY * VALUE WAS 135K
9. FOR 407D SER. NO. 1279 AND ON AND 407DR SER. NO. 892 AND ON VALUE IS 0.1 uf
   ALL OTHER SER. NOS. THE VALUE WAS 0.047 uf

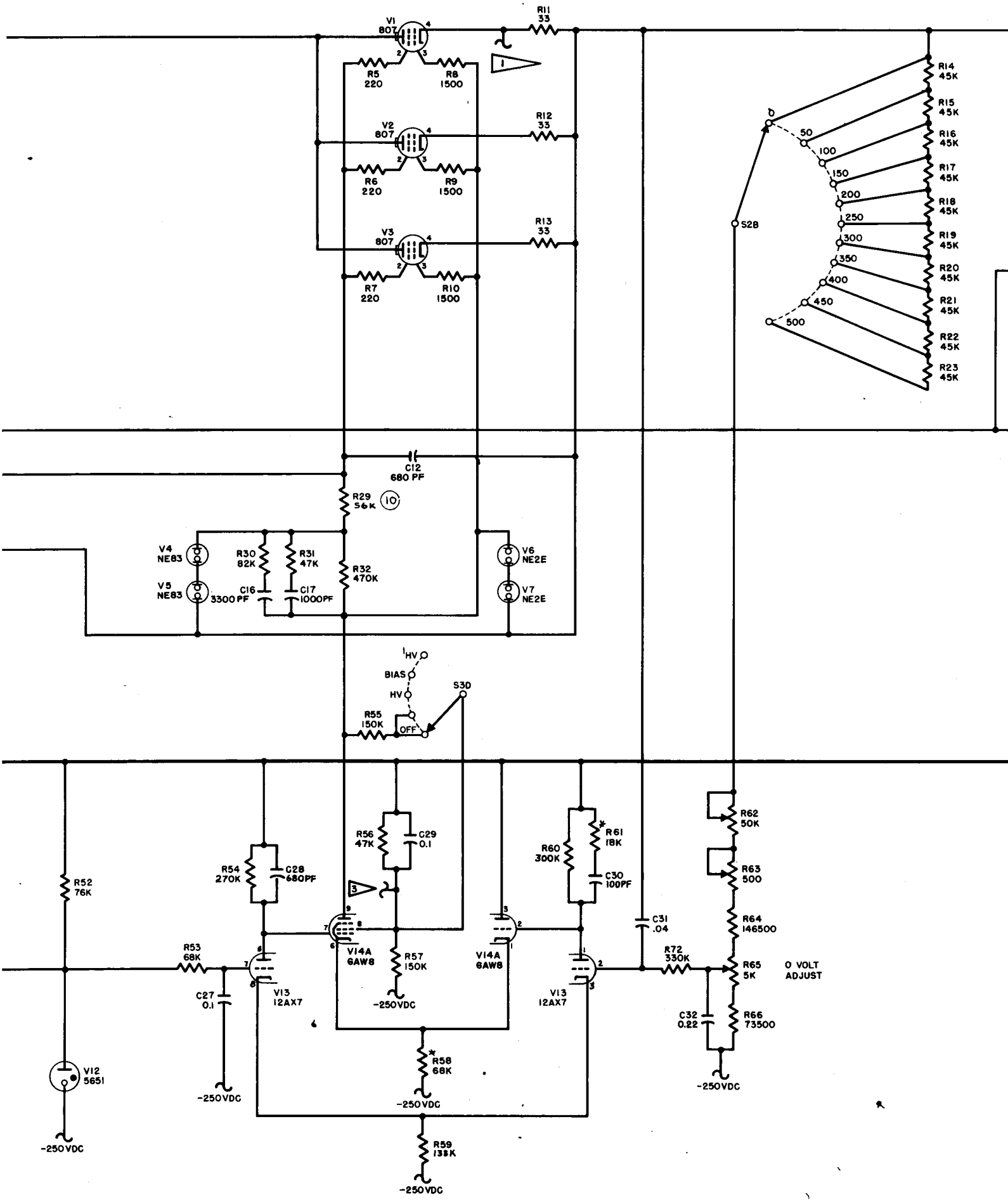
(10) FOR 407D SER NO 396 THRU 1348 AND FOR 407DR SER NO 286 THRU 1011 R29 WAS 22K

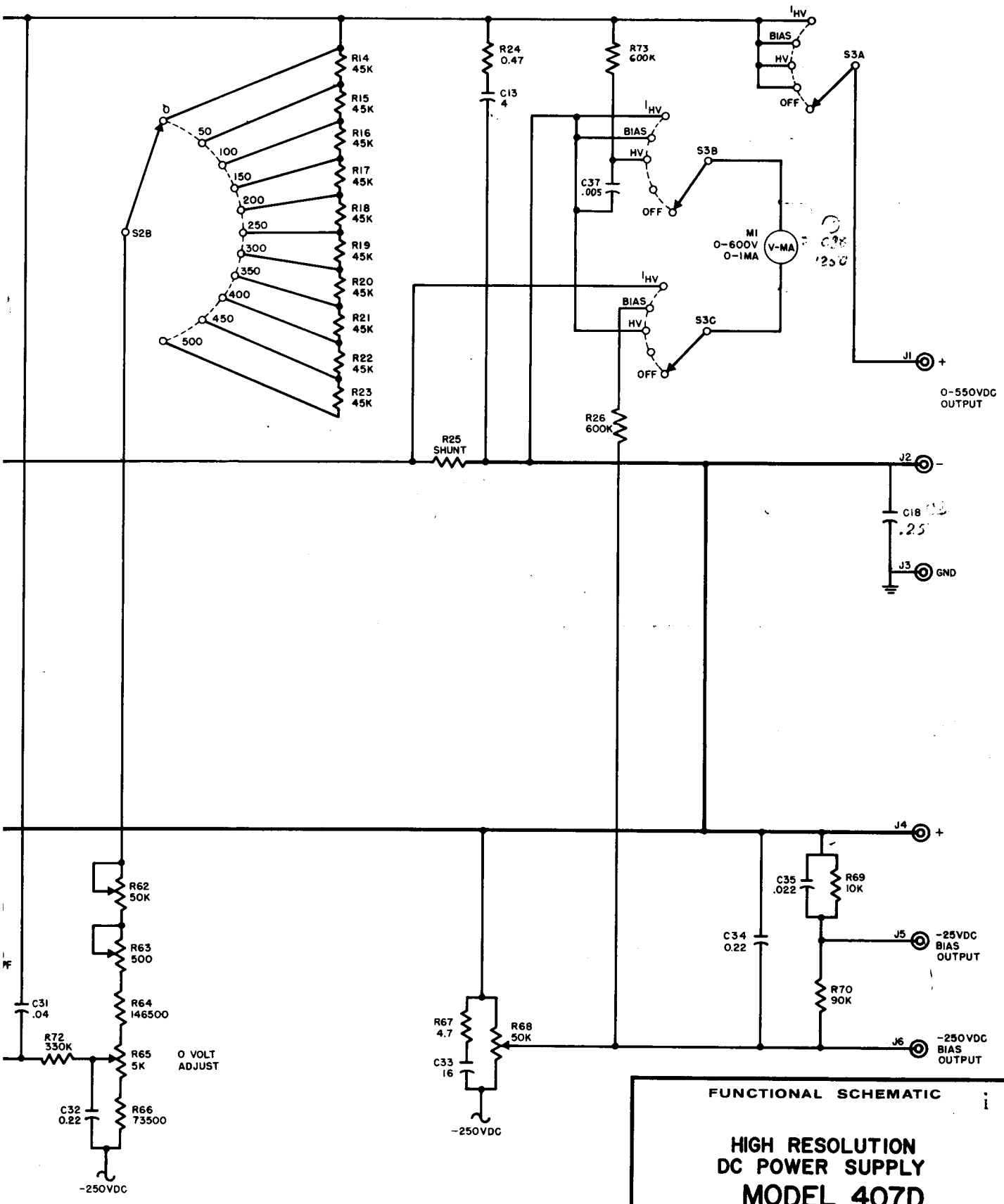
(11) C38 USE WITH HONEYWELL METERS ONLY.

(12) FOR 407D SER NO 1379 AND ON, 407DR SER NO 1032 AND ON, C18 CHG'D TO 0.25 uf. FROM 0.1 uf.









FUNCTIONAL SCHEMATIC

HIGH RESOLUTION DC POWER SUPPLY MODEL 407D

407 D SER. NO. 396 & ON
407 DR SER. NO. 286 & ON

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