JOHN FLUKE MFG. CO., INC.

P. O. Box 7428, Seattle 33, Washington

Preliminary Operating Instructions

for

MODEL A55
THERMAL CONVERTERS

and

MODEL 550A
THERMAL TRANSFER STANDARD

SERIAL NO. 123 and above

FOR REFERENCE PURPOSES ONLY

July 10, 1962

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SECTION I

ACCESSORIES AND SPECIFICATIONS

1-1. SUPPLIED ACCESSORIES

The following hardware and interconnecting cables are supplied with the 550A. These accessories are stored in a zippered case attached to the 550A bottom access panel.

ITEM	DESCRIPTION
GR874-QBPL Adaptor	Consists of an 874-BL Connector and a BNC Plug for connecting an 874 Connector to a BNC Jack.
GR874-QNPL Adaptor	Consists of an 874-BL Connector and an N Plug for connecting an 874 Connector to an N Jack.
GR874-QUPL Adaptor	Consists of an 874-BL Connector and a UHF Plug for connecting an 874 Connector to a UHF Jack.
GR874-TL Tee	Consists of a ridged coaxial tee terminated with three 874-BL Connectors for connecting stubs and other elements in shunt with a coaxial line.

ITEM	DESCRIPTION
GR874-R22L Coaxial Cable	Consists of three feet of coaxial cable with an 874-CL58 Locking Connector at each end. Used to connect AC source to coaxial tee.
Galvanometer Shielded Cable	Consists of approximately four feet of shielded two wire cable with an Amphenol 80-PC2M two-pin connector at one end. A connector which will fit the galvanometer to be used may be connected to the other end of the shielded cable. Otherwise, the cable may be permanently connected to the galvanometer.
Thermal Converter Shielded Cable	Consists of approximately four feet of shielded two-wire cable with an Amphenol 80-PC2M two-pin connector at each end. Used to connect A55 Thermal Converter to THERMAL CONVERTER output connector.

1-2. SPECIFICATIONS

a. 550A TRANSFER STANDARD

REFERENCE VOLTAGE RANGE: 1.4 to 8.2 millivolts. (Output voltage range of Fluke Model A55 Thermal Converters is approximately 1.8 to 7 millivolts from 1/2 to 1 times rated voltage).

APPROXIMATE GALVANOMETER RESOLUTION: (When used with Model A55 Thermal Converters and a Leeds and Northrup Model 2430A galvanometer).

SENSITIVITY RANGE	MAXIMUM CONVERTER INPUT	MINIMUM CONVERTER INPUT
Search	1% mm	6%/mm
Low	0.1%/mm	0.6%/mm
Medium	0.01%/mm	0.06%/mm
High	0.001%/mm	0.006%/mm

BATTERY: Two mercury cells are used for the internal reference supply eliminating the need for line voltage and thus eliminating all problems due to internal AC fields. The normal operating life of the batteries is greater than 2000 hours.

POLARITY REVERSAL SWITCH: Fast-acting, low DC resistance. (Galvanometer does not have to be disconnected when switching).

DC INPUT CONNECTOR: Two banana jacks with 3/4" spacing.

DC OUTPUT CONNECTOR: GR Type 874 and two banana jacks with 3/4" spacing provided for measuring DC voltage at output connector.

GALVANOMETER AND THERMAL CONVERTER INPUT CONNECTOR: Amphenol 80-PC2M two-pin microphone type.

SIZE: 9-3/8" high, 15" wide, 10-3/4" deep (including cover).

WEIGHT: 14-1/2 lbs. (including accessories and cover).

b. A55 THERMAL CONVERTERS

RANGE: 0.5, 1, 2, 3, 5, 10, 20, 30, and 50 volts. (Each converter may be used from 1/2 to 1 times voltage rating).

MAXIMUM AC TO DC DIFFERENCE. The values below indicate the maximum percent difference between the alternating current of sine wave form used to produce a given converter output voltage and the mean value of the two directions of direct current required to produce the same output voltage. A positive sign signifies that more alternating voltage than direct voltage was required.

VOLTAGE RANGE	1 MC	10 MC	30 MC	50 MC
0.5 V	+0.01%	+0.10%	+0.50%	+1.50%
1V-10 V	±0.01%	±0.03%	±0.10%	±0.10%
20V-50V	±0.01%	±0.05%	±0.10%	-

CALIBRATION: The National Bureau of Standards will calibrate the A55 converters directly against the national primary standards at specific frequencies upon request. However, to help reduce the NBS work load and to reduce the waiting time, John Fluke maintains a secondary standardizing laboratory with standards that are periodically checked by NBS. Thus, Fluke can calibrate the A55 converters indirectly against the national primary standards. Fluke certified test reports showing the precise AC to DC difference at specified frequencies within the normal National Bureau of Standards uncertainty are available at extra cost.

OUTPUT VOLTAGE: 7 millivolts at rated input.

INPUT IMPEDANCE: Approximately 200 ohms/volt.

OUTPUT RESISTANCE: 8 ohms nominal.

INPUT CONNECTOR: GR Type 874L.

OUTPUT CONNECTOR: Amphenol 80-PC2M two-pin microphone type.

SIZE AND WEIGHT:

Converter	Diameter	Length	Weight
0.5 V	1-3/8"	3-5/16"	10 oz.
1V, 2V	"	5-3/16"	13 oz.
3V, 5V	"	6-1/2"	15 oz.
10V, 20V, 30V 50V	"	7-1/16"	1 lb.

SECTION II

OPERATING INSTRUCTIONS

2-1. GENERAL

a. The 550A along with the auxiliary equipment listed in figure 2-1 and 2-2 forms a complete system capable of calibrating an AC voltage, measuring an unknown AC voltage, and measuring frequency response of various devices.

AUXILIARY EQUIPMENT	SPECIFICATIONS DESIRED FOR MAXIMUM ACCURACY
Galvanometer	COIL RESISTANCE: 17 Ω CRITICAL DAMPING RESISTANCE: 30 to 90 Ω SENSITIVITY: 0.5 UV/millimeter
DC Voltage Measuring Equipment	RANGE: 0.25 to 50 volts ACCURACY: 0.01%
DC Source	AMPLITUDE STABILITY: 0.002% short term AMPLITUDE RESOLUTION: 0.002% at any desired calibrating voltage. OUTPUT VOLTAGE: 0.25 to 50 volts floating output. OUTPUT CURRENT: 5 to 10 ma.
AC Source	AMPLITUDE STABILITY: 0.01% short term. AMPLITUDE RESOLUTION: 0.002% at any desired calibrating voltage. OUTPUT VOLTAGE: 0.25 to 50 volts. OUTPUT CURRENT: 5 to 10 ma FREQUENCY: Dependent on application.

Figure 2-1. DESIRED AUXILIARY EQUIPMENT SPECIFICATIONS

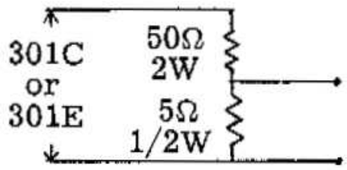
AUXILIARY EQUIPMENT	RECOMMENDED INSTRUMENT
Galvanometer	Leeds and Northrup Model 2430A
DC Voltage Measuring Equipment	John Fluke Differential DC Voltmeter Model 825A (0.025%)
DC Source	John Fluke Model 301C or 301E Note: The 301C and 301E require the following voltage divider for use with the 0.5 and 1 volt A55 Converters.  Use low temperature coefficient wirewound resistors.
AC Source	No one AC source will meet the specifications desired for maximum accuracy over the frequency range covered by the A55 Thermal Converters. However, AC signal sources and amplifiers that will give satisfactory results in most cases are made by Boonton Radio Corp., Hewlett Packard, Holt Inst. Lab., Krohn-Hite, Rohde and Schwarz, and Tektronix, Inc.

Figure 2-2. RECOMMENDED INSTRUMENTS

b. A John Fluke certified test report on each A55 thermal converter may be used to obtain the precise AC to DC difference at various frequencies. These reports state the percent difference between the RMS value of an alternating voltage (at a certain frequency) required to produce a given output voltage and the mean value of direct voltage (for both directions of current flow) required to produce the same output.

c. Prior to use, remove all necessary interconnecting cables and hardware stored in the zippered case attached to the bottom access panel. Replace access panel before using 550A.

2-2. THERMAL CONVERTER PRECAUTIONS

a. Do not operate any A55 thermal converter at a voltage higher than the rated value. The reversal error may change if the converters are operated at more than their rated value and they will burn out at approximately 100% overload.

b. Do not perform any switching of either voltage level or frequency range with the converter in the circuit unless the switching transient voltage is known to be less than the rated value of the converter.

c. To prolong the life of the batteries, always set BATTERY switch to OFF when the 550A is not in use.

2-3. CONTROLS AND TERMINALS

Before attempting to use the 550A, the operator should read and understand the following discussion of controls and terminals:

a. DC input terminals (J1 and J2). The DC input voltage is applied to these terminals. The terminals are general purpose binding posts mounted on 3/4 inch centers. The DC supply must be floating.

b. THERMAL CONVERTER INPUT terminals (J3, J4, and J5). DC voltage measuring equipment is connected to the THERMAL CONVERTER INPUT binding posts to accurately determine the DC voltage available at the THERMAL CONVERTER INPUT coaxial connector. The thermal converter input is connected to this coaxial connector.

c. THERMAL CONVERTER OUTPUT terminal (J7). The thermal converter output is connected to this terminal with the supplied shielded cable.

d. POLARITY switch (S1). This DPDT toggle switch reverses the polarity of the DC voltage supplied to THERMAL CONVERTER INPUT terminals. Due to the fast action of this switch, the galvanometer need not be disconnected while switching.

e. TO GALVANOMETER terminal (J6). The galvanometer is connected to this terminal with the supplied shielded cable. This places the galvanometer in the circuit between the thermal converter output and the variable reference potential. The galvanometer is used to establish a reference point for comparison of the AC and DC inputs to the thermal converter.

f. BATTERY switch (S2). This toggle switch closes the voltage divider circuit across the series connection of batteries B1 and B2. This switch should always be left in the off position when the 550A is not in use.

g. SENSITIVITY controls (SEARCH - R1A and R1B, LOW - R2A and R2B, MEDIUM - R3, and HIGH - R5). These variable resistors allow the reference potential to be adjusted so as to balance the thermocouple output at the galvanometer.

h. SENSITIVITY pushbutton switches (SEARCH - S3, LOW - S4, MEDIUM - S5, and HIGH - S6). These switches provide search, low, medium, and high galvanometer sensitivity for nulling the galvanometer with the search, low, medium, and high sensitivity controls respectively.

2-4. CALIBRATING AN AC VOLTAGE

a. Connect equipment as shown in figure 2-3. Make sure DC source is floating. Also, make sure the proper range A55 thermal converter is connected to THERMAL CONVERTER OUTPUT. The thermal converter used must have a rated voltage that is equal to or greater than the RMS value of AC voltage desired.

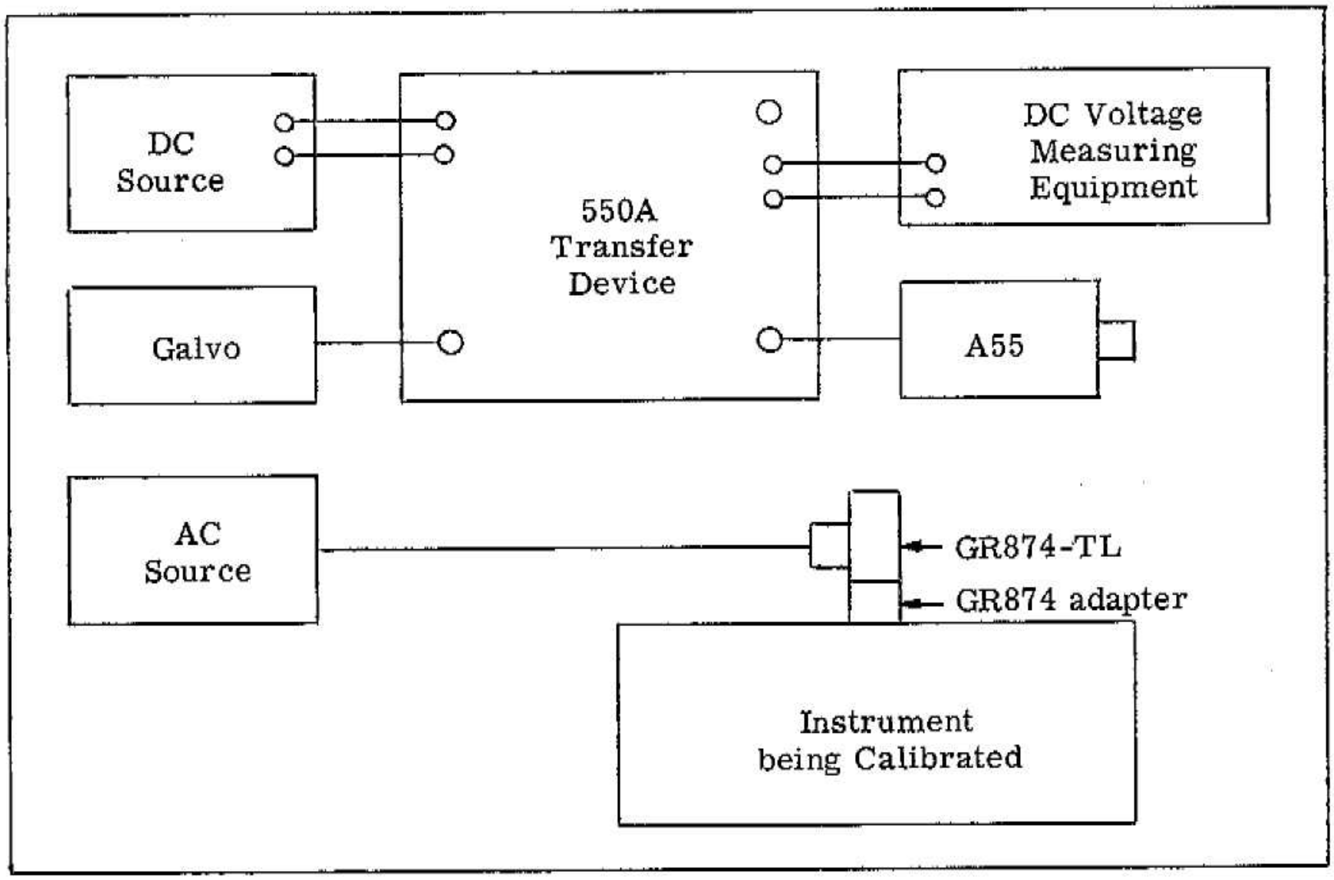


Figure 2-3. VOLTAGE CALIBRATION SETUP DIAGRAM

b. Set BATTERY switch to the on position.

c. Adjust mechanical zero on galvanometer for desired null position.

d. Set POLARITY switch to NORMAL.

e. Adjust the DC source voltage until the DC voltage measuring equipment connected to the THERMAL CONVERTER INPUT binding posts indicates the approximate RMS value of AC voltage desired.

f. Connect thermal converter to THERMAL CONVERTER INPUT coaxial connector.

g. Adjust the DC source voltage until DC voltage measuring equipment indicates the exact RMS value of AC voltage desired.

h. If the AC to DC differences from the certified test report are used, adjust the DC source voltage until DC voltage measuring equipment indicates $\frac{100}{100 + a_o}$ times the RMS value of the AC voltage desired. a_o is the AC to DC percent difference at the center of the tee for the frequency used. $a_o = \left(\frac{Vac - Vdc}{Vdc}\right)100.$

i. If the input impedance of the instrument being calibrated is not 50 ohms, it may be necessary to correct for the voltage standing wave between the center of the tee and the instrument being calibrated at frequencies above 5 MC. In this case, adjust the DC source voltage until DC voltage measuring equipment indicates $\frac{100}{100 + a_1}$, times the RMS value of the AC voltage desired. Calculate a_1 from the following equation

$$a_1 = \left[\left(\frac{a_o}{100} + 1\right) \left(\frac{1}{\cos \beta s - R_o B_1 \sin \beta s + j R_o G_1 \sin \beta s}\right) - 1 \right] 100$$

where $a_1 = \left(\frac{Eac - Edc}{Edc}\right) 100 =$ AC to DC percent difference at input of instrument being calibrated for the frequency used.

$a_o = \left(\frac{Eac - Edc}{Edc}\right) 100 =$ AC to DC percent difference at center of tee for the frequency used.

$R_o = \sqrt{L/C} =$ characteristic resistance of transmission line.

$\beta = \frac{2\pi}{\lambda} = \omega \sqrt{LC} =$ phase constant of line

$s =$ length from center of tee to instrument

$Y_1 = G_1 + j B_1 =$ input admittance of instrument

j. Null galvanometer as follows:

(1) Depress SEARCH SENSITIVITY pushbutton and adjust SEARCH SENSITIVITY control for a null.

(2) Depress LOW SENSITIVITY pushbutton and adjust LOW SENSITIVITY control for a null.

(3) Depress MEDIUM SENSITIVITY pushbutton and adjust MEDIUM SENSITIVITY control for a null.

(4) Depress and lock (turn CW) HIGH SENSITIVITY pushbutton and adjust HIGH SENSITIVITY control for a null.

k. Check for DC reversal error as follows:

(1) Set POLARITY switch to REVERSE.

(2) If galvanometer moves off null, thermal converter reversal error is present. To compensate for error, reduce off-null deflection by exactly one-half with HIGH SENSITIVITY control.

(3) Set POLARITY switch to NORMAL, and observe if an equal and opposite deflection is obtained. If necessary, repeat adjustment and polarity reversal until equal and opposite deflections are obtained.

l. Unlock (turn CCW) HIGH SENSITIVITY pushbutton.

m. Make sure AC voltage is equal to or less than rated voltage of converter.

n. Remove thermal converter from THERMAL CONVERTER INPUT.

o. Connect thermal converter to GR874-TL tee.

p. Null galvanometer by adjusting magnitude of AC voltage while depressing each SENSITIVITY pushbutton in proper SEARCH, LOW, MEDIUM, and HIGH order. Do not move SENSITIVITY controls. The RMS value of AC voltage now equals the desired value.

q. Set BATTERY switch to OFF.

2-5. MEASURING AN UNKNOWN AC VOLTAGE

a. Connect equipment as shown in figure 2-4. Make sure DC source is floating. Also make sure proper range A55 thermal converter is connected to THERMAL CONVERTER OUTPUT. If approximate value of AC is unknown, measure AC with a high frequency voltmeter. Always use a thermal converter whose rated voltage is equal to or greater than the RMS value of AC voltage to be measured.

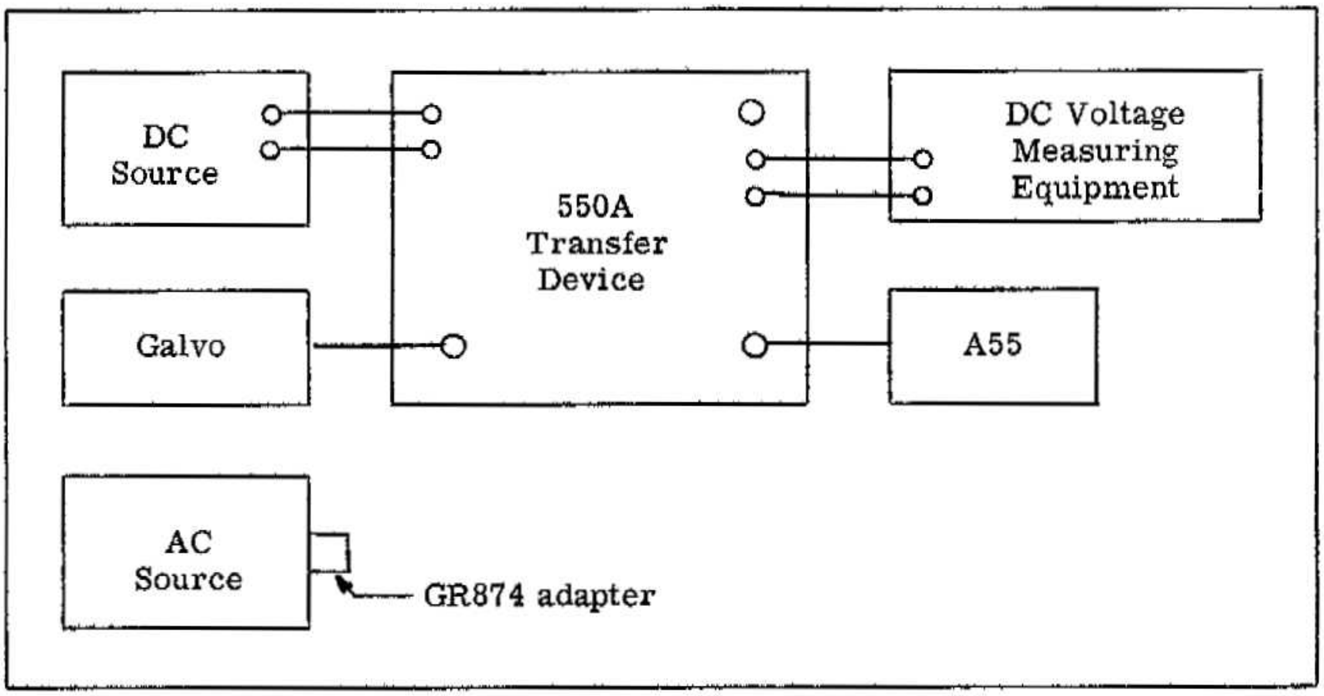


Figure 2-4. VOLTAGE MEASURING SETUP DIAGRAM.

b. Set BATTERY switch to the on position.

c. Adjust output voltage of DC source to a voltage less than rated voltage of converter.

d. Adjust mechanical zero on galvanometer for desired null position.

e. Set POLARITY switch to NORMAL.

f. Connect thermal converter to GR874 adaptor.

g. Null galvanometer as in step j. of paragraph 2-4.

h. Unlock (turn CCW) HIGH SENSITIVITY pushbutton.

i. Remove thermal converter from adaptor.

j. Connect thermal converter to THERMAL CONVERTER INPUT coaxial connector.

k. Null galvanometer by adjusting DC source voltage with each SENSITIVITY pushbutton depressed in proper SEARCH, LOW, MEDIUM, and HIGH order. Do not move SENSITIVITY controls.

l. Depress HIGH SENSITIVITY pushbutton and check for reversal error as in step k. of paragraph 2-4, except adjust galvanometer by varying magnitude of DC voltage instead of varying HIGH SENSITIVITY control. Do not move SENSITIVITY controls. Adjusted magnitude of DC voltage measured at THERMAL CONVERTER INPUT binding posts is now equal to RMS value of AC at output of AC source.

m. Since the thermal converters are calibrated at the center of a GR874-TL tee and the tee is not used for this measurement, a correction must be made for the voltage standing wave that would occur between the center of the tee and the plane of the insulating bead at the input to the converter. Another voltage standing wave correction must be made if anything, such as a GR874 adaptor, is connected between the AC source and the thermal converter input. The equation given here corrects for these standing waves and for any calibration error. Below five megacycles, the voltage standing wave errors are usually insignificant. Calculate E_{ac} (the RMS value of AC at output connector of AC source) from the following equation:

$$E_{ac} = \left(\frac{a_3}{100} + 1\right) Edc$$

where Edc = voltage indicated by DC voltage measuring equipment

$$a_3 = \left(\frac{Eac-Edc}{Edc}\right)100$$ = AC to DC percent difference at output connector of AC source for frequency used.

calculate a_3 from the following equation:

$$a_3 = \left[A\left(\frac{a_o}{100} + 1\right) (\cos\beta s - R_oB_2 \sin\beta s + j\, R_oG_2 \sin\beta s) - 1 \right] 100$$

where $A = \frac{E_2}{E_o}$ = ratio of AC voltage at the plane of the insulating bead on input of converter to AC voltage at center of tee. Obtain from figure 2-5.

$a_o = (\frac{Eac-Edc}{Edc})100$ = AC to DC percent difference at center of tee for the frequency used.

$R_o = \sqrt{L/C}$ = characteristic resistance of transmission line.

$\beta = \frac{2\pi}{\lambda} = \sqrt{LC}$ = phase constant of line.

s = length of line from thermal converter to AC source.

$Y_2 = G_2 + j\, B_2$ = input admittance of thermal converter. Obtained from figure 2-6.

n. Set battery switch to OFF.

	CONVERTER RANGE								
FREQ.	0.5V	1V	2V	3V	5V	10V	20V	30V	50V
1 MC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3 MC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5 MC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0001	1.0001	1.0001	1.0001
10 MC	1.0000	1.0001	1.0001	1.0001	1.0001	1.0002	1.0002	1.0002	1.0002
20 MC	0.9999	1.0003	1.0004	1.0005	1.0005	1.0009	1.0009	1.0009	1.0009
30 MC	0.9997	1.0007	1.0009	1.0011	1.0011	1.0019	1.0020	1.0020	1.0020
50 MC	0.9991	1.0020	1.0024	1.0030	1.0030	1.0054	1.0057	1.0056	1.0055

NOTE: The above typical values of A are believed to be accurate to ±0.0001 at 10 megacycles, ±0.0002 at 20 megacycles, ±0.0005 at 30 megacycles, and ±0.0010 at 50 megacycles for the various converters.

Figure 2-5. TYPICAL VALUES OF "A".

	FREQUENCY						
CONVERTER RANGE	1 MC	3 MC	5 MC	10 MC	20 MC	30 MC	50 MC
0.5 V	10.9-j0.0124	10.9-j0.0429	10.9-j0.0732	10.9-j0.148	10.9-j0.295	10.9-j0.444	10.9-j0.720
1 V	4.98+j0.0131	4.98+j0.0297	4.98+j0.0472	4.98+j0.0926	4.98+j0.185	4.98+j0.275	4.98+j0.449
2 V	2.52+j0.0162	2.52+j0.0395	2.52+j0.0634	2.52+j0.125	2.52+j0.249	2.52+j0.372	2.52+j0.627
3 V	1.67+j0.0210	1.67+j0.0545	1.67+j0.0883	1.67+j0.175	1.67+j0.349	1.67+j0.520	1.68+j0.860
5 V	1.02+j0.0206	1.02+j0.0540	1.02+j0.0875	1.02+j0.173	1.02+j0.346	1.03+j0.515	1.03+j0.863
10 V	0.500+j0.0415	0.500+j0.117	0.500+j0.192	0.500+j0.382	0.503+j0.763	0.505+j1.14	0.511+j1.91
20 V	0.236+j0.0446	0.236+j0.126	0.237+j0.207	0.238+j0.413	0.238+j0.823	0.240+j1.23	0.244+j2.07
30 V	0.153+j0.0433	0.153+j0.123	0.154+j0.202	0.154+j0.401	0.154+j0.801	0.157+j1.19	0.160+j2.01
50 V	0.0926+j0.0433	0.0926+j0.120	0.0926+j0.198	0.0934+j0.394	0.0939+j0.786	0.0961+j1.17	0.1000+j1.97

NOTE: The above typical values of converter admittance ($Y_2 = G_2 + jB_2$) are in millimhos as measured at the plane of the input connector insulating bead.

Figure 2-6. TYPICAL VALUES OF CONVERTER ADMITTANCE.

2-6. MEASURING FREQUENCY RESPONSE OF VOLTAGE INDICATING INSTRUMENTS

a. Connect equipment as shown in figure 2-7. Make sure proper range A55 thermal converter is connected to THERMAL CONVERTER OUTPUT. The thermal converter used must have a rated voltage that is equal to or greater than the RMS value of AC voltage desired.

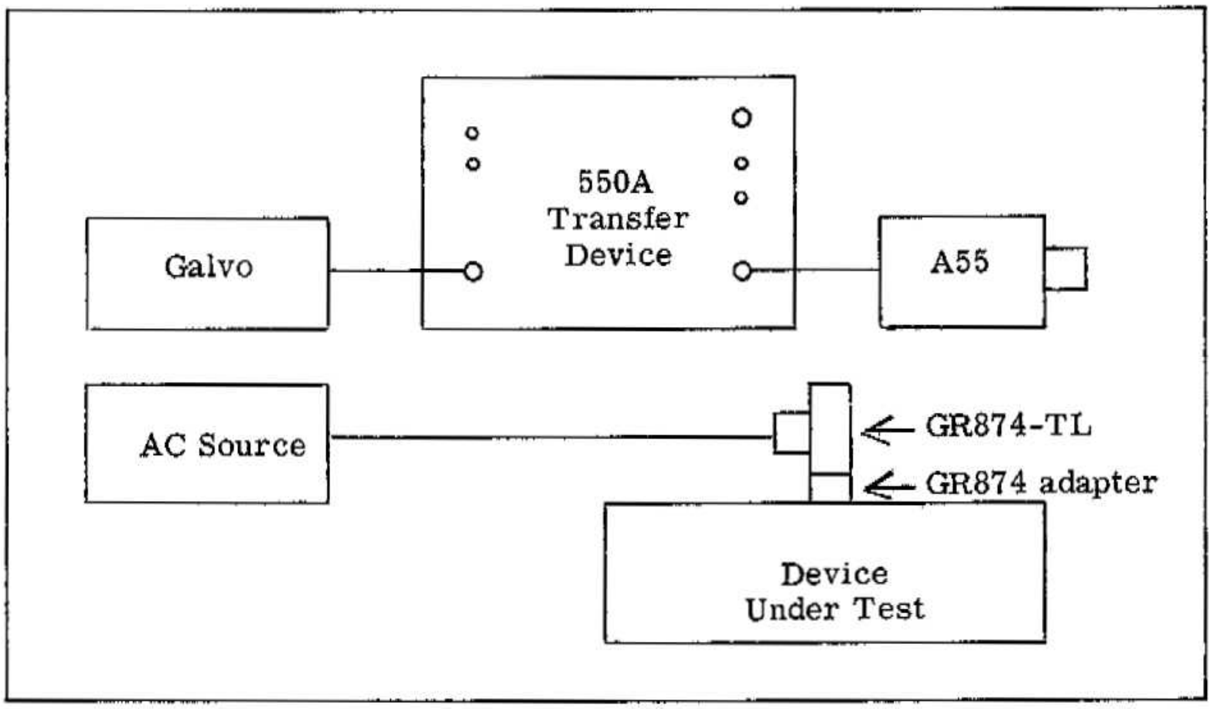


Figure 2-7. FREQUENCY RESPONSE SETUP DIAGRAM FOR VOLTAGE INDICATING INSTRUMENTS.

b. Set BATTERY switch to the on position.
c. Adjust AC source to approximate desired level.
d. Adjust mechanical zero on galvanometer for desired null position.
e. Connect thermal converter to GR874-TL tee.
f. Null galvanometer as follows:

(1) Depress SEARCH SENSITIVITY pushbutton and adjust SEARCH SENSITIVITY control for a null. If 1%/mm to 6%/mm resolution is desired, proceed to step g.

(2) Depress LOW SENSITIVITY pushbutton and adjust LOW SENSITIVITY control for a null. If 0.1%/mm to 0.6%/mm resolution is desired, proceed to step g.

(3) Depress MEDIUM SENSITIVITY pushbutton and adjust MEDIUM SENSITIVITY control for a null. If 0.01%/mm to 0.06%/mm resolution is desired, proceed to step g.

(4) Depress HIGH SENSITIVITY pushbutton and adjust HIGH SENSITIVITY control for a null. Resolution is approximately 0.001%/mm to 0.006%/mm.

CAUTION

Do not perform any switching of either voltage level or frequency range with the thermal converter in the circuit unless the switching transient is known to be less than the rated value of the converter.

g. While depressing desired SENSITIVITY pushbutton, change frequency of AC source and hold galvanometer on null with AC amplitude control.

h. Record changes in voltage level, as indicated by device under test, at frequencies desired.

i. If greater accuracy is desired, follow procedure for calibrating and AC voltage (Paragraph 2-4) at each frequency desired.

j. Set BATTERY switch to OFF.

2-7. MEASURING FREQUENCY RESPONSE OF AN AC AMPLIFIER

a. Connect equipment as shown in figure 2-8. Make sure DC source is floating. Also make sure the proper range A55 thermal converters are used. The thermal converters used must have a rated voltage that is equal to or greater than the RMS value of AC voltage they are to handle.

b. Adjust AC source to approximate desired level.

c. Adjust DC source voltage to a value less than rated voltage of converter 2.

d. Adjust mechanical zero on each galvanometer for desired null position.

e. Connect converter 1 to GR874-TL tee and converter 2 to AC amplifier output.

f. Null both galvanometers as follows:

(1) Depress SEARCH SENSITIVITY pushbutton and adjust SEARCH SENSITIVITY control for a null. If 1%/mm to 6%/mm resolution is desired, proceed to step g.

(2) Depress LOW SENSITIVITY pushbutton and adjust LOW SENSITIVITY control for a null. If 0.1%/mm to 0.6%/mm resolution is desired, proceed to step g.

(3) Depress MEDIUM SENSITIVITY pushbutton and adjust MEDIUM SENSITIVITY control for a null. If 0.01%/mm to 0.06%/mm resolution is desired, proceed to step g.

(4) Depress HIGH SENSITIVITY pushbutton and adjust HIGH SENSITIVITY control for a null. Resolution is approximately 0.001%/mm to 0.006%/mm.

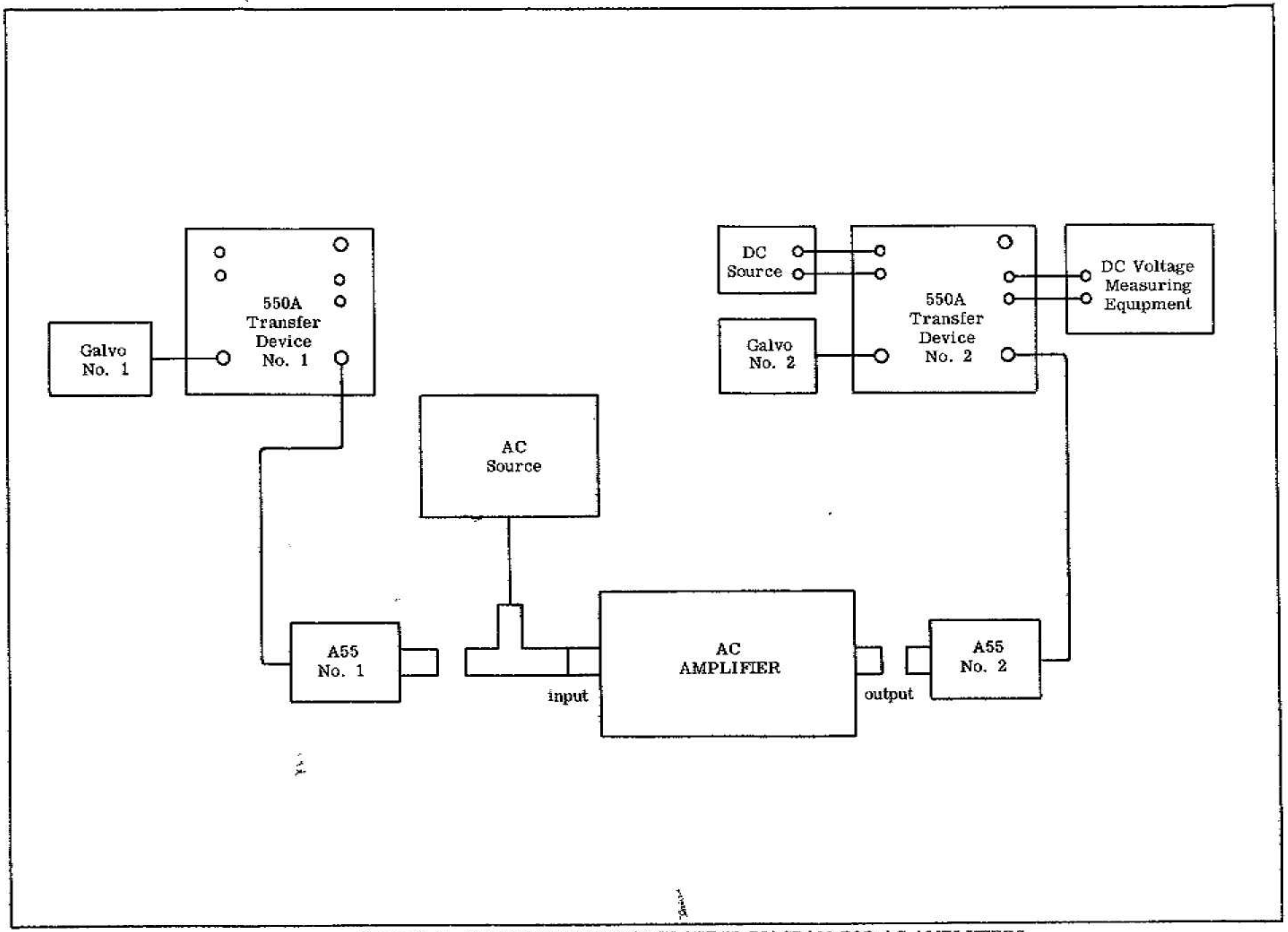


Figure 2-8. FREQUENCY RESPONSE SETUP DIAGRAM FOR AC AMPLIFIERS

CAUTION

Do not perform any switching of either voltage level or frequency range with the thermal converter in the circuit unless the switching transient is known to be less than the rated value of the converter.

g. While depressing desired SENSITIVITY pushbutton on transfer device 1, change frequency of AC source and hold galvanometer 1 on null with AC amplitude control.

h. Note variation of output of converter 2 as indicated by the galvanometer as frequency is changed.

i. The deflection of the galvanometer may be calibrated in per cent as follows:

(1) Remove thermal converter 2 from amplifier output.

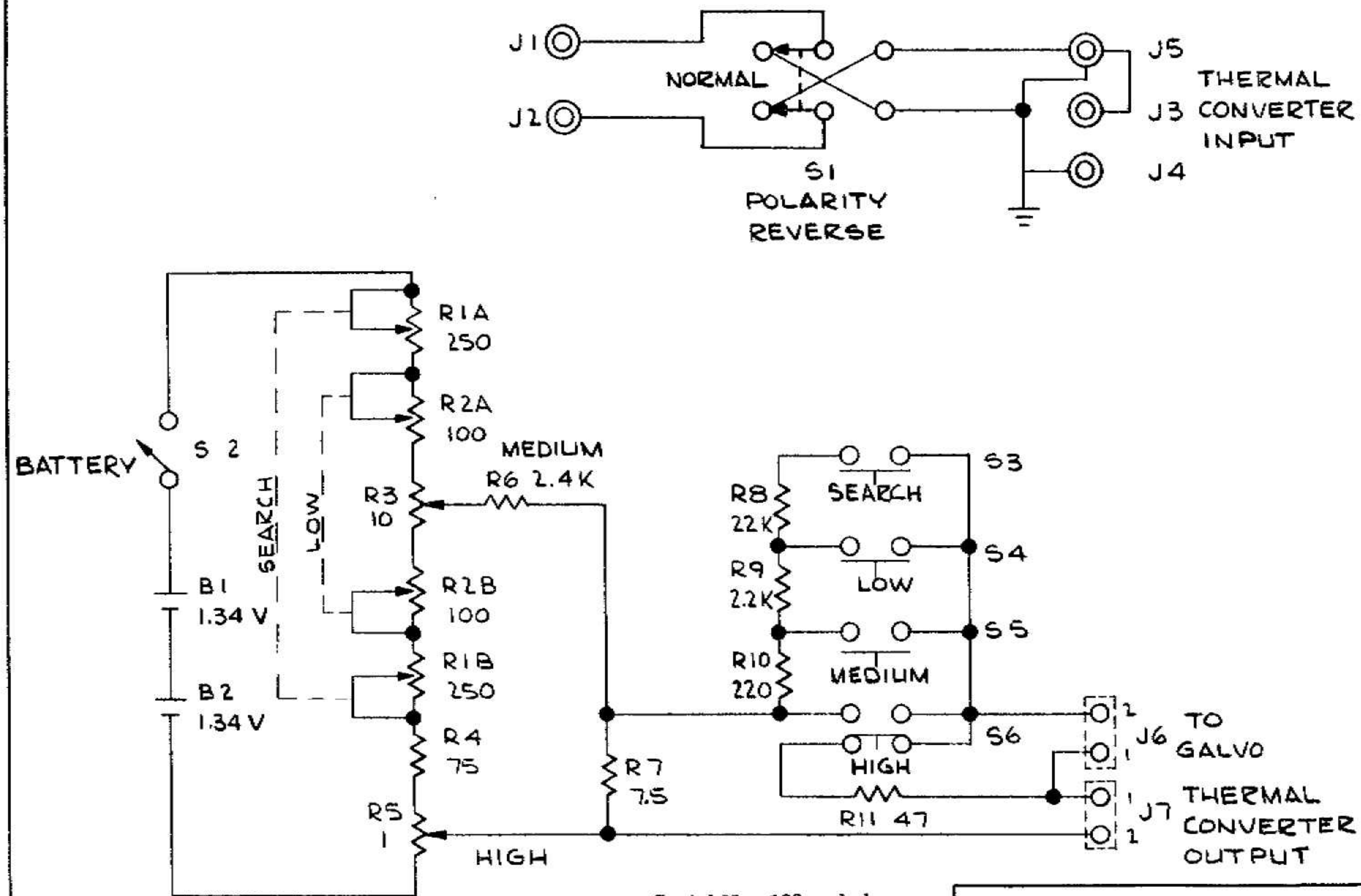
(2) Connect thermal converter 2 to THERMAL CONVERTER INPUT coaxial connector.

(3) Null galvanometer as in step j. of paragraph 2-4.

(4) Change DC source by an appropriate amount and note galvanometer deflection.

j. For greater accuracy at each frequency desired, follow the procedure described in paragraph 2-4 for adjusting the AC amplifier input voltage and the procedure described in paragraph 2-5 for measuring the AC amplifier output voltage.

k. Set BATTERY switch to OFF.



Serial No. 123 and above

Functional Schematic

MODEL 550A

THERMAL TRANSFER STANDARD