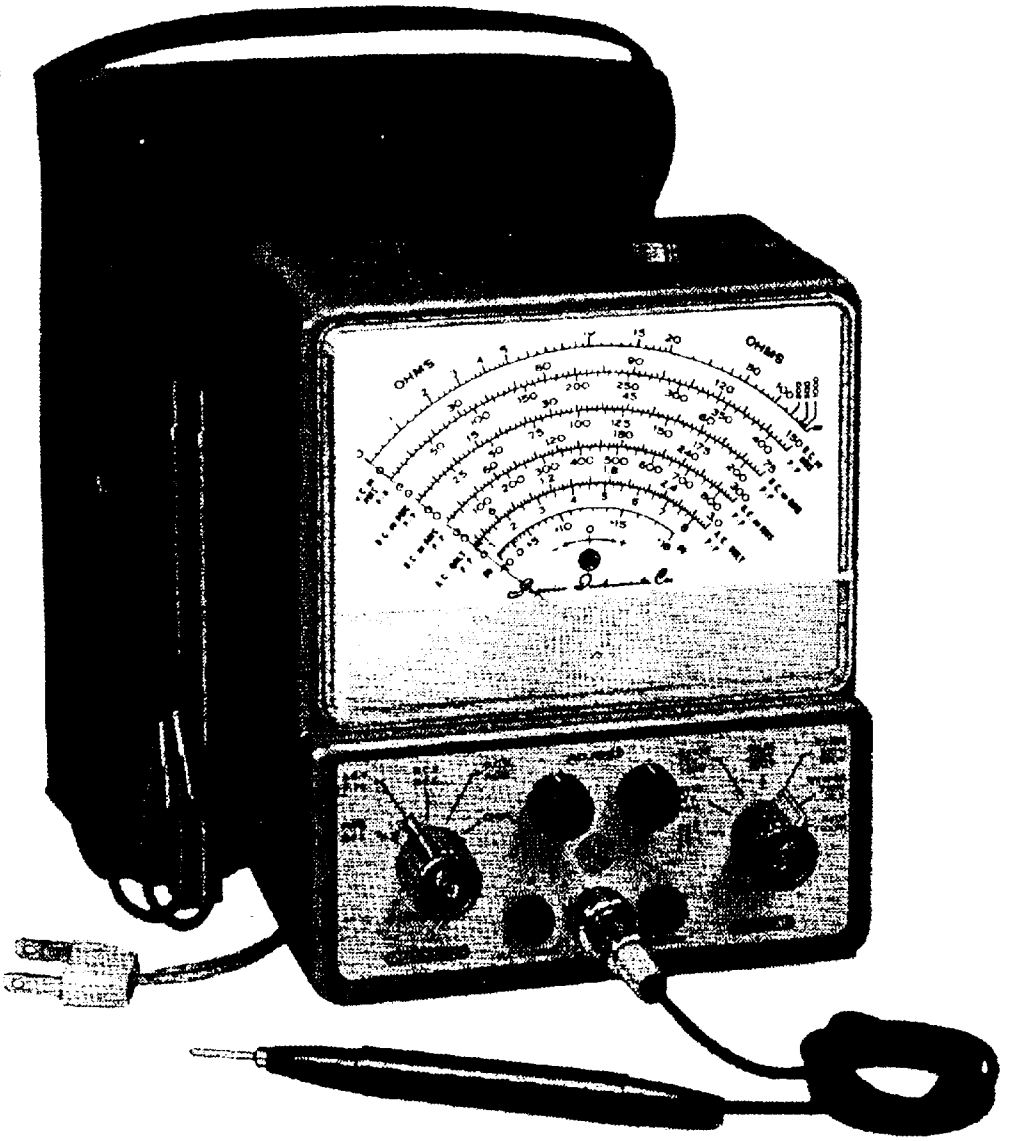
OPERATING INSTRUCTIONS FOR P391

MODEL 77

VACUUM TUBE VOLTMETER



MANUFACTURED BY

SUPERIOR INSTRUMENTS CO.
2435-41 WHITE PLAINS ROAD NEW YORK 67, N.Y

THE MODEL 77 PROVIDES THE FOLLOWING SERVICES:

DC VOLTS (at 11 megohms input resistance): 0 to 3/15/75/150/300/750/1500 volts

AC VOLTS (RMS): 0 to 3/15/75/150/300/750/1500 volts

AC VOLTS (peak to peak): 0 to 8/40/200/400/800/2000 volts

RESISTANCE: 0 to 1000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms

DECIBELS (Based on 0 db = 1.73 v on 500 ohms line): −10 db to +18 db, +10 db to +38 db, +30 db to +58 db

DC VOLTS (Zero center): 0 to 1½/7½/37½/75/150/375/750 volts

TEST LEADS

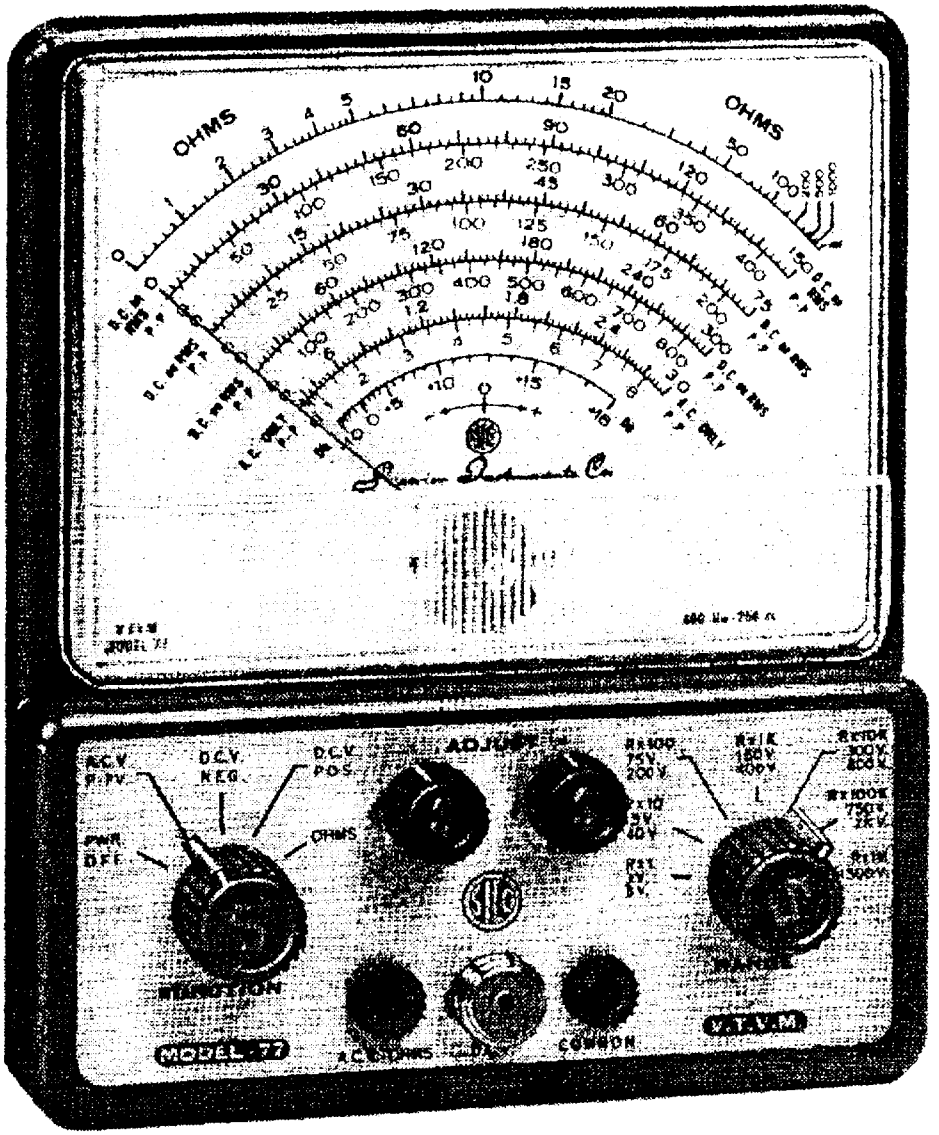
3 TEST LEADS ARE FURNISHED WITH THE MODEL 77

STANDARD BLACK TEST LEAD — used for ALL measurements.

STANDARD RED TEST LEAD — used in conjunction with Black standard test lead when making A.C. voltage and resistance measurements.

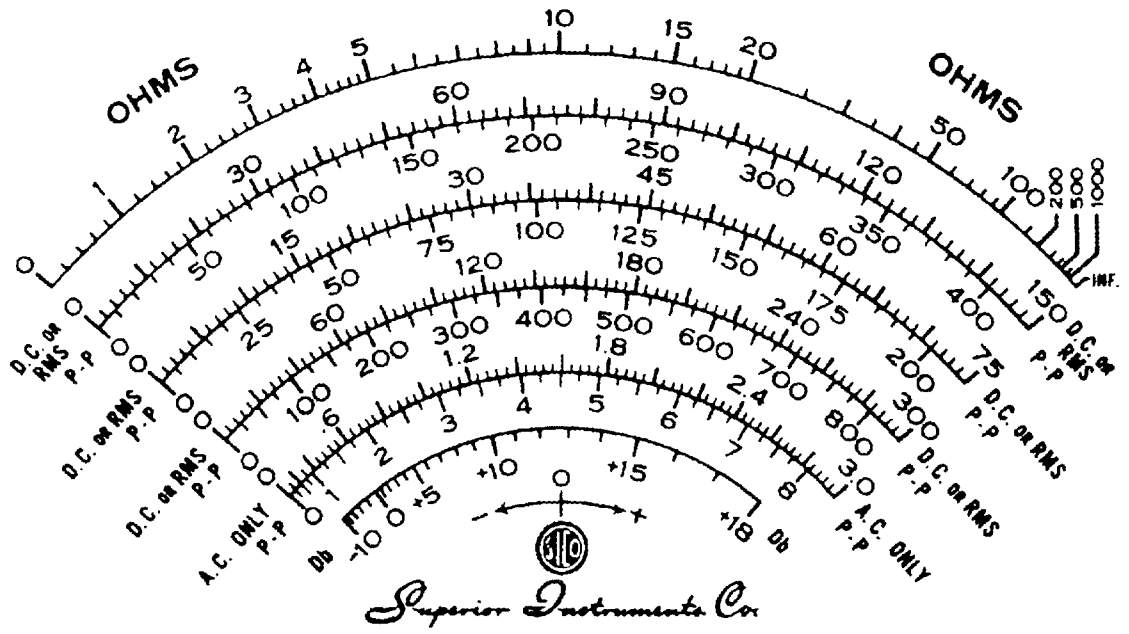
D.C. VOLTAGE PROBE — used in conjunction with Black standard test lead when measuring D.C. voltage only.

MODEL 77 PANEL LAYOUT



DESCRIPTION	LOCATION	USE
METER	Upper part of instrument	Indicator
METER CORRECTOR	Lower center of meter	Adjust meter to read zero (with power off)
RANGE SWITCH	Right on panel	Indicates range in use
FUNCTION SWITCH	Left on panel	Indicates function in use
OHMS ADJUST CONTROL	Left top of panel	Adjust meter to full scale on res. ranges
BALANCE ADJUSTER	Right top of panel	Adjust meter for zero reading
RED TIP JACK	Lower left center of panel	AC Volts and resistance measurements
DC VOLTS CONNECTOR	Lower center of panel	DC Volts measurements
BLACK TIP JACK	Lower right center of panel	"Common" for all ranges

MODEL 77 METER SCALES



The Model 77 meter face contains the 7 main calibrated scales that are used for all measurements. Four of the scales are dual scales printed in black and red.

RESISTANCE SCALE

The top-most meter scale, printed in black, is used for all resistance measurements.
Each division, between the 0 and 5 ohm points, represents .2 ohms.
Each division, between the 5 ohm and 10 ohm points, represents .5 ohms.
Each division, between the 10 ohm and 20 ohm points, represents 1 ohm.
Each division, between the 20 ohm and 50 ohm points, represents 5 ohms.
Each division, between the 50 ohm and 100 ohm points, represents 10 ohms.
Each division, between the 100 and 200 ohm points, represents 50 ohms.
Each division, between the 200 ohm and 500 ohm points, represents 100 ohms.
The division, between the 500 ohm and 1,000 ohm represents 750 ohms.

All divisions of the resistance scale are multiplied by the factor indicated on the range switch. Thus, if the range switch is on the R X 1 position, all readings are read directly as indicated. If the range switch is in the R X 1K position, the reading is multiplied by 1000 (a further explanation is given on page 10).

VOLTAGE SCALES

The black 0-75, 0-150, and 0-300 scales are used for all AC and DC voltage ranges.
For the DC 0-3 volt range use the 300 scale and divide by 100.
Each major division is .2 volts. Each minor division is .04 volts.
For the AC 0-3 volt range, use the special 3 volt AC scale.
Each major division is .2 volts. Each minor division is .04 volts.
For the 0-15 AC and DC volt ranges — use the 0-150 scale and divide by 10.
Each major division is 1 volt. Each minor division is .2 volts.
For the 0-75 volt AC and DC ranges — use the 0-75 scale and read directly.
Each major division is 5 volts. Each minor division is 1 volt.

MODEL 77 METER SCALES (continued)

For the 0-150 volt AC and DC ranges — use the 0-150 scale and read directly.
Each major division is 10 volts. Each minor division is 2 volts.
For the 0-300 volt AC and DC ranges — use the 0-300 scale and read directly.
Each major division is 20 volts. Each minor division is 4 volts.
For the 0-750 volt AC and DC ranges — use the 0-75 scale and multiply by 10.
Each major division is 50 volts. Each minor division is 10 volts.
For the 1,500 volt AC and DC ranges — use the 0-150 scale and multiply by 10.
Each major division is 100 volts. Each minor division is 20 volts.

PEAK TO PEAK SCALES

The red calibrations, directly below the black voltage scales, are the peak to peak AC voltage scales. For an explanation of RMS and peak to peak voltages, see page 16.

For the 0-8 volt peak to peak range
use the 0-8 volt scale and read directly
Each Major division is .5 volts
Each Minor division is .25 volts
For the 0-40 volt peak to peak range
use the 0-400 scale and divide by 10
Each Major division is 5 volts
Each Minor division is 1 volt
For the 0-200 volt peak to peak range
use the 0-200 scale and read directly
Each Major division is 25 volts
Each Minor division is 5 volts
For the 0-400 volt peak to peak range
use the 0-400 scale and read directly
Each Major division is 50 volts
Each Minor division is 10 volts
For the 0-800 volt peak to peak range
use the 0-800 scale and read directly
Each Major division is 50 volts
Each Minor division is 25 volts
For the 0-2000 volt peak to peak range
use the 0-200 scale and multiply by 10
Each Major division is 250 volts
Each Minor division is 50 volts

DECIBEL SCALES

Directly below the voltage scales is the logarithmic decibel scale which is used for all db measurements.
Each division between −10db and zero db is −2db.
Each division between 0db and +18db is +1db.
The basic db scale is used directly with the 0-15 volt AC range.
When used with the 0-150 volt AC range, +20db is added to all the calibration points.
When used with the 0-1500 volt AC range, +40db is added to all the calibration points.

ZERO CENTER METER SCALE

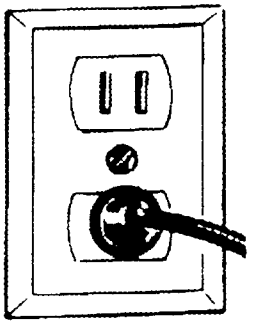
Directly below the decibel scale is the zero center meter scale. This scale consists of a zero mark at the electrial center of the meter and directional marks to indicate direction of positive and negative voltages.

To use the zero center function of the instrument, the instrument "function" switch must be in the DCV-pos. position and the "balance" adjust knob has to be so set as to bring the meter pointer to the zero center mark. To read voltages using the zero center feature, see page 14.

TO MEASURE DC VOLTS

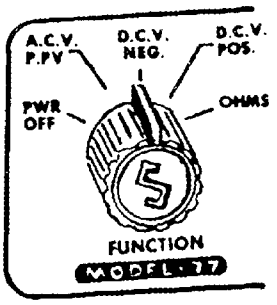
The Model 77 provides the following DC Voltage ranges: 0-3/15/75/150/300/750/1,500 volts.

1



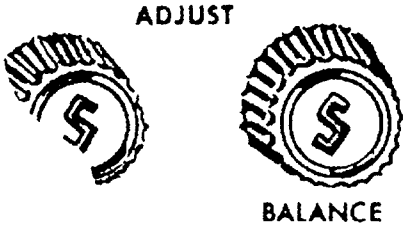
Insert the line cord into a 110-120 volt 60 cycle power source.

2



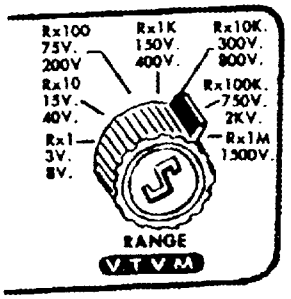
Put the instrument "on" by turning the function switch to either the "positive volts" or "negative volts" position.

3



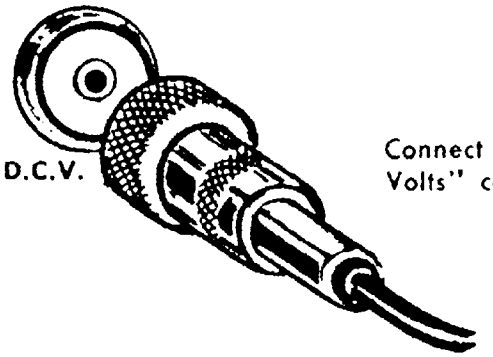
Balance the meter (adjust the meter to read zero volts) by means of the "Balance" adjust control.

4



Set the "range" selector switch to the range desired. When in doubt use the highest range.

5



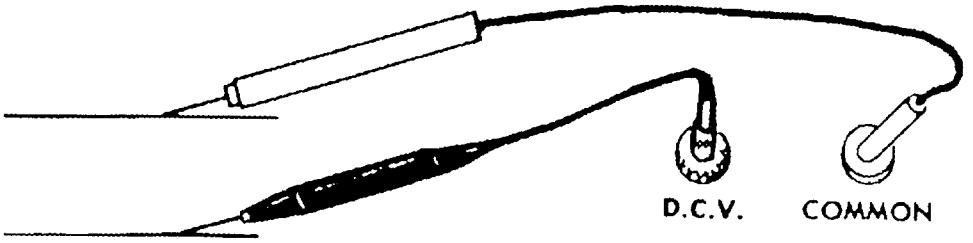
Connect the "DC Volts" lead to the "DC Volts" connector.

6

Insert one regular test-lead into the Black tip jack.

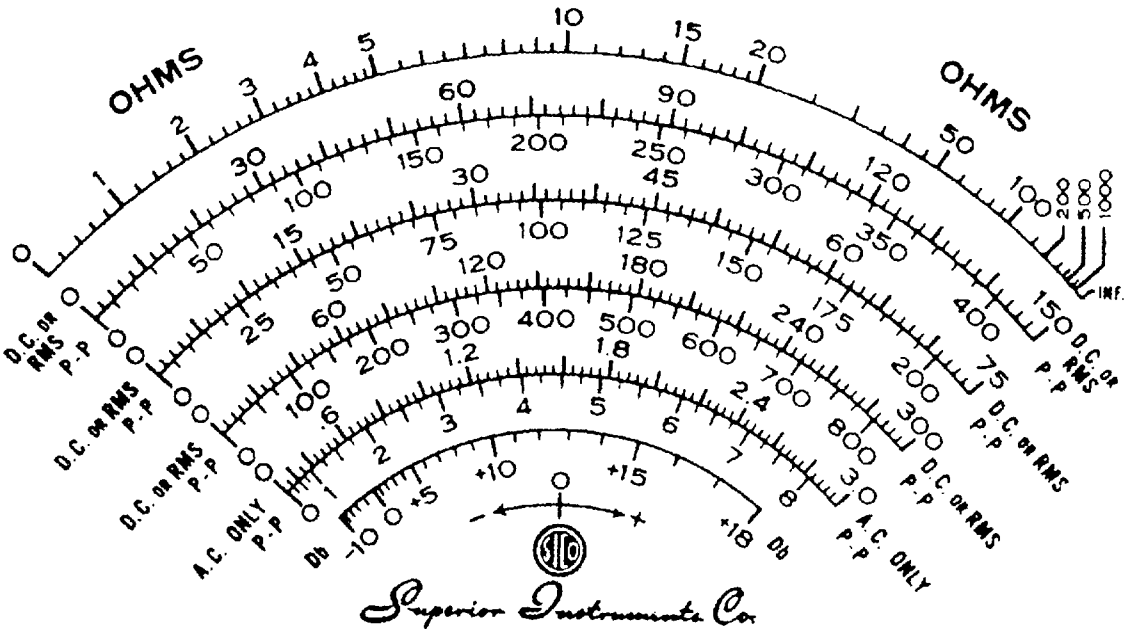
TO MEASURE DC VOLTS
(continued)

7



Connect the test-leads across the voltage to be measured.

8



Read the voltage directly from the meter scale.

For extreme accuracy, it is advised that the Model 77 be allowed at least five minutes to warm up before any measurement be made.

DC voltages are read using the black voltage scales.

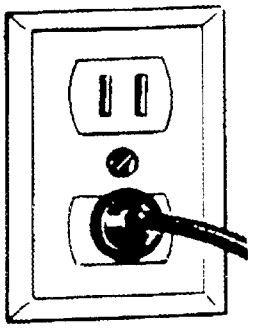
For the 3 volt range — use the 300 scale and divide by 100.
For the 15 volt range — use the 150 scale and divide by 10.
For the 75 volt range — use the 75 scale and read directly.
For the 150 volt range — use the 150 scale and read directly.
For the 300 volt range — use the 300 scale and read directly.
For the 750 volt range — use the 75 scale and multiply by 10.
For the 1500 volt range — use the 150 scale and multiply by 10.

AC VOLTS – RMS

For explanation of RMS and Peak-to-Peak voltages, see page 16.

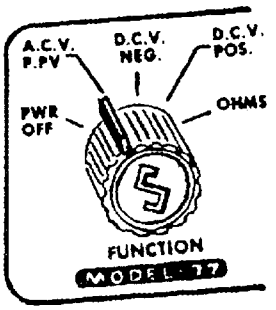
The Model 77 provides the following RMS AC Voltages ranges:
0-3/15/75/150/300/750/1,500 volts.

1



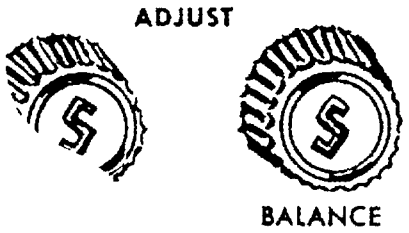
Insert the line cord into a 110-120 volt AC power source.

2



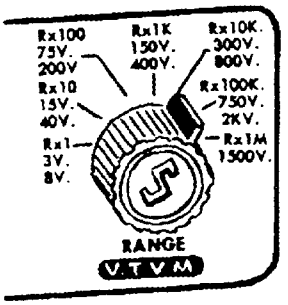
Put the instrument "on" by turning the function switch to the "AC Volts" position.

3



Balance the meter (Adjust the meter to read zero volts) by means of the "Balance" adjuster control.

4

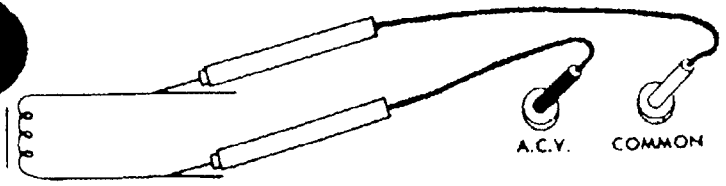


Set the "range" selector switch to the range desired. When in doubt, use the highest range.

5

Insert the test-leads into the "AC volts" and "common" tip jacks.

6



Connect the test-leads across the voltage to be measured.

7

RMS voltages are read from the *black* scales.

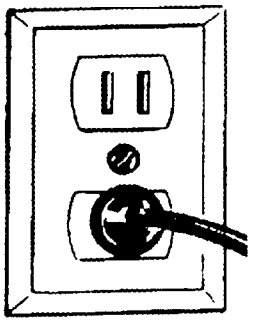
For the 3 volt range — use the special 3 volt scale.
For the 15 volt range — use the 150 scale and divide by 10.
For the 75 volt range — use the 75 scale.
For the 150 volt range — use the 150 scale.
For the 300 volt range — use the 300 scale.
For the 750 volt range — use the 75 scale and multiply by 10.
For the 1500 volt range — use the 150 scale and multiply by 10.

AC VOLTS – PEAK TO PEAK

For explanation of RMS and Peak to Peak voltages see page 16.

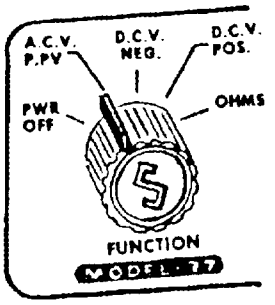
The Model 77 provides the following peak to peak AC voltage ranges: 0-8/40/200/400/800/2000 volts.

1



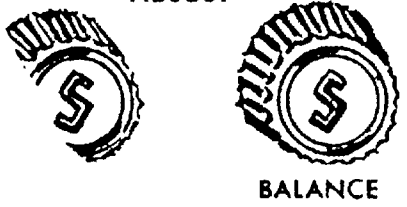
Insert the line cord into a 110-120 volt AC power source.

2



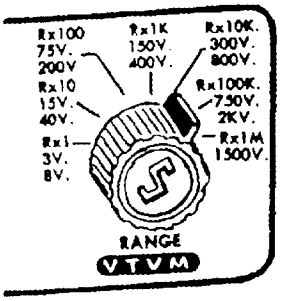
Put the instrument "on" by turning the function switch to the "AC-volts" position.

3



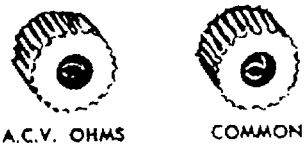
Balance the meter (adjust the meter to read zero volts) by means of the "Balance" adjuster control.

4



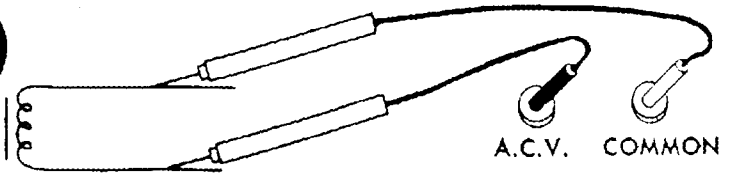
Set the "range" selector switch to the range desired. When in doubt, use the highest range.

5



Insert the test-leads into the "AC Volts" and "common" tip jacks.

6



Connect the test-leads across the voltage to be measured.

7

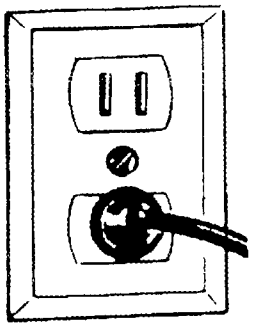
Read the voltage from *red* scales.

For the 0-8 volt range — read the 0-8 volt P-P scale.
For the 40 volt range — read the 0-400 volt P-P scale and divide by 10.
For the 200 volt range — read the 0-200 volt P-P scale.
For the 400 volt range — read the 0-400 volt P-P scale.
For the 800 volt range — read the 0-800 volt P-P scale.
For the 2,000 volt range — read the 0-200 volt P-P scale and multiply by 10.

RESISTANCE

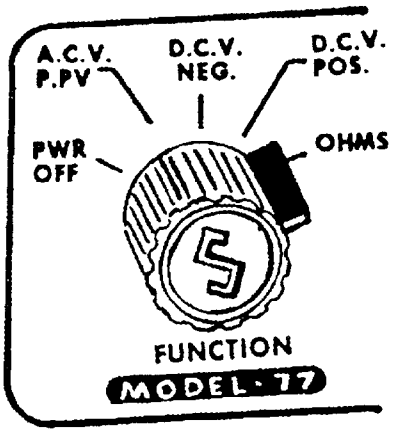
The Model 77 provides seven resistance ranges:
0-1000 ohms/10,000 ohms/100,000 ohms/1 megohm/
10 megohms/100 megohms/1,000 megohms.

1



Insert the line cord into a 110-120 volt 60 cycle power source.

2



Place the instrument "on" by turning the selector switch to the "ohms" position.

3

Allow at least five minutes for the instrument to fully warm up.

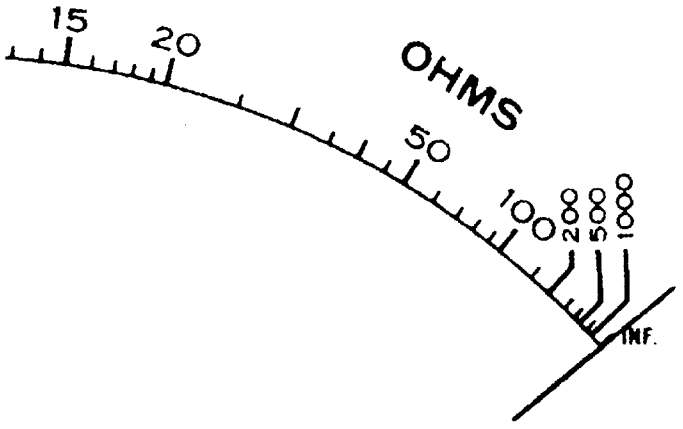
4

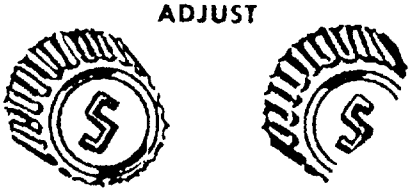
A.C.V. OHMS

COMMON

Insert the test leads into the jacks marked "ohms" and "common".

5

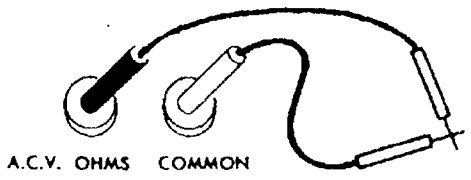


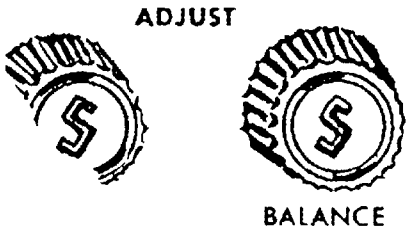


Adjust the meter to read "infinity" (full scale) by means of the "ohms adjust control."

RESISTANCE
(continued)

6



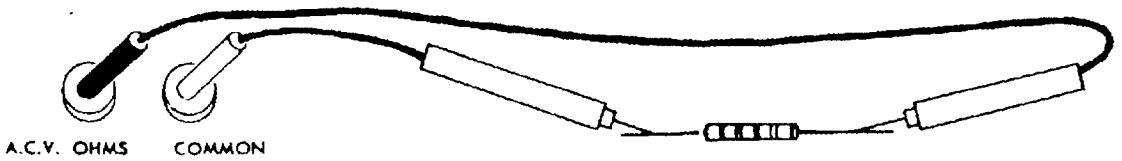


Short the test leads and adjust the meter to read zero by means of the "balance" adjust control.

7

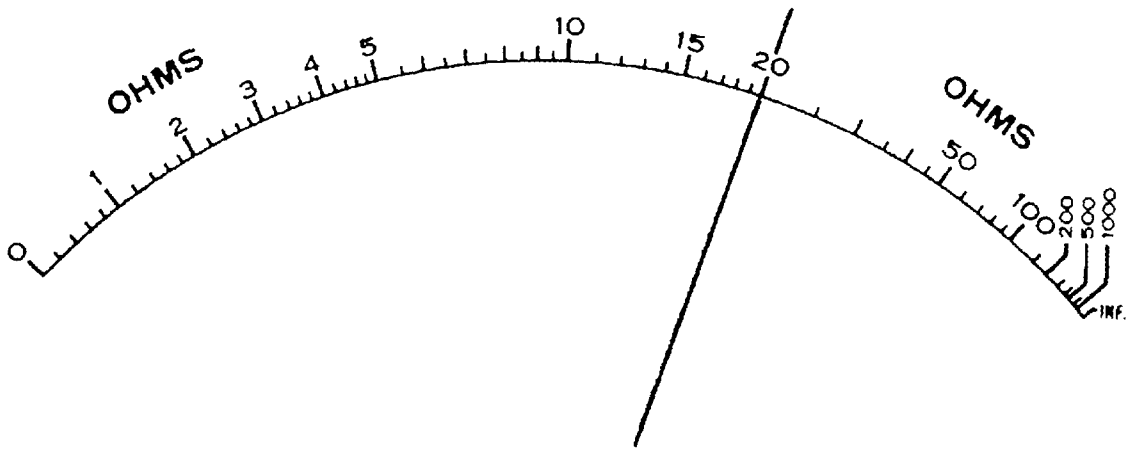
Repeat steps 5 and 6 to insure that the meter reads full scale with the leads open and zero with the leads shorted.

8



Place the test leads across the resistance to be measured.

9

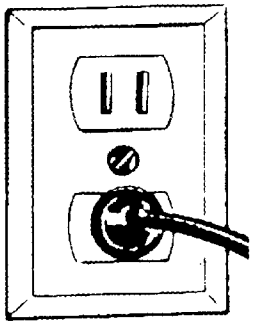


Read the resistance directly from the resistance scale, multiplying the reading by the factor on the range switch.

DECIBELS

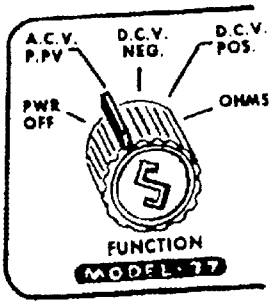
The Model 77 provides three decibel ranges:
−10 db to +18 db, +10 db to +38 db, +30 db to +58 db.
All based on zero db = 1.73 volts (6 milliwatt) on a 500 ohm line.

1



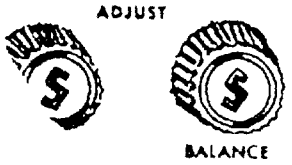
Insert the line cord into a 110-120 volt 60 cycle power source.

2



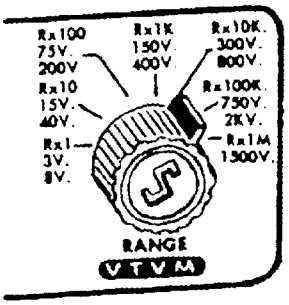
Put the instrument "on" by turning the function switch to the "AC volts" position.

3



Balance the meter (adjust the meter to read zero volts) by means of the "balance" adjuster control.

4

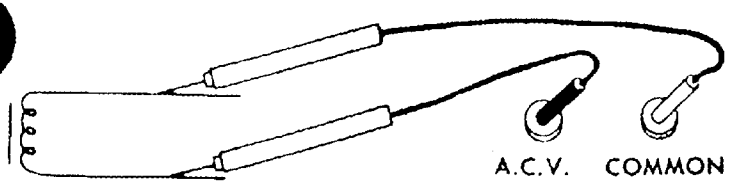


Set the "range" selector switch to the range desired.
For the −10 db to +18 db range — use the 15 volt position.
For the +10 db to +38 db ranage — use the 150 volt position.
For the +30 db to +58 db range — use the 1500 volt position.

5

Insert the test-leads into the "AC volts" and "common" tip jacks.

6



Connect the test-leads across the voltage to be measured.

7

Read the voltage directly from the meter and convert to db by means of the db chart which follows or read the scale and add the following corrections.
For the −10 db to +18 db range — no correction needed.
For the +10 db to +38 db range — add +20 db to the db scale.
For the +30 db to +58 db range — add +40 db to the db scale.

DB CHART

NOTE: The chart holds true only for 500 ohm lines. For any other line, the voltage can be calculated as follows:

$$P = \frac{E^2}{R}$$

P = Power in Watts
E = Voltage
R = Resistance

The table may be extended in any direction by the following formulae:

$$\text{D.B. } +10 = P \times 10$$
$$\text{D.B. } -10 = \frac{P}{10} = \frac{E}{\sqrt{10}} = -E \times \sqrt{10}$$

or

Where P = Watts
E = Volts
$\sqrt{10} = 3.16$

TECHNICAL DB DATA

POWER LEVEL DB	POWER 6 MW AT 0 DB WATTS	VOLTS BASED ON 6 MW AT 0 DB IN 500 OHMS
−10	0.00060	0.5477
− 9	0.00075	0.6145
− 8	0.00095	0.6895
− 7	0.00119	0.7737
− 6	0.00150	0.8681
− 5	0.00189	0.9740
− 4	0.00238	1.0928
− 3	0.00300	1.2262
− 2	0.00378	1.3758
− 1	0.00476	1.5437
0	0.00600	1.7321
1	0.00755	1.9434
2	0.00950	2.1805
3	0.01197	2.4466
4	0.01507	2.7451
5	0.01987	3.0801
6	0.02388	3.4559
7	0.0300	3.8776
8	0.0378	4.3507
9	0.0476	4.8816
10	0.0600	5.4772
11	0.0755	6.1455
12	0.0950	6.8954
13	0.1197	7.7368
14	0.1507	8.6808
15	0.1897	9.7400
16	0.2388	10.9285
17	0.300	12.2620
18	0.37857	13.7582
19	0.47660	15.4369

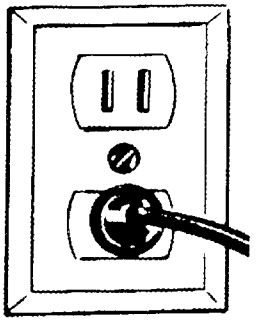
POWER LEVEL DB	POWER 6 MW AT 0 DB WATTS	VOLTS BASED ON 6 MW AT 0 DB IN 500 OHMS
20	0.60000	17.3205
21	0.75535	19.434
22	0.95093	21.805
23	1.19716	24.466
24	1.50713	27.451
25	1.89747	30.801
26	2.38865	34.559
27	3.0071	38.776
28	3.7857	43.507
29	4.7660	48.816
30	6.000	54.772
31	7.5535	61.455
32	9.5093	68.954
33	11.9716	77.368
34	15.0713	86.808
35	18.9747	97.400
36	23.8865	109.285
37	30.071	122.620
38	37.857	137.582
39	47.660	154.369
40	60.000	173.205
41	75.535	194.34
42	95.093	218.05
43	119.716	244.66
44	150.713	274.51
45	189.747	308.01
46	238.865	345.59
47	300.71	387.76
48	378.57	435.07
49	476.60	488.16
50	600.00	547.72

DC VOLTS — ZERO CENTER

A DC Zero center meter is a requirement for all discriminator, ratio-detector and bridge measurements. The Model 77 provides seven zero center ranges: 0 to 1½/7½/37½/75/150/375/750 volts.

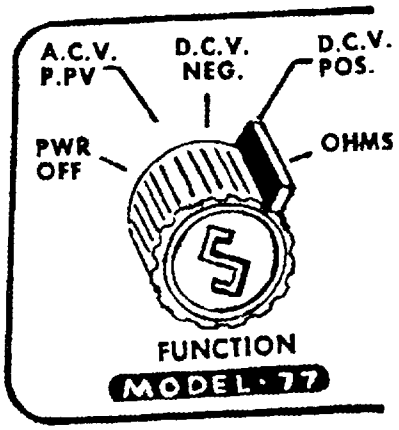
TO USE THE ZERO CENTER RANGES

1



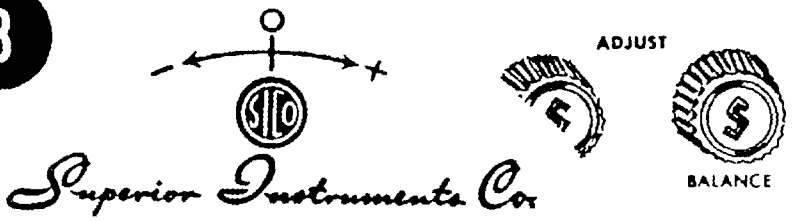
Insert the line cord into a 110-120 volt 60 cycle power source.

2



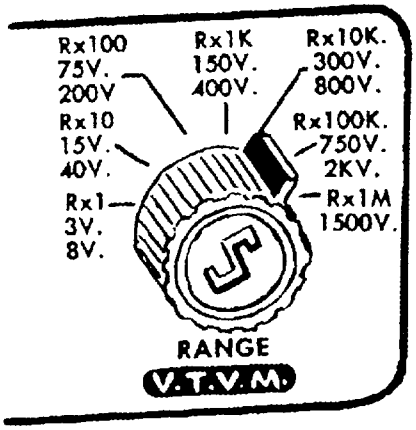
Put the instrument "on" by turning the function switch to the "positive volts" position.

3



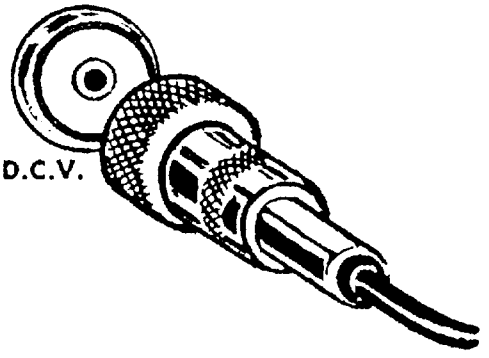
Adjust the meter to the zero mark located directly in the center of the meter by means of the "balance" adjust control.

4



Set the "range" switch to the range desired. Since the meter is already reading at half scale, all ranges will be ½ of the markings appearing on the range switch.

5



Connect the "DC Volts" lead to the DC Volts connector at the lower center of the panel.

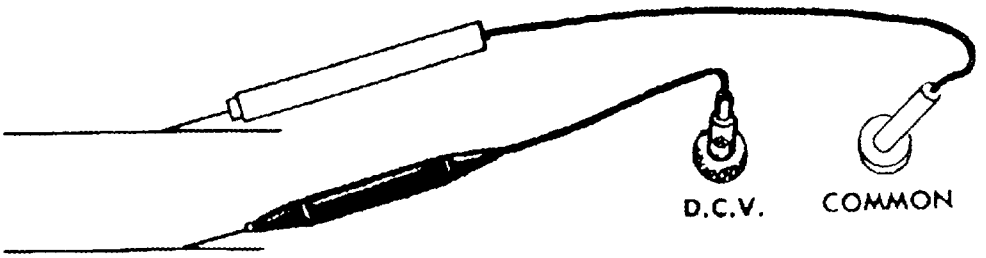
DC VOLTS – ZERO CENTER
(continued)

6

COMMON

Insert the regular test lead into the "common" tip jack.

7



Connect the test leads across the circuit to be measured.

8

Positive voltages will cause the meter to deflect upscale. Negative voltages will cause the meter to read down scale.

It is usually unnecessary to know an exact voltage reading when using a zero-center meter. If it is desirous to know the exact voltage being measured, read the voltage scale corresponding to the position of the range switch and *subtract* ½ of the range switch position.

EXAMPLE: If the meter reads 120 when using the 300 volt position of range switch (which corresponds to the 150 volt zero center scale) then

120 (meter reading)
−150 (½ the range switch setting)

−30 volts

EXAMPLE #2:

Meter reading	260
½ range switch setting of 300	−150
	+110 volts

RMS and PEAK-TO-PEAK MEASUREMENTS

The wave forms encountered in Radio, Television and Hi-fi systems, can take many shapes.

The power that supplies the system is usually a sine wave. The signal that tests the overall response of an amplifier can be a square wave. The signals that trigger the oscillators of a television receiver, are pulses. The television signal itself consists of a complex wave having several square waves superimposed on pulses and having a definite width.

The ordinary AC volt meter reads the RMS value of power line. The peak value of this voltage (if it is a sine wave) is 1.414 times as much as that indicated by the voltmeter. If the voltage were a square wave, the RMS and peak voltages would be the same. The voltage value for a pulse and television signal is dependant upon how fast the signal rises to maximum and how long it remains there before dropping to zero. The negative component of such waves are also important, contributing to a major portion of the signal voltage.

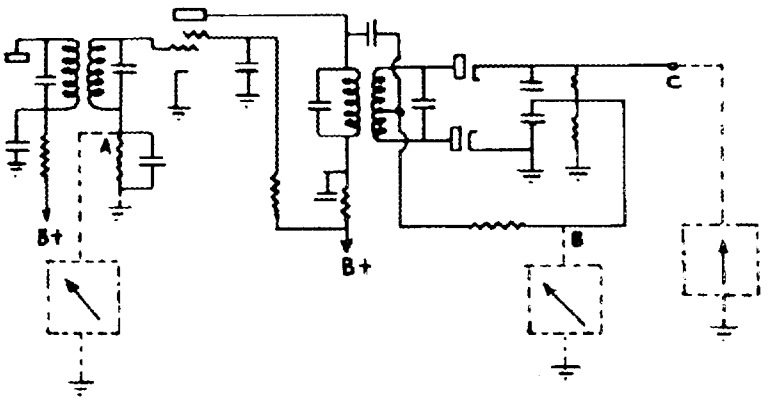
It, therefore, has become common practice to measure symmetrical waveforms such as power voltages in RMS values. Complex waves such as pulses are measured in peak to peak values.

USES OF THE VTVM

Although the V T V M may be used wherever a good volt-ohm milliameter is necessary, it has its main use wherever a zero current meter is needed. The following are some suggested uses of the VTVM.

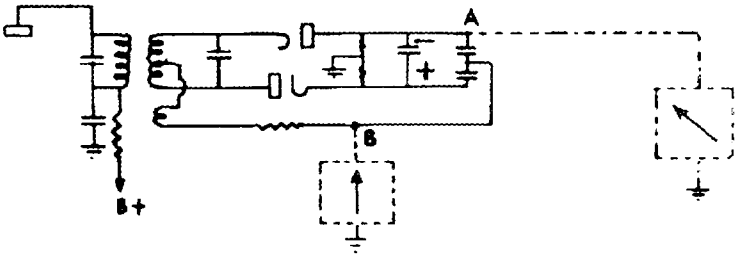
ALIGNMENT OF LIMITER AND DISCRIMINATOR.

With a signal being fed into the I.F. amplifier, connect the VTVM as a negative reading voltmeter to point A. Adjust all I.F. transformers for *maximum* indication. Move the negative voltmeter to point B and adjust the limiter plate winding for *maximum* indication. Connect the VTVM to point C as a zero center voltmeter. Adjust the secondary winding of the I.F. transformer to read zero voltage. Moving the frequency of the signal above and below the normal I.F. frequency, the zero center voltmeter will read first positive and then negative voltage.



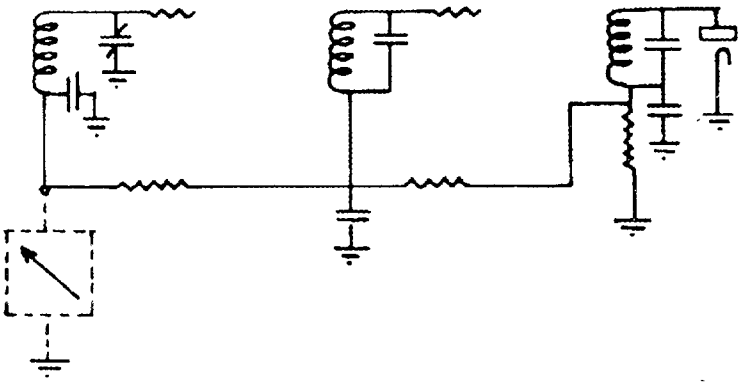
ALIGNMENT OF RATIO-DETECTOR.

With the signal being fed into the I.F. system, connect the negative reading VTVM to point A and adjust all the I.F. transformers for *maximum* indication. Connect the VTVM as a zero center voltmeter to point B and adjust the secondary of the transformer so that a zero reading is obtained. Shifting the signal above and below the I.F. frequency will cause the meter to read positive and negative voltage.



MEASUREMENT OF A.V.C. VOLTAGE.

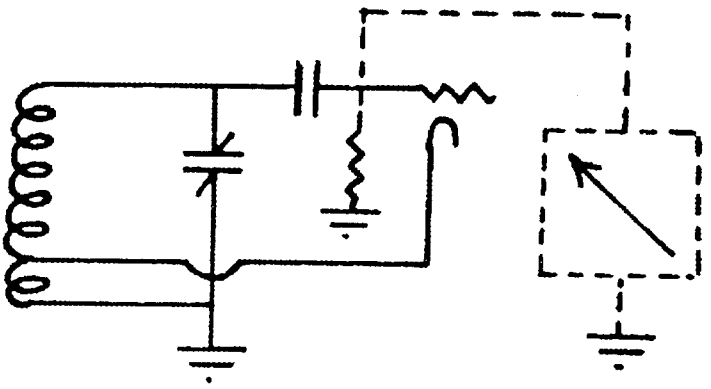
Connect the negative reading VTVM to the AVC buss. The stronger the signal, the greater the voltage that will be obtained. The I.F. system of a superhet can be aligned in this manner as the adjustment of each I.F. transformer will cause the meter reading to progressively increase when properly adjusted.



USES OF THE VTVM

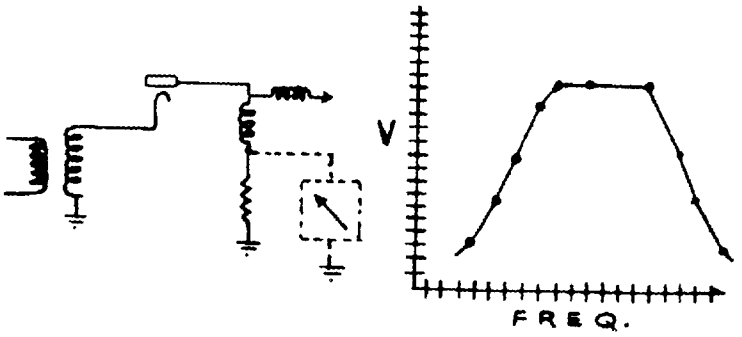
MEASUREMENT OF OSCILLATOR STRENGTH.

The stronger the oscillator in a receiver, the greater will be the grid voltage developed at the oscillator. A negative reading VTVM connected at the oscillator grid will indicate the grid voltage developed. Rotating the variable condenser should not change the voltage developed. A change in voltage indicates that sensitivity may be lost because of low oscillator strength.



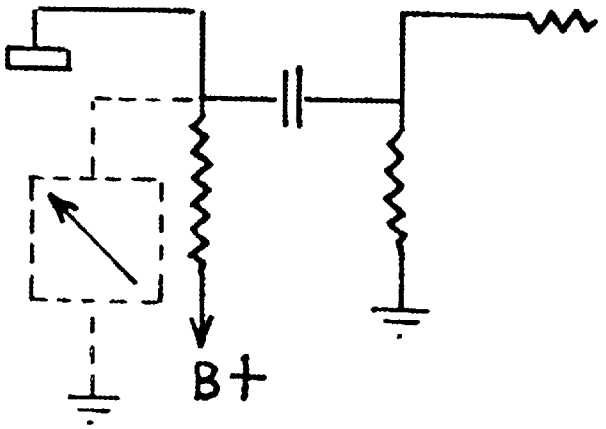
MEASURING THE BAND WIDTH AND ALIGNMENT OF A TV RECEIVER.

By connecting a VTVM across the diode load resistor of a TV receiver and connecting a signal generator to the TV I.F. system, the response curve of a TV receiver can be plotted on cross section (graph) paper. Use the vertical ordinate to signify voltage developed across the resistor and the horizontal ordinate to signify the frequency of the generator.



MEASUREMENT OF PLATE VOLTAGE IN A RESISTANCE COUPLED AMPLIFIER.

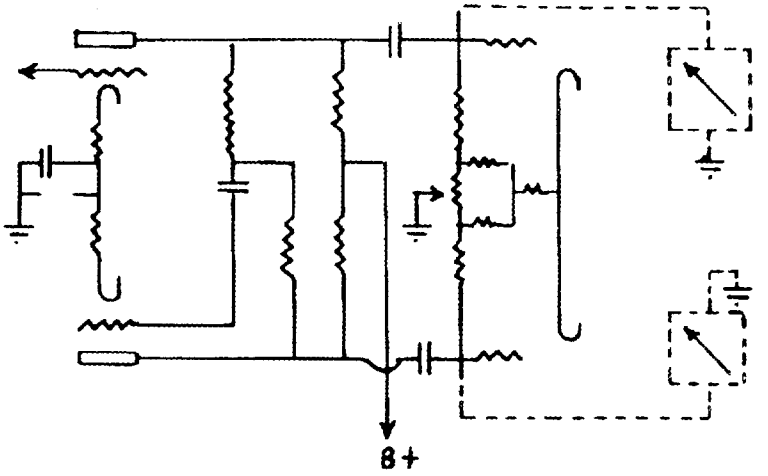
The voltage applied to the plate of a resistance coupled amplifier is applied through a resistance that may be as high as 5 megohms. A positive reading VTVM can be used to measure the actual voltage. An ordinary voltmeter cannot read the correct voltage because it will require more current for operation than is available, thus giving a false reading.



USES OF THE VTVM

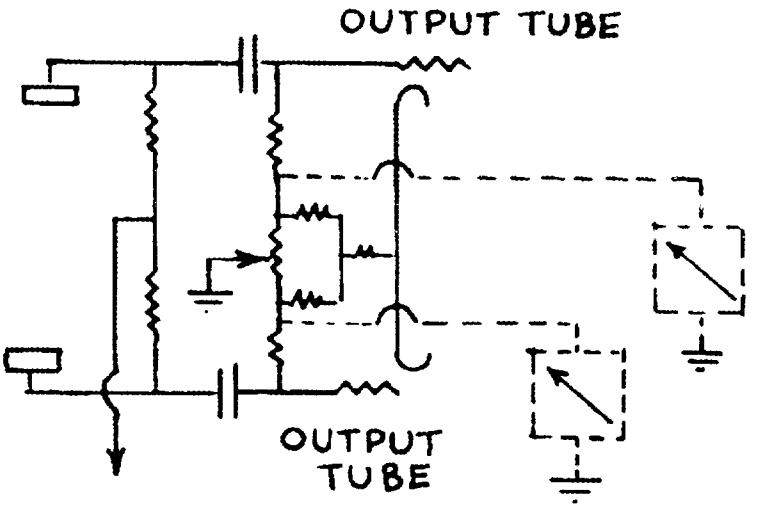
SIGNAL BALANCE IN A HI-FI AMPLIFIER.

Th output stage of a Hi-Fi amplifier should have equal voltages applied to each grid. The AC reading VTVM will indicate if the preceeding stages are supplying equal voltage at the grids.



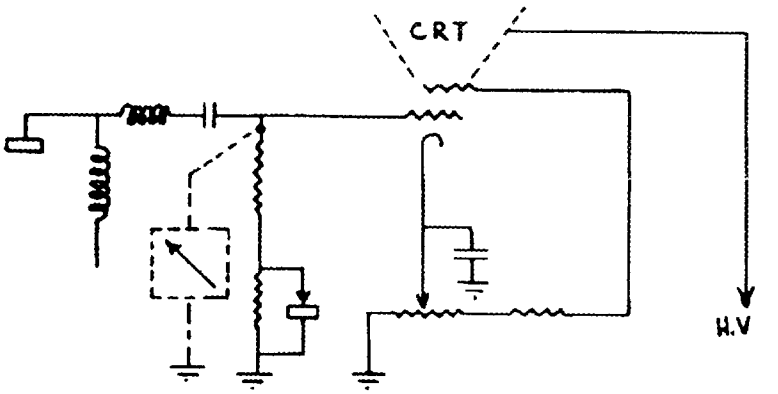
BALANCE OF OUTPUT TUBES IN HI-FI SYSTEMS.

To obtain the highest degree of fidelity in a Hi-Fi system, the plate currents flowing through the output transformer should be exactly the same for each tube. The DC positive reading VTVM connected to the cathodes of the output tubes will indicate when both cathodes have identical voltages indicating that equal currents are flowing through the output tubes.



PEAK TO PEAK SIGNAL VOLTAGE AT PICTURE TUBES.

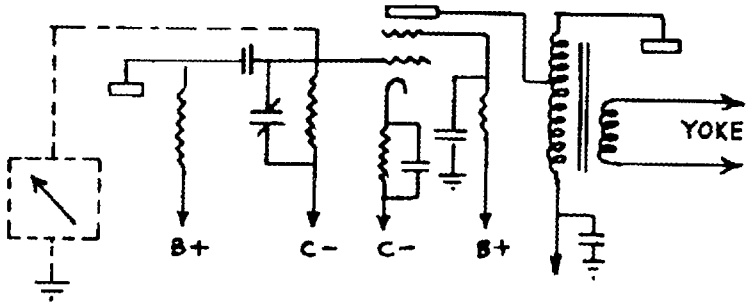
The signal voltage applied to a picture tube can be measured with the VTVM connected as a peak reading voltmeter. If the CRT uses cathode drive, connect to the cathode of the picture tube. If conventional grid drive is used (as in the schematic), connect to the signal grid.



USES OF THE VTVM

DRIVE ON THE HORIZONTAL OUTPUT TUBE.

Lack of width and brightness in a TV receiver can often be traced to insufficient grid drive on the horizontal output tube. The peak reading VTVM connected between the control grid and ground will measure the grid drive coming into the output tube.

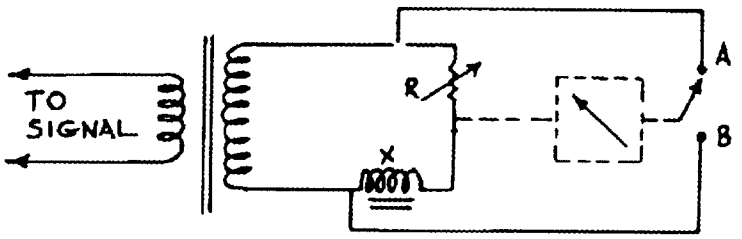


MEASUREMENT OF IMPEDANCE.

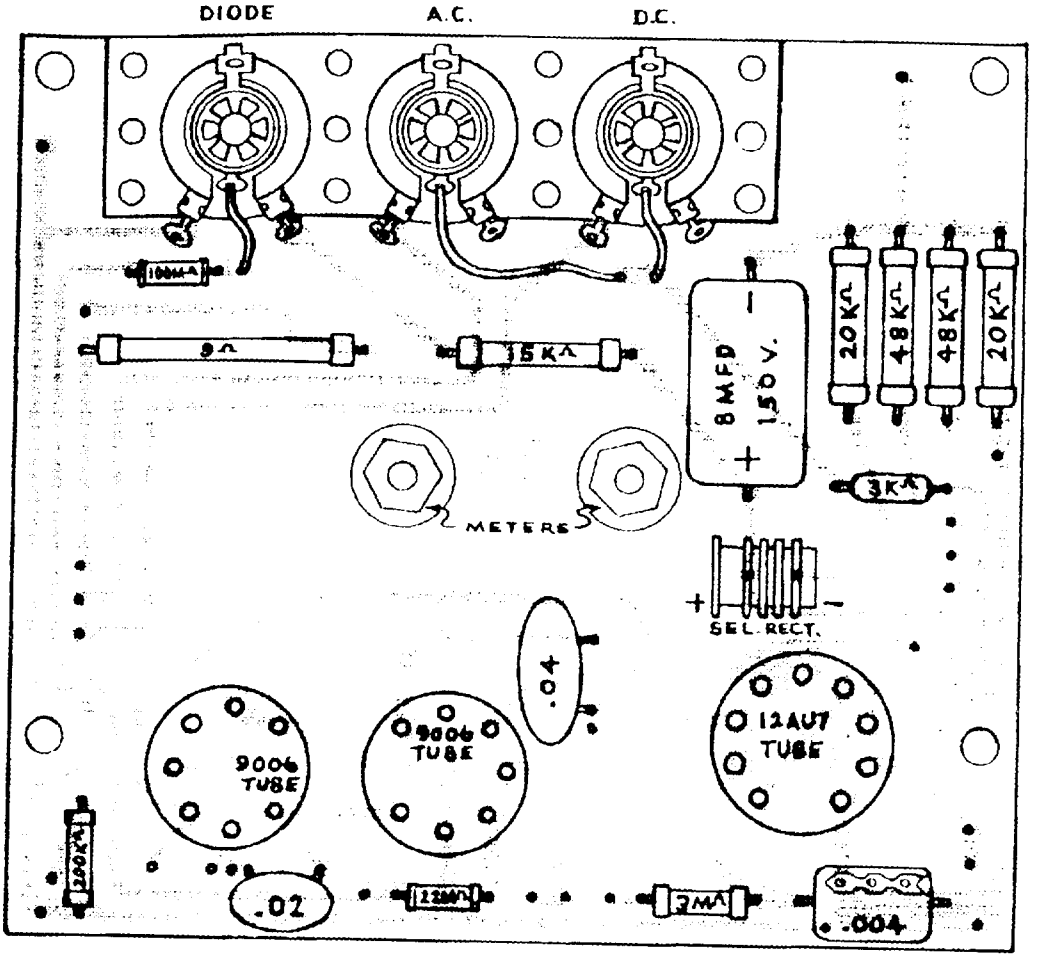
By connecting a resistance box or variable resistor in series with an inductor or capacitor and applying an AC voltage across both, the impedance of the inductor or the capacitor can be measured very accurately. The AC VTVM is connected across each in turn and the decade box or variable resistor is adjusted until both readings are equal. The impedances will then also be equal and the value can be read directly from the resistance box. If a variable resistance is used, its exact value can be read by the resistance section of the VTVM. The exact value of a capacitor can be determined by the formula

$$C = \frac{1}{2\pi fr}$$

where r = the resistance of the decade box.



PRINTED CIRCUIT BOARD



The Model 77 utilizes the latest development in printed circuitry. All the components on the printed board are mounted *below* the board for protection except the 3 controls.

When soldering to the printed board, it is advisable to use a small soldering iron. Connections must be completed as quickly as possible. Prolonged contact between the iron and board may result in damage to the printed board.

REPLACEMENTS PARTS PRICE LIST

PLASTIC METER FRONT	$1.00
METER	11.00
TRANSFORMER	2.50
SELENIUM RECTIFIER	1.50
8 MFD-150 VOLT CONDENSER	.50
SPECIAL 12AU7 TUBE	2.50
SPECIAL 9006 TUBE	2.50
3 CALIBRATION CONTROLS ON BOARD	2.50
PRECISION RESISTORS (GIVE VALUE)	.15
BALANCE ADJUST CONTROL 25K OHMS	1.00
OHMS ADJUST CONTROL 5000 OHMS	1.00
FUNCTION SWITCH	1.50
RANGE SWITCH	1.50
.02 MFD DISC CAPACITOR	.35
.04 MFD DISC CAPACITOR	.35
.01 MFD 2000 VOLT CAPACITOR	.35
.004 MFD CAPACITOR	.35

SERVICE and MAINTENANCE NOTES

The Model 77 is a rugged instrument designed for years of trouble free service.

Should trouble develop in your instrument, it is always advisable to write to our service department for the necessary steps to clear up the difficulty. Many troubles that do develop are caused by misuse. Care should be exercised in connecting the instrument so that burn-outs and overloading are avoided. Many of the difficulties can be corrected by the instrument user.

To remove the instrument from its case, remove the six screws located in back of the instrument.

The following are some of the troubles that may develop in a VTVM and their cures.

Inability to balance the meter is usually caused by one section of the 12AU7 tube burning out. *Replace with a low gas tube. Tube types 6211, 5965, 3223 and 5743 are low gas, ruggedized versions of the 12AU7.*

Inability to measure AC is usually caused by a burnt out 9006 rectifier. *Replace with a new tube.*

"Creeping of the meter" on the lower resistance range, but good operation on the higher ranges, is caused by burn out of the 9 and/or the 90 ohm resistors in the resistance section.

Inability to reach full scale on the resistance ranges is usually caused by a defective 1.5 volt "D" cell.

Inaccurate readings on the low resistance range is usually caused by a defective 1.5 volt "D" cell.

CALIBRATION

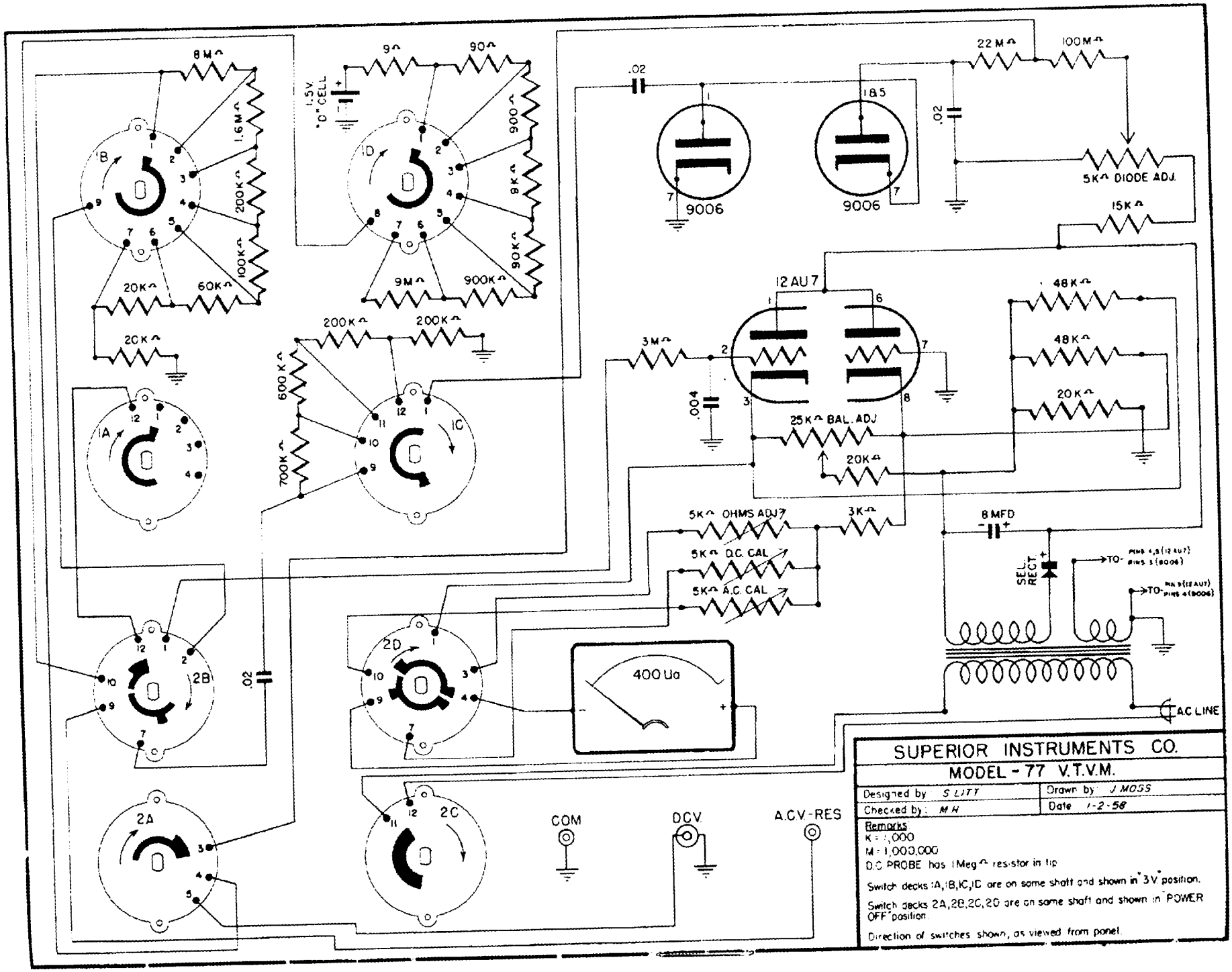
It is not suggested that any calibration be attempted unless test equipment standards are available. In no case should calibration be attempted unless the instrument has been warmed up for at least 15 minutes.

DC voltages are calibrated on the 15 volt range at 12 volts.

AC voltages are calibrated on the 75 volt range at 60 volts.

The "Diode" control is adjusted on the 3 volt range before AC calibration. It is adjusted so that the meter does not read when switched between the 3 and 15 volt ranges. *No test leads should be connected when adjusting this control.* The purpose of this control is to balance out the contact potential present in all diodes.

The 12AU7 tube used in this instrument has been picked for low gas and contact potential. Use of an ordinary tube will cause zero shift whenever ranges are changed. The use of a special tube will minimize zero shift when changing ranges.



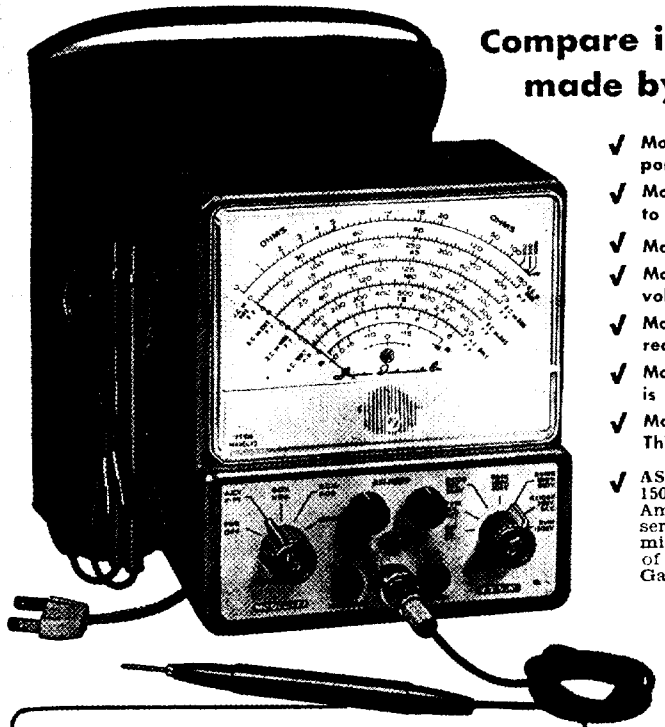
SUPERIOR INSTRUMENTS CO.	
MODEL - 77 V.T.V.M.	
Designed by S. LITT	Drawn by J. MOSS
Checked by M. H.	Date 1-2-58

Remarks
K = 1,000
M = 1,000,000
D.C. PROBE has 1 Meg Ω resistor in tip
Switch decks 1A, 1B, 1C, 1D are on same shaft and shown in "3 V." position.
Switch decks 2A, 2B, 2C, 2D are on same shaft and shown in "POWER OFF" position.
Direction of switches shown, as viewed from panel.

Superior's New MODEL 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER



Compare it to *any* peak-to-peak V. T. V. M. made by *any* other manufacturer at *any* price!

- ✓ Model 77 completely wired and calibrated with *all* accessories (including even portable carrying case) sells for only $42.50.
- ✓ Model 77 employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- ✓ Model 77 uses new improved SICO printed circuitry.
- ✓ Model 77 employs a 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability.
- ✓ Model 77 uses a selenium-rectified power supply resulting in less heat and thus reducing possibility of damage or value changes of delicate components.
- ✓ Model 77 meter is virtually burn-out proof. The sensitive 400 microampere meter is isolated from the measuring circuit by a balanced push-pull amplifier.
- ✓ Model 77 uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.
- ✓ AS A DC VOLTMETER: The Model 77 will measure any voltage up to 1500 volts with negligible loading. It is indispensable in receiver and Hi-Fi Amplifier servicing and a must for Black and White and Color TV Receiver servicing where circuit loading cannot be tolerated. A special feature permits accurate zero center measurements necessary for the true alignment of Foster-Seely (Armstrong) FM detectors, Ratio Detectors and the newer Gated Beam Detectors.
- ✓ AS AN AC VOLTMETER: The old-fashioned laboratory AC V.T.V.M. was cumbersome, erratic and required several dial manipulations to arrive at a reading. The Model 77 when connected to a circuit will quickly and simply measure its RMS value if sine wave, and its peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers, sync. pulses and saw tooth voltages are easily read with the Model 77.
- ✓ AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement in the resistance range (from .2 ohms to 1,000 megohms) the Model 77 will be your most frequently used resistance meter. Leaky capacitors which may not show up on other resistance meters, show up glaringly when tested with the new model 77. Because of its sensitivity and low loading, intermittents are more easily found, isolated and repaired.

Model 77—Vacuum Tube Voltmeter
Total Price $42.50

Terms: $12.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

Traditionally, the V. T. V. M. has been the one instrument used for voltage measurements where low-drain or wide frequency response is essential. And now, the Model 77 V. T. V. M. by taking advantage of new developments including modern balanced push-pull circuit design, etched circuitry, an extra large meter and other improvements provides such measurements quicker, with a higher degree of accuracy and with better readability.

The Model 77 will measure DC with negligible loading AC of ANY FORM WAVE; whether sine wave, pulse wave, spike wave, square wave or other complex wave forms. It will measure all AC from 30 cycles to over 5 megacycles and will do so without additional accessories or cables.

SPECIFICATIONS

- **DC VOLTS**—0 to 3/15/75/150/300/750/1500 volts at 11 megohms input resistance.
- **AC VOLTS (RMS)**—0 to 3/15/75/150/300/750/1500 volts.
- **AC VOLTS (Peak to Peak)**—0 to 8/40/200/400/800/2000 volts.
- **ELECTRONIC OHMMETER**—0 to 1000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms.
- **DECIBELS** —10 db to +18 db, +10 db to +38 db, +30 db to +58 db. All based on 0 db = .006 watts (6mw) into a 500 ohm line (1.73v).
- **ZERO CENTER METER**—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Model 77 comes complete with operating instructions, probe and test leads. Use it on the bench—use it on calls. A streamlined carrying case, included at no extra charge, accommodates the tester, instruction book, probe and leads. Operates on 110-120 volt 60 cycle. Only

$42.50 NET

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Try any of the instruments on this or the facing page for 10 days before you buy. If completely satisfied then send down payment and pay balance as indicated on coupon. No interest or Finance Charges Added! If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC, INC.
Dept. D-661, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligations.

- ☐ Model 77.....Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Model TV-50A...Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TW-11....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model 83.....Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

Name .....

Address .....

City .....Zone...State.....

All prices net. F.O.B., N.Y.C.