INSTRUCTION MANUAL

FOR THE

STARK

"VOHMASTER"

MODEL TA-1

ELECTRONIC

VOLT-OHM-CAPACITY-INDUCTANCE-MILLIAMETER

STARK

STARK ELECTRONIC INSTRUMENTS LIMITED

STARK BUILDING - AJAX, ONT.

11952

1,000-1-53-D.Co.Ltd.

STARK ELECTRONIC INSTRUMENTS LIMITED manufacture a complete line of Electrical Indicating Meters, Tube Testers, Circuit Analyzers, and Signal Generators, in sizes and ranges to suit every purpose.

TUBE TESTERS are modern and up-to-date, accurate, and easily operated.

CIRCUIT ANALYZERS can be had in many designs from the handy pocket size to large de-luxe models. They cover an extremely wide range of all electrical measurements.

ELECTRICAL INDICATING METERS incorporated in Stark Tube Testers and Circuit Analyzers are completely manufactured in our own plants.

All meter needs for AC or DC voltage and current measurements, both Panel Mounting and Portable, can be supplied in five distinctive styles, in round or rectangular, from 2" to 9" sizes.

See inside back cover for further details.

NOTE

WHEN MAKING ENQUIRIES PERTAINING TO THIS INSTRUMENT, PLEASE PROVIDE THE SERIAL NUMBER AS WELL AS THE MODEL NUMBER.

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1. GENERAL

The "STARK" Model TA-1 "Vohmaster" is a compact and efficient test instrument, covering all ranges of measurement likely to be encountered in the servicing and maintenance of all high frequency instruments as well as standard electrical equipment. A highly versatile electronic circuit, employing six vacuum tubes and a flexible switching arrangement, permits a wide range of measurements to be made on A.C. and D.C. voltages, D.C. milliamperes, resistances, capacitances and inductances. The usual high standards of manufacture associated with "STARK" instruments insures the utmost accuracy and dependable service.

2. GENERAL DESCRIPTION

2.1 TECHNICAL CHARACTERISTICS.

The instrument is designed with a very high internal impedance which insures a minimum loading effect to the circuit under test. Further, the meter is protected against possible damage due to overloads on all ranges except D.C. Mills.

The operating characteristics of the "STARK" Model TA-1 are as follows:

(a) Power Supply: 105 -125 volts, 60 cycles
or 105-125 volts, 25 cycles
or 210-250 volts, 50 cycles
dependent on markings specified on the panel.

(b) Power Consumption: 25 watts at specified voltage and frequency.

(c) Scales: Volts—Mills: 0-3, 0-12
0-3 Volts A.C. only

Ohms: 0-10,000-Inf.

Capacity: MMF - 0-1000) 50-60 cycles
MF - 0-10)

For 25 cycle capacity tests, use conversion chart with above scales.

(d) **Ranges:**

Volts, A.C.:	0-3, 12, 30, 120, 300, 1200.
Volts, D.C.:	0-3, 12, 30, 120, 300, 1200.
Mills (D.C.):	0-3, 12, 30, 120, 300, 1200.
Ohms:	1 ohm to 10,000 megohms in 7 ranges.
Capacity:	0-10,000 mmf. in 2 ranges 0-1000 mf. in 5 ranges 50 mh - 100 henries (use conversion chart)

(e) **Frequencies:** A.C. voltages from 20 cycles to 300 megacycles may be measured.

(f) **Accuracy:** 2% of full scale deflection for D.C.

3% of full scale deflection for A.C.

3% of centre scale and proportional accuracy to the right of centre scale for ohms.

3% of centre scale and proportional accuracy to the left of centre scale for capacity.

(g) **Meter:** "STARK" Model 804, 350 microamperes, 760 ohms.

(h) **Tube Complement:**

Tube Type	*Function*
6X5GT	A.C. Power Rectifier
VR150	Voltage Regulator
6X5GT	A.C. Input Rectifier
6SN7	Vacuum Tube Voltmeter
6SJ7	Cathode Follower
9006	High Frequency Input Rectifier

2.2 PHYSICAL

(a) The instrument is contained in a steel case, 8½" x 11" x 6". A finely calibrated "STARK" Model 804, 4 inch meter, selector and range switches, ohms and voltage adjust controls, pilot light, and line power switch, are all conveniently arranged on the front panel. The D.C. voltage lead, A.C. electronic probe, and the A.C. line cord are all permanently attached to the instrument.

(b) One pair of "STARK" Test Leads is supplied with the instrument, as well as a short ground lead for voltage measurement above 100 M.C. The standard test leads are used for D.C. Mills, capacity, and ohms measurement, while A.C. and D.C. voltage measurements are conveniently made with the fixed leads in conjunction with the ground lead and the alligator clip supplied with the instrument. For very high frequency voltage measurement, the short test lead should be used as the ground connection between the ground pin on the probe and the low side of the circuit under test.

2.3 ELECTRICAL CIRCUIT

(a) A conventional power supply circuit is employed, utilizing a transformer, full wave rectifier, filter circuit, and a voltage regulator tube. The ohmmeter bridge circuit is fed by two dry cells in series.

(b) The Selector Switch controls the type of circuit desired for measurement purposes, by utilizing one of the three divider circuits present in the instrument. A convenient switch arrangement permits D.C. voltages, either positive or negative, with respect to ground, to be measured without reversing the position of the leads.

3. THEORY OF MEASUREMENT

3.1 GENERAL

The versatile circuit employed in the "STARK" Model T-A1 "VOHMASTER," is the result of detailed study, and the design, based upon accepted and proven principles, along with the many associated features, has been intricately and accurately engineered. To enable the user to operate the instrument with the utmost efficiency, a brief explanation of the theory associated with each of the measurement circuits is given in the following paragraphs.

3.2 D.C. MILLIAMETER—Fig. 1.

MILLIAMETER CIRCUIT

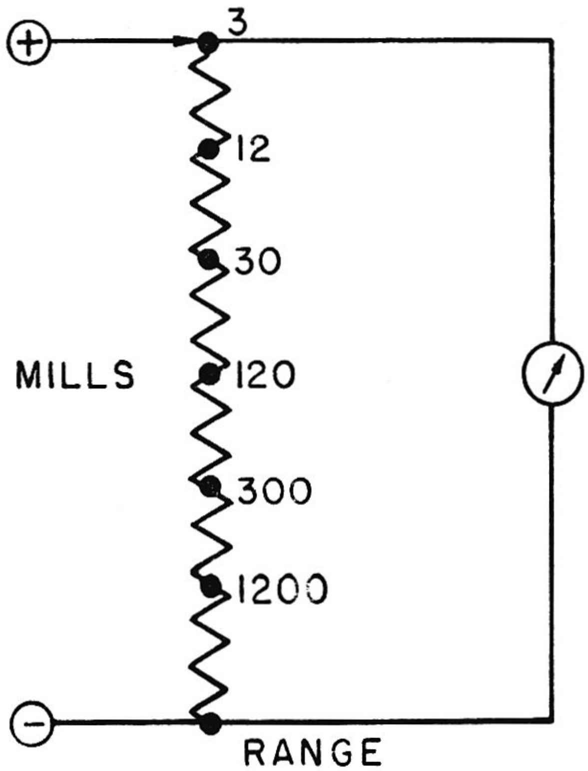
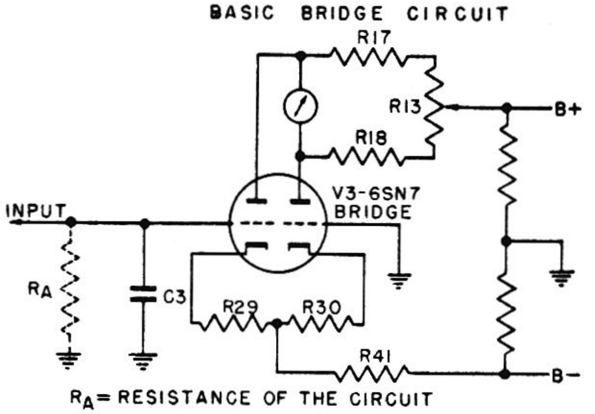


FIGURE 1

The D.C. Mills circuit is a standard measuring circuit, employing a tapped resistance network and the 350 micro-ampere meter. The selector controls the measurement range by proper adjustment of the shunt network as shown in Figure 1. This is the only circuit which does not employ the vacuum tube principle of measurement.

3.3 ELECTRONIC BRIDGE CIRCUIT—Fig. 2

BASIC BRIDGE CIRCUIT



R_A= RESISTANCE OF THE CIRCUIT

FIGURE 2

The basic bridge circuit, common to all measurement circuits except D.C. Mills is illustrated in Figure 2. The basic Wheatstone bridge principle is employed, utilizing a 6SN7 double triode as the balance tube. The "B" supply potential is applied at R.13 and feeds through R.41 which is connected between the bridge elements R.29 and R.30. Zero voltage adjustment is provided by means of the adjustable potentiometer R.13 so that the meter reads zero, indicating balance between the two triodes, when there is no voltage input to either grid. The grid of one triode is at ground potential for all measurements except capacity, and the potential of the other grid is dependent upon the characteristic of the element or circuit being measured. Thus, changing the potential of only one of the grids will cause a meter deflection which is proportional to the changing plate current since the plate current varies with the grid potential. The meter is accurately calibrated to interpret the deflection in terms of volts, ohms, capacity, etc., and operates in conjunction with the Selector Switch.

3.4 A.C. VOLTMETER—Fig. 3

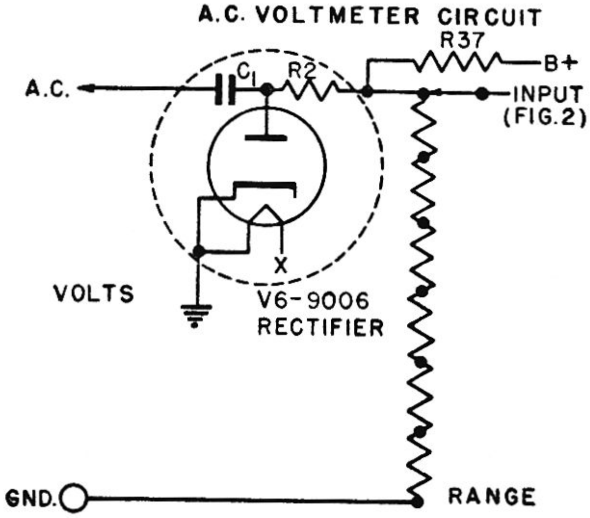


FIGURE 3

The A.C. input voltage, applied to the probe and ground connection, is rectified by the condenser C1 and U.H.F. miniature diode contained within the probe. The type 9006 diode permits rectification at very high frequencies, and a portion of the resultant D.C. potential, as controlled by the voltage divider network, is fed to one grid of the bridge tube. To eliminate the meter deflection which results due to the normal emission of electrons by the rectifier cathode resulting from a negative contact potential, a positive voltage is fed to the voltage divider network through a 90 megohm resistor R.37.

The input impedence at the terminals of the A.C. probe is approximately 15 Megohms with a shunt capacity of about 6 MMF. The loading impedence at lower frequencies is about 12 Megohms, while the shunt reactance drops to a negligible value.

3.5 D.C. VOLTMETER—Fig. 4

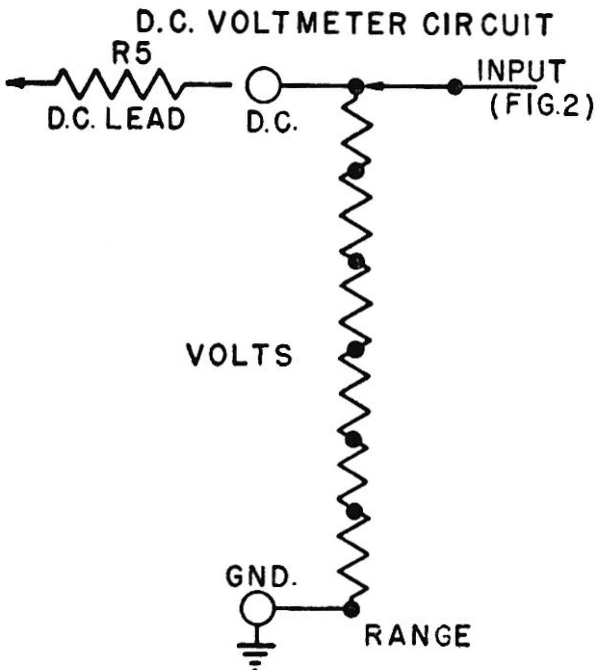


FIGURE 4

Measurements for this circuit are made between D.C. prod and ground, through the decoupling 1 Megohm resistor R.5, to the divider network. The range switch controls the potential which is applied to the input grid of the 6SN7, causing the bridge circuit to function. When the polarity of the voltage being measured is reversed, a switching arrangement reverses the grids of the tube permitting the measurement of either polarity and eliminating the necessity of reversing test leads.

3.6 OHMMETER—Fig. 5

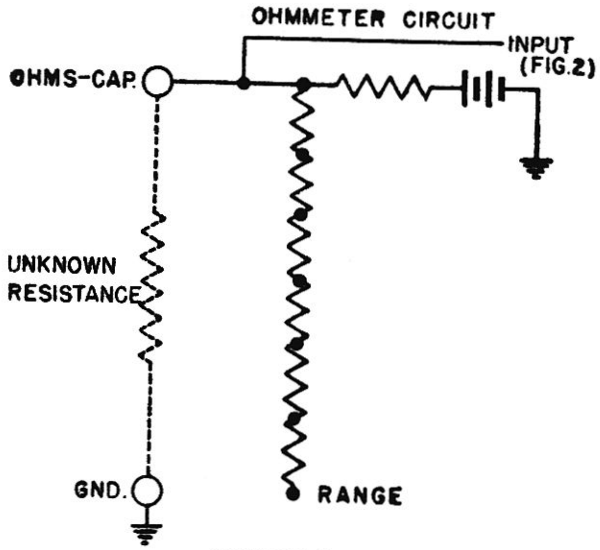


FIGURE 5

The grid of one section of the 6SN7 tube is grounded and a negative potential of 3 volts from the dry cells is applied to the other grid through a calibrated divider network. This D.C. voltage, plus the unbalance caused by the unknown resistance across OHMS-CAP and GROUND, controls the resultant current flow, and thus the meter deflection can be calibrated in terms of resistance.

3.7 CAPACITY AND INDUCTANCE MEASUREMENT—Fig. 6

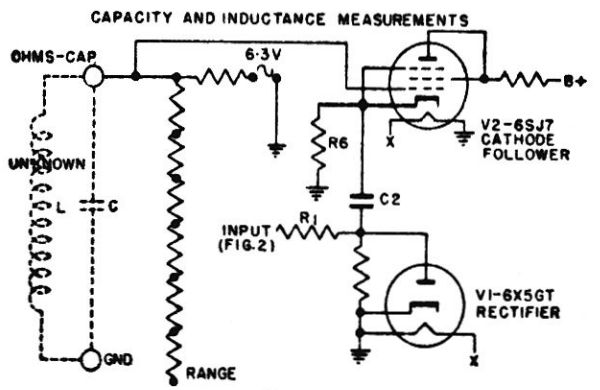


FIGURE 6

(a) Capacity measurements are made in a manner similar to the ohmmeter circuit, but since an A.C. voltage must be used to measure capacity, and the grid of the balance tube must be supplied with a D.C. potential, a cathode follower and rectifier circuit is employed. A low A.C. voltage is tapped off the voltage divider network and is fed to the grid of the cathode follower, 6SJ7, which is used as an impedance matching device. The cathode output is fed to the rectifier circuit which consists of one half of the 6X5, condenser C.2 and the resistance R.6. The output of the rectifier is, in turn, fed to the grid of the 6SN7.

The scale is calibrated directly for capacity readings with the frequency of the input supply at 50-60 cycles per second. Since the readings are dependent upon the frequency of the power supply a conversion chart is supplied for 25 cycle operation, Fig. 8.

(b) Inductance measurement theory is exactly the same as capacity measurements with the impedance of the coil replacing the impedence of the condenser. A chart is supplied (Fig. 7) relating capacity readings to impedances and also directly to henries if the resistance of the coil is low.

4. OPERATION

4.1 GENERAL

Refer to the panel markings prior to operating the instrument. Instruments marked "25-60 Cycles" may be used at either 25 or 60 cycle, but instruments marked "60 Cycle" must not be operated from a 25 cycle source. Allow the instrument a three minute "warm up" period after the line switch is thrown to the "power" position. For capacity and inductance tests it is advisable to remove the unknown entirely from the circuit, while it is sufficient to free one terminal of the resistor under test for resistance measurement. *If the instrument is to be used intermittently, it is advisable to leave the power on, as the power drain is negligible.*

4.2 A.C. VOLTAGE MEASUREMENT

(a) Operate the line switch to "power" position and allow three minute period for tubes to reach correct operating temperature.

(b) Turn the selector switch to A.C. Volts position.

(c) Operate the Range switch to the range which will cover the voltage to be measured. If an approximate value is not known, choose highest range.

(d) Check the meter for zero setting at the range in which the measurement is to be made and adjust to zero with the Zero Adjust control.

(e) Connect the voltage to be measured between the ground lead and the permanently attached prod of the probe for low R.F. measurements.

For high R.F. measurements, utilize the short ground lead and the ground contact on the probe with the prod of the R.F. probe. Read the scale directly according to the position of the Range Switch.

IMPORTANT NOTE

Do not attempt to measure A.C. voltages above 500 volts.

The A.C. Voltage Measurement Circuit has been designed specifically for R.F. use and the potential limitation of the high frequency rectifier diode in the probe prohibits the measurement of A.C. voltages above 500 volts. As voltages of this magnitude are employed primarily in power circuits, the usefullness of the instrument is in no way impaired.

4.3 D.C. VOLTAGE MEASUREMENT

(a) Operate the line switch to "power" position.

(b) Turn the Selector Switch to + D.C. volts position.

(c) Operate the Range Switch to the range which will cover the voltage to be measured. If an approximate value is not known, choose highest range.

(d) Check the meter for zero setting at the range in which the measurement is to be made, and adjust to zero with the Zero Adjust control.

(e) Connect the voltage to be measured between the ground lead and the permanently attachd D.C. prod. If the meter reads in the wrong direction, operate the Selector Switch to D.C. Volts.

(f) Read the scale directly according to the position of the Range Switch.

4.4 D.C. CURRENT MEASUREMENTS

(a) Turn the Selector Switch to Mills position.

(b) Operate the Range Selector to the range which will cover the currents to be measured. To protect the meter, choose the highest range if an approximate value of the test current is not known.

(e) Connect the unknown, using the black lead for— Mills and the red for + Mills.

(f) Read the numerical value directly from the scale according to the position of the range switch.

4.5 RESISTANCE MEASUREMENTS

(a) Operate the line switch to "power" position.

(b) Turn the Selector switch to Ohms position.

(c) Turn the Range switch to the range which will cover the resistance to be measured.

(d) Connect the red and black test leads supplied to OHMS-CAP and GROUND respectively, and check the meter for zero setting by shorting the leads together and adjusting with the Zero Adjust control. Open the leads and adjust to full scale deflection with the OHMS-CAP ADJUST control.

(e) Connect the unknown resistance between the test leads and read the numerical value from the scale directly, applying the proper multiplying factor according to the position of the Range switch. Note that the resistance being measured should be isolated from any other circuit components which might introduce error.

HIGH OHMS MEASUREMENT

IMPORTANT !

A warm-up period of from five to seven minutes should be allowed prior to the use of the High Ohms, (RXIM) range.

This range is exceedingly sensitive, and full scale adjustment may not be instantly attained on this range if the tubes are not sufficiently heated.

4.6 CAPACITANCE MEASUREMENTS

NOTE: (1) The meter scale is calibrated for capacity measurements, when the input to the "Vohmaster" is 50-60 cycle. For 25 cycle use, a convenient conversion chart is supplied.

(2) The instrument has an internal capacity of 20 to 30 MMF, and when the Range Switch is on X1 or X10 MMF the meter will read this capacity. Therefore, always turn the Range switch to some position other than X10 or X1 MMF when making adjustments to zero with the OHMS-CAP ADJUST control, as this small internal capacity will have no effect at other positions. If it is necessary to make measurements on the X1 or X10 range, the true capacity will always be the difference between the reading obtained with the unknown capacity connected to the input and the initial reading obtained with no capacity connected.

(3) The capacity measurement circuit on the X1 and X10 MMF ranges is extremely sensitive and the test leads will pick up stray A.C. voltages. Therefore, the meter will read off scale in some cases when using these ranges, resulting in erratic readings. It is suggested, therefore, that the test capacitor be connected directly to the OHMS-CAP and GROUND pin jacks without using the test leads on these ranges.

4.6a OPERATING INSTRUCTIONS

(a) Operate the line switch to "power" position.

(b) Turn the Selector switch to Capacity position.

(c) Turn the Range switch to the range which will cover the capacity to be measured.

(d) Connect the red and black test leads supplied to OHMS-CAP and GROUND respectively and check the zero setting by shorting the leads together. Open the leads to check for full scale deflection and adjust to full scale with the OHMS-CAP ADJUST control.

(e) Remove the capacitor under test from its associated circuit and connect between the test leads.

(f) The numerical value noted on the scale is multiplied by the multiplying factor governed by the position of the Range switch. For 25 cycle use, the conversion chart, Fig. 7, should be employed.

4.7 INDUCTANCE MEASUREMENTS

Follow the instructions outlined in paragraph 4.6, read the numerical capacity value and apply the multiplying factor. If the range is other than X1 MFD., values indicated in the graph Fig. 7 must be converted as it is drawn on a basis of microfarads. Any change in units must be made inversely on the impedance scale, i.e., if the reading is X1 MFD, multiply the impedance or inductance X10. The impedance value derived from the chart Z_L can be simplified to give true inductance values as follows:—

Determine the resistance of the inductance through the use of the ohmmeter circuit. The ohmic value is R_L. Then, $Z_L^2 = (2\pi f L)^2 + R_L^2$ where $\pi = 3.1416$ and f = line frequency.

This formula can be simplified as follows:

$$L^2 = \frac{Z_L^2 - R_L^2}{(2\pi f)^2} \qquad \text{If } f = 60 \text{ cps.} \quad 2\pi f = 377 \qquad \therefore L = \sqrt{\frac{Z_L^2 - R_L^2}{(2\pi f)^2}}$$

Substitute the value for R_L and Z_L obtained in the formula to find L, the inductance.

If R_L is very small compared to L, the inductance may be read directly from the graph by disregarding R_L.

EXAMPLE OF INDUCTANCE MEASUREMENT—60 CYCLE

R_L is 100 ohms determined by ohmmeter.

Capacity reading is 8.8 MFD. Therefore, Z_L = 300 ohms from graph.

$$\text{Hence} \quad L = \sqrt{\frac{Z_L^2 - R_L^2}{(377)^2}} = \sqrt{\frac{90{,}000 - 10{,}000}{(377)^2}} = .748 \text{ henries.}$$

EXAMPLE OF INDUCTANCE MEASUREMENT—25 CYCLE

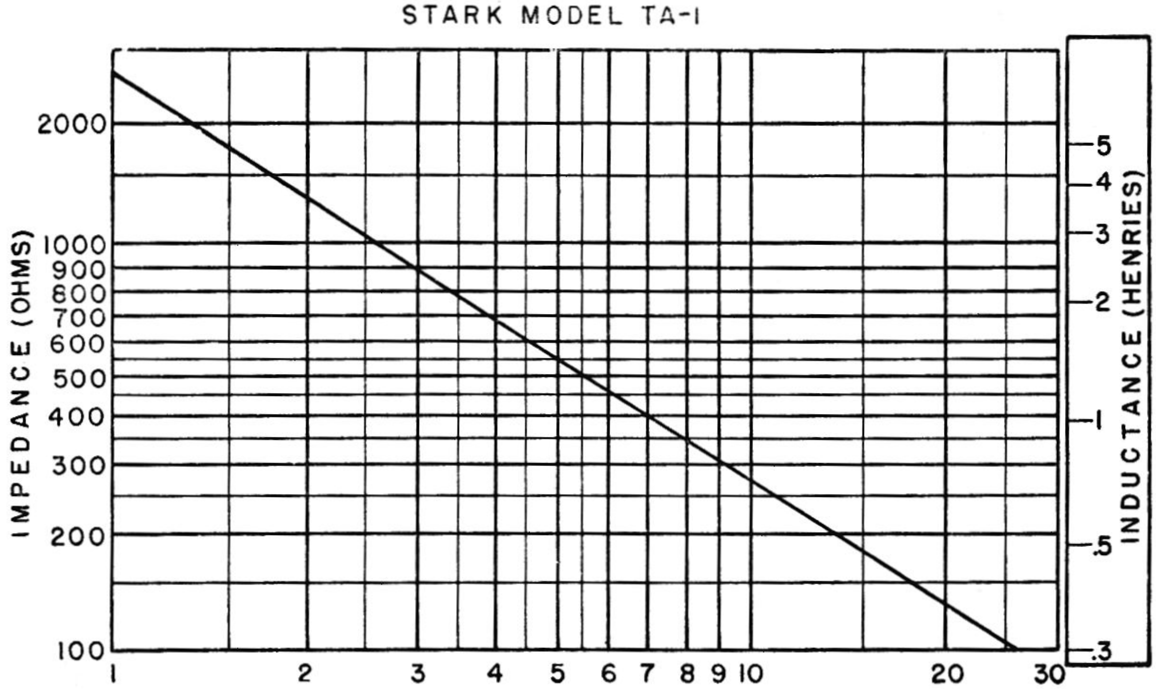
R_L is 100 ohms.

Capacity scale reading is 22MFD.

From chart, Fig. 8, the actual capacity is 8.8 MFD. Therefore, Z at 60 cycle = 300 ohms from chart, Fig. 7.

L = .748 as above from formula.

IMPEDANCE CHART
STARK MODEL TA-1



CAPACITY (MF)
FIGURE 7

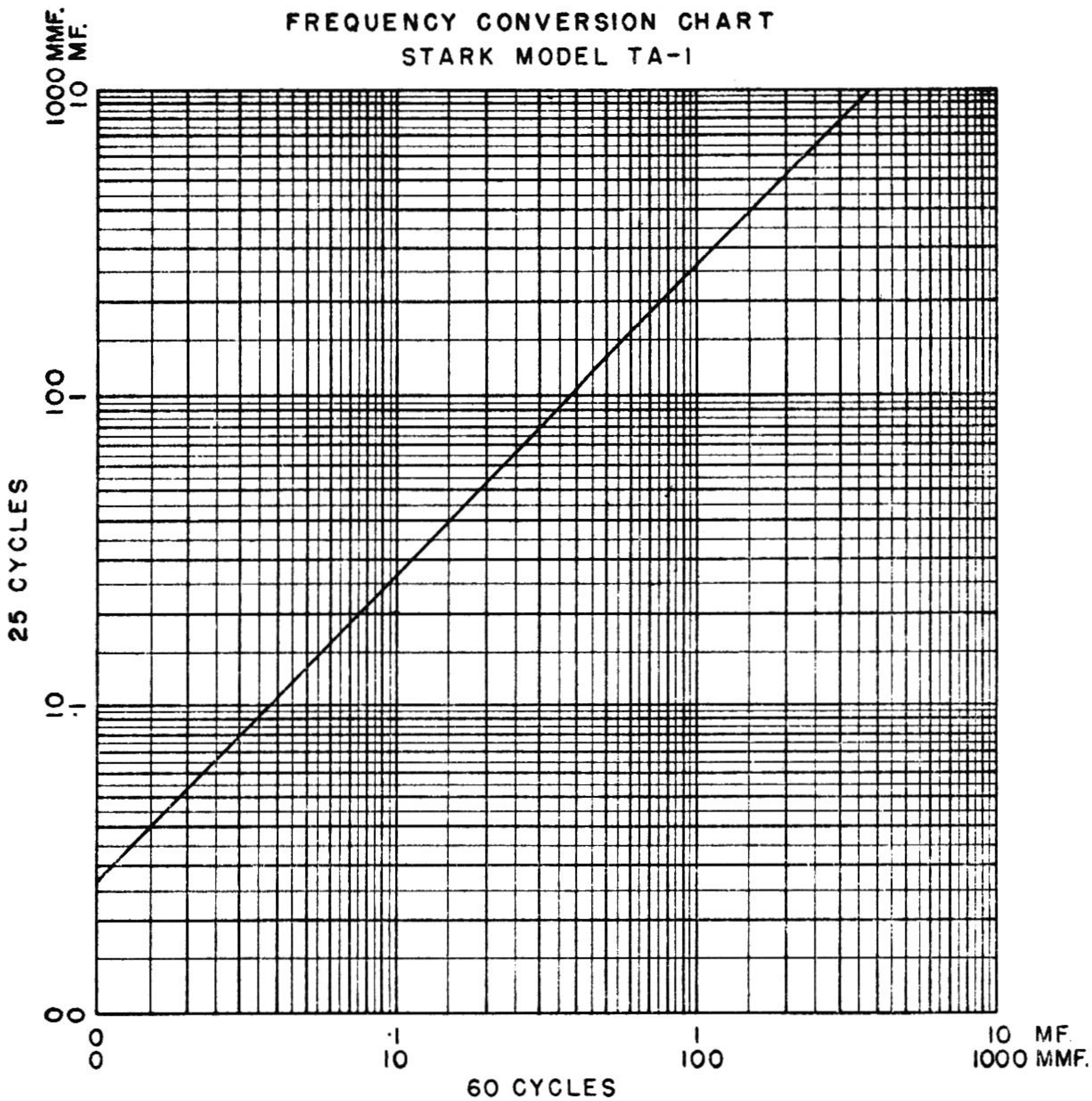


FIGURE 8

5. APPLICATION

5.1 GENERAL

The "STARK" Model TA-1 can be utilized successfully in all general electronic, electrical and power applications within the scope of the ranges available in the instrument. As such, it is an exteremely accurate and versatile instrument, stabilized against line voltage fluctuations through the use of a regulator tube in the power circuit.

Further, there are numerous specialized applications associated with electronic measurements which can only be accomplished through the use of an instrument of this type.

5.2a HIGH INPUT IMPEDANCE CIRCUIT

This enables the measurement of D.C. voltages in any electrical circuit without appreciably loading the test circuit and thus the actual operating voltage is measured without any errors being introduced due to the loading caused by a standard low impedance test instrument.

5.2b R.F. — I.F. CIRCUITS

The measurement of A.V.C. voltages at the control grids of R.F. and I.F. stages, as well as the measurement of voltage on the grid of oscillator sections can be conveniently carried out without any appreciable loading effect due to the use of the one megohm isolating resistor in the D.C. probe.

5.2c OSCILLATION CHECK

An immdiate oscillation check can be carried out by following the method outlined below. Connect the voltmeter to measure the voltage at the grid of the oscillator tube and tune from one end of the band to the other. Note the grid voltage throughout the entire range as a normal negative voltage of 5 to 30 volts will be found at the grid of the oscillator tube when the stage is operating properly. Dead spots on one or more of the tuning ranges can be detected very simply by this test.

5.2d F.M. DISCRIMINATOR ALIGNMENT

Service instructions for the alignment of many frequency modulated receivers specify the use of a zero-centre microammeter in the discriminator circuit. Misalignment is indicated by any positive or negative reading, and alignment is indicated by a zero reading. The D.C. Voltmeter may be utilized much more readily to indicate such alignment by connecting it across the discriminator load resistance and advance the zero adjust control to bring the normal position of the meter to some arbitrary position on the scale where swings either positive or negative may be noted. Thus a satisfactory alignment can be made, without breaking the circuit to insert a microammeter, by making the necessary alignment which will bring the meter back to the position at which it had been set prior to the connection to the load resistance.

5.3 A.C. VOLTMETER

The A.C. Voltmeter section input impedance is constant at 12-15 megohms shunted by 6 MMF. Measurements may be made on frequencies ranging to 200 megacycles without appreciably disturbing normal operation and with negligible error. Pure A.C. is measured through the use of the blocking condenser in the probe.

When voltages of line supply frequency are measured, small discrepancies may result in the readings if the polarity of the test leads is reversed as the ground lead changes in position with respect to the voltage being measured. In such cases, the actual voltage is the average of the two readings obtained.

5.4 OHMMETER — CAPACITY — MILLIAMETER

The applications associated with these measurements are numerous and can be conveniently carried out with the minimum of preparation. Also, the Model TA-1 has instituted a unique means of measuring capacity which does not require the use of a high test voltage and thus eliminates a possible hazard to the operator.

6. MAINTENANCE

The excellent standards of workmanship associated with all "STARK" Instruments, have been incorporated into the Model TA-1. No maintenance, other than normal replacement of tubes and batteries should be required. If some difficulties do occur, it is suggested that you contact our Engineering Department for advice.

6.1 DRY CELLS

Two 1½ volt cells are used in series for the ohmmeter circuit and it it is impossible to bring the meter to full scale deflection, it is probable that one or both of the standard cells would need to be replaced. Remove the clamps holding the batteries prior to releasing them from their contact clips. Use standard General Type D, Eveready Type 950, or Burgess No. 2 cells, and observe correct polarity.

6.2 VACUUM TUBES

All tubes are operated well below their normal rating to insure long life and good service and replacement, if necessary, can be carried out by removing the eight screws fastening the instrument to the cabinet and removing the tube from its socket.

7. PARTS LIST

Item No.	"Stark" Stock No.	Description
1	804	Meter — 350 Microamps — 760 ohms.
2	115-A-13	Base — battery holder.
3	101-A-1	Battery, flashlight, Eveready 950, General "D" Burgess No. 2.
4	119-S-2	Manual — Instruction.
5	104-J-4	Bracket — spool mounting.
6	152-G-2	Cable, Microphone, single conductor shielded, r/c.
7	112-L-1	Condenser, paper 1 mfd. 400 volt.
8	112-A-9	Condenser — 10 mfd. electrotype 450 volt.
9	112-A-10	Condenser, Mica .001 mfg.
10	112-A-7	Condenser, Mica — 500 mmfg. 500 volt.
11	112-C-1	Condenser, paper .05 mfg. 400 volt.
12	107-F-1	Case (cabinet) 11 x 8½ x 6, C.R. steel.
13	110-C-1	Clip, alligator, overall 2¼" insulated, black, c/p.
14	121-D-1	Knob, cap black.
15	121-C-1	Knob, pointer, 2¼ black.
16	131-A-1	Lamp, pilot, 6-8 watt, screw base.
17	128-B-19	Panel, machined, 8½ x 11 x .062, panel screened.
18	133-A-8	Plug -- Phone tips for test prods.
19	124-A-19	Potentiometer — 3,000 ohms ⅜ x 32 x ¼ lg.
20	134-A-12	Potentiometer — 3,000 ohms linear wirewound.
21	134-B-13	Potentiometer — 10,000 ohms carbon linear.
22		Resistor — 3,300 ohms 5% BT½ single carbon.
23		Resistor — 1 megohm—½ watt 10% BTS single carbon.
24		Resistor — 20 megohms 10%—½ watt single carbon.
25		Resistor — 1,000 ohms 10% ½watt single carbon.
26		Resistor — 100 ohms 2% ½ watt paired carbon.
27		Resistor — 900 ohms 2% ½ watt paired carbon.
28		Resistor — 9,000 ohms 2% ½ watt paired carbon.
29		Resistor — 20,000 ohms 2% ½ watt paired carbon.
30		Resistor — 60,000 ohms 2% ½ watt paired carbon.
31		Resistor — 90,000 ohms 2% ½ watt paired carbon.
32		Resistor — 1 megohm, 10% ½ watt carbon.
33		Resistor — 33,000 ohms ½ watt 10 % carbon.
34		Resistor — 600,000 ohms 2% ½ watt paired carbon.
35		Resistor — 1.2 megohms 2% ½ watt paired carbon.
36		Resistor — 120,000 ohms, 2% ½ watt paired carbon.
37		Resistor — 220,000 ohms, 10% ½ watt carbon.
38		Resistor — 560,000 ohms 10% ½ watt carbon.
39		Resistor — 3,000 ohms, 10% ½ watt single carbon.
40		Resistor — 47,000 ohms 10% ½ watt carbon.

Item No.	"Stark" Stock No.	Description
41		Resistor — 3.3 megohms 10% ½ watt carbon.
42		Resistor — 2.2 megohms 2% ½ watt paired carbon.
43		Resistor — 6 megohms 2% ½ watt paired carbon.
44		Resistor — 330,000 ohms 10% ½ watt carbon.
45		Resistor — 900,000 ohms 2% ½ watt paired carbon.
46		Resistor — 9 megohms 2% ½ watt paired carbon.
47		Resistor — 2,700 ohms, 5% ½ watt carbon.
48		Resistor — 15,000 ohms 5% ½ watt carbon.
49		Resistor -- Approx. 7,500 ohms 10% ½ watt carbon.
50		Resistor — 0 to 10,000 ohms ½ watt carbon
51		Resistor — calibrating 10 megohms, ½ watt, used in conjunction with 90 megohms, carbon.
52		Resistor — 90 megohms 10% 1 watt carbon.
53		Resistor — 1,800 ohms 10% 2 watt carbon.
54		Resistor — spool, .4 ohms.
55		Resistor — spool, 1.22 ohms.
56		Resistor — spool, small 2.42 ohms.
57		Resistor — spool, 12.11 ohms.
58		Resistor — spool, 475 ohms.
59		Resistor — spool, 24.25 ohms.
60		Resistor — spool, 121.1 ohms.
61		Test Leads — set assembly, standard.
62	148-H-1	Transformer, 60 cycle 115 volts.
	or	
	148-H-2	Transformer, 25 cycle 115 volts.
	or	
	148-H-3	Transformer, 50 cycle 220 volts.
63		Tube — 6SJ7.
64		Tube — 6SN7.
65		Tube — 6X5GT.
66		Tube — OD3—VR150.
66A		Tube — 9006.
67	140-E-1	Socket, octal, crimp on type with "T" shaped grounding lug.
68	131-B-1	Pilot socket assembly, pilot lamp.
69	144-A11	Switch, toggle, S.P.S.T. bat handle, with one hex. nut.
70	144-J1	Switch, 7 pole 6 position, 4 deck. Selector.
71	144-J2	Switch, 3 pole, 7 position, 5 deck.

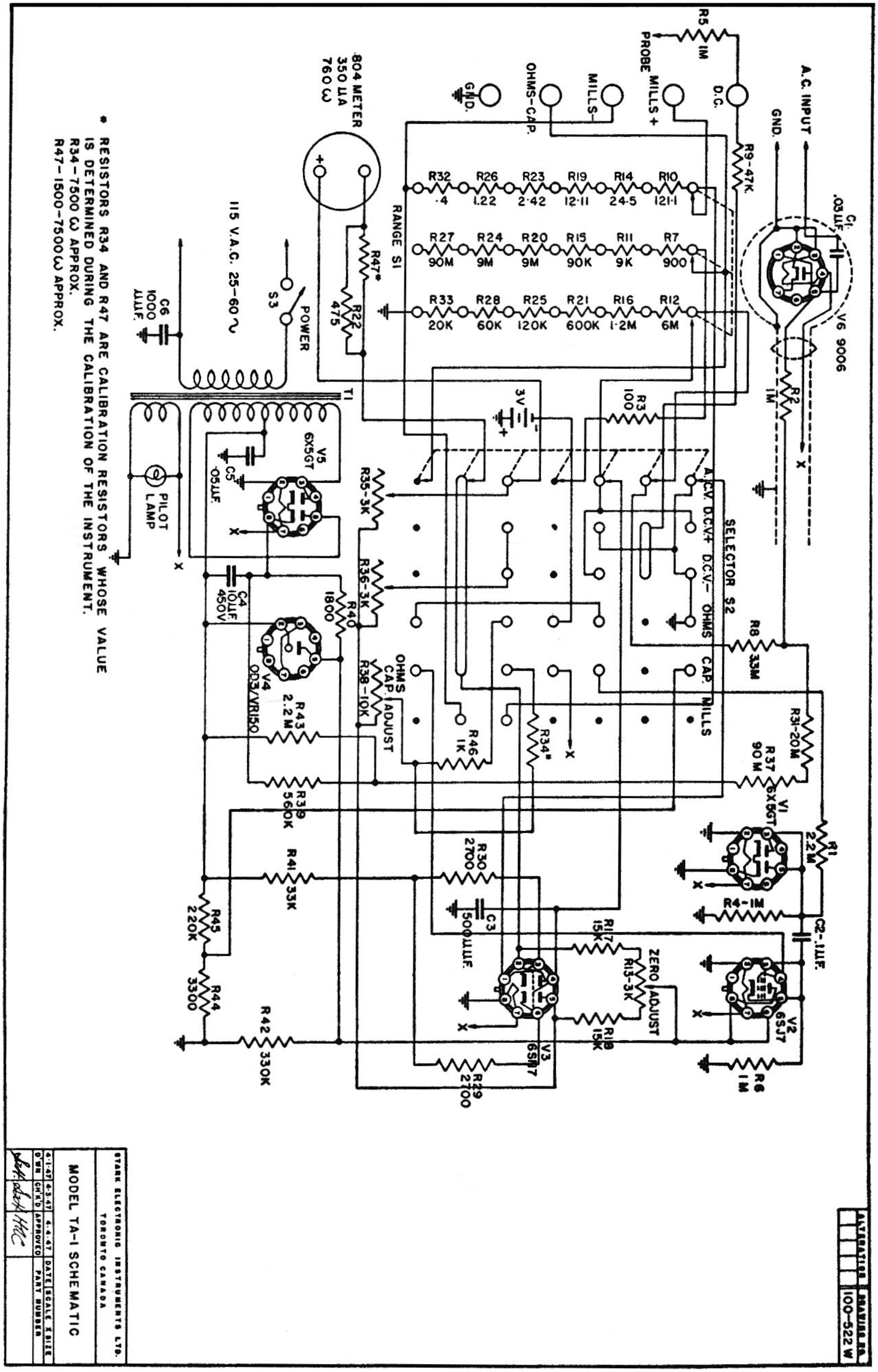

A.C. INPUT
GND.
D.C.
PROBE
MILLS +
MILLS-
OHMS-CAP.
GND.
R5 1M
R9-47K
C1 .03µF
V6 9006
R2 1M
804 METER 350 µA 760 Ω
RANGE S1
R32 .4
R26 1.22
R23 2.42
R19 12.11
R14 24.5
R10 121.1
R27 90M
R24 9M
R20 9M
R15 90K
R11 9K
R7 900
R33 20K
R28 60K
R25 120K
R21 600K
R16 1.2M
R12 6M
R47*
R22 475
POWER S3
115 V.A.C. 25-60 ~
T1
3V
R3 100
V5 6X5GT
C5 .05µF
PILOT LAMP
C6 1000 µµF.
SELECTOR S2
A.C.V. D.C.V.+ D.C.V.- OHMS CAP. MILLS
R35-3K
R36-3K
R38-10K
OHMS CAP. ADJUST
R40 1800
C4 10µF. 450V
V4 OD3/VR150
R43 2.2 M
R39 560K
R46 1K
R34*
R8 33M
R31-20M
R37 90M
V1 6X5GT
R1 2.2M
R4-1M
C2-.1µF.
V2 6SJ7
R6 1M
R30 2700
C3 500µµF.
R17 15K
R13-3K
ZERO ADJUST
R18 15K
V3 6SN7
R29 2700
R41 33K
R45 220K
R44 3300
R42 330K
* RESISTORS R34 AND R47 ARE CALIBRATION RESISTORS WHOSE VALUE IS DETERMINED DURING THE CALIBRATION OF THE INSTRUMENT.
R34-7500 Ω APPROX.
R47-1500-7500 Ω APPROX.
STARK ELECTRONIC INSTRUMENTS LTD.
TORONTO CANADA
MODEL TA-1 SCHEMATIC
100-522 W

FIGURE 9

INDEX

STARK TUBE TESTERS:

Model 9-11A Portable "Three Control" Tube Tester.

Model 9-56—Tube Merchandiser, with Battery and Continuity Tests.

Model 9-66—Dynamic Mutual Conductance Tube Tester.

STARK ANALYZERS:

Model AF-2–DC 1000 Ohms per Volt, Pocket Size Volt-Ohm Milliammeter

Model SD-1—AC & DC 5,000 Ohms per Volt, Pocket Size Volt-Ohm-Milliammeter.

Model ES-1—AC & DC 20,000 Ohms per Volt, Open Face Analyzer.

Model KM —AC & DC 20,000 Ohms per Volt, DeLuxe Analyzer.

Model TA-1—Electronic Volt-Ohm-Milliammeter (Vacuum Tube) Analyzer.

Model VT-9—Electronic Volt-Ohm-Milliammeter (Vacuum Tube) Analyzer (Large Size).

STARK SIGNAL GENERATORS:

Model 10-A—R.F. Signal Generator, 95 K.C. to 144 M.C.

STARK CATHODE RAY OSCILLOGRAPH:

Model OS-9—5" With Internal FM Generator.

TELEVISION ALIGNMENT:

Model 610A—Universal Television Alignment Signal Generator.

Model 620 —Crystal Controlled Linearity Pattern Generator.