

OPERATING INSTRUCTIONS
for
TYPE 1803-A
VACUUM-TUBE VOLTMETER

Form 714-A



OPERATING INSTRUCTIONS
for
TYPE 1803-A VACUUM-TUBE VOLTMETER

INTRODUCTION

The Type 1803-A Vacuum-Tube Voltmeter is a high-impedance voltmeter with ranges for a-c voltage measurement up to 150 volts. The upper-frequency limit is in the vicinity of 200 Mc.

Except on the lowest range, the voltmeter is essentially a peak-reading instrument, but the scales are calibrated to give readings of the r-m-s value of sinusoidal applied voltages.

1.0 OPERATING CONTROLS AND PROCEDURE

1.1 MECHANICAL ZERO

Before turning on the power, check and reset if necessary the mechanical zero on the meter.

1.2 POWER SUPPLY

Be sure that the line voltage and frequency correspond to the values on the plate on the cabinet near the power cord. The power transformer primaries can be connected for either 115-volt or 230-volt operation. Details of the connection changes for converting from one voltage to the other are given in Section 2.0. The plate indicates the voltage for which the instrument was connected when it was shipped from the factory. If connections are changed, the plate should be reversed. One side is stamped for 115 volts, the other for 230 volts.

1.21 Connect the instrument to the a-c line with the attached power cord.

1.3 ELECTRICAL ZERO

Turn the RANGE switch from OFF to 1.5 and allow the instrument to warm up for about five minutes. With the ZERO control adjust the meter reading to zero. The zero is now adjusted for all ranges.



GENERAL RADIO COMPANY

1.4 VOLTAGE MEASUREMENTS

1.41 Probe: All a-c voltages to be measured are applied to the probe. The probe may be attached to the left side of the instrument by means of the attaching device provided, or it may be used free to reduce the length of connecting leads. The General Radio Type 274 Plug Terminals may be removed in order to reduce the length of connecting leads to a minimum.

1.42 It is usually advisable to ground the low probe terminal, which is attached to the shell of the probe. However, when the voltage that is being measured is at some d-c potential above ground, the low terminal should not be grounded. In such a case it must be remembered that there is considerable shock hazard, for the entire voltmeter will be at the same d-c potential from ground.

1.43 D-C Potential: The maximum d-c voltage that should be applied across the probe terminals is 300 volts with negative polarity on the high terminal, and 300 volts peak (including any impressed a c) with positive polarity on the high terminal.

The maximum d-c voltage that may be applied from the low probe terminal to ground is 500 volts.

1.44 Meter Scales: The two outer scales, which are linear, are used for voltages greater than 5 volts. The two non-linear inner scales are used for voltages of 5 volts and less.

2.0 CIRCUIT AND CONSTRUCTION

2.1 GENERAL CONSTRUCTION

The Type 1803-A Vacuum-Tube Voltmeter has been made light and small so that it can be easily handled. The rectifier tube, voltmeter tube, and most of the circuit components are mounted on a simple chassis that is attached to the panel. All components are easily accessible for servicing.

2.2 PROBE

The shielded probe contains a dual-diode miniature type tube and a few small components. The tube and components are made accessible by removing two small thumb screws and sliding back the cylindrical shield.

TYPE 1803-A VACUUM-TUBE VOLTMETER

When the shield is in place, the probe is completely shielded except for the small area of insulation around the high terminal. The probe circuit is connected to the d-c amplifier with a three-wire shielded cable.

2.3 D-C AMPLIFIER

The d-c amplifier consists of two balanced triodes operating in a degenerated circuit. The a-c voltage to be measured is rectified and applied to the control grid of one triode. The control grid of the other triode is connected to the output of a diode which serves only to balance the effect of the initial voltage of the rectifying diode. Both of the triodes are contained in one envelope.

The indicating meter is connected in series with stable resistors between the cathodes of the two triodes. The voltage range is changed by changing the value of the series resistance.

2.4 RECONNECTING POWER TRANSFORMER FOR DIFFERENT LINE VOLTAGE

The transformer primaries can be connected for either 115-volt or 230-volt operation. The a-c line is connected, through the power switch and fuses to power transformer terminals No. 1 and No. 4. For 115-volt operation connect terminal No. 1 to terminal No. 3 and terminal No. 2 to terminal No. 4. For 230-volt operation connect terminal No. 2 to terminal No. 3. If the transformer connections are changed from the factory connections, reverse the plate on the cabinet near the power cord, and replace the two line fuses. (See Parts List.)

3.0 OPERATING CHARACTERISTICS

3.1 VOLTAGE RANGE

0.1 to 150 volts, a-c in five ranges (1.5, 5, 15, 50, and 150 volts, full scale).

3.2 ACCURACY

$\pm 3\%$ of full scale on all ranges for sinusoidal voltages.

3.3 WAVEFORM ERROR

The instrument operates as a peak voltmeter calibrated to read r-m-s values of a sine wave, or 0.707 of the peak value of a complex

GENERAL RADIO COMPANY

wave. On distorted waveforms the percentage deviation of the reading from the r-m-s value may be as large as the percentage of harmonics present.

3.4 FREQUENCY ERRORS

At high frequencies resonance in the input circuit and transit-time effects in the diode rectifier introduce errors in the meter reading. The resonance effect causes the meter to read high and is independent of the applied voltage. The transit-time error is a function of the applied voltage and tends to cause the meter to read low. The accompanying curves give the frequency correction for several different voltage levels. It will be noted that at low voltages the transit-time and resonance effects tend to cancel, while at higher voltages the error is almost entirely due to resonance. The resonant frequency is about 410 Mc.

At low frequencies the response drops off because of the increasing reactance of the series capacitance of the input circuit. At 20 cycles per second the drop is 2% or less.

3.5 INPUT IMPEDANCE

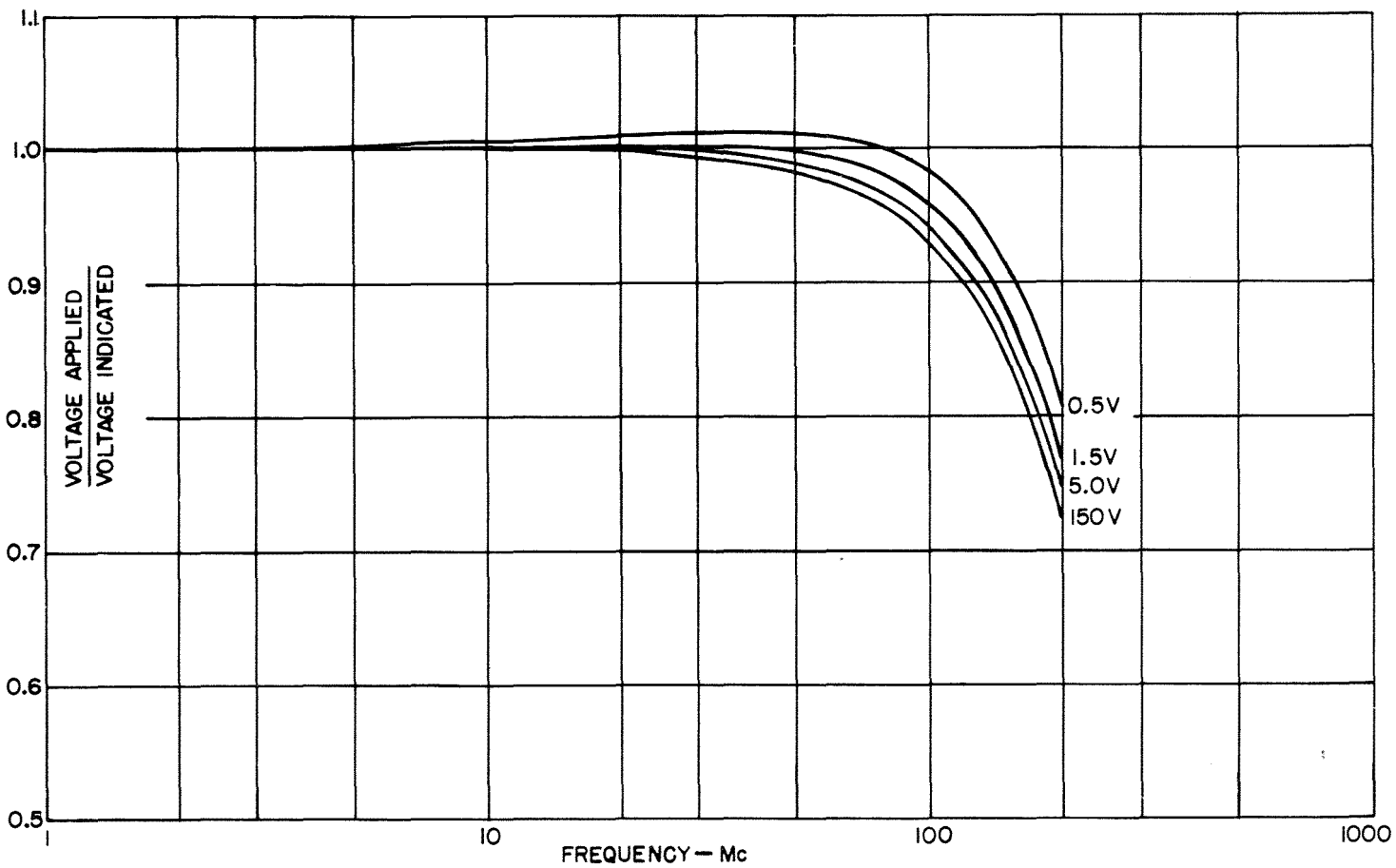
The equivalent a-c input circuit is a resistance in parallel with a capacitance. At low frequencies the equivalent parallel resistance is 7.7 megohms. At high frequencies this resistance is reduced by losses in the shunt capacitance. The equivalent parallel capacitance at radio frequencies is 10 $\mu\mu\text{f}$. At audio frequencies the capacitance increases to 11.5 $\mu\mu\text{f}$. The accompanying curves give the variations of R_p and X_p with frequency.

3.6 POWER SUPPLY

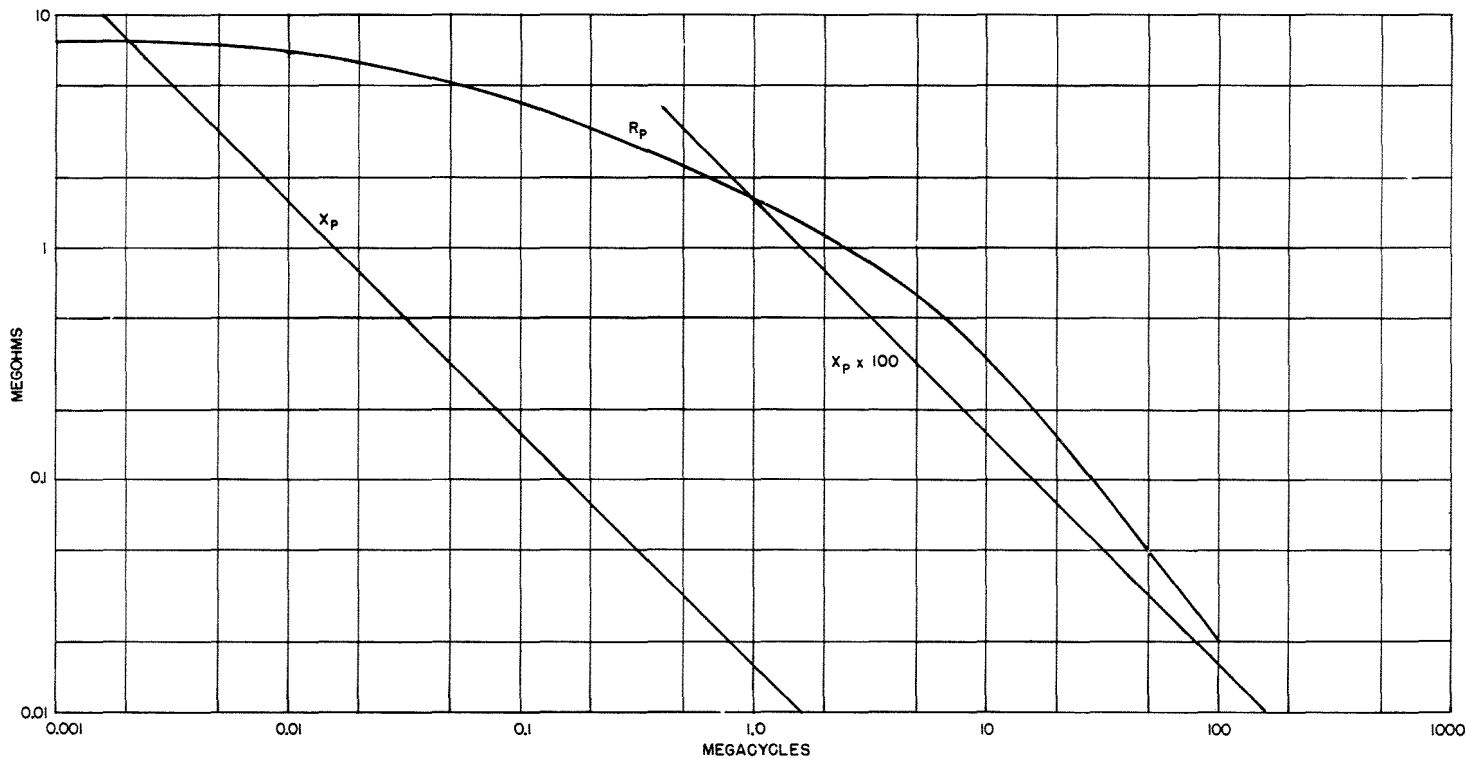
105 to 125 volts or 210 to 250 volts, a-c, 50 to 60 cycles. The power input is about 11 watts.

3.7 TUBES

One Type 6AL5, one Type 6SU7-GT, and one Type 6X5-GT/G are used; all are supplied.

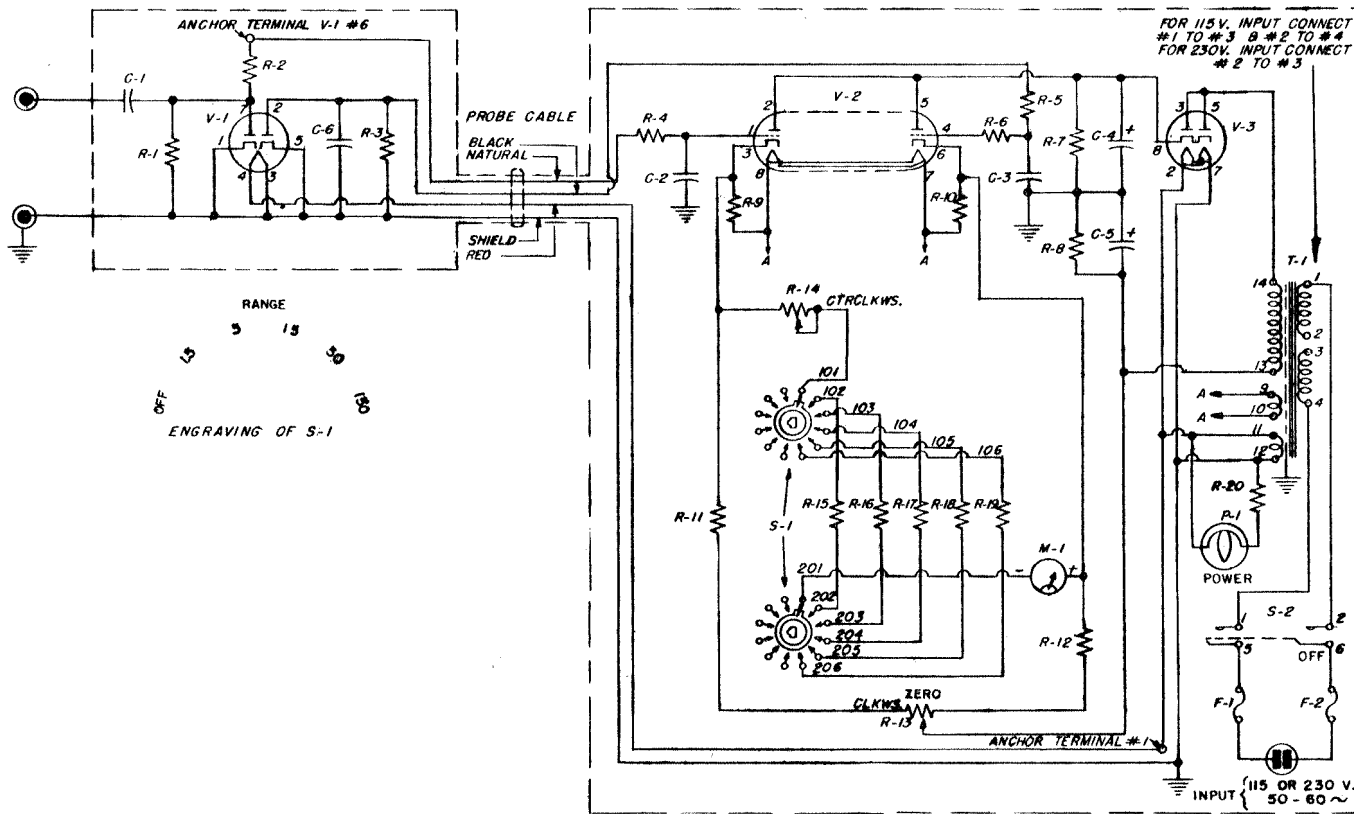


Plots Showing the Ratio of Applied Voltage to Indicated Voltage as a Function of Frequency for Various Values of Indicated Voltage.



Plots of Resistance and Reactive Components of the Input Impedance of the Type 1803-A Voltmeter.





RESISTORS

RESISTOR	VALUE	TOLERANCE	TYPE	MANUFACTURER
R-1	47 Megohms	±10%	IRC	REC-210F □
R-2	15 Megohms	±10%	IRC	REC-210F □
R-3	47 Megohms	±10%	IRC	BTS
R-4	47 Ohms	±10%	ERIE	504B
R-5	47 Ohms	±10%	ERIE	504B
R-6	15 Megohms	±10%	IRC	BTS
R-7	450 K Ohms	±1%	CC	X $\frac{1}{2}$
R-8	820 K Ohms	±1%	CC	X $\frac{1}{2}$
R-9	18 Megohms	±10%	IRC	BTA
R-10	18 Megohms	±10%	IRC	BTA
R-11	330 K Ohms	±1%	CC	X $\frac{1}{2}$
R-12	330 K Ohms	±1%	CC	X $\frac{1}{2}$
R-13	200 K Ohms	±10%	GR	POSC-7
R-14	2 K Ohms	±5%	GR	301-485
R-15	5,500 Ohms	±1%	CC	X $\frac{1}{2}$
R-16	28,200 Ohms	±1%	CC	X $\frac{1}{2}$
R-17	97,300 Ohms	±1%	CC	X $\frac{1}{2}$
R-18	336 K Ohms	±1%	CC	X $\frac{1}{2}$
R-19	1.015 Megohms	±1%	CC	X $\frac{1}{2}$
R-20	15 Ohms	±10%	IRC	BW $\frac{1}{2}$ *

MUST BE IRC TYPE BTS

CONDENSERS

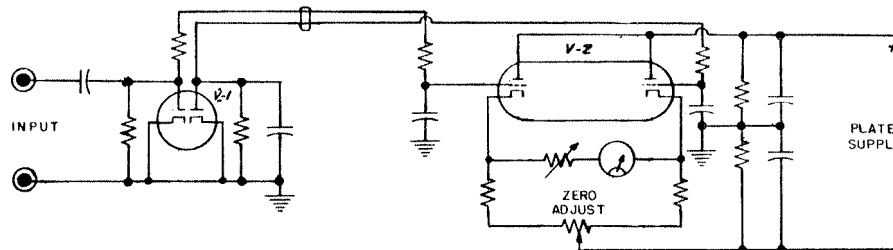
CONDENSATOR	VALUE	TOLERANCE	TYPE	MANUFACTURER
C-1	.01 μ f	±10%	GR	COM-41B
C-2	.01 μ f	±10%	GR	COM-35B
C-3	.01 μ f	±10%	GR	COM-35B
C-4	20 μ f	±10%	GR	COE-5
C-5	20 μ f	±10%	GR	COE-14
C-6	50 μ f	±10%	ERIE	N750A

MISCELLANEOUS

S-1	Banged Switch	GR	SWRW-43
S-2			
M-1	0-200 μ A Meter	GR	MEDS-37
F-1, F-2	0.2 amp Slow-Blow 3AG	GR	FBF-1 (115/V)
F-1, F-2	0.1 amp Slow-Blow 3AG	GR	FBF-1 (230/V)
T-1	Power Transformer	GR	245-449
P-1	6.3 Volts	GR	2LAP-939

*Part of P-1 Socket

Wiring Diagram for Type 1803-A Vacuum-Tube Voltmeter



Schematic Diagram for Type 1803-A Vacuum-Tube Voltmeter

TUBES

V-1	RCA	6AL5
V-2	Tungsten	6X5-6TY
V-3	RCA	6X5-6T/G

