

MODEL 117A
VACUUM TUBE VOLTMETER
OPERATION MANUAL

印刷表紙使用のこと

KIKUSUI ELECTRONICS CORP.

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.

(Revision should be applied to items indicated by a check mark)

Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

Input fuse

The rating of this product's input fuse is _____ A, _____ VAC, and _____.

WARNING

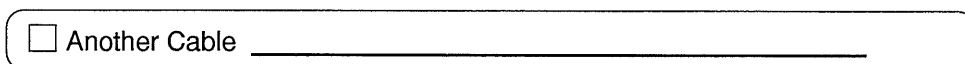
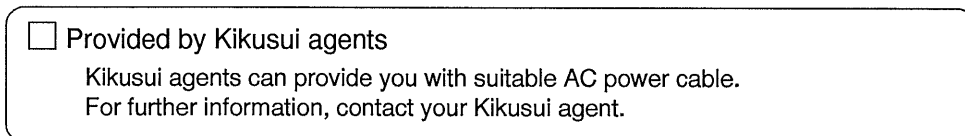
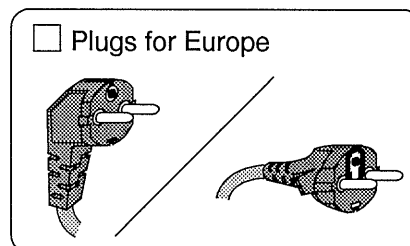
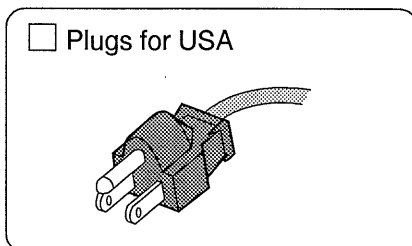
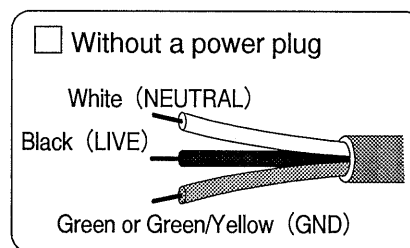
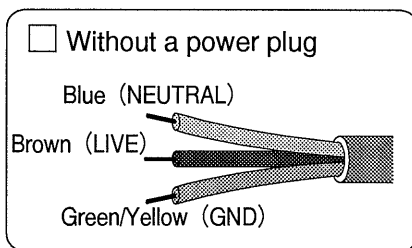
- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

AC power cable

The product is provided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.



1. GENERAL

The Model 117A Vacuum Tube Voltmeter is a modified version of famous Model 107A Vacuum Tube Voltmeter, and using its high frequency probe, it can measure high frequency voltage up to 50MHz. The high input impedance of this equipment enables accurate measurement in high impedance circuits in all ranges.

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2. SPECIFICATION

Type	Peak-to-peak voltage indication type	
Power Requirement	-----V, 50/60Hz Approx.7VA	
Dimensions	150 (W) x 200 (H) x 100 (D) mm	
(Maximum)	160 (W) x 240 (H) x 160 (D) mm	
Weight	Approx. 3kg	
Meter	Length of scale 105mm,	
	Sensitivity	100 μ A
Tubes Used	12 AU7 (Amplifier)	1
	6 AL5 (Detector)	1
Accessories	PR - 6 Probe	1
	G - 1 Prod	1
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3. MEASUREMENT RANGE

3.1 AC Voltmeter

1. Type Peak-to-peak voltage indication type
2. Ranges
 - Sine-wave in RMS
 - Through PR-6 RF Probe 0 ~ 1.5/5/15/50/150 volts RMS
 - Direct (1) 0 ~ 1.5/5/15/50/150/500/1500V RMS
 - Composite wave in peak-to-peak
 - Through PR-6 RF Probe 0 ~ 4.2/14/42/140/420/
 - Direct (1) 0 ~ 4.2/14/ 42/140/420/1400 Vp-p
 - Sine-wave in dBm (0 dBm ~ 1 mW into 600Ω)
 - Through PR-6 RF Probe -20 ~ +6/16/26/36/46 dBm
 - Direct (1) -20 ~ +6/16/26/36/46/56/66 dBm
3. Accuracy (at 1000Hz) Within ± 5%
4. Frequency Response (in reference to 1000Hz, through PR-6RF probe)
 - 50Hz ~ 30MHz ± 3%
 - 20 Hz ~ 50MHz ± 10%
5. Input Impedance (at tip of PR-6 RF Probe, resistive component only)
 - At 100kHz More than 2 MΩ
 - At 1 MHz More than 1 MΩ
 - At 10 MHz More than 200 KΩ
6. Input Capacitance (in case of direct input (1))
 - 1.5 ~ 150 V ranges Less than 80 pF
 - 500 , 1500 V ranges Less than 65 pF
7. Maximum Input (in case of direct input (1))
 - Sine-wave without DC component 1500V RMS maximum
 - Composite wave without DC component 2000V RMS maximum
 - When DC component is included 2000V RMS maximum

3.2 DC Voltmeter

- | | |
|---------------------|--|
| 1. Polarity | Either positive or negative |
| 2. Range | 0 ~ 1.5/5/15/50/150/500/1500 V |
| 3. Input resistance | 11 M Ω shunted by less than 1.5 pF
in all ranges |
| 4. Sensitivity | 7.33 M Ω /V in 1.5 V range |
| 5. Accuracy | within $\pm 3\%$ |
| 6. Maximum input | Pure DC voltage 1500 V maximum
Composite DC voltage 1500 V maximum
at peak |

3.3 Resistance

- | | |
|------------------------|--|
| 1. Coverage | Minimum 0.1 Ω , Maximum
Maximum 1000M Ω |
| 2. Range (at center) | 10/100/1 K/ 10K /100K/1 M/10 M Ω |
| 3. Test Voltage | Maximum 1.5 V |
| 4. Accuracy | Between 0.3 ~ 3 on the scale
within $\pm 5\%$
Between 0.1 ~ 10 on the scale
within $\pm 10\%$ |

Note (1) Installing PR-6 RF Probe inside the equipment,
and using G-1 Probe

INSTALLATION

1. Position

Since meter indicator has been dynamically balanced the Model 117A can be installed in any position, vertically or horizontally, or with an inclination.

2. Power Source

The standard Model 117A works on prescribed line voltage of 50 to 60 Hz. The voltage variation is allowed between +10% to -15% of the line voltage.

3. Insulation

Insulation between power line and cabinet of this equipment withstands at 1000V DC for 1 minute and measures more than 200 M Ω . Input return is connected to the cabinet, however, four rubber bushes on the bottom of cabinet may serve to isolate the cabinet from the ground when necessary.

4. Adjustment of Mechanical Zero Point

Before operation, meter pointer is placed exactly over zero point of the scale turning screw driver adjustment on the meter.

5. Stability

Fluctuation of meter indication becomes negligible after warm-up of 3 to 5 minutes. should

When high degree of stability is required for long period, however, warm-up time of 15 to 20 minutes should be allowed.

6. Battery

A battery installed in the Model 117A should be replaced every 6 months. A standard 1.5 V dry battery (JIS UM-1, RCA VS-036, Eveready 950, or equivalent) is used.

7. RF Probe

During operation, PR-6 Probe should be always connected to the equipment.

8. Upper Lid

Lid provided on the upper side of the cabinet is used when PR-6 Probe is installed inside the cabinet.

9. Switches

A knob on lefthand side of the panel is a range switch. A knob on righthand side of the panel is a function selector switch.

MEASUREMENT OF AC VOLTAGES

1. Adjustment of Electrical Zero Point

Function selector switch is placed in AC position, and tip of PR-6 Probe is grounded using GND clip. Range switch is then first turned to 150 or 1500 V position, and meter pointer is placed at zero on the scale by ZERO ADJ knob. Then, placing range switch at 1.5 V position, meter pointer is again placed at zero by AC ZERO screw driver adjustment.

This procedure is repeated to obtain exact zero indication in all ranges.

2. Probe

When PR-6 Probe is installed within the cabinet, G-1 probe is used.

In measurement of AC voltages below 1 MHz, G-1 Probe may be much convenient. When using G-1 Probe in measurement of AC voltages, red knob on the probe is turned to AC position.

3. RMS Scale

RMS scale has been calibrated applying pure sinewave. Therefore, in measurement of voltages of composite waveforms, RMS value indicated on the meter may deviate from true RMS value of composite waveform.

When range switch is placed in 1.5V position, indication on scale 1.5V AC is read. When range switch is placed in 5 V position, indication on scale 5 V AC is read. When range switch is placed in 15, 150, or 1500 V position, indication on scale 50 V DC OR RMS is read. In ranges 50 and 500 V, indication on scale 50 V DC OR RMS is read.

4. P-P Scale

Peak-to-peak voltages can also be read on the meter. When range switch is placed in 15, 150, or 1500V position, indication on scale 40 Vp-p is i read. When range switch is placed in 50 or 500V position, indication on scale 140.Vp-p is read. However, when range switch is placed in 1.5 or 5 V position, RMS value read on 1.5 V AC or 5 V AC scale should be transferred on 15 V DC OR RMS or 50 V DC OR RMS scale to obtain corresponding peak-to-peak value.

5. DBM Scale

DBM Scale has been calibrated in reference to 0 dBm = 1 mW into 600Ω applying pure sine-wave voltage. When range switch is placed in 1.5 V or 5 V position, indication on scale 5 dBm or 15 dBm is read. When range switch is placed above 15 V position, RMS value read on such scale should be transferred to 1.5 V AC or 5 V AC scale to obtain corresponding dBm value. Following is a conversion table to obtain dBm value on each range.

Maximum Voltage dBm	Range V	Scale Used dBm	Add dBm
+ 6	1.5	5	0
+16	5	15	0
+26	15	5	20
+36	50	15	20
+46	150	5	40
+56	500	15	40
+66	1,500	5	60

MEASUREMENT OF DC VOLTAGES

1. Adjustment of Electrical Zero point

Function selector switch is placed in either + DC or - DC position, and red knob on G-1 Probe is pushed toward DC position.

Then, tip of probe is grounded using alligator clip connected to the probe. Meter pointer is then placed exactly to zero on the scale by ZERO ADJ knob.

2. Measurement

Contacting tip of G-1 Probe at any point to be measured, voltage is directly read off on the scale 15 V DC or 50 V DC. In measurement of more than 1500 V, HV-2 High Voltage Probe is used (available upon separate order). With this probe, voltages up to 35,000 V can be measured.

3. Zero Center DC Volts

Placing range switch in +DC position, meter pointer is placed at 7.5 on 15 V DC scale or 25 on 50 V DC scale by ZERO ADJ knob.

Then, voltage is observed on 15 V DC or 50 V DC scale. With function selector switch placed in +DC position, a positive voltage causes a deflection rightward from the center, and negative voltage causes a deflection leftward.

MEASUREMENT OF RESISTANCES

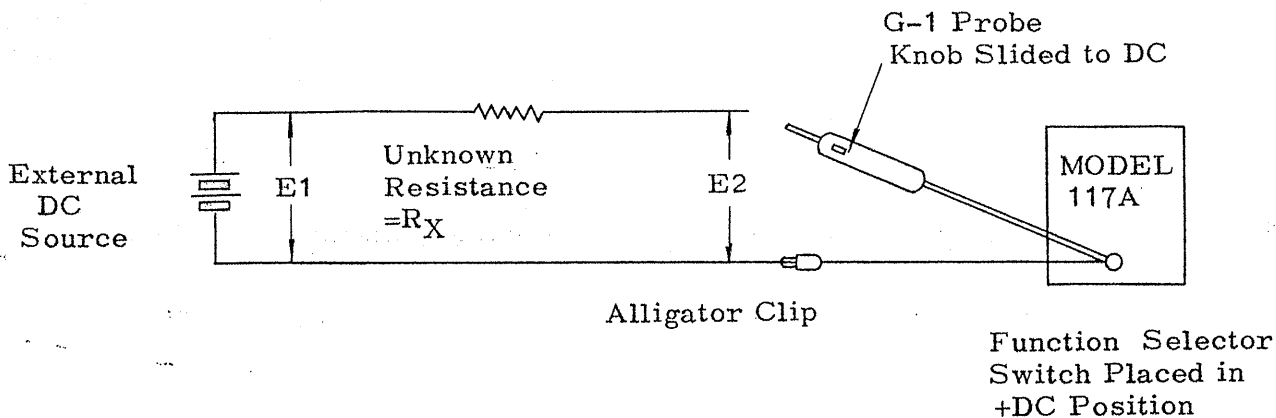
1. Adjustment of Electrical Zero Point

Function selector switch is placed in OHMS position, and red knob on G-1 Probe is pushed to AC Ω position. Grounding tip of probe using alligator clip, meter pointer is placed at zero with ZERO ADJ knob.

Disconnecting alligator clip, then, meter pointer is placed at ∞ position with OHMS ADJ knob. The equipment is then ready for measurement of resistances.

2. Measurement of Very High Resistances

Resistances more than $1000\text{M}\Omega$ can also be measured using an external DC source as shown below;



Unknown resistance, R_X , can then be calculated by formula:

$$R_X = \frac{11 (E1 - E2)}{E2} \text{ M}\Omega$$

3. Measurement of Very Low Resistances

In measurement of very low resistances at 10Ω range, error may be included in the meter indication due to series resistance of G-1 Probe. This resistance is approximately 0.1Ω , therefore, this value should be subtracted from the meter reading.

4. Replacement of Battery

Range switch is placed in $10\text{k}\Omega$ position, and both zero point and ∞ point are accurately obtained. Then, range switch is placed in 10Ω position. Connecting probe to alligator clip for a period of about 10 seconds, meter indication is checked if it returns to ∞ point as disconnecting probe. If meter indicates below ∞ point, battery should be drained up and such battery should be replaced.