MODEL 102A

VOLTAGE SCALE CALIBRATOR

for

VACUUM TUBE VOLTMETER

INSTRUCTION MANUAL

KIKUSUI ELECTRONICS CORPORATION

This instrument, a device for generating highly stable voltage that is applied mainly to the calibration of vacuum tube voltmeters, generates DC and AC (RMS and P-P) voltage of 500V maximum, and enables to obtain the wide range voltage of high accuracy by means of a contained attenuator, thus facilitating the voltage calibration of the various instruments of high input impedance.

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.

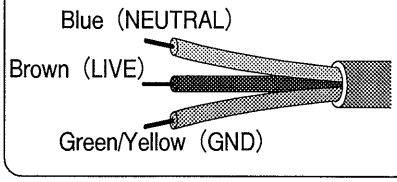
☐ AC power cable

The product is porvided 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.

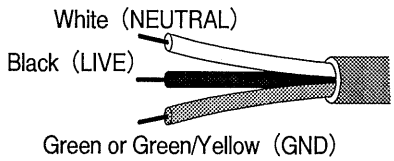
WARNING

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

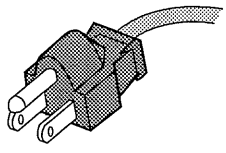
☐ Without a power plug



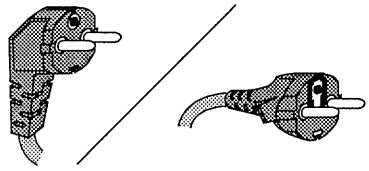
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

MODEL 102A VTVM VOLTAGE SCALE CALIBRATOR SPECIFICATIONS

Power supply	100V 50/60 c/s approx. 170VA	
Dimensions (max)	520(550)W, 200(220)H, 454(500)D mm	
Weight	20 Kg	
Accessories	Short bar	1
	Instruction manual & test data	1 each
	Plug	2

DC Output Polarity +DCV and -DCV

Voltage range Optional selection within 0.075mV~500V (± 5%) by the combination of the following knobs

5 3 2 1.5 1 0.75	X	100V 10V 1V 100mV 10mV 1mV	X	1.0 0.9 ⋮ (0.1 step) ⋮ 0.1 0	Deviation to the indication values of the left knobs	+5.0% ⋮ (0.5% step) ⋮ 0% ⋮ (0.5% step) ⋮ -5.0%

Output resistance Approx. 0 ~ 8.2Ω (varied by output voltage)

Accuracy 500V output ± 0.1% (at 30 min. after start or thereafter)

Attenuator accuracy ± (0.1% + 10μV)

Ripple 10mV P-P

AC Output Waveform Sine wave 400c/s ± 2%

(changeable to 1000c/s by the internal switch)

Distortion factor	0.3%
Unit	V RMS and V peak to peak
Voltage range	Same as DC output
Output impedance	" "
Accuracy	500V output ± 0.25% (at 30 min. after start or thereafter)
	Attenuator accuracy ±(0.1% + 10μV)

Output Stability

Power supply voltage ± 0.1% to ± 10% fluctuation

Load Impedance

Resistance	More than 0.9MΩ
Capacitance	Less than 200pF

DESCRIPTIONS OF PANEL FURNISHINGS

AC/DC

is a selector switch for the output waveform also usable as a STAND BY switch, and when this switch is rotated in clockwise order from the counterclockwise extreme (marked as p-p), the following positions are prepared.

p-p When set to this position, AC voltage (400c/s or 1000c/s sine wave) of 500V p-p maximum (≃176.8V RMS) comes out to the output terminal. The output voltage value is determined by the positions of the four knobs provided on the right side of this knob, and the unit becomes VOLT p-p.

RMS is same as the position of the above p-p, and the unit becomes VOLT RMS and enables to obtain the output voltage of 500V RMS maximum.

OFF — The internal 500V power source is cut off from the input terminal of the attenuator contained, no voltage comes out to the output terminal and thus the state of standing by is attained.

+DC — enables to obtain the DC voltage of 500V maximum as the output, and the red output terminal is of plus polarity.

OFF — is same as the above OFF.

-DC — is same as the above +DC except the polarity reversed, and the red terminal becomes minus.

OUTPUT VOLTS

are the selector knobs for the attenuator contained, the product of the numerical values indicated by these three knobs represents the output voltage value. All these knobs increase the output by the clockwise rotation. That is to say, when the three knobs are all set to the position rotated clockwise to the extreme, the output voltage is maximized to 5 x 100V x 1 = 500V.

%

is the knob for finely adjusting in 0.5% step the ±5% range of the voltage value determined by the above OUTPUT VOLTS knobs.

LOAD RESISTANCE

is the knob for minimizing the error in attenuation ratio of the attenuator contained, in accordance with the

input impedance of the device that is connected to the output terminal to be calibrated, and is well done by setting this knob to the input resistance value in the DC range and even in the AC range if the input capacitance is lower than 200 pF.

OUTPUT G G'

are the output terminals of this instrument to which the input terminal of the device to be calibrated shall be connected. Ordinarily, G and G' are short-circuited by the accessory short bar to which the earth side of the input terminal of the device to be calibrated is connected, while the hot side connected to the red terminal, in order to perform the calibration. Particularly in case of calibrating high sensitivity ranges, take off the short bar and use the red terminal and G(grey) terminal, and the error will be lessened.

INTERNAL CALIBRATION P-P RMS DC

are the semi-fixed resistors for adjusting the output voltage, and shall be adjusted by taking off the caps and inserting a screwdriver therein. On such occasions as this instrument has been used for a long time or specially high accuracy is required, the calibration can be made by an external standard instrument.

POWER ON OFF

is the power supply switch, and when turned to the upper side, the power is supplied and the upper pilot lamp is lighted.

OPERATE

is for indicating that the voltage is coming out to the output terminal in the manner of lighting when the above AC/DC switch is set to the positions other than OFF.

CALIBRATION OF VACUUM TUBE VOLTMETER

When the line cord of this instrument is connected to the power outlet of 100V 50/60 c/s and POWER switch is turned to ON, this instrument becomes ready for operation after some 30 seconds then, but it takes more than 30 minutes till the completely stabilized state is attained.

1) After making sure that the AC/DC switch is in the middle OFF position, connect to the G' terminal the earth side terminal of the vacuum tube voltmeter to be calibrated and then connect the input terminal (the hot side) to the red terminal.

2) For example, in case of calibrating the range of +DC 500V full scale, set the OUTPUT VOLTS knobs to 5, 100V, 0 from the left and the % knob to the middle 0%.

3) Set the LOAD RESISTANCE knob to the input resistance of the device to be calibrated.

4) Change the AC/DC switch to +DC, rotate the right side knob of OUTPUT VOLTS to 0.1, 0.2, - - - in sequence, rotate the % knob so that the meter pointer of the vacuum tube voltmeter comes to the middle position on the corresponding scale line in the preceding respective positions, and the proportion of error in indication in the respective positions will be readable direct.

5) In order to calibrate the 150V range of the same voltmeter continuously, perform the calibration in the respective positions in the same method as the 500V range after setting the left side knob of OUTPUT VOLTS to 1.5 position, and in case of the 50V range, after setting the middle knob to 10V position.

6) And then, in order to calibrate the AC range of the same voltmeter, put the AC/DC switch back to the middle OFF position, change the range of that voltmeter, set the OUTPUT VOLTS knob to the measuring range, change the AC/DC switch to RMS or P-P, and start the calibration. That is to say, the OFF position of the AC/DC switch indicates STAND BY (the state of standing by), and in this position, the range of the device to be calibrated shall be changed, and the input terminal be connected and taken off.

READJUSTMENT OF OUTPUT VOLTAGE

In order to maintain the output voltage accuracy of this instrument, readjustment by a standard instrument is required at determined intervals regardless of the used time having been long or short. The circuit of this instrument is based on DC 500V and arranged in the order of AC 500V P-P and 500V RMS, so that the adjustment shall be performed in this order except the time when only one of them is used singly. When the respective volts are not obtained in the predetermined accuracy even if the 500V output has been readjusted, the attenuator shall be repaired.

1. Adjustment of DC 500V

A standard DC voltmeter of input resistance more than 100KΩ shall be connected to the output terminal, and the DC 500V output be adjusted to 500V correctly by means of INTERNAL CALIBRATION semi-fixed resistor provided on the panel. In this instance, if the determined voltage change (±25V ±1%) is not obtained correctly when the % knob is rotated in full, the rubber cap at the back of the case shall be taken off, and the semi-fixed resistor shall be readjusted. The 500V output is also varied by this readjustment, so that the 500V shall be adjusted at each time by the INTERNAL CALIBRATION.

In case of error allowable up to approx. 0.2%, the 500V can be adjusted by a DC ammeter that enables to measure 20mA. That is to say, the adjustment can be attained by connecting the DC ammeter with this instrument via the ammeter connecting jack (marked as 20mA) provided on the left side (viewing from the panel side) of the chassis, setting the AC/DC switch on the panel to +DC or -DC position, and adjusting the above semi-fixed resistor so that the ammeter indicates 20mA. Even if the indication error of the ammeter is 0 at this time, the input resistance of the attenuator is 25KΩ ±0.2%, so that the error of the 500V output does not become 0. (see the circuit-diagram as for the internal connection)

2. Adjustment of AC 500V

Readjustment shall be performed by means of INTERNAL CALIBRATION semi-fixed resistors(p-p and RMS) on the panel in like manner as the adjustment of DC 500V using a standard AC voltmeter of input resistance more than 100KΩ.

500V P-P ≒ 176.777V RMS

In case that the DC range is adjusted correctly, the AC range can be adjusted by a DC voltmeter, that is able to measure some 10mA, without using an AC meter. In other words, connect the said voltmeter to the mV meter connecting jack (marked as 8mV) provided on the left side (viewing from the panel) of the chassis, push the push switch adjoining thereto, and measure the output voltage of the internal thermocouple. Memorize the average value of the indications (approximately equal) in the +DC and -DC range, and adjust the INTERNAL CALIBRATION (RMS) so that the same indication is obtained when changed to the RMS range. This method is not applicable to the P-P range.

The above push switch is always (while the switch is not pushed) short-circuiting the hot-wire for protecting the thermocouple. This switch is locked when rotated clockwise in the state of being pushed, but it is not preferable to use this as is locked, since the hot-wire may be damaged at such time as operating the AC/DC selector switch.

3. 1000 c/s Output

This instrument can be used with the frequency of the AC output changed to 1000 c/s by the internal slide switch (to be operated from the top of the chassis). But, since the 500V RMS and P-P output of this instrument are calibrated at 400 c/s, readjustment is required when the frequency is changed.