MODEL 102B

ELECTRONIC VOLTMETER

CALIBRATOR

OPERATION MANUAL

KIKUSUI ELECTRONICS CORP.

1175, Higashi 3-Chome, Shinmaruko, Kawasaki-City, Japan

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.

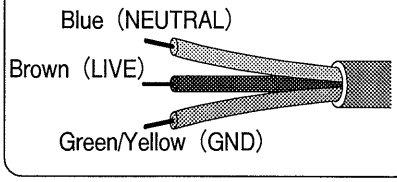
☐ AC power cable

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.

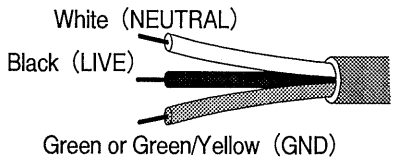
WARNING

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

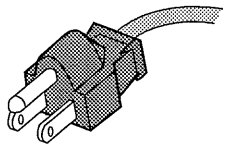
☐ Without a power plug



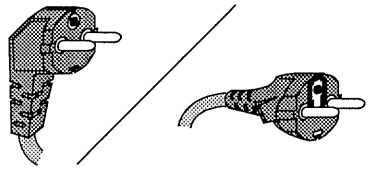
☐ Without a power plug



☐ 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

1. INTRODUCTION

The Model 102B is a highly stable voltage generator designed primarily for calibrating an electronic voltmeter. It generates a maximum of 500V DC and AC voltages (RMS and P-P). A wide range of voltages can be obtained with high accuracy by a built-in attenuator. The Model 102B can easily calibrate various voltmeters with a high input impedance.

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* Circuit diagram .....

2. SPECIFICATION

Power supply	---------V, 50/60 Hz	Approx. 100VA
Dimensions	430mm(W) x 200mm(H) x 375mm(D)	
(Maximum)	(445mm(W) x 215mm(H) x 400mm(D))	
Weight		Approx. 18 kg
Accessories	Plug (with lead wire)	1
	941B terminal adapter	1
	Operation Manual	1
	Test data	1

DC output

Polarity: +DC and -DC

Voltage range: Various voltages up to 500V can be optionally selected by using one of the following combinations of the knobs.

[5 / 3 / 2 / 1.5 / 1 / 0.75] × [100 V / 10 V / 1 V / 100mV / 10mV / 1mV] × [1.0 / 0.9 / 0.8 / ⋮ / 0.1 step / ⋮ / 0.1 / 0]

% deviations from the value determined by the setting of the left three knobs.

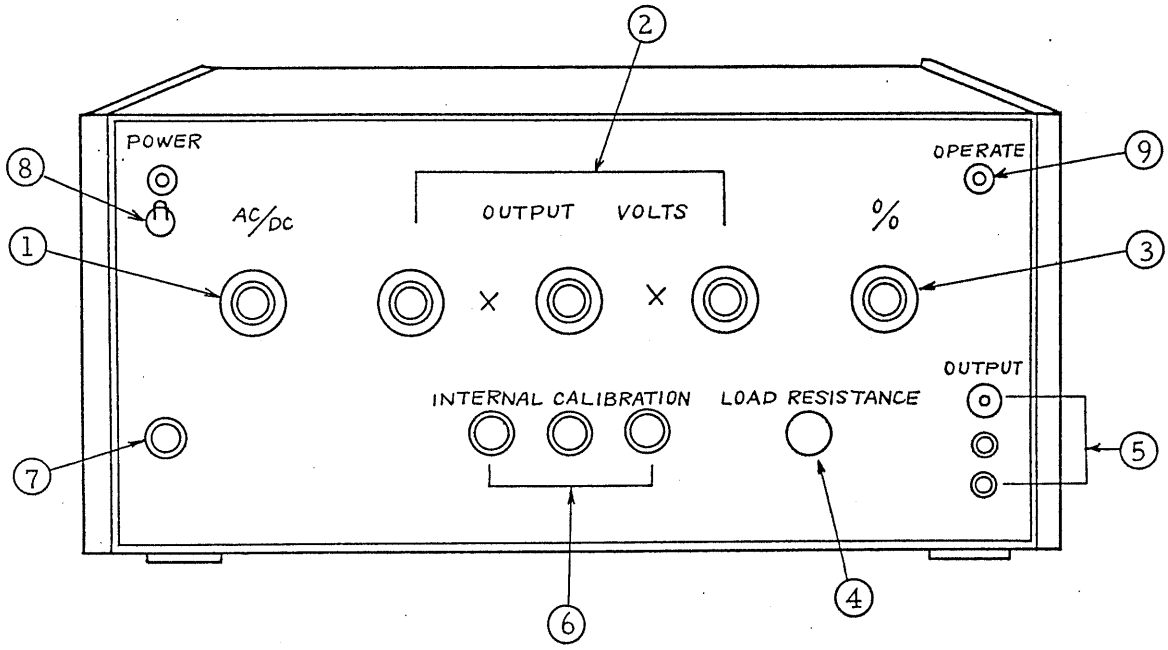
[+5% / ⋮ / 0.5% step / ⋮ / 0 / -5%]

Output resistance: Approx. 0 ~ 8.3 k ohms (depending on output voltage setting)

Accuracy	500V output	±0.1% (after 30 minutes warm-up)
	Attenuator accuracy (1M ohm load)	± (0.15% +100μV)
	Maximum output deviation caused by load variation	±0.1%
	(With LOAD RESISTANCE control on the panel set properly for load impedance.)	
Ripple	Less than 10 mVrms	
AC output		
Waveform	Sine wave	400 Hz ± 2%
	(Can be changed over to 1,000 Hz with internal switch.)	
Distortion	0.3%	
Units	Vrms and V_{p-p}	
Voltage range	Same as DC output	
Output impedance	Same as DC output	
Accuracy	500V output ±0.25% (after 30 minutes warm-up)	
	Attenuator accuracy	Same as DC output
Load impedance	Resistance	0.9M ohms or more
	Capacitance	200pF or less

3. OPERATION

3.1 Explanation of front panel



① AC/DC

The output changeover switch, which also serves as a stand-by switch, can be turned to the following positions, given here in clockwise order from the fully counter clockwise position (P-P):

P-P — When the set is in this position, a maximum of $500V_{p-p}$ (≒ 176.8V RMS) AC voltage (400 Hz or 1,000 Hz sine wave) appears at the output terminal.

	An output voltage value is determined by the 4 knobs to the right of knob (unit: V_{p-p}).
RMS	Same as the P-P position above, except that the unit is Vrms. A maximum of 500Vrms output is attained.
OFF	Since the 500V internal power supply is cut off from the input terminal of the attenuator, no voltage is detected at the output terminal, and the instrument is in stand-by condition.
+DC	DC output up to 500V is attained.
OFF	Same as OFF above.
-DC	Same as +DC above.

② OUTPUT VOLTS

These are the changeover switches for the built-in attenuator, and the product of values indicated by the three knobs is the value of the output voltage. The output is increased by

turning any of these knobs clockwise. The maximum output voltage, i.e., 5 x 100V x 1.0 = 500V, is attained when all these knobs are turned fully clockwise.

③ %

This knob is for fine adjustment in 0.5% increments within ±5% of the voltage determined by the three knobs of OUTPUT VOLTS.

④ LOAD RESISTANCE

This control is set in accordance with the input resistance of the equipment to be connected to the output terminal for calibration. The control is used to minimize the errors of the built-in attenuator.

⑤ OUTPUT G' GND

Connect the input terminal of the calibration equipment to the output terminal with a type M plug or the 941B terminal adapter furnished with the instrument. When the 941B terminal adapter is used, connect the input terminal ground to the G'terminal. The G terminal is connected directly to the panel of the set.

⑥ INTERNAL CALIBRATION P-P RMS DC

These are trimmer resisters for fine adjustment of the

output voltage. After removing the cap by counter clockwise turning, the output voltage can be simply adjusted with a screwdriver. When it has been in use for a long time or when a high precision is required, the 500V voltage can be readjusted by connecting an outside standard unit to the output terminal.

⑦ THERMAL CONVERTER OUTPUT

This is the jack for measuring the output voltage of the built-in thermocouple. Calibration is performed by comparing the AC output of 500Vrms with the DC output.

⑧ POWER

To turn on the power, tilt this power switch upward, and the upper pilot lamp will light.

⑨ OPERATE

When the AC/DC switch is in a position other than OFF, this lamp lights to indicate voltage is being applied to the output terminal.

3.2 Calibration of electronic voltmeter

Connect the power cord of the set to an AC 50/60 Hz power source and turn on the power switch. The set will immediately start to operate. If highly stable output voltage is required,

warm up the set more than 30 minutes.

1. Set the AC/DC switch to the central OFF position and, to the output terminal (OUTPUT) of the set, connect the input terminal of the electronic voltmeter to be calibrated.

2. Set the LOAD RESISTANCE control according to the input resistance of the electronic voltmeter.

3. To calibrate a range of the full scale +DC 500V, for example, set the OUTPUT VOLTS controls to 5, 100V and 0 respectively and the % control to 0%.

4. Change over the AC/DC switch to +DC, turn the rightmost OUTPUT VOLTS control to 1, then 2, and so on, and then turn the % control so that the pointer of the electronic meter comes around to corresponding scale marks (50, then 100, and so on). The indicated errors can then be directly read.

5. To calibrate the 150V range of the electronic voltmeter, change over the leftmost OUTPUT VOLTS control to the "1.5" position and then change the voltmeter range. Thus, calibration of the 150V range is performed in the same way as calibration of the 500V range.
   To calibrate the 50V range, change over only the central

knob in the OUTPUT VOLTS section to 10V.

6. To calibrate the AC range of the voltmeter, turn the AC/DC switch back to the middle OFF position and change over the voltmeter range to AC. Set the appropriate OUTPUT VOLTS control to the voltage range to be measured and then change over the AC/DC switch to RMS (or P-P). Since the OFF position of the AC/DC switch corresponds to the STAND-BY condition, operations such as range changeover of the equipment to be calibrated, and connection or detachment of the input terminal are performed with the switch in this position.

3.3 Application

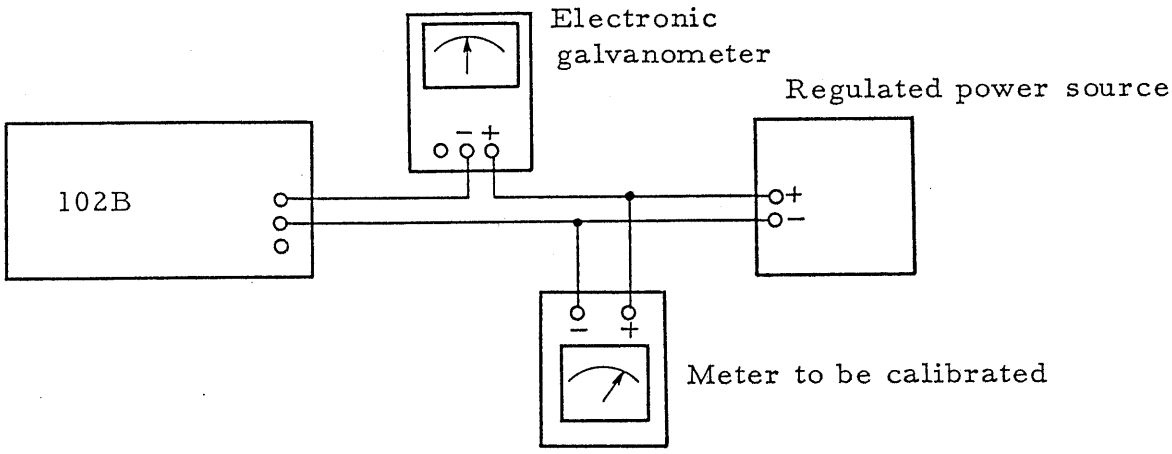
The Model 102B was originally designed to calibrate the electronic voltmeter with an input resistance of over 0.9M ohms, but general low-input-resistance meters without an electronic circuit can be indirectly calibrated via the electronic voltmeter. In addition to the Model 102B, a power source with sufficient current capacity to drive the voltmeter may be provided to compare an electronic voltmeter previously calibrated by the Model 102B and the voltmeter to be calibrated by connecting them in parallel. To increase the accuracy, observe the following instructions.

1. Use an external DC power source with low ripple or a low-distortion AC power source. Voltage of such a power source must be finely adjustable and high stable at least for a short period.

2. Use an electronic voltmeter with high indication stability and high reading accuracy.

3. In AC operation, special care must be exercized with the frequency response of the electronic voltmeter and equipment to be calibrated. When, for example, the frequency of the external power source (e.g., a commercial frequency of 50/60 Hz) differs from that of the Model 102B (400 Hz or 1,000 Hz), use an electronic voltmeter with a small enough indication difference between these two frequencies.

In DC operation in particular, a highly stable external power source and a highly sensitive electronic DC voltmeter with floating-type input terminals (such as an electronic galvanometer), if available, can be connected as shown below to perform high accurate calibration.



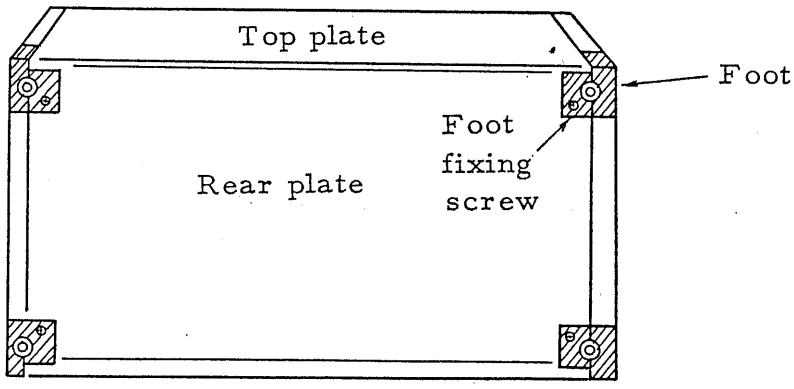
Note: Use a highly sensitive electronic voltmeter with an input resistance of more than 1 M ohms.

4. MAINTENANCE

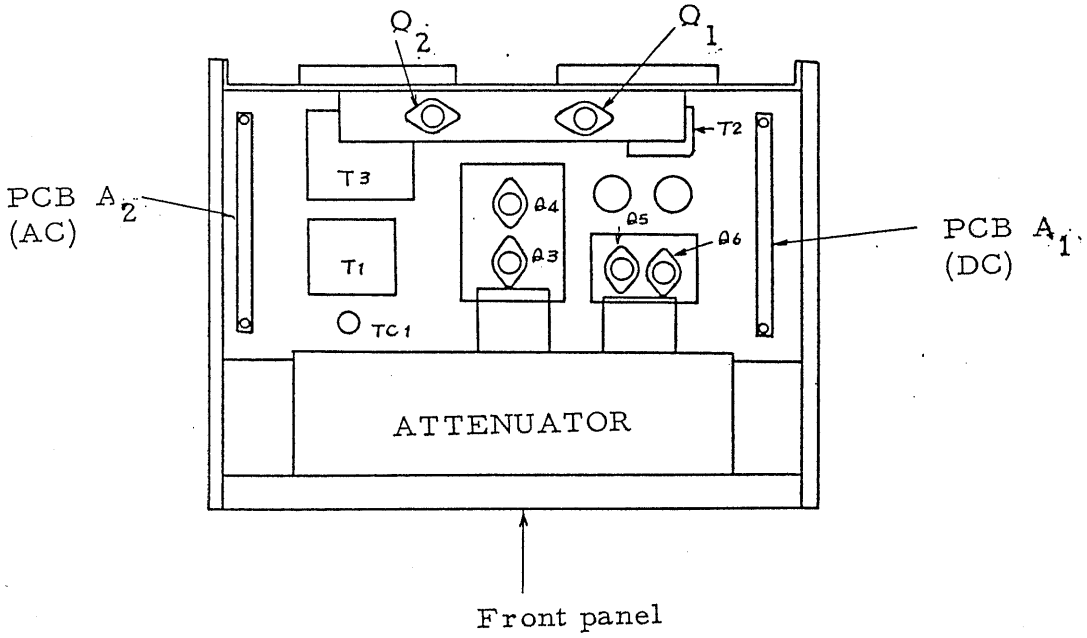
4.1 Interior check

To check the interior for readjustment, repair or the like, remove the four feet at the rear of the case and gently pull out the top, bottom and side plates. Voltage check of sections on the PCB, etc., can be performed by removing the side plates only. The PCB attached to the chassis by a connector can be pulled out upward by removing the holders at the top. However, the PCB A_2 must be removed by pulling out the pin contact in order to detach the wiring to the power transistors.

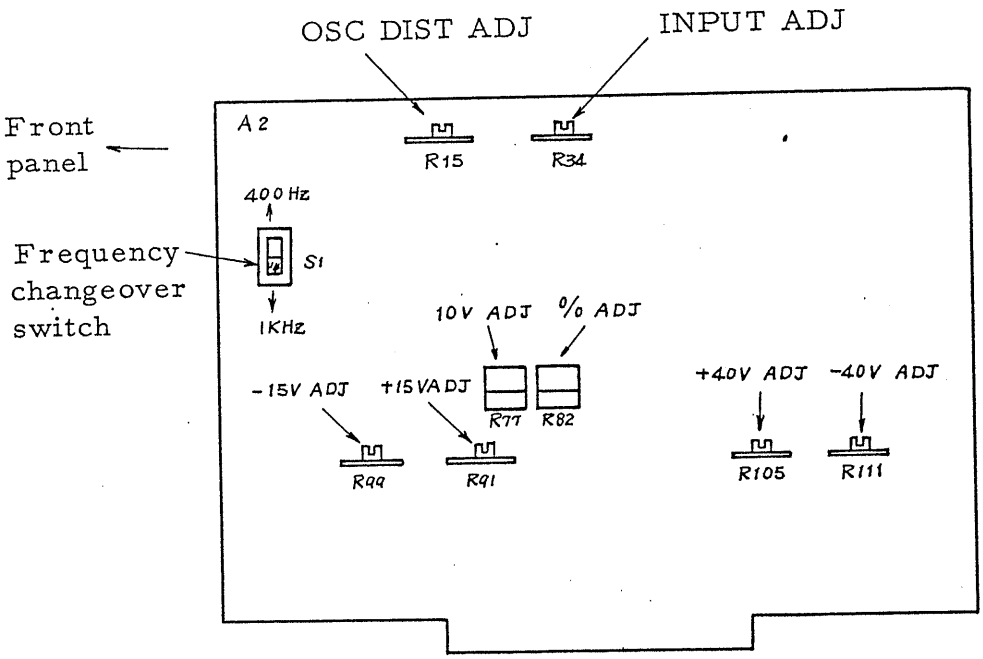
Rear view



Top view



4.2 Adjustment of trimmer resistors (PCB A_2)



OSC. DIST. ADJ (A_2 R_{15})

This is the trimmer resistor for distortion adjustment of the oscillator section. When it is turned fully counterclockwise, oscillation stops. When it is turned clockwise, oscillation starts. If it is turned further clockwise, distortion starts to increase abruptly after a certain point. The resistor should therefore be set to a position a little short of that point. The FET A_2 Q_8 and A_2 Q_9 gate voltages in AGC of the oscillator become approximately -1V.

INPUT ADJ (A_2 R_{34})

This is the trimmer resistor for input voltage adjustment of the amplifier section. Within the functioning range of the AGC of the amplifier section, the output is kept constant despite the level of input. Set the % control on the panel to +5% and set this resistor to a position a little short of the point at which distortion increases abruptly by turning the trimmer resistor while measuring the distortion factor at the same time. The FET A_2 Q_{21} and A_2 Q_{22} gate voltages in AGC of the amplifier become approximately -1V.

+15V ADJ (A_2 R_{91}), -15V ADJ (A_2 R_{99}), +40V ADJ (A_2 R_{105}) and -40V ADJ (A_2 R_{111})

These are the trimmer resistors for voltage adjustment of the

regulated power sources. They require readjustment when the zener diodes for the reference voltage are replaced and so on. To make the readjustment, keep the voltage within the ranges of +15V ± 0.5V, -15V ± 0.5V, +40V ± 1V and -40V ± 1V.

4.3 Readjustment of output voltage

To maintain the output voltage accuracy of Model 102B, it is necessary to regularly readjust the 500V output with the standard instrument irrespective of the length of operating time.

1. DC 500V adjustment

Connect a standard DC voltmeter with an input resistance of over 100 K ohms to the output terminal and turn the trimmer resistor of INTERNAL CALIBRATION on the panel until the DC 500V output becomes exactly 500V. If the specified voltage change of ±25V is not accurately obtained when the percentage control is turned from -5% to +5%, remove the top plate of the case to readjust the trimmer resistor DC (R_{32}) at the PCB A_2. The output level with the % control set at 0% is changed, The control should be so set that a output voltage variation, of 50V corresponds to the range between -5% and +5% of the control. Then turn the % control back to 0 and turn the trimmer resistor of INTERNAL CALIBRATION (DC)

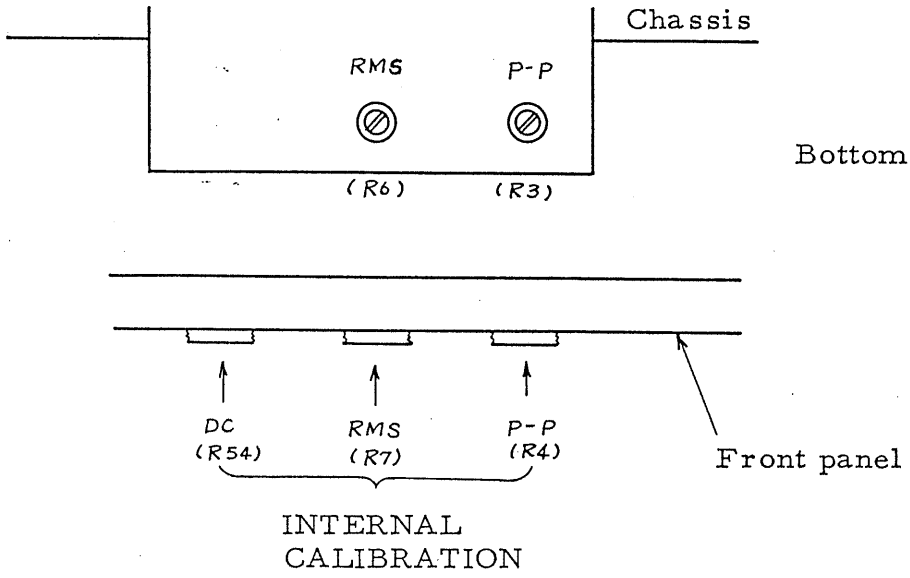
until the DC 500V output becomes exactly 500V.

2. AC 500V adjustment

Readjust with a standard AC voltmeter having an input resistance of over 100 K ohms, as in the case of DC 500V, by turning the trimmer resistors of INTERNAL CALIBRATION on the panel (RMS or P-P). Each trimmer resistor is connected in series to another trimmer resistor in the interior. If this adjustment cannot be made on the panel, remove the bottom plate and make it.

$$500V_{p\text{-}p} \fallingdotseq 176.78Vrms$$

If the specified voltage change is not attained by turning the % control on the panel, readjust the semi-fixed resistors of the % ADJ (A_2 R_{82}) on the PCB A_2 and the 10V ADJ (A_2 R_{77}). If the percentage change falls short of the specified level, turn the % ADJ, turn the % control back to 0, set the output voltage to 500V with the 10V ADJ and then turn the % control again to check the variation. The range of 500V ± 25V is attained by repeating the above procedure.



3. AC 500V RMS adjustment with thermocouple

If DC 500V is properly adjusted, the Model 102B can be adjusted to AC 500V RMS by a DC voltmeter capable of measuring 8m V without using AC equipment. Insert the attached plug in the THERMAL CONVERTER OUTPUT jack on the panel to measure the output voltage of the thermocouple. Adjust INTERNAL CALIBRATION (RMS) so that the average of indicated values (nearly equal) in the +DC and -DC ranges is obtained in the RMS range.

This procedure does not apply to the P-P range.

Note: If the thermocouple, in which protective diodes are connected in parallel, is broken due to an overcurrent, vibration or the like, replace the thermocouple with its socket. Even if the thermocouple is broken, output comes out through the protective diodes. The error increases in that case. (500V output decreases by approximately 0.5V.)