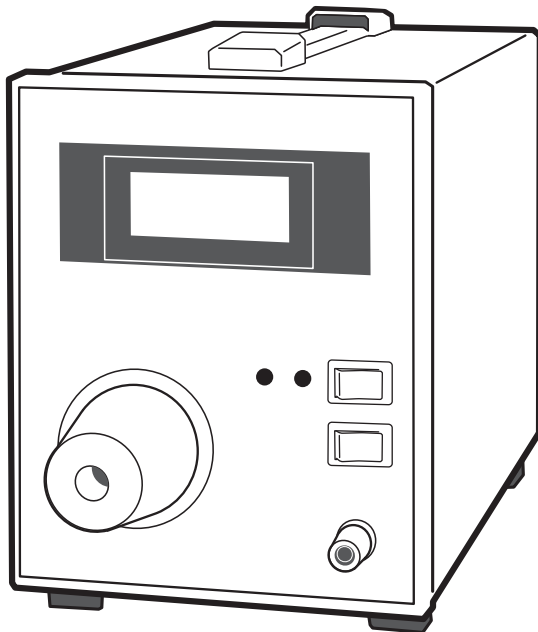


OPERATION MANUAL

High Voltage Digitalmeter

149-10A



Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

If you find any incorrectly arranged or missing pages in this manual, they will be replaced. If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact Kikusui distributor/agent, and provide the "Kikusui Part No." given on the cover.

This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact Kikusui distributor/agent.

Reproduction and reprinting of this operation manual, whole or partially, without our permission is prohibited.

Both unit specifications and manual contents are subject to change without notice.

Power Requirements of this Product

Power requirements of this product have been changed and 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 power cord or turn off 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.

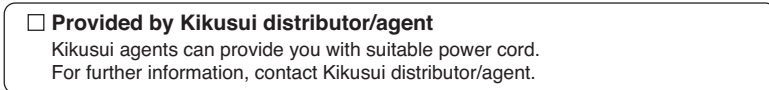
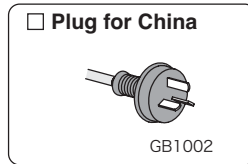
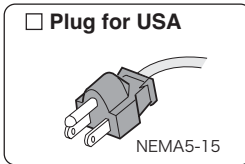
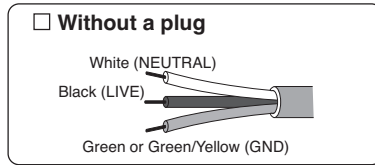
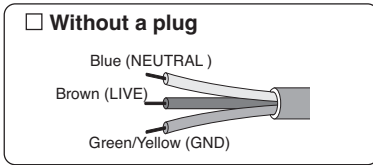
Power Requirements of this Product (cont'd)

Power cord

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

WARNING

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



Safety Precautions

The following safety precautions must be observed to avoid fire hazard, electrical shock, accidents, and other failures. Keep them in mind and make sure that all of them are observed properly.



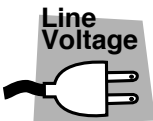
Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If it is handled by disqualified personnel, personal injury may result. Be sure to handle it under supervision of qualified personnel (those who have electrical knowledge.)
- This product is not designed or manufactured for general home or consumer use.



Purposes of use

- Do not use the product for purposes other than those described in the operation manual.



Input power

- Use the product with the specified input power voltage.
- For applying power, use the power cord provided. Note that the provided power cord is not use with some products that can switch among different input power voltages or use 100 V and 200 V without switching between them. In such a case, use an appropriate power cord. For details, see the relevant page of this operation manual.



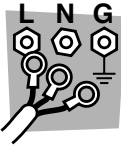
Fuse

- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one. When replacing a fuse, use the one which has appropriate shape, ratings, and specifications.



Cover

- There are parts inside the product which may cause physical hazards. Do not remove the external cover.



Installation

- To avoid electrical shock, connect the protective conductor terminal to electrical ground (safety ground).
- When installing products with casters, be sure to lock the casters.



Relocation

- Turn off the power switch and then disconnect all cables when relocating the product.
- Use two or more persons when relocating the product which weights more than 18 kg. The weight of the products can be found on the rear panel of the product and/or in this operation manual.
- Use extra precautions such as using more people when relocating into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- Be sure the operation manual be included when the product is relocated.



Operation

- Check that the AC input voltage setting and the fuse rating are satisfied and that there is no abnormality on the surface of the power cord. Be sure to unplug the power cord or stop applying power before checking.
- If any abnormality or failure is detected in the products, stop using it immediately. Unplug the power cord or disconnect the power cord from the switchboard. Be careful not to allow the product to be used before it is completely repaired.
- For output wiring or load cables, use connection cables with larger current capacity.
- Do not disassemble or modify the product. If it must be modified, contact Kikusui distributor/agent.



Maintenance and checking

- To avoid electrical shock, be absolutely sure to unplug the power cord or stop applying power before performing maintenance or checking.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

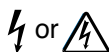


Service

- Internal service is to be done by Kikusui service engineers. If the product must be adjusted or repaired, contact Kikusui distributor/agent.

Safety Symbols

This operation manual and this product use the following safety symbols. Note the meaning of each of the symbols to ensure safe use of the product. (As using symbols depend on the product, all of symbols may not be used.)



Indicates the presence of 1000V or higher. Inadvertently touching such a part may cause electrical shock resulting in death. If it is necessary to touch such a part to conduct work, first make sure no voltage is being supplied.



Indicates the possibility of personal injury or death. Never fail to follow the operating procedure. Do not proceed beyond a WARNING sign until the noted conditions are fully understood and met.



Indicates the existence of damage to the product or connected equipment. Always follow the operating procedure. Do not proceed beyond a CAUTION sign until the indicted conditions are fully understood and met.



Indicates additional information such as operating procedure.



Describes technical terms used in this manual.



Indicates action prohibited.



Indicates general warning, caution, risk of danger. When this mark is indicated on the product, refer the relevant section of the Operation Manual.



Indicates a protective conductor terminal.



Indicates a chassis (frame) terminal.

Contents

Power Requirements of this Product	1
⚠ Safety Precautions	3
Safety Symbols	6
Chapter 1 General Description	8
Chapter 2 Preparation	9
2.1 Receiving Inspection	9
2.2 AC Line Requirements	9
2.3 Connecting the Power Cord	10
Chapter 3 Operation Method	11
3.1 Part Names and Functions	11
3.2 Measuring Method	12
3.2.1 Measuring Procedure	12
3.2.2 To Correct the Meter Reading for High Impedance Measured Object	14
3.2.3 Measured Object's Polarity and Ground	14
Chapter 4 Specifications	16
Chapter 5 Calibration	17
5.1 Calibration of Digitalmeter	17
5.2 Replacing the Fuse	18
Chapter 6 Block Diagram	19

Kikusui Model 149-10A High Voltage Digitalmeter measures AC and DC voltages of up to 10 kV, with a high accuracy.

As the meter input impedance is as high as $1000\text{M}\Omega$, the meter is best suited for measurement of voltages of high source impedance circuits.

The meter is compact and light (approx.3kg), but its measuring accuracy is high. Thus the meter can also be used conveniently as a portable calibration instrument or to calibrate the voltage of a withstanding voltage tester.

2.1 Receiving Inspection

Immediately upon receipt of the product, inspect it for any damage which might have been sustained while in transportation. If any signs of damage are found, contact Kikusui distributor/agent.

2.2 AC Line Requirements

Before turning on the POWER switch of the tester, be sure that your AC line voltage.

The AC line requirements of the tester are as follows:

- Nominal voltage: 100 V
- Voltage tolerance: $\pm 10\%$ of nominal voltage
- Nominal frequency: 50/60 Hz

Testers that operate on other AC line voltages as shown below also are available as factory-modification options.

- 110 V, 120 V, 220 V, 230 V, or 240 V

The following table is printed on the rear panel of the tester. If nothing is marked in the "LINE VOLTAGE" column, the nominal voltage is 100 V. If a change has been made, a mark is indicated to the left of the corresponding voltage.

LINE VOLTAGE		FUSE
STANDARD	100 V	250V 0.5A
	110 V	
	120 V	
	220 V	250V 0.3A
	230 V	
	240 V	

2.3 Connecting the Power Cord

This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from a fixed installation).

WARNING

Risk of electric shock.

- This product is IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).
- The product is grounded through the power cord ground wire. Connect the protective conductor terminal to earth ground.

NOTE

- Use the supplied power cord to connect to the AC line.
 - Do not use the supplied power cord with other instruments.
 - The power cord with a plug can be used to disconnect the product from the AC line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time.
 - Secure adequate space around the power plug. Do not insert the power plug to an outlet where accessibility to the plug is poor. And, do not place objects near the outlet that would result in poor accessibility to the plug.
1. Turn off the POWER switch.
 2. Check whether or not the AC line is compatible with the input rating of the the tester.
See section 2.2, "AC Line Requirements."
 3. Connect the power cord to the AC inlet (AC LINE) on the rear-panel.
 4. Connect the power cord plug to an outlet with a ground terminal.

3.1 Part Names and Functions

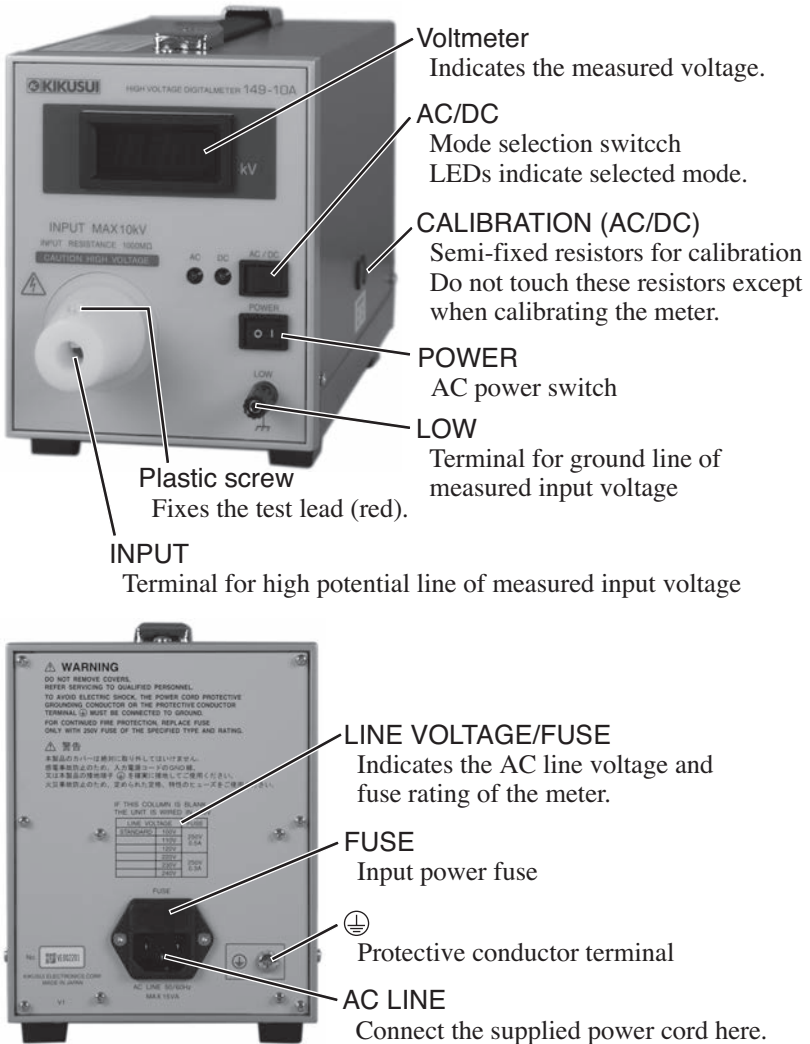


Fig.3.1 Front panel/Rear panel

3.2 Measuring Method

3.2.1 Measuring Procedure

WARNING

- For measurement of 5 kV or higher voltage, be sure to use the HTL2.5DH high voltage test lead.
- Be sure to connect securely between the 149-10A and the measured object with the supplied high voltage test leads. Note that, if the low voltage test lead is accidentally disconnected while the high voltage is being input, electric shock hazards may be caused or the meter may be seriously damaged.

NOTE

- To measure with highest accuracy, warm up the 149-10A for at least 15 minutes.
 - If the 149-10A is used in dusty atmosphere or the meter is used continuously for a long time with a high voltage being input, dust may be collected on the INPUT terminal section. Because input resistance degradation or voltage dividing ratio disturbance, clean at appropriate intervals the INPUT terminal and the internal insulators using a clean, dry cloth.
 - The AC/DC converter of the 149-10A is a mean-value response system and is calibrated with the rms value of sine wave. Therefore, that errors may be caused if the measured voltage waveform is largely different from sine wave.
1. Turn on (I) the POWER switch.
 2. Connect the supplied high voltage test lead (black) to the LOW terminal of the tester as shown in Fig. 3.2.

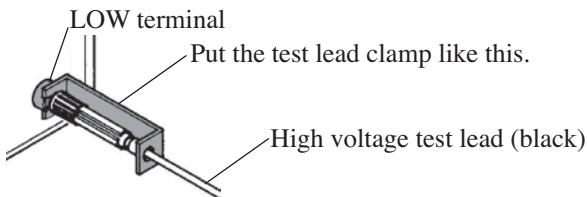


Fig. 3.2 Low terminal connection

3. Connect the supplied high voltage test lead (black) to the low voltage side (GND side) of the measured object.
 If the low voltage side (GND side) of the measured object is unknown, see section 3.2.3, "Measured Object's Polarity and Ground."
4. Insert the end of the supplied high voltage test lead (red) for a sufficient length in the INPUT terminal of the tester, and fix the lead with the plastic screw.
5. Set the AC/DC switch in accordance with the output of the measured object.
6. Connect the supplied high voltage test lead (red) to the high voltage side of the measured object.
7. Check that the 149-10A and measured object are connected as shown in Fig. 3.3.
8. Turn on the power of the measured object.

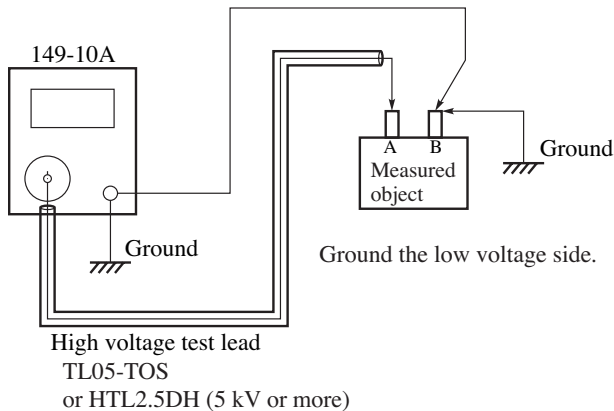


Fig. 3.3 Connection for measuring

3.2.2 To Correct the Meter Reading for High Impedance Measured Object

The 149-10A input impedance is very high (1000M Ω). When the internal impedance of the measured object is substantially high, however, errors can be caused. In such a case, make correction calculation as follows:

$$E = E_o \left(1 + \frac{\gamma_o}{1000M} \right)$$

where, E : True voltage
 E_o : Meter reading
 γ_o : Internal impedance of measured object

In most cases the value of internal impedance (γ_o) is unknown. In such cases, use the above equation as follows:

When $\gamma_o \leq 10 \text{ M}\Omega$ for example,

$$E_o < E \leq 1.01 \times E_o$$

As above, when the internal impedance is lower than 10M Ω , the error caused impedance-wise is less than 1%. Measurement can be done with an accuracy of this error plus meter accuracy.

3.2.3 Measured Object's Polarity and Ground

Be sure to connect the power cord of the 149-10A to a properly grounded outlet. If grounding is not possible through the power cord, ground the \oplus (protective conductor terminal) on the rear panel.

As shown in Fig. 3.4, if the 149-10A is not grounded and the low and high voltage sides of the measured object are connected in reverse, the applied high voltage may damage the inside of the meter.

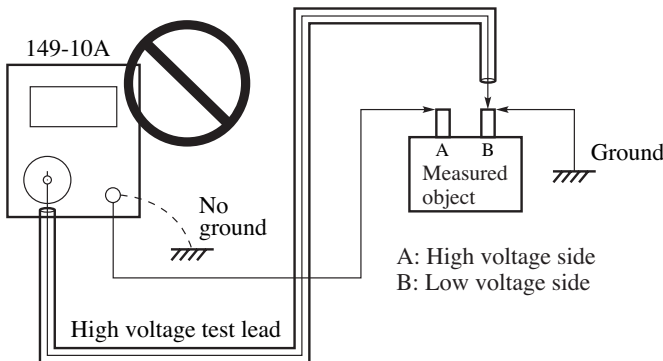


Fig. 3.4 Improper connection

If the 149-10A is grounded in Fig.3.4, terminals A and B of the measured object are shorted through the ground and the measured object is adversely affected. As such, if the low voltage side (GND side) of the measured object is unknown, determine it by following the procedure below, and connect properly.

■ **How to determine the polarity of the measured object**

As shown in Fig. 3.5, connect a high voltage test lead to terminal A or B, and assume the side with the higher voltage reading to be the high voltage side.

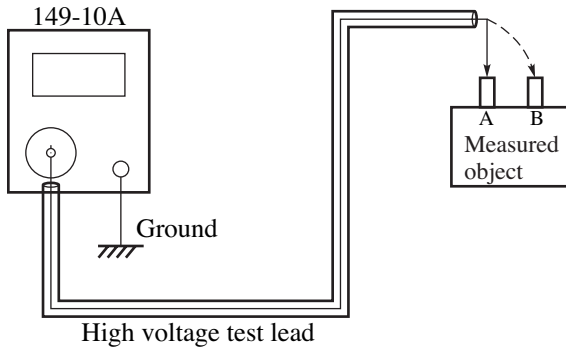


Fig. 3.5 Polarity check

Chapter 4

Specifications

Item	Specification
Power requirements	100V±10%, 50/60 Hz AC, approx. 10VA
Measuring ranges	0.500 to 10.000 kV AC/DC
Measuring accuracies	AC: ±(1% of rdg + 0.05% of range) DC: ±(0.5% of rdg + 0.03% of range) at 23°C±10°C *(for sine wave, at 50 to 60 Hz)
Maximum allowable input voltages	AC : 11kV rms (sine wave, 50 to 60 Hz) DC : ±14 kV Pulse : 15 kV peak
Display	7-segment LEDs
Type of voltmeter	Double integration type. For AC measurement, mean value response, sine wave rms value calibration. 3 samples/sec
Input resistance	1000 MΩ ±2%
Ambient temperature and humidity:	0°C to 35°C (32°F to 95°F), 80% RH
Overall Dimensions	External dimensions : 134W×164H×270D mm (5.28W×6.46H×10.63 D in.) Maximum dimension 140W×190H×325D mm (5.51W×7.48H×12.80 D in.)
Weight	Approx. 3 kg (6.6 lbs)
Accessories	Power cord 1 TL05-TOS High voltage test leads 1 set HTL2.5DH High voltage test lead 1 Operation manual 1

5.1 Calibration of Digitalmeter

Calibrate the 149-10A once a year or more frequently.

■ Instruments required for calibration

To calibrate the 149-10A covering its all measuring ranges, a standard voltage generator which will provide the following voltages is required.

AC: $10\text{ kV} \pm 0.1\%$

DC: $10\text{ kV} \pm 0.05\%$

If you cannot prepare an above standard voltage generator, calibrate the 149-10A with a calibrator which can generate the voltage range which you use, or order Kikusui distributor/agent for calibration.

■ Notes before calibration

- As a high voltage of 10 kV is dealt with when calibrating the 149-10A, pay full attention for safety.
- Before calibration, warm up the 149-10A for at least 60 minutes.

■ Calibration

Set the 149-10A in the DC mode, apply a calibration voltage of 10 kV DC to the input terminal of the meter, and so adjust CALIBRATION (DC) semi-fixed resistor on the side panel of the 149-10A that it displays 10.000. Next, set the 149-10A in the AC mode, apply a calibration voltage of 10 kV AC, and so adjust the CALIBRATION (AC) semi-fixed resistor that the 149-10A displays 10.000. When doing this, the displayed value may change by about three digits. For calibration, use the center value. When adjustment for DC measurement is done, the voltage dividing ratio of the input circuit varies. Be sure to perform the DC calibration first.

5.2 Replacing the Fuse

WARNING

- To avoid electric shock, always turn off the POWER switch and unplug the power cord from an outlet before replacing the fuse.
 - Make sure that the replacement fuse is of the correct shape, and rating for mater specifications. Never use a fuse having a different rating; never short-circuit the fuse holder.
1. Turn off the POWER switch and unplug the power cord from the outlet.
 2. Disconnect the power cord from the AC inlet on the rear panel.
 3. Use a screwdriver to remove the fuse holder, as shown in Fig. 5.1.

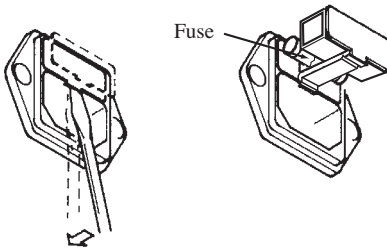
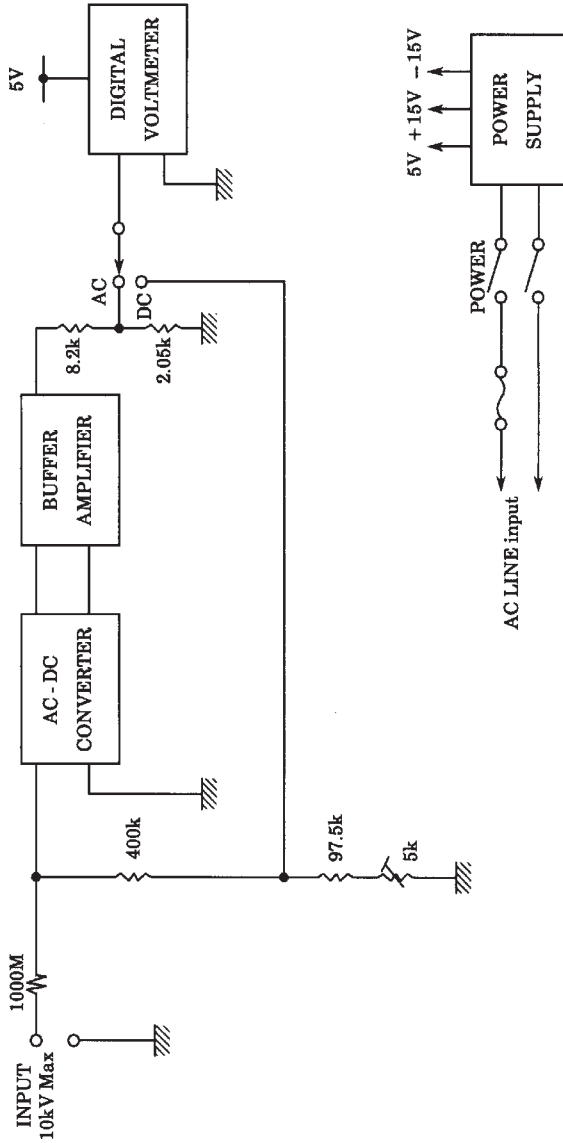


Fig. 5.1 Fuse holder



All resistors are in ohms.

KIKUSUI ELECTRONICS CORP.

1-1-3 Higashiyamata, Tsuzuki-ku, Yokohama,
224-0023, Japan

Tel: +81-45-593-7570 Fax: +81-45-593-7571



Website

<http://www.kikusui.co.jp/en>