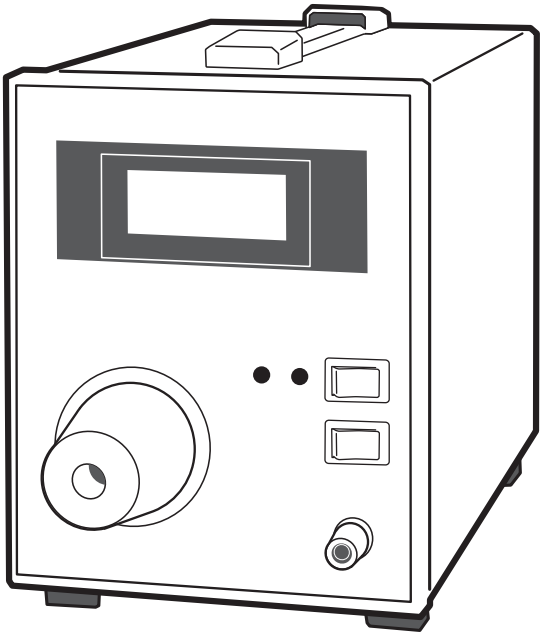
Part No. Z1-109-820, IA001704
Mar. 2011

OPERATION MANUAL

High Voltage Digitalmeter

149-10A



KIKUSUI

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 Operation Manual can be purchased. In either case, please contact your Kikusui agent, and provide the "Kikusui Part No." given on this page.
- This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact your Kikusui agent.

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)

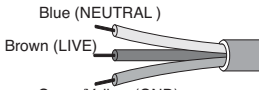
☐ Power cord

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.

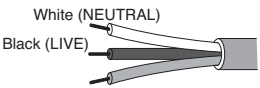
WARNING

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

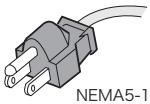
☐ Without a plug



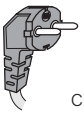
☐ Without a plug



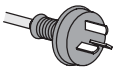
☐ Plug for USA



☐ Plug for Europe



☐ Plug for China



☐ Provided by Kikusui distributor/agent

Kikusui agents can provide you with suitable power cord.
For further information, contact Kikusui distributor/agent.

⚠Safety Precautions

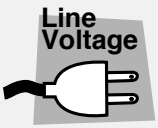
The following safety precautions must be observed to avoid fire hazard, electrical shock, accidents, and other failures. Keep them in mind and make sure that all of them are observed properly.

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

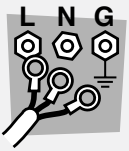
- Use the product with the specified input power voltage.
- For applying power, use the AC power cord provided. Note that the provided power cord is not use with some products that can switch among different input power voltages or use 100 V and 200 V without switching between them. In such a case, use 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

- When installing products be sure to observe "Precautions for Installation" described in this manual.
- To avoid electrical shock, connect the protective ground terminal to electrical ground (safety ground).
- When applying power to the products from a switchboard, be sure work is performed by a qualified and licensed electrician or is conducted under the direction of such a person.
- 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 20 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 AC power cord. Be sure to unplug the AC power cord or stop applying power before checking.
- If any abnormality or failure is detected in the products, stop using it immediately. Unplug the AC power cord or disconnect the AC 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

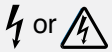
- To avoid electrical shock, be absolutely sure to unplug the AC power cord or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking.
- To maintain performance and safe operation of the product, it is recommended that periodic 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.

WARNING 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.

CAUTION 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.

NOTE Indicates additional information such as operating procedure.

— Description — 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 grounding (earth) terminal.

Indicates a chassis grounding terminal.

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Chapter 1 GENERAL DESCRIPTION

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 1000MΩ, 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.

Chapter 2 PRECAUTIONS

2.1 Receiving Inspection

Immediately upon receipt of the device, 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 Notes for Use

1. Be sure to connect securely between the meter and the measured voltage source with the supplied cord. Note that, if the ground line is accidentally disconnected while the high voltage is being applied, electric shock hazards may be caused or the meter may be seriously damaged.
2. Be sure to connect the LOW terminal (Protective grounding terminal) on the front or rear panel of this meter to a good earth ground. If the meter is connected to the measured voltage source without earth-grounding and, moreover, if the low voltage line and high voltage line are wrongly connected, the instrument may be damaged irretrievably.

Example of bad connections

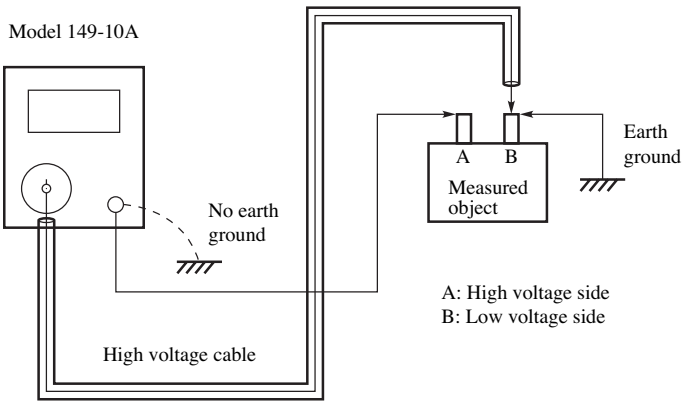

Fig. 2.1

If the 149-10A is earth-grounded in the above bad example, terminals A and B of the measured object are shorted through the earth-ground and the measured object is adversely affected. In order to prevent this, be sure to earth-ground securely the 149-10A and to identify correctly the high voltage and low voltage lines of the measured object (refer to 3.4.1 Measuring Procedure) and to make connections correctly and securely.

3. Use the instrument within the specified ambient temperature and humidity ranges with Section 4 Specifications.
4. Calibrate the meter once a year or more frequently.
5. If the meter is used in dusty atmosphere or the meter is used continuously for a long time with a high voltage being applied, dust may be collected on the high voltage terminal section. Because input resistance degradation or voltage dividing ratio disturbance, clean at appropriate intervals the high voltage section and the internal insulators using a clean, dry cloth.
6. The AC/DC converter of this meter is a mean-value response system and is calibrated with the rms value of sine wave. Note, therefore, that errors may be caused if the measured voltage waveform is largely different from sine wave.

Chapter 3 OPERATION METHOD

3.1 Description of Front Panel

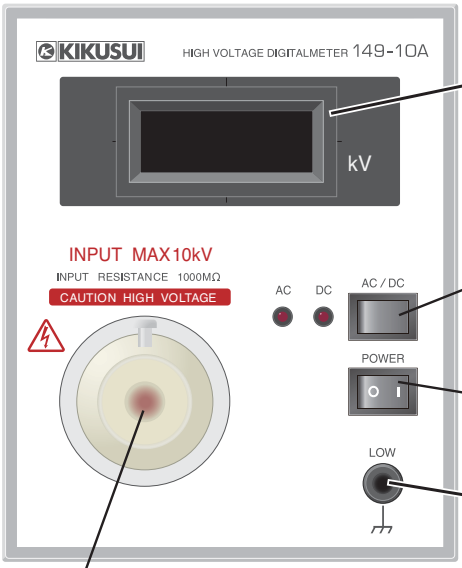

Fig.3-1

3.2 Description of Rear Panel

Protective grounding terminal:

For grounding the casing to the earth.

Fuse: 0.5 A fuse

3.3 Description of Side Panel

CALIBRATION (AC/DC):

Semi-fixed resistors for calibration of AC and DC voltages, respectively. Do not touch these resistors except when calibrating the instrument.

3.4 Measuring Method

3.4.1 Measuring Procedure

1. Connect the protective grounding terminal of the rear panel to a good earth ground. Note that, unless the LOW terminal is securely connected to the earth, a hazardously high voltage will be induced on the casing when the ground line from the measured voltage source is disconnected accidentally. Be sure to check the earth ground when using this instrument.
2. Connect the AC power cord to an AC power line outlet of the correct voltage, and turn ON the POWER switch. To measure with highest accuracy, warm up the 149-10A for at least 15 minutes.
3. Securely connect the LOW terminal of the front panel to the low line of the measured voltage source using the cord (supplied).
4. Insert the end of the HIGH VOLTAGE cord (supplied) for a sufficient length in the INPUT terminal on the front panel, and securely fix the cord with the plastic screw (supplied). Note that serious hazards can be caused if the HIGH VOLTAGE cord is accidentally disconnected while in measurement.

   For measurement of 5 kV or higher voltage, be sure to use the HTL2.5DH.
5. A typical method of identifying the low voltage line (the GND line) when it is unknown which one of the two lines of the measured object is shown in the following:

   Connect the high voltage cable to terminal A and then B as shown in Fig. 3.1. The terminal which presents a voltage higher than the other can be construed to be the high voltage line and the other to be the GND line.

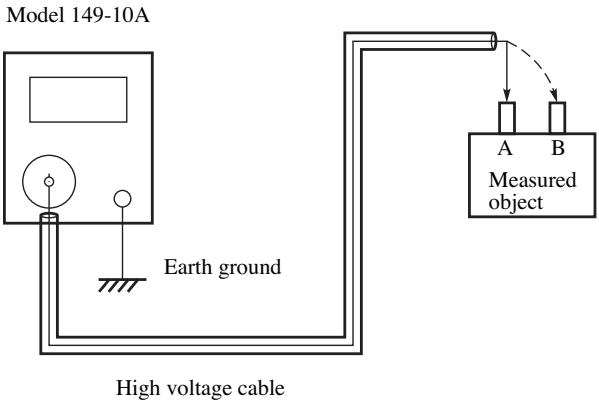

Fig. 3-2

After the high voltage line and low voltage line are identified as above, make complete connections of the cables as shown in Fig. 3-3 and, then, measure the voltage.

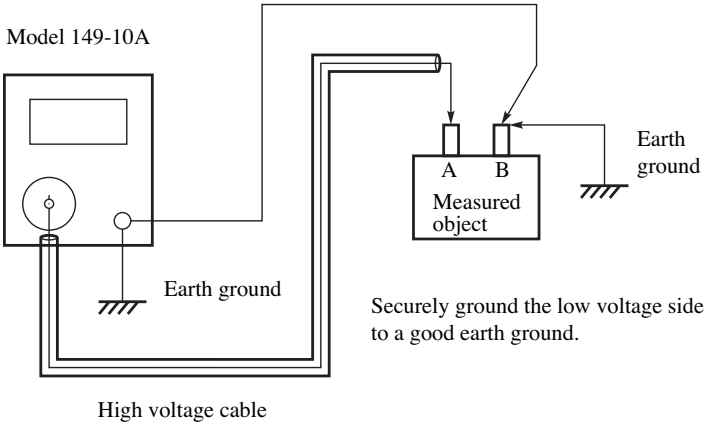

Fig. 3-3

Note: For the 149-10A Digitalmeter, grounding may be done via the protective grounding terminal on the rear panel.

6. Set the AC/DC selector switch in accordance with the measured voltage. The meter will not be damaged even if a voltage is measured with a wrong setting of this selector switch, although the meter does not indicate the correct voltage.
7. Connect the high voltage cable of the instrument to the high voltage line of the measured voltage source. The meter will digitally indicate the measured voltage.
8. Turn ON the power of the measured voltage source.

3.4.2 To Correct the Meter Reading for High Impedance Voltage Source

The meter input impedance is very high (1000MΩ). When the voltage source impedance is substantially high, however, errors can be caused. In such a case, make correction calculation as follows:

$$E = Eo \left(1 + \frac{\gamma o}{1000M} \right)$$

where, E : True voltage
Eo : Meter reading
γo : Source impedance of measured voltage

In most cases the value of source impedance (*g*o) is unknown. In such cases, use the above equation as follows:

When γo ≤ 10 MΩ for example,

$Eo < E \leq 1.01 \times Eo$

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

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 accurancies	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˚C to 95˚C), 80% RH
Overall Dimentions	External dimensions : 135W×165H×270D mm (5.32W×6.50H×10.63 D in.) Maximum dimensions: 135W×190H×345D mm (5.32W×7.48H×13.58 D in.)
Weight	Approx. 3 kg (6.6 lbs) 1 set
Accessories	AC power cord 1 High voltage test cords (TL05-TOS) 1 HTL2.5DH 1 Operation manual 1

Chapter 5 CALIBRATION

5.1 Calibration of Digitalmeter

1. 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 kV ± 0.1%

   DC: 10 kV ± 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 your KIKUSUI agent for calibration.

2. Notes before calibration

   (a) As a high voltage of 10 kV is dealt with when calibrating the 149-10A, pay full attention for safety.

   (b) Before calibration, warm up the 149-10A for at least 60 minutes.

3. Set the 149-10A in the DC mode, apply a calibration voltage of 10 kV DC to the input terminal of the 149-10A, 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.

Chapter 6 BLOCK DIAGRAM