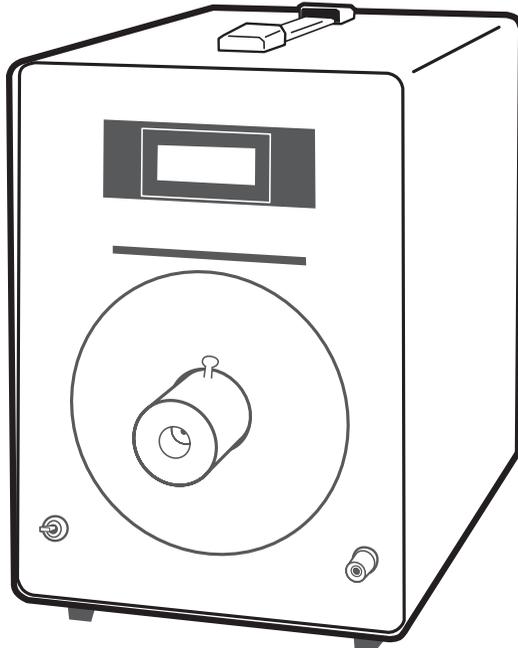


OPERATION MANUAL

High Voltage Digitalmeter

149-30A



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.

All or any parts of this manual may not be reproduced in any forms, without express written permission of Kikusui Electronics Corporation.

The contents of this manual, including the specifications of the instrument, are subject to change without notice.

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 cord 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.

Power Requirements of this Product (cont'd)

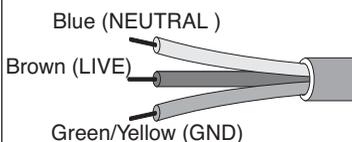
AC power cord

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

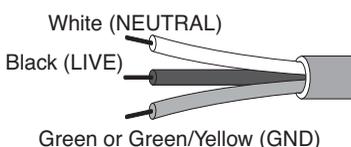
WARNING

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

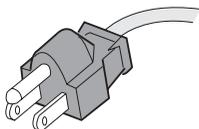
Without a power plug



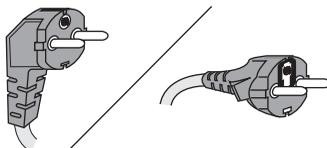
Without a power plug



Plugs for USA



Plugs for Europe



Provided by Kikusui distributor/agent

Kikusui agents can provide you with suitable AC 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.



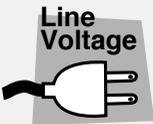
Users

- 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.

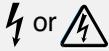


Service

- 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.



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 grounding (earth) terminal.



Indicates a chassis grounding terminal.

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Chapter 1 GENERAL DESCRIPTION

Kikusui Model 149-30A High Voltage Digitalmeter measures DC voltages of up to ± 30 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 high DC voltage of a source impedance circuits, such as the high voltage circuit of a television set.

The meter is compact and light (approx. 7.5kg), but its measuring accuracy is high. Thus the meter can also be used conveniently as a portable calibration instrument.

Chapter 2 PRECAUTIONS

2.1 Receiving Inspection

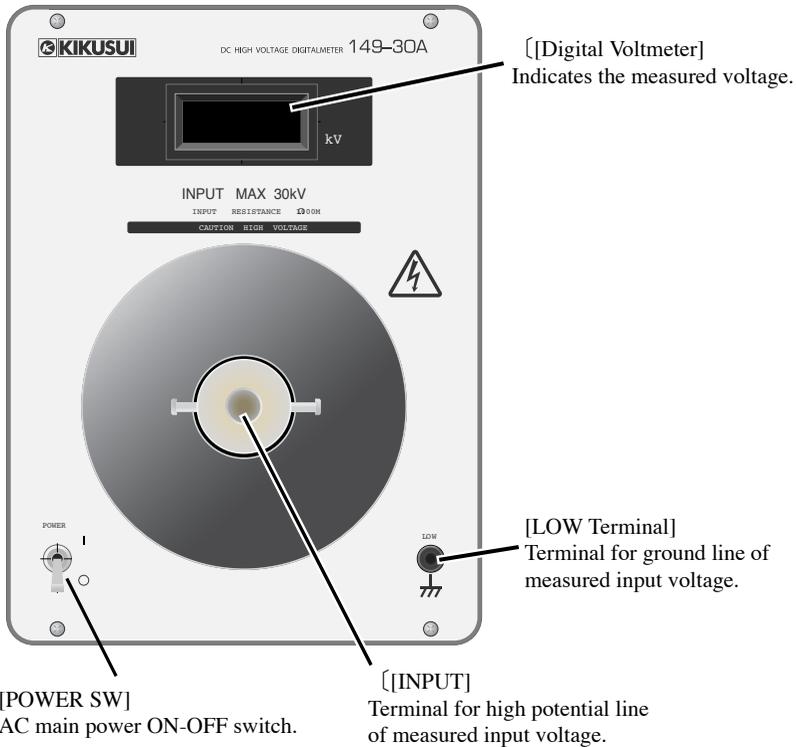
Immediately upon receipt of the device, inspect it for any damage which might have been sustained while in transportation. If any signs of damage are found, contact Kikusui distributor/agent.

2.2 Notes for Use

1. Be sure to connect securely between the meter and the measured voltage source. 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 Protective grounding terminal on the 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.
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.

Chapter 3 OPERATION METHOD

3.1 Description of Front Panel



3.2 Description of Rear Panel

Protective grounding terminal:

For grounding the casing to the earth.

Fuse: 0.5 A fuse

CALIBRATION

Semi-fixed resistor for adjustment of full scale of the display

3.3 Measuring Method

3.3.1 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 149-30A for at least 15 minutes.
3. Securely connect the LOW terminal of the front panel to the low line of the measured voltage source.
4. Connect the high voltage input terminal of this instrument to the high voltage line of the measured input voltage using a cable of rated withstanding voltage of 30kV or over.

Make it double sure that the cable is securely connected to the terminal using the hex bar wrench supplied, for very dangerous state can be caused if the cable is disconnected when in measurement. If no suitable cable is available, contact Kikusui agent/distributor.

To measure a voltage higher than $\pm 20\text{kV}$, use the input terminal cover to prevent discharge from the high voltage input terminal section.

3.3.2 To Correct the Meter Reading for High Impedance Voltage Source

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

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

where, E : True voltage

E_o : Meter reading

γ_o : Source impedance of measured voltage

In most cases the value of source 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 source impedance is lower than $10\text{M}\Omega$, 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. 7VA
Measuring ranges	± (0.50 to 30.00) kV
Measuring accuracy	±(0.5% rdg + 2 digits)
Maximum allowable input voltages	DC : ±33kV Pulse : 40 kV peak
Display	7-segment LEDs
Type of voltmeter	Double integration type. 3 samples/sec
Input resistance	1000 MΩ ±2%
Specification ambient temperature and humidity:	5°C to 35°C (41° F to 95° F), less than 80% RH
Ambient temperature and humidity:	0°C to 40°C (32° F to 104° F), less than 80% RH
Overall Dimentions	External dimensions : 203W×273H×313D mm (7.99W×10.75H×12.32 D in.) Maximum dimensions: 210W×300H×385D mm (8.27W×11.81H×15.16 D in.)
Weight	Approx. 7.5 kg (17 lbs)
Accessories	Input terminal cover 1 Wrench (hex bar) 1 Operation manual 1

Chapter 5 CALIBRATION

5.1 Calibration of Digitalmeter

1. Instruments Required for Calibration

To calibrate the 149-30A covering its all measuring ranges, a standard voltage generator which will provide the following voltages is required.

DC: $30 \text{ kV} \pm 0.05\%$

If you cannot prepare an above standard voltage generator, calibrate the 149-30A with a calibrator which can generate the voltage range which you use, or order your KIKUSUI agent for calibration.

2. Notes before calibration

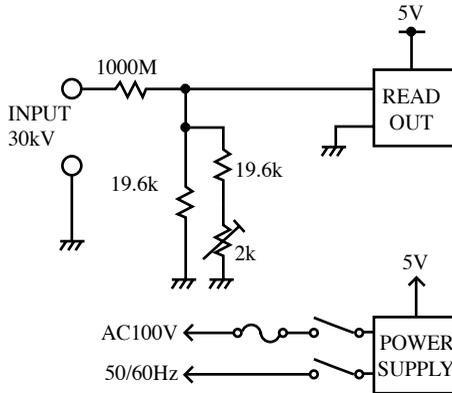
(a) As a high voltage of 30 kV is dealt with when calibrating the 149-30A, pay full attention for safety.

(b) Before calibration, warm up the 149-30A for at least 30 minutes.

3. Apply a calibration voltage of 30 kV DC to the input terminal of the 149-30A, and so adjust CALIBRATION semi-fixed resistor on the rear panel of the 149-30A that it displays 30.00.

Chapter 6 OPERATION PRINCIPLE

6.1 Block Diagram



6.2 Calibration of Digitalmeter

1. Voltage divider:

The 1000MΩ voltage divider consists of thirty 33MΩ resistor of high voltage type.

The divider provides a high voltage dividing accuracy. The dividing ratio is $1/10^5$.

2. Display:

The display unit is a digital voltmeter of 2.0000V full scale. The 30kV input voltage is divided by the divider into a 0.3V voltage and the display unit indicates this voltage as "30.00".

3. Power supply:

Provides a 5V supply power for the display unit.

High Voltage Digitalmeter 149-30A

OPERATION MANUAL