HIOKI

Instruction Manual

DT4281
DT4282

DIGITAL MULTIMETER

HIOKI E. E. CORPORATION

February 2014 Revised edition 5 DT4281A981-05 14-02H

600380265

Contents

Introduction

Thank you for purchasing the HIOKI DT4281, DT4282 Digital Multimeter. To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

Verifying Package Contents

When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping.
In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your authorized Hioki distributor or reseller.

Check the package contents as follows.

☐ **DT4281 or DT4282**

DT4281

DT4282

☐ **L9207-10 Test Lead (p. 28)**

☐ **LR6 Alkaline battery × 4**

☐ **Instruction Manual**

(English)

Instruction manuals may also be available in other languages. Please visit our website at http://www.hioki.com.

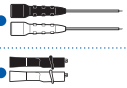
Options (sold separately)

The following options are available for the instrument. Contact your authorized Hioki distributor or reseller when ordering.

Connecting cables

*1: CATIV 600 V/CATIII 1000 V/CATII 1000 V
*2: CATIV 600 V/CATIII 1000 V
*3: CATIII 1000 V
*4: CATIII 600 V
*5: CATIII 300 V/CATII 600 V
*6: 33 V AC/70 V DC
*7: CATIII 600 V/CATII 600 V

L9207-10*1
Test Lead



L4933*6
Contact Pin Set

L4934*5
Small Alligator Clip Set

L4930*2
Connection Cable Set
(Length: 1.2 m)

L4931*2
Extension Cable Set
(Length: 1.5 m, with the coupling connector)

L4935*2
Alligator Clip Set

9243*3
Grabber Clip

L4936*4
Bus Bar Clip Set

L4937*3
Magnetic Adapter Set

L4932*1
Test Pin Set

L4938*7
Test Pin Set

L4939*4
Breaker Pin Set

For the clamp current measurement (only compatible with the DT4281)

9704 Conversion Adapter

9010-50, 9018-50, 9132-50*4
Clamp-on Probe

Clamp-on probe	Rated current	Diameter of the measurable conductor
9010-50, 9018-50	500 Arms	ϕ46 mm or less
9132-50	1000 Arms	ϕ55 mm or less, 80 × 20 mm bus-bar

Temperature measurement

DT4910 Thermocouples (K) (p. 44)

- Temperature measuring junction: Exposed type (welding)
- Sensor length: Approx. 800 mm
- Operating temperature: -40°C to 260°C (temperature measuring part), -15°C to 55°C (connector)

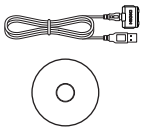
C0202 Carrying Case

The instrument, test leads, instruction manual, and others can be stored in the case.

Z5004 Magnetic Strap (p. 31)

Attach this strap to the instrument and secure it on the wall surface such as a metal plate for use.

DT4900-01 Communication Package (USB) (p. 69)



A communication adapter, USB cable, PC software, and communication specifications are included. The instrument data can be stored on the PC.

Safety Notes

This instrument is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, using the instrument in a way not described in this manual may negate the provided safety features.

Before using the instrument, be certain to carefully read the following safety notes.

⚠DANGER

Mishandling during use could result in injury or death, as well as damage to the instrument. Be certain that you understand the instructions and precautions in the manual before use.

⚠WARNING

With regard to the electricity supply, there are risks of electric shock, heat generation, fire, and arc discharge due to short circuits. If persons unfamiliar with electricity measuring instruments are to use the instrument, another person familiar with such instruments must supervise operations.

Protective gear

⚠WARNING

To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.

Notation

In this manual, the risk seriousness and the hazard levels are classified as follows.

⚠ **DANGER**	Indicates an imminently hazardous situation that will result in death or serious injury to the operator.
⚠ **WARNING**	Indicates a potentially hazardous situation that may result in death or serious injury to the operator.
⚠ **CAUTION**	Indicates a potentially hazardous situation that may result in minor or moderate injury to the operator or damage to the instrument or malfunction.
IMPORTANT	Indicates information related to the operation of the instrument or maintenance tasks with which the operators must be fully familiar.
	Indicates a high voltage hazard. If a particular safety check is not performed or the instrument is mishandled, this may give rise to a hazardous situation; the operator may receive an electric shock, may get burnt or may even be fatally injured.
	Indicates a strong magnetic-field hazard. The effects of the magnetic force can cause abnormal operation of heart pacemakers and/or medical electronics.
	Indicates prohibited actions.
	Indicates the action which must be performed.
*	Additional information is presented below.

Symbols affixed to the instrument

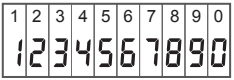
	Indicates cautions and hazards. When the symbol is printed on the instrument, refer to a corresponding topic in the Instruction Manual.
	Indicates that dangerous voltage may be present at this terminal.
	Indicates a double-insulated device.
	Indicates a fuse.
	Indicates a grounding terminal.
	Indicates DC (Direct Current).
	Indicates AC (Alternating Current).
	Indicates DC (Direct Current) or AC (Alternating Current).

Symbols for various standards

	Indicates the Waste Electrical and Electronic Equipment Directive (WEEE Directive) in EU member states.
	Indicates that the instrument conforms to regulations set out by the EC Directive.

Screen display

This instrument uses the following screen displays.



A different display is used in the case below.

Appears when a broken Thermocouple (K) is detected. (p. 44)

Accuracy

We define measurement tolerances in terms of rdg. (reading) and dgt. (digit) values, with the following meanings:

rdg.	(Reading or displayed value) The value currently being measured and indicated on the measuring instrument.
dgt.	(Resolution) The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a “1” as the least-significant digit.

Measurement categories

To ensure safe operation of measuring instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories.

⚠DANGER

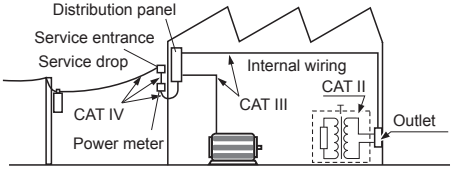
- **Using a measuring instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.**
- **Using a measuring instrument without categories in an environment designated with the CAT II to CAT IV category could result in a severe accident, and must be carefully avoided.**

This instrument conforms to the safety requirements for CAT III 1000 V, CAT IV 600 V measuring instruments.

CAT II: When directly measuring the electrical outlet receptacles of the primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)

CAT III: When measuring the primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets

CAT IV: When measuring the circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel)



See: “2.3 Using Test Leads” (page 28)

Usage Notes

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

⚠ DANGER

If the test lead or the instrument is damaged, there is a risk of electric shock. Before using the instrument, perform the following inspection.

- **Before using the instrument, check that the coating of the test leads are neither ripped nor torn and that no metal parts are exposed. Using the instrument under such conditions could result in electrocution. Replace the test leads with those specified by our company.**
- **Before using the instrument for the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your authorized Hioki distributor or reseller.**

Installation

Installing the instrument in inappropriate locations may cause a malfunction of instrument or may give rise to an accident. Avoid the following locations.
For details on the operating temperature and humidity, see the specifications. (p. 93)

⚠ CAUTION

- Exposed to direct sunlight or high temperature
- Exposed to corrosive or combustible gases
- Exposed to water, oil, chemicals, or solvents
- Exposed to high humidity or condensation
- Exposed to a strong electromagnetic field or electrostatic charge
- Exposed to high quantities of dust particles
- Near induction heating systems (such as high-frequency induction heating systems and IH cooking equipment)
- Susceptible to vibration

Handling the cables

⚠ WARNING

To prevent electric shock, when measuring the voltage of a power line use a test lead that satisfies the following criteria:

- **Conforms to safety standards IEC61010 or EN61010**
- **Of measurement category III or IV**
- **Its rated voltage is higher than the voltage to be measured**

All of the optional test leads for this device conform to the safety standard EN61010. Use a test lead in accordance with its defined measurement category and rated voltage.

⚠ CAUTION

- Avoid stepping on or pinching the cable, which could damage the cable insulation.
- To avoid damaging the cables, do not bend or pull the leads and the probe bases.

⚠CAUTION

The ends of the test leads are sharp. Be careful to avoid injury.

For the test leads supplied with the instrument or the options to be connected to the instrument, see the following information.

Accessories and options	Reference
Test lead	“2.3 Using Test Leads” (p. 28)
Thermocouples (K)	“3.8 Measuring Temperatures” (p. 44)
Clamp-on probe	See the Instruction Manual which accompanies the optional clamp.
USB cable	“4.12 Communicating with PC” (p. 69)
Magnetic strap	“2.4 Installation in Measurement Location” (p. 31)

Precautions during measurement

⚠ WARNING

If the instrument is used in locations where the rating indicated on the instrument or probes is exceeded, the instrument may be damaged resulting in personal injury. Do not use the instrument in such locations. See “Measurement categories” (p. 9).

- **With regard to the 10 A range, the maximum input current is 10 A DC/10 Arms AC. Supplying a current in excess of the maximum input may damage the instrument and result in personal injury. Do not supply current in excess of the specified limit. (Only the DT4282)**

Observe the following to avoid electric shock and/or short circuits.

- **Hazardous voltage may be generated in a free measurement terminal. Do not touch the free terminal.**
- **Use only test leads and optional equipment specified by our company.**
- **Do not allow the metal part of the test lead to touch any exposed metal, or to short between 2 lines. Never touch the metal end.**
- **When connecting the clip-type test lead to the active terminal, do not allow the lead to touch any exposed metal, or to short between 2 lines.**
- **When the clamp-on probe is opened, do not allow the metal part of the clamp to touch any exposed metal, or to short between 2 lines, and do not use over bare conductors. (For the clamp current measurement, only the DT4281)**

⚠CAUTION

- Do not input voltage or supply current exceeding the specified measurement range. Doing so may damage the instrument.
- During the continuity check, diode test, or measurement of resistance, conductance, or electrostatic capacity, measurement signals are generated in the terminals of the instrument. Depending on the target for measurement, the measurement signal may cause damage.
  Seeing “Measurement current” and “Open circuit voltage” in the accuracy table (p. 79), check, in advance, that there are no adverse effects of the measurement current and the open circuit voltage.

Precautions during shipment

Observe the following during shipment. Hioki cannot be responsible for damage that occurs during shipment.

⚠CAUTION

- During shipment of the instrument, handle it carefully so that it is not damaged due to a vibration or shock.
- To avoid damage to the instrument, remove the accessories and optional equipment from the instrument before shipment.

If the instrument is not to be used for an extended period of time

IMPORTANT

To avoid corrosion and/or damage to the instrument due to battery leakage, remove the batteries from the instrument if it is to be kept in storage for an extended period.

1 Overview

1.1 Overview and Features

This measuring instrument is a multi-function, high-precision digital multimeter which ensures both safety and durability.

Main features

- Speedy display of the RMS measured value
- Environmental performance (can be used anywhere) (Operation temperature: -15 to 55°C)
- High noise-proof performance
- Filter function effective for the inverter measurement
- Solid body which can be used for an extended period of time (drop-proof)

Useful functions during measurement

- Noise reduction (FILTER)
- Display stability (SLOW)
- Display hold (HOLD)
- Maximum/Minimum value display

- High accuracy (DCV: 0.025%), wide band (20 Hz to 100 kHz) measurement
- Speedy measurement via a fast response (0 V → 100 V response 1 second*)
  * Until the value falls within the accuracy specification range.

If there is an excessive input, a hazard is indicated by the red display.

Large, easily-viewable display

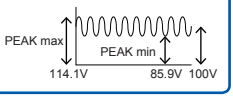
Backlighting for use in dark environments

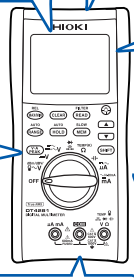
Problem finding a suitable installation location?

The strap with magnet allows the device to be hung conveniently.

For the DC power supply maintenance

The peak measurement function is used to capture the ripple voltage superimposed on the DC signal.





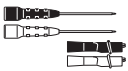
Memorizing measured values

For control of the UPS battery cell voltage, etc., the measurement value can be saved to the embedded memory (up to 400 data). The measurement value can also be read.

Data transmission to PC, control

The optional DT4900-01 Communication Package is required.

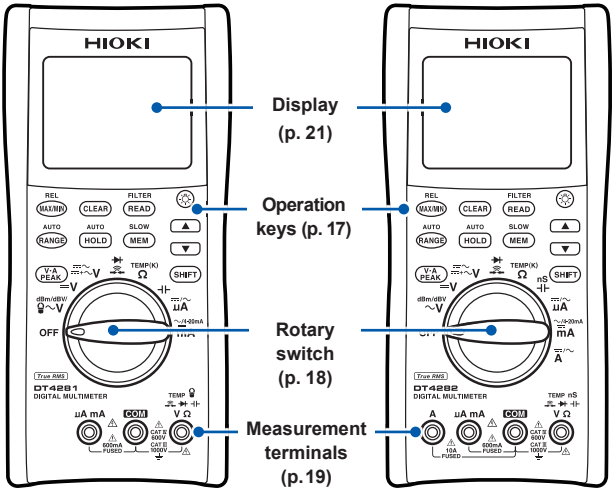
The measurement test leads and the end pins can be selected depending on the purpose of use.



1.2 Parts Names and Functions

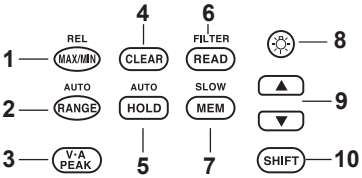
Front

Some indications are different between the DT4281 and DT4282.



DT4281 DT4282

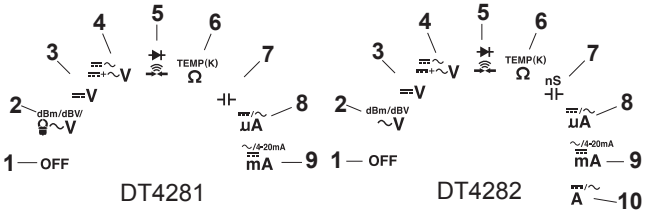
Operation keys



(*) Pressing a key **for at least 1 second** activates the function indicated above the key. To disable the function, change the rotary switch setting.

1	REL MAX/MIN	• Displays the maximum or minimum value. (p. 59) • **(*)** activates the relative value display function. (p. 61)
2	AUTO RANGE	• Selects the range (manual range). (p. 53) • **(*)** changes to the auto range. (The default is the auto range.)
3	V·A PEAK	Changes to the peak measurement. The maximum or minimum instantaneous value is measured. (p. 60)
4	CLEAR	• Deletes the stored data. (p. 66) • Clears the maximum or minimum value. (p. 59) • Clears the peak value. (p. 60)
5	AUTO HOLD	• Retains the displayed value. (p. 55) • **(*)** activates the auto hold function.
6	FILTER READ	• Reads the stored data. (p. 65) • **(*)** toggles the filter function between on and off. (p. 58)
7	SLOW MEM	• Saves the measurement data. (p. 63) • **(*)** toggles the display update speed between normal and slow. ([SLOW] is used to stabilize the display.) (p. 57)
8	☼	Turns on or off the display backlighting. (p. 67)
9	▲ ▼	Increases/Decreases the memory No. or numeric value. (When ▲/▼ are displayed on the LCD, these keys can be operated.)
10	SHIFT	Changes the function of the rotary switch to that indicated shown in blue.

Rotary switches and measurement descriptions

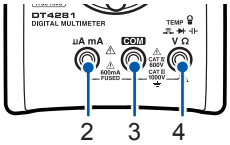


SHIFT **is used to change to the measurement shown in blue.**

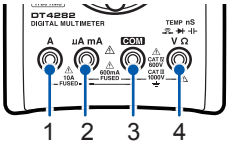
(**DT4281**: DT4281 only, **DT4282**: DT4282 only)

1	OFF	Turns off the power to the instrument.
2	dBm/dBV V	AC voltage measurement (p. 37) → dBm measurement → dBV measurement (p. 40) → **DT4281** Clamp current measurement (p. 50)
3	=V	DC voltage measurement (p. 38)
4	V	Synthesized voltage measurement of DC and AC → Voltage measurement of AC and DC components (p. 38)
5		Continuity check (p. 41) → Diode test (p. 42)
6	TEMP(K) Ω	Resistance measurement (p. 43) → Temperature measurement (compatible with the Thermocouples (K)) (p. 44)
7	nS	Capacitance measurement (p. 46) → **DT4282** Conductance measurement (p. 47)
8	µA	(6000 µA range) DC measurement → AC measurement (p. 48)
9	4-20mA mA	(600 mA range) DC measurement → AC measurement (p. 48) → % conversion of the 4-20 mA input (The % conversion of the 0-20 mA input can be specified via the power-on option.) (p. 52)
10	A	**DT4282** (10 A range) DC measurement → AC measurement (p. 48)

Measurement terminals



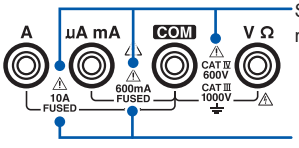
DT4281



DT4282

1	**DT4282** Current measurement (A) terminal. The red test lead is connected. When the rotary switch is set to the current measurement, the shutter opens.
2	Current measurement (µA, mA) terminal. The red test lead is connected. When the rotary switch is set to the current measurement, the shutter opens.
3	Commonly used for each measurement. The black test lead is connected.
4	Used for voltage measurement, resistance measurement, continuity check, diode test, temperature measurement, clamp current measurement **DT4281**, or conductance **DT4282**. Hereafter referred to as “V terminal”. The red test lead is connected. When the rotary switch is set to any of the measurements above, the shutter of the current measurement terminal is closed.

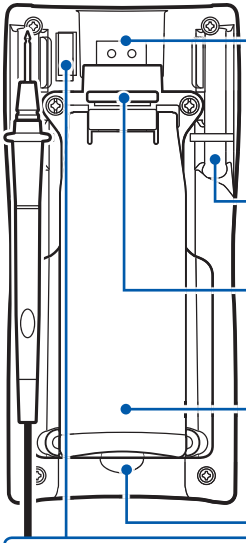
Be sure to carefully read the precautions in the following references.



See “Precautions during measurement” (p. 13).

See “Replacing Fuses” (p. 103).

Rear



Communication port
When the communication adapter supplied with the optional DT4900-01 Communication Package is connected, the data can be transmitted to the PC. (p. 69)

Test lead holder
The test lead can be held.

Strap hole
The optional Z5004 Magnetic Strap can be attached. (p. 31)

Stand
The instrument can be set on the stand. (p. 31)

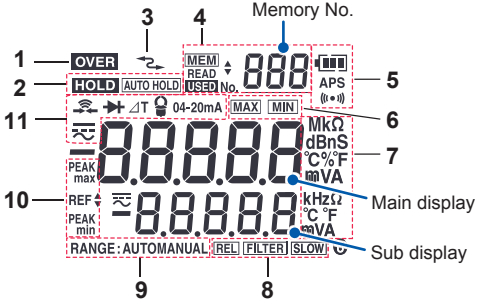
Battery cover
When replacing the batteries (p. 26) or fuse (p. 103), remove the cover.

⚠ See p. 26.

Serial number label
It is necessary for production control such as product warranty.
Do not peel off the label.

1.3 Display

For error displays, see “6.3 Error Display” (p. 102).



1	OVER	Blinks if the maximum value in each range is exceeded. (Voltage, current, continuity, diode, resistance, temperature, electrostatic capacity, conductance)
2	HOLD	Holds measured value. (p. 55)
	AUTO HOLD	The auto hold function is activated. (p. 55)
3		Communicating with the PC. (p. 69)
4	MEM	The memory function is activated. (p. 63)
	READ	Memory reading state (p. 65)
	USED	Stored data exist. (p. 63)
		(▲)/(▼) can be operated. (p. 63)
5		Battery indicator (p.24)
	APS	The auto power save function is activated. (p. 68)
		The buzzer can be used. (p. 67)

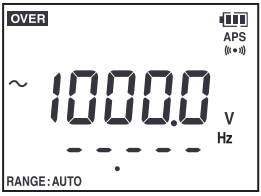
6	MAX	Maximum value (p. 59)
	MIN	Minimum value (p. 59)
7	(Unit)	Each unit
8	SLOW	The display update (sampling) is performed at SLOW speed. (p. 57)
	FILTER	The filter function is activated. (p. 58)
	REL	The relative value display function is activated. (p. 61)
9	RANGE: AUTO MANUAL	Auto range (p. 53) Manual range (p. 53)
10	PEAK max	Maximum value in the peak measurement (p. 60)
	PEAK min	Minimum value in the peak measurement (p. 60)
	REF ▲▼	When ▲▼ are displayed, (▲)/(▼) can be used to change values. Threshold of the continuity check (p. 41) Threshold of the diode test (p. 42)
11	~	AC measurement
	⎓	DC measurement
	⎓~	AC measurement + DC measurement
	ΔT	During the temperature measurement, the temperature difference from the standard is displayed. (p. 44)
		Continuity check (p. 41)
		Diode test (p. 42)
		DT4281 Clamp current measurement (p. 50)
	04-20mA	% conversion measurement of 4-20 mA (0-20 mA) (p. 52)

(DT4281: DT4281 only, DT4282: DT4282 only)

1.4 Alarm Display and Battery Indicator

The following conditions are informed via the red backlight, OVER display, and buzzer.

When the maximum input range is exceeded



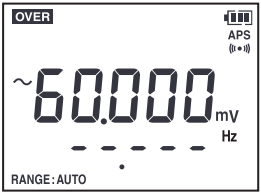
Voltage/Current measurement

OVER blinks, the red backlight blinks, the maximum value within the maximum range blinks, and the buzzer sounds.

Corrective action:

Immediately move the test leads away from the measurement object.

When the measured value exceeds the maximum value in each range (Range over)

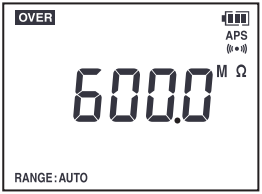


Voltage/Current measurement

OVER blinks, the red backlight lights up, and the maximum value blinks.

Corrective action:

RANGE Change the range.



Measurements other than voltage and current

OVER and the maximum value blinks.

Corrective action:

Change the range, or measure the samples in the specified range.
If the same symptom still occurs, check that the test leads are not broken. (p.34)

When the Thermocouple (K) is broken (Temperature measurement)

Corrective action:

Check that the thermocouple has been connected correctly to the measurement terminal. If the display does not change, replace with a new Thermocouple (K). (p. 44)

Battery indicator

	Fully charged.	(Charge: 60% or more)
	As the battery charge diminishes, black charge bars disappear, one by one, from the left of the battery indicator.	(Charge: 20% or more)
	The battery voltage is low. Replace the batteries as soon as possible.	(Charge: 5% or more)
	(Blinks) The battery is exhausted. Replace the batteries.	(Charge: less than 5%)

The charge is only a reference for the continuous operation time. (p. 94)

Power shutdown

When the charge is 0% (less than 3.8 V ± 0.2 V), “bAtt Lo” is displayed for 1 second and the power is shut down.

2 Preparation for Measurements

2.1 Measurement Workflow

Before using the instrument, be sure to read “Usage Notes” (p. 10).

Installation and connection

Insert the batteries. (p. 26)

↓

Perform the startup check. (p. 33)

↓

As necessary, have other optional items available and ready.

Measurement

Turn on the power and select the measurement function.

↓

Attach the test leads to the measurement terminals. (p. 28)
(As necessary, perform zero adjustment. (p. 62))

↓

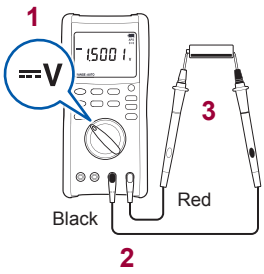
Connect the test leads to the measurement object.

↓

(As necessary)

Hold the display of the measured value. (p. 55)
Save the measured value. (p. 63)

↓



End of the measurement

Move the test leads away from the measurement object and then turn off the power.

2.2 Inserting/Replacing Batteries

Before using the instrument first time, insert 4 LR6 alkaline batteries. Before measurements, check that the battery level is sufficient. When the battery charge diminishes, replace the batteries.

Nickel-metal hydride batteries

Nickel-metal hydride batteries can be used. However, the discharge characteristic of these batteries is different from that of alkaline batteries. Be aware that the remaining battery power display does not function properly.

⚠ WARNING

To avoid electric shock, disconnect the test leads from the object to be measured before replacing the batteries.

To avoid the possibility of explosion, do not short circuit, charge, disassemble, or incinerate batteries.

After battery replacement but before using the instrument, reattach and screw down the battery cover.

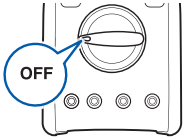
⚠ CAUTION

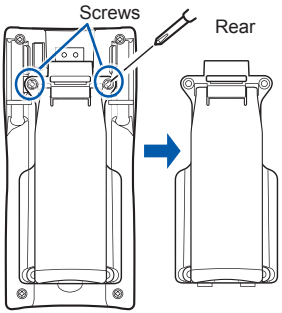
Poor performance or damage from battery leakage could result. Observe the cautions listed below.

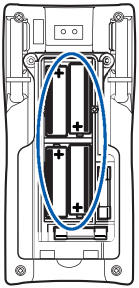
- Do no mix new and old batteries, or different types of batteries.
- Be careful to observe the battery polarity during installation.
- Do not use batteries after their recommended expiry date.
- Do not allow used batteries to remain in the instrument.

- To avoid corrosion from battery leakage and/or damage to the instrument, remove the batteries from the instrument if it is to be kept in storage for an extended period.

- The [ ] indicator appears when the battery charge diminishes. Replace the batteries as soon as possible.
- After use, be sure to turn off the instrument.
- Handle and dispose of batteries in accordance with local regulations.







1 **Have the following items available and ready.**
- Phillips screwdriver
- Alkaline (LR6) battery or manganese (R6P) battery × 4

2 **Remove the test leads from the instrument.**

3 **Set the rotary switch to OFF.**

4 **Using a Phillips screwdriver, remove the screws (2 locations) from the battery cover on the rear of the instrument.**

5 **Remove the battery cover.**

6 **When replacing the batteries, remove all old batteries.**

7 **Insert 4 new batteries (LR6 or R6P), being careful to the battery polarity.**

8 **Reattach the battery cover.**

9 **Secure the cover with the screws.**

After the battery cover is removed, the fuse can be seen. When replacing the fuse, see “6.4 Replacing Fuses” (p. 103).

2.3 Using Test Leads

The L9207-10 Test Lead supplied with the instrument are used for measurements.
Depending on measurement locations, use our optional measurement cables. For details on the optional items, see “Options (sold separately)” (p. 2).

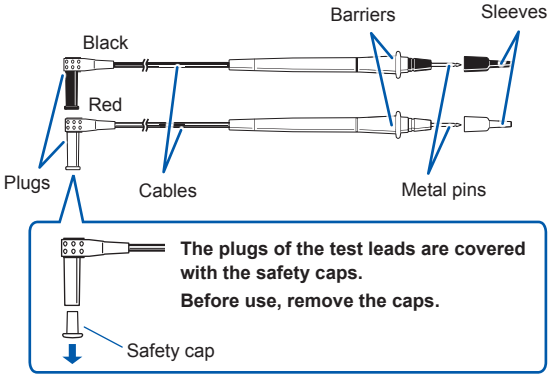
⚠ WARNING

- **To prevent a short circuit accident, be sure to use the test leads with the sleeves attached when performing measurements in the CAT III and CAT IV measurement categories. (For the measurement categories, see “Measurement categories” (p. 9).)**
- **If the sleeves are inadvertently removed during measurement, stop the measurement.**

⚠ CAUTION

- To ensure safe operation, use only test leads specified by our company.
- When carrying out measurements with the sleeves in place, be careful to avoid damaging the sleeves.
- The tips of the metal pins are sharp and may cause injury. Do not touch the tips.

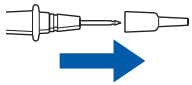
L9207-10 Test lead



Metal pin	Connect to the object to be measured. 4 mm or less (sleeve attached) 19 mm or less (sleeve removed) Diameter ϕ approx. 2 mm
Sleeve	Attach to the metal pins to prevent short circuit accidents.
Barrier	Represents the safe handling distance from the metal pins. **During measurement, do not touch the area between the barrier and the tip of the sleeve.**
Plug	Connect to the measurement terminals on this instrument.
Cable	Double sheathed cables (Length: approx. 900 mm, Diameter: ϕ approx. 3.6 mm) **When the white portion inside the cable is exposed, replace with a new L9207-10 Test Lead.**

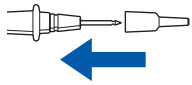
Removing and attaching the sleeves

Removing the sleeves



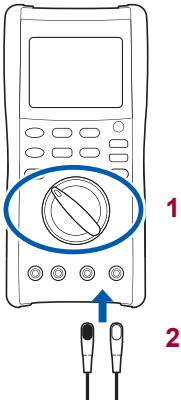
Gently hold the bottom of the sleeves and pull the sleeves off. Safely store the removed sleeves so as not to lose them.

Attaching the sleeves



Insert the metal pins of the test leads into the holes of the sleeves, and firmly push them all the way in.

Connecting to the instrument



1 **Turn the rotary switch to the desired measurement function.**

2 **Connect the test leads to the relevant measurement terminals.**

- Besides the current measurement (excluding the clamp)

COM terminal	Connect the black test lead.
V terminal	Connect the red test lead.

- Current measurement

COM terminal	Connect the black test lead.
µA/mA terminal	Connect the red test lead.
A terminal (Only the DT4282)	

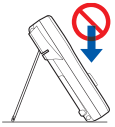
2.4 Installation in Measurement Location

Using the instrument with the stand

Position the instrument with the stand at the rear.

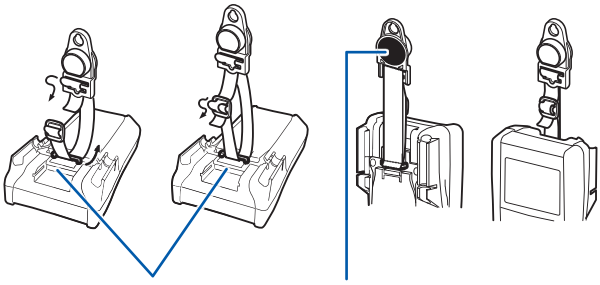
⚠CAUTION

- Do not position the instrument on an unstable table or inclined surface.
- When the instrument is set on the stand, do not apply a strong force above. Doing so may damage the stand.



Hanging the instrument with the strap

Attach the optional Z5004 Magnetic Strap to the instrument and attach the magnet to the wall surface (with metal plate affixed).



Strap holes

Magnet
Attach it to the wall surface (with metal plate affixed).

⚠DANGER

Those with medical electronics such as pacemakers should not use the Z5004 Magnetic Strap. Nor should such persons approach the Z5004. It is extremely dangerous. The electronics may not operate properly and the life of the operator may be put at great risk.

⚠CAUTION

- Do not use the Z5004 in locations where it may be exposed to rainwater, dust, or condensation. In those conditions, the Z5004 may be decomposed or deteriorated. The magnet adhesion may be diminished. In such case, the instrument may not be hung in place and may fall.
- Do not bring the Z5004 near magnetic media such as floppy disks, magnetic cards, pre-paid cards, or magnetized tickets. Doing so may corrupt and may render them unusable. Furthermore, if the Z5004 is brought near precision electronic equipment such as PCs, TV screens, or electronic wrist watches, they may fail.

3 Performing Measurements

3.1 Inspection Before Use

Before using the instrument the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your authorized Hioki distributor or reseller.

Appearance check of the instrument and test leads

Check item	Action
The instrument is neither damaged nor cracked. The internal circuits are not exposed.	Visually check the instrument. If it is damaged, there is a risk of electric shock. Do not use the instrument but send it for repair.
The terminals are not contaminated with debris.	Remove contamination with a cotton swab.
The coating of the test leads is neither broken nor frayed, or the white portion or metal part within the lead is exposed.	If the test lead is damaged, there is a risk of electric shock. Do not use the instrument but send it for repair.

Check when turning on the power

(Set the rotary switch to any position other than OFF.)

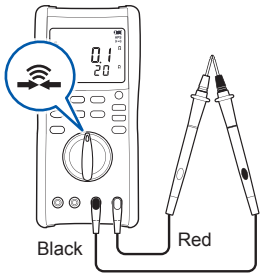
Check item	Action
The battery voltage is sufficient.	When the  indicator appears in the top right corner of the display, the battery voltage is low. Replace the batteries as soon as possible.

Check item	Action
No indicators are missing.	Display all indicators and ensure that no indicators are missing. (p. 71) If any of the indicators are missing, send the instrument for repair.

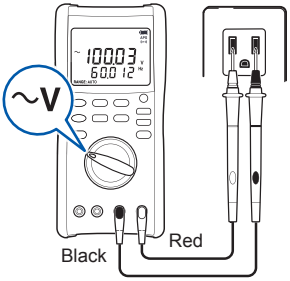
Operation check

This section introduces some of the operation checks. Periodical calibration is necessary in order to ensure that this instrument operates according to its specifications.

1 Check that the test leads are not broken.

Check method	Action
Regarding the continuity check, deliberately short circuit the test leads and then check the display.  	**Normal:** The value stabilizes at around 0.1Ω to 0.2Ω. **Abnormal:** A numeric value other than the above appears. **Corrective action:** The test leads may be broken. Replace with those specified by our company. If the same phenomena persist even after the test leads are replaced, a malfunction may occur. Halt inspection and then send the instrument for repair.

2 Measure samples (such as battery, commercial power supply, and resistor) of which values have already been known, and check that the appropriate values appear.

Check method	Action
Example: Perform the AC voltage measurement to measure the commercial power supply, and then check the display.  	**Normal:** An already-known value appears. (In this example, the commercial voltage level should appear.) **Abnormal:** The measured value does not appear. The malfunction may occur. Stop the inspection and do not use the instrument.

3 Check that the fuse is not broken.

Check method	Action
1. Remove the fuse from the instrument. (p. 103) 2. Reattach the battery cover. 3. In the resistance measurement, check the resistance of the fuse. (Resistance measurement (p. 43))	**Normal:** Fuse rating / Resistance 630 mA / Approx. 1.2Ω 11 A / 0.1Ω or less **Abnormal:** If the value above is not obtained (the value higher than that is displayed), replace the fuse. (p. 103)

Before measurements

⚠ WARNING

Observe the following to avoid short circuit accidents.

- **Always verify the appropriate setting of the rotary switch before connecting the test leads.**
- **Disconnect the test leads from the measurement object before switching the rotary switch.**
- **Operate or connect the instrument by following the procedure of each measurement example (or procedure steps).**

Auto power save function

- Before shipping (In the default setting), the auto power save function is set to enabled. If the instrument has not been operated for approx. 15 minutes, the power turns off automatically.
- To recover from the auto power save state, set the rotary switch to OFF and then turn on the power again.
- During current measurement, before setting the rotary switch to OFF, disconnect the test leads. If the rotary switch is forcibly turned, the shutter may be damaged.
- If the instrument will be used for an extended period of time, disable the auto power save function. (p. 68)
- After use, set the rotary switch to OFF. The auto power save function consumes a small amount of current.

Numerical value display with no input

When the measurement terminal is open during DC voltage (DCV) measurement or AC voltage (ACV) measurement in the 60 mV range or 600 mV, a random value is displayed. This does not indicate a malfunction of the instrument. When the probe is connected to the measurement target, a normal numerical value is displayed. A high-input impedance voltmeter is used in the instrument for highly sensitive measurement. Consequently, external noise, such as inductive noise, appears as a numerical value.

3.2 Measuring Voltage

AC voltage, DC voltage, synthesized voltage of DC and AC, and voltage of AC and DC components can be measured. Furthermore, the maximum, minimum, and peak (instantaneous) values of measured values can be checked. (p. 59)

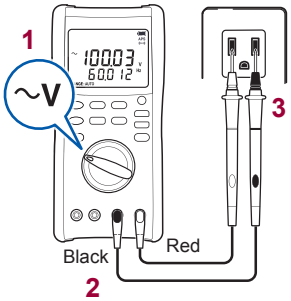
Before measurements

⚠WARNING

If the instrument is used in locations where the rating indicated on the instrument or probes is exceeded, the instrument may be damaged resulting in personal injury. Do not use the instrument in such locations. See “Measurement categories” (p. 9).

The autoranging function of this instrument automatically selects the optimum measurement range. To change the range arbitrarily, use the manual range. (p. 53)

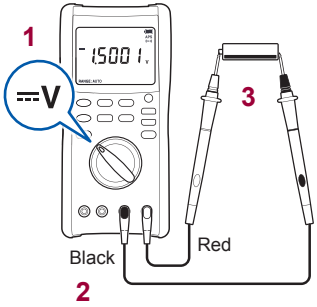
Measuring AC voltage



Measure the AC voltage.
Measure the frequency simultaneously.

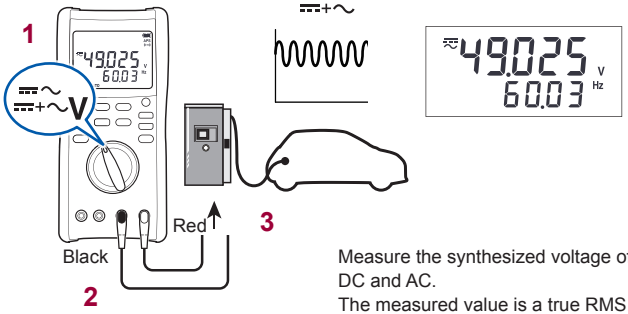
The measured value is a true RMS. (p. Appx.1)

Measuring DC voltage



Measure the DC voltage.

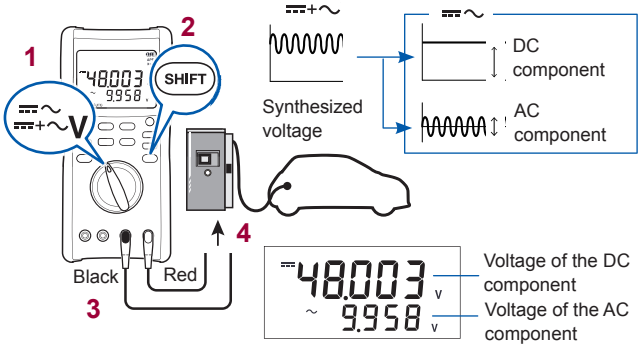
Measuring synthesized voltage of DC and AC



Measure the synthesized voltage of DC and AC.
The measured value is a true RMS. (p. Appx.1)

It is also possible to check the AC or DC components individually. (p. 39)

Measuring voltage of DC and AC components



3.3 Measuring Frequencies

During voltage/current measurement of AC, the frequency can be checked in the sub display. It is not possible to change the frequency range.

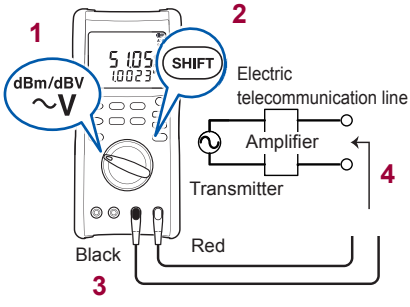
- If signals out of the range of frequency measurement are measured, "------" appears. Be aware of it.
- The sensitivity of the frequency measurement is regulated by range. (Minimum sensitivity voltage (p. 90), Minimum sensitivity current (p. 90)) When the value is less than the minimum sensitivity voltage (current), the indicated value may fluctuate. When the voltage range is lowered, the value stabilizes. This does not apply to cases where the value fluctuates due to noise.
- During the measurement of low frequency, if the auto range does not stabilize and frequency cannot be measured, fix the range and measure again.

3.4 Decibel Conversion (dBm/dBV)

The result of the AC voltage measurement is decibel-converted for the standard and then displayed. For details on the conversion formula, see “Decibel conversion measurement” (p. 91).

dBm For the voltage measurement, the “power ratio” for power 1 mW by the standard resistance is decibel-converted and then displayed. (Cable loss)

dBV For the voltage measurement, the “voltage ratio” for the standard voltage 1 V is decibel-converted and then displayed. (Voltage gain)



Example: Measuring the [dBm] cable loss

([**dBm**] or [**dBV**] lights up)

In the case of [dBm]

Frequency

In the case of [dBV]

Frequency

Changing the standard impedance of the dBm conversion

Standard impedance selection range (p. 91)

1. **Turn on the power while pressing ▼.**
2. **▲ / ▼ (Select a desired value.)**
3. **HOLD (Confirm the value.)**

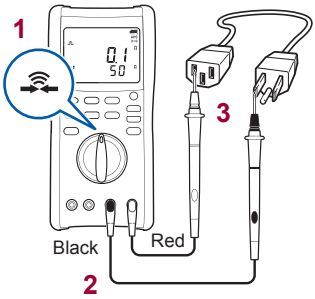
The regular display reappears.
Even after the power is turned off, the setting is retained.

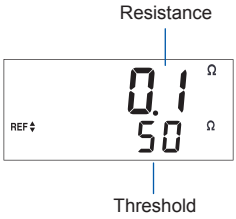
3.5 Checking Continuity

The input short circuit is detected and informed via a buzzer and red backlight.

⚠ WARNING

Before measuring, be sure to turn off the power to the measurement circuit. Otherwise, electric shock may occur or the instrument may be damaged.





Changing thresholds

Use ▲ / ▼ to change a threshold. Even after the power is turned off, the setting is retained.

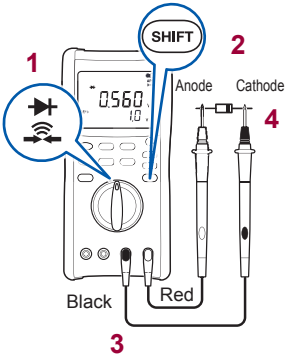
Detection	Threshold				Measurement result	
	20Ω (default)	50Ω	100Ω	500Ω	Buzzer	Red backlight
Open detection	220Ω or more	250Ω or more	300Ω or more	600Ω or more	Does not sound	Turns off
Short circuit detection	20Ω or less	50Ω or less	100Ω or less	500Ω or less	Sounds	Turns on

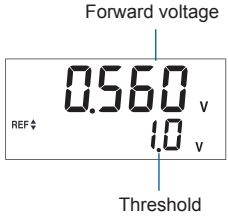
3.6 Measuring Diode

The forward voltage of the diode is measured. If the forward voltage of the diode is the threshold or less, it is informed via a buzzer and red backlight.

⚠ WARNING

Before measuring, be sure to turn off the power to the measurement circuit. Otherwise, electric shock may occur or the instrument may be damaged.





In the case of the opposite connection

Changing thresholds

Use ▲ / ▼ to change a threshold.

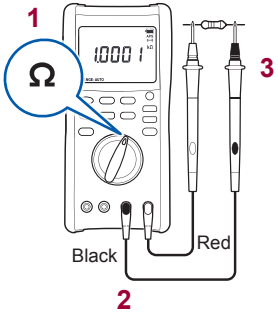
Threshold: 0.15 V/0.5 V (default)/1 V/1.5 V/2 V/2.5 V/3.0 V
Even after the power is turned off, the setting is retained.

3.7 Measuring Resistance

Resistance is measured.

⚠ WARNING

Before measuring, be sure to turn off the power to the measurement circuit. Otherwise, electric shock may occur or the instrument may be damaged.



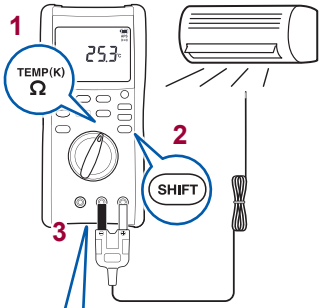
The open terminal voltage is approx. 2.5 V or less. The measurement current (DC) varies depending on the range. (p. 84)
To avoid damage to the measurement object, check the specifications before use.

3.8 Measuring Temperatures

Using our optional DT4910 Thermocouples (K), temperatures can be measured.

⚠ CAUTION

To avoid damage to the instrument, do not input any voltage or supply current to the thermocouple.

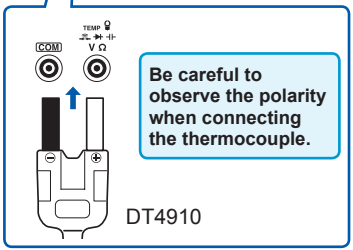


When a breaking state of the Thermocouples (K) is detected

Checking the temperature change

Check the following values.

- Relative value display (p. 61)
- Maximum/Minimum value display (p. 59)



Changing the temperature units

Celsius and Fahrenheit can be switched. (p. 72)

When measuring temperatures with the thermocouple applied to the surface of the measurement object

Clean the surface so that the thermocouple can make contact with the object securely.

If no numeric value is displayed after the thermocouple is attached ([OPEn] is displayed):

The instrument or thermocouple may be malfunctioning. Check this with the following procedure.

1 **Short-circuit the V and COM terminals of the instrument using the test leads.**

The ambient temperature is displayed.	To step 2
The ambient temperature is not displayed.	The instrument is malfunctioning. Send it for repair.

2 **Connect the thermocouple in the correct direction.**

[OPEn] remains displayed.	The thermocouple may be malfunctioning (blown). Replace the thermocouple with a new one.

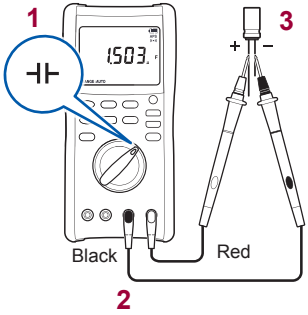
3.9 Measuring Electrostatic Capacities

The capacity of the capacitor is measured.

⚠ WARNING

Before measuring, be sure to turn off the power to the measurement circuit. Otherwise, electric shock may occur or the instrument may be damaged.

Do not measure the capacitor which has been charged.



- **When measuring the polar capacitor**
  Connect the V terminal (red test lead) to the + terminal of the capacitor and the COM terminal (black test lead) to the - terminal.
- For components on a circuit board, measurement may not be possible due to the effect of the peripheral circuit.
- If the capacity changes when the measurement range is changed (p. Appx.3)

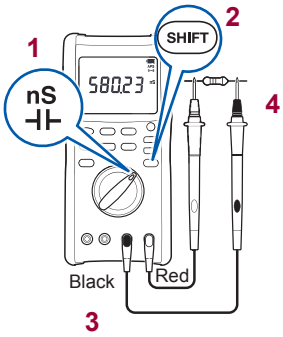
3.10 Measuring Conductances (DT4282)

The resistance is measured and the inverse number is displayed (Unit: nS, nano-siemen). When the resistance is excessively large, it is used.

Example: When the resistance is 50MΩ, 1/50MΩ = 20 nS.
($M = 10^6$, $n = 10^{-9}$)
When the terminal is open, 0 nS appears.

⚠ WARNING

Before measuring, be sure to turn off the power to the measurement circuit. Otherwise, electric shock may occur or the instrument may be damaged.



The open terminal voltage is approx. 2.5 V or less. The measurement current (DC) is approx. 96 nA. (p. 85)
To avoid damage to the measurement object, check the specifications before use.

3.11 Measuring Current

DC/AC is measured.

⚠DANGER

- **Do not input any voltage to the current measurement terminals.**
  Doing so may result in short circuit accidents.
- **To avoid electrical accidents, turn off the power to the circuit before measuring and then connect the test leads.**

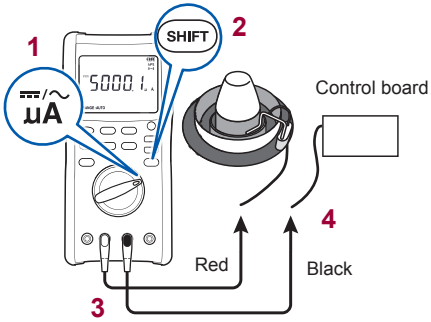
Measuring DC/AC

Function		(SHIFT) is used to toggle between DC and AC.
µA	Selected to measure 6000 µA or less.	⎓ → ∿
mA	Selected to measure 600 mA or less.	⎓ → ∿ → 4-20mA *
A	Selected to measure 10 A or less. (DT4282)	⎓ → ∿

* The 0-20 mA input can be selected via the power-on option. (p. 74)

When measuring an unknown current
Set to the high range (**mA** for the DT4281, **A** for the DT4282).

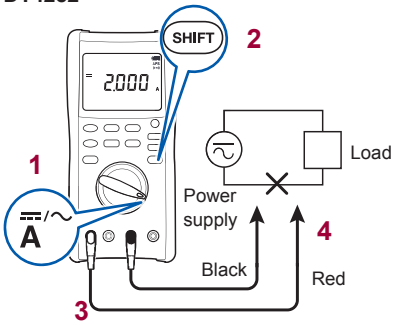
DT4281, DT4282



Example: Measuring the current of the burner flame (**μA**)

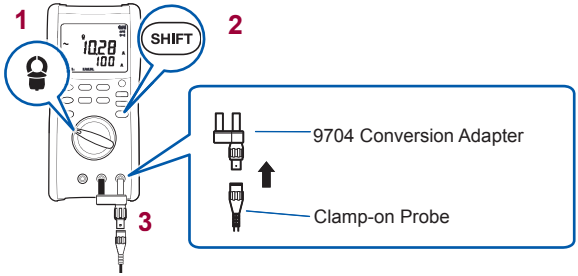
The measured current value of the burner flame varies with the input impedance of the instrument.
The μA input impedance of this instrument is approx. 100Ω.

DT4282

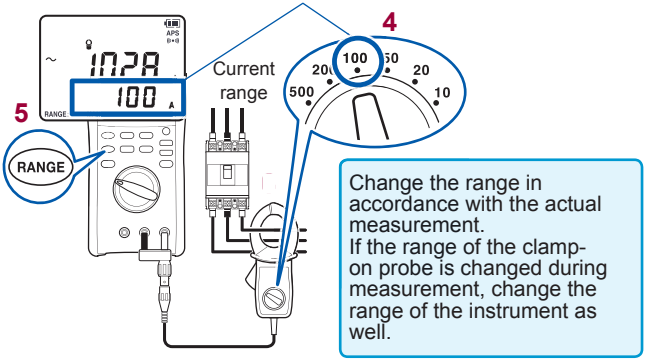


3.12 Measuring AC Using Clamp-on Probe (DT4281)

The current is measured using our optional clamp-on probe (9010-50, 9018-50, 9132-50). To connect to this instrument, the 9704 Conversion Adapter is required. Before using the clamp-on probe, be sure to read the Instruction Manual which accompanies the optional clamp.

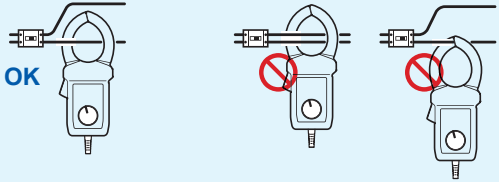


Set the clamp-on probe and the instrument to the same range.



When clamping a cable

Attach the clamp around only one conductor.
Single-phase (2-wire) or three-phase (3-wire) cables clamped together will not produce any reading.



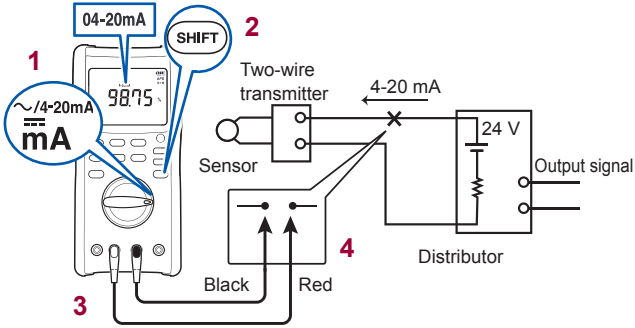
When OVER blinks

The measured value exceeds maximum display counts. Increase the range.

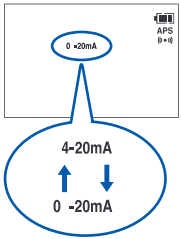
3.13 4-20 mA (0-20 mA) % Conversion

The 4-20 mA (or 0-20 mA) signal of the instrumentation system can be converted to 0% to 100% and checked.

- 4 mA - 20 mA → 0% - 100%
  (An input exceeding 20 mA is displayed up to a maximum of 350%.)
- 0 mA - 20 mA → 0% - 100%
  (An input exceeding 20 mA is displayed up to a maximum of 300%.)



Changing to the 0-20 mA signal



1 **Turn on the power while pressing ▲.**

2 **▲ / ▼ (Select a desired value.)**

3 **HOLD (Confirm the value.)**

The regular display reappears.
Even after the power is turned off, the setting is retained.

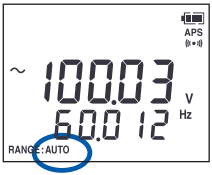
4 Using Instrument Conveniently

4.1 Selecting the Measurement Range

Auto or Manual range can be selected. In the case of measurement where the desired range can be selected, [RANGE:] lights up in the bottom left of the display.

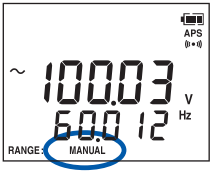
- Auto range — Sets the optimum range automatically in accordance with the actual measurement.
- Manual range — Sets the range and fixes it specifically.

Measuring with the auto range



When the manual range is set, pressing AUTO RANGE for at least 1 second changes to the auto range. The instrument automatically selects the optimum measurement range.

Measuring with the manual range



Press AUTO RANGE.

Each time the key is pressed, a higher range is specified.
When the key is pressed at the highest range, the lowest range is specified once again.
Example: When measuring the AC voltage

60 mV → 600 mV - - - - → 600 V → 1000 V

When the measurement function is switched using the rotary switch or **SHIFT**, or when the peak measurement is canceled, the auto range is enabled.

Range display list

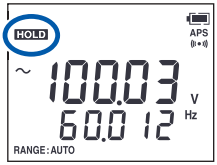
ACV, DCV	60 mV, 600 mV, 6 V, 60 V, 600 V, 1000 V
DC+ACV	6 V, 60 V, 600 V, 1000 V
Ω	60Ω, 600Ω, 6kΩ, 60kΩ, 600kΩ, 6MΩ, 60MΩ, 600MΩ
⊣⊢ (Electrostatic capacity)	1 nF, 10 nF, 100 nF, 1 µF, 10 µF, 100 µF, 1 mF, 10 mF, 100 mF
DCA, ACA	600 µA, 6000 µA, 60 mA, 600 mA, 6 A, 10 A
AC clamp	10 A, 20 A, 50 A, 100 A, 200 A, 500 A, 1000 A
PEAK (DCV)	6 V, 60 V, 600 V, 1000 V
PEAK (ACV)	18 V, 180 V, 1500 V
PEAK (DC+ACV)	18 V, 180 V, 1500 V
PEAK (DCA/ACA)	1200 µA, 12000 µA, 120 mA, 1200 mA, 12 A, 15 A
PEAK (AC clamp)	30 A, 60 A, 150 A, 300 A, 600 A, 1500 A, 3000 A

4.2 Retaining the Measured Value

The measured value is retained manually or automatically.

- Manually — When **HOLD** is pressed, the measured value is retained.
- Automatically — When **HOLD** is pressed and held for at least 1 second, auto mode starts. When the measured value stabilizes, it is retained.

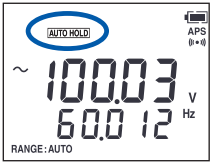
Retaining the measured value manually (HOLD)



To retain the measured value, press HOLD. (**HOLD** lights up and the measurement value is retained.)

To cancel the hold state, press it again. (**HOLD** goes off.)

Automatically retaining the measured value when the value stabilizes (AUTO HOLD)



Press AUTO HOLD for at least 1 second.
(AUTO HOLD lights up.)

When the measured value stabilizes, a beeping sound is generated and the value is retained. (**HOLD** lights up.)
If **HOLD** is pressed again, or the input signal exceeds the dead zone threshold again (see table on the next page), or when the range is switched internally and the measured value is stabilized once again, the hold state is canceled. (**HOLD** goes off.)
To disable the auto hold function, press it for at least 1 second again. (AUTO HOLD goes off.)

- If the input signal is too small for the relevant range (dead zone threshold p. 56), the measured value cannot be automatically retained.
- If the difference between the current and previous measured values remains less than the counts in the stable field of the table below, the instrument determines the current value has stabilized.

Dead zone threshold

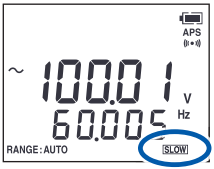
Function		Stable (count)	Dead zone threshold (count)
AC voltage		1200, 200 (1000 V range)	1200, 200 (1000 V range) *
DC voltage		1200, 200 (1000 V range)	1200, 200 (1000 V range) *
DC voltage + AC voltage		1200, 200 (1000 V range)	1200, 200 (1000 V range)
Continuity check		100	5900
Diode test		80	3520
Resistance		1200, 120 (60/600MΩ range)	58800, 5880 (60/600MΩ range)
Conductance		1200	1200
DC	μA	1200	1200
	mA	1200	1200
	A	1200, 200 (10 A range)	1200, 200 (10 A range)
AC	μA	1200	1200
	mA	1200	1200
	A	1200, 200 (10 A range)	1200, 200 (10 A range)
AC (clamp input)		5% of the range	5% of the range

* No function is available for the mV range.

4.3 When the Measured Value Fluctuates (SLOW)

When the measured value fluctuates and cannot be read, it is possible to stabilize the value. (When SLOW is lit)

- When SLOW is off (normal): refer to the display update rate (p.78) (Default setting)
- When SLOW is lit (slow): five times normal (average of 5 times)



Press SLOW MEM **for at least 1 second.**

(SLOW lights up.)

To cancel the state, press it for at least 1 second again.
(SLOW goes off.)

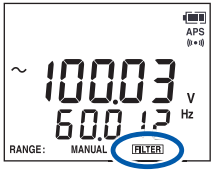
When the measurement function is switched using the rotary switch or **SHIFT**, the SLOW setting is disabled.

4.4 Removing the Harmonic Components of the Inverter (FILTER)

⚠ WARNING

To prevent electric shock, before setting the filter function, confirm if there is a voltage or not with the filter function disabled (OFF).

Remove the harmonic components when measuring the inverter output.
This function can be used when measuring the AC voltage or AC+DC voltage. The cut-off frequency is 630 Hz.



FILTER

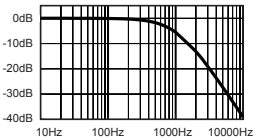
Press (READ) for at least 1 second.

(FILTER lights up.)

To cancel the state, press it for at least 1 second again.
(FILTER goes off.)

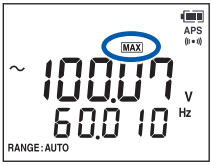
Only 600V/1000V range.
When the measurement function is switched using the rotary switch or **SHIFT**, the filter function is canceled.

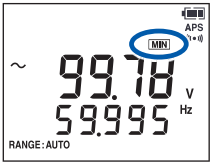
When measuring voltage with a 400 Hz fundamental frequency (such as that on an aircraft), be aware that the FILTER function may cause attenuation and the indicated voltage may be 20% lower than the actual voltage.
The characteristics of the FILTER function (low pass filter) are shown in the graph.



4.5 Checking the Maximum/Minimum Value (MAX/MIN)

The maximum/minimum value after start of the measurement can be checked.





Press (MAX/MIN).

Each time the key is pressed, the display is changed in the order of the maximum value (MAX), minimum value (MIN), and current value.

A buzzer sounds when the maximum value is updated with MAX displayed or the minimum value is updated with MIN displayed.

The maximum and minimum values are for the displayed value; they do not relate to peak values such as AC signals.
The main and sub displays update their maximum and minimum values individually.

Clearing the existing maximum/minimum value

When MAX or MIN appears, press (CLEAR).

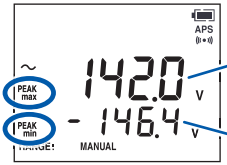
Both maximum and minimum values are cleared.
After this, the maximum and minimum measurement values after clearing the previous ones are retained.

When saving to memory, only the value displayed on the screen (current value, maximum value, or minimum value) can be saved.

4.6 Checking the Peak Value (V • A PEAK)

After starting the voltage/current peak measurement, the maximum/minimum instantaneous value can be checked.

The peak measurement can be performed only with the manual range. Press **RANGE** to select the appropriate range before starting the measurement. (For the range configuration and display range, see page 82)



Maximum instantaneous value

Minimum instantaneous value

Press (V·A PEAK).

The maximum/minimum instantaneous value can be retained, from the point at which (V·A PEAK) is pressed.

To cancel the display of the peak value, press it again.

A buzzer sounds when PEAKmax or PEAKmin is updated.

Clearing the maximum/minimum instantaneous value

Press (CLEAR).

The maximum/minimum instantaneous value can be displayed, from the point at which (CLEAR) is pressed.

4.7 Checking the Relative Value/ Performing Zero Adjustment

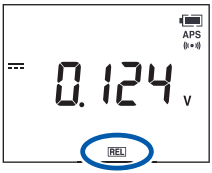
The relative value comparing to the standard value can be checked (relative function).
It can also be used as the zero adjustment function.
Zero adjustment eliminates the influences of the wiring resistance (resistance measurement) and the wiring capacity (capacitor measurement).

When the following measurement function is selected, this function is disabled.
Peak measurement, Continuity, Diode, dBm/dBV, 4-20 mA

The measurement range cannot be changed when [REL] is lit. To change the range, press **REL** for at least 1 second to reset the REL function.

Checking the relative value (REL)

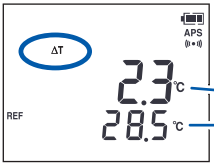
Example 1: DC voltage measurement



When the standard value is measured, press REL (MAX/MIN) for at least 1 second ([REL] lights up).

To cancel the state, press it for at least 1 second again. ([REL] goes off.)

Example 2: Temperature measurement



When measuring temperature, [REF] lights up and a standard temperature appears in the sub display.

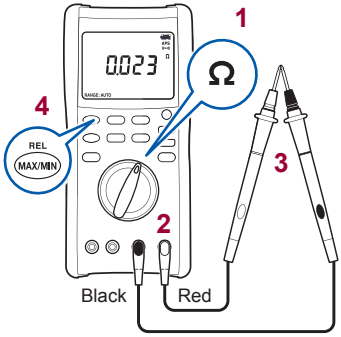
Deviation from the standard temperature

Standard temperature

Performing zero adjustment

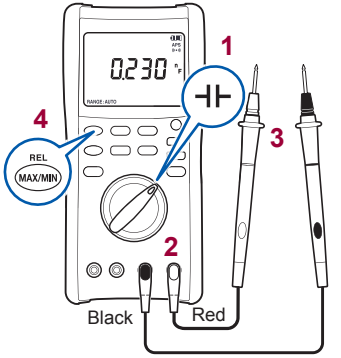
When performing zero adjustment, the condition of the test leads varies depending on the measurement function.
Perform zero adjustment, referring to the table below.

Measurement function	V, A, Ω	⊣⊢ , nS
Condition of the test leads	Short circuit	Open



Example 1: Resistance measurement

1. **Select the measurement function.**
2. **Connect the test leads to the measurement terminals.**
3. **Allow the test leads to short circuit.**
4. **Press REL MAX/MIN for at least 1 second.**
   (After zero adjustment: 0.000Ω)
5. **Measure the resistance.**



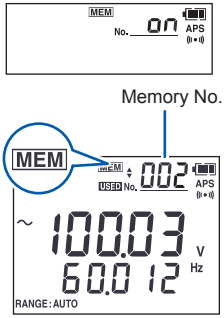
Example 2: Capacitor measurement

1. **Select the measurement function.**
2. **Connect the test leads to the measurement terminals.**
3. **Allow the test leads to open.**
4. **Press REL MAX/MIN for at least 1 second.**
   (After zero adjustment: 0.000 nF)
5. **Measure the capacitor.**

4.8 Using the Memory Function

The measurement result can be saved and read using the memory function. Up to 400 data can be saved. Data can also be deleted arbitrarily.
The saved data can be imported to the PC using the DT4900-01 Communication Package (optional).

Saving the measured value (MEM)



1 Press MEM (MEM lights up).

Memory mode starts.
This function applies until the power is turned off.

The memory No. appears (only for the measurement which can be saved).

2 Select the memory No. to be saved using ▲ / ▼.

When the key is pressed and held, the memory No. can be incremented/ decremented faster.

3 Press MEM to save the measured value.

When the measured value is saved, the memory No. for which the value is to be saved next appears.
Even when the power is turned off, the memory data are retained.

- If the memory No. for which the data have already been saved is selected, [USED] appears.
- When **MEM** is pressed, the data are overwritten.
- When the value is saved with memory No. “400” displayed, a buzzer sounds and “FULL” appears in the display, and then “001” reappears.
- When [READ] (data reading) is displayed, it is not possible to save the value.
- The current value, maximum value (MAX), minimum value (MIN), instantaneous maximum value (Peak max), and instantaneous minimum value (Peak min) cannot be saved simultaneously. Only the displayed numeric value can be saved.
- The continuity check data and the diode test data cannot be saved.

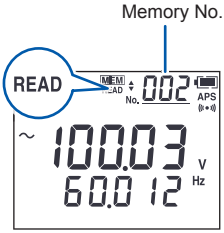
When both hands cannot be used during measurement

Enable the auto hold function. After the measured value is retained automatically, press **MEM** to save the data.

Items to be saved per data

- Function
- Measurement range
- Measured value in the main display
- Measured value in the sub display
- Whether or not the REL function is executed
- Filter ON/OFF

Reading the memory data (READ)



1 **Press** (READ) **(READ lights up).**

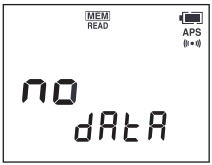
Read mode starts.

2 **Select the desired memory No. using ▲ / ▼.**

Only the memory Nos. corresponding to saved data are displayed.

Canceling the read mode

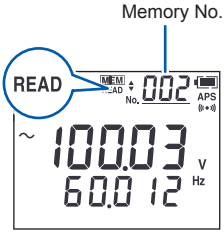
Press **READ** again or turn the rotary switch. (READ goes off.)



When no memory data exist

The relevant message appears and then the regular measurement display reappears.

Clearing the memory data (CLEAR)



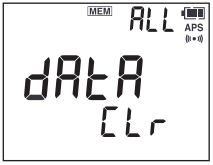
1 **Press READ (READ lights up).**

Read mode starts.

2 **Select the No. to be cleared using ▲ / ▼.**

3 **Press CLEAR.**

Clearing all memory data



1 **Turn on the power while pressing CLEAR.**

The relevant message appears in the display.

2 **Press CLEAR again within 3 seconds.**

All memory data are now cleared.

When 3 seconds elapse without pressing **CLEAR**, all memory data are not cleared and the regular display reappears.

4.9 Muting the Buzzer

The buzzer sound can be disabled.
Note, however, that the buzzer cannot be muted in the following cases.
Continuity check, diode test, and overload warning (only for the maximum value)

Turn on the power while pressing MAX/MIN.

When MAX/MIN is released, the regular display appears ((•)) goes off).

Canceling the buzzer mute function

Turn on the power again while pressing MAX/MIN .

When MAX/MIN is released, the regular display appears ((•)) lights up).
Even after the power is turned off, the buzzer setting is retained.

4.10 Turning On the Backlight

The backlight can be turned on/off by pressing ☼.

When PC communication is started, the backlight is turned off forcibly.

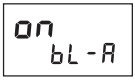
Enabling/disabling the automatic deactivation of the backlight

Turn on the power while pressing ☼.

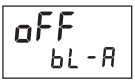
Even after the power is turned off, the automatic backlight deactivation setting is retained.

Automatic deactivation

Enable



Disable



- When the automatic deactivation setting is enabled (on), the backlight goes off automatically, approximately 40 seconds after the backlight comes on.
- When the automatic deactivation setting is cancelled (oFF) and the auto power save function is disabled, if the instrument has not been operated for 3 minutes, the backlight automatically goes off.

4.11 Using the Auto Power Save (APS)

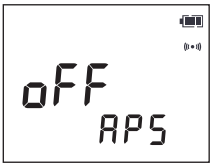
The auto power save function saves on power consumption. If the instrument has not been operated for approx. 15 minutes, the power is automatically turned off.
Before shipping (as one of the default settings), the auto power save function is set to enabled. (APS lights up)
It is also possible to disable the auto power save function.
At 15 seconds before the power is turned off, the APS blinks and an intermittent buzzer sounds. To continuously use the instrument, press any key or turn the rotary switch.

After use, set the rotary switch to OFF. The auto power save function consumes a small amount of current.

Recovering from the auto power save

Set the rotary switch to OFF and turn on the power again.
(When the current measurement is used, disconnect the measurement cable and then turn on the power again.)

Disabling the auto power save function



Turn on the power while pressing AUTO HOLD.

When AUTO HOLD is released, the regular display appears.
(APS goes off.)

This function is disabled until the power is turned off.

4.12 Communicating with PC

Using the optional DT4900-01 Communication Package, it is possible to transmit data to the PC or to control the instrument. For details, see the Instruction Manual which accompanies the communication package.

Install the special software on the PC.

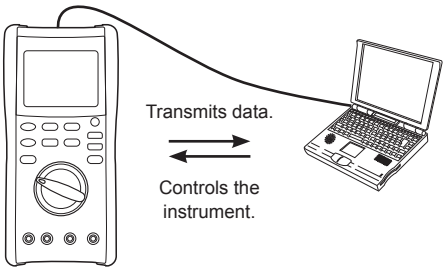
(See the Instruction Manual which accompanies with the communication package.)
Dedicated Software (p.Appx.4)

Attaching the USB cable to the instrument (p. 70)

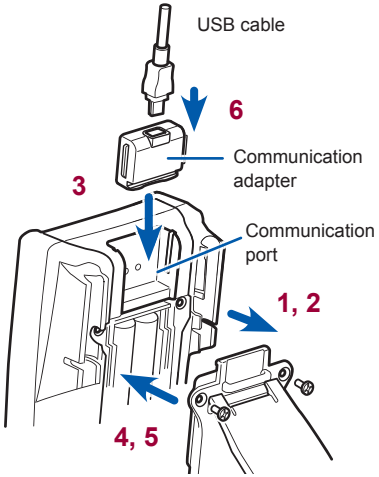
Connect to the PC.

The virtual COM ports of the PC can be used as the USB interface.

- Communication method: Start-stop system, half-duplex transmission
- Baud rate: 19,200 bps fixed
- Data bit length: 8 bits
- Stop bit: 1 bit
- Parity: None
- Flow control: None
- Delimiter: CR+LF



Attaching the communication adapter to the instrument



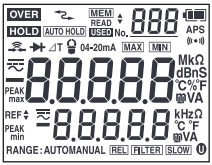
1. **Using a Phillips screwdriver, remove the screws (2 locations) from the battery cover.**
2. **Remove the battery cover.**
3. **Attach the communication adapter.**
4. **Reattach the battery cover.**
5. **Secure the battery cover with the screws.**
6. **Connect the USB cable to the communication adapter.**

- Connect the cables, being careful to orient each cable correctly.
- During communication, appears in the display.
- When is lit, the operation keys of the instrument is disabled.
- During communication, do not disconnect the USB cable. Disconnecting the cable stops the communication. In that case, a warning is displayed by the PC software. Connect the cable again.
- It is possible to use the instrument while the communication adapter is attached, however, the communication adapter is excluded from the drop-proof.

4.13 Setting and Checking the System

Checking that all indicators are displayed

Check that there is no missing indicator.
If any indicator is missing, stop using the instrument and send it for repair.



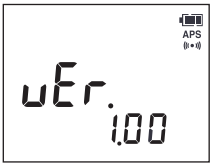
Turn on the power while pressing (V·A PEAK).

When (V·A PEAK) is released, the regular display appears.

Checking the software version of the instrument

For repair or calibration, check the version if necessary.

Example: Ver 1.00

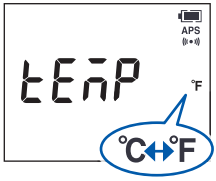


Turn on the power while pressing (RANGE).

When (RANGE) is released, the regular display appears.

Changing the temperature display unit

The units of temperature (°C or °F) can be changed.



(Display: tEMP)

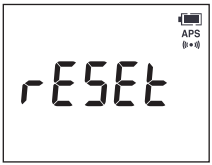
1. **Turn on the power while pressing REL MAX/MIN and ▲ simultaneously.**
2. **Press REL MAX/MIN for at least 3 seconds.**
3. **Change the unit of the temperature using ▲ ▼.**
4. **Press HOLD to determine the setting.**

After a few moments, the regular display reappears.

The setting of the temperature unit is retained even after the power is turned off.

4.14 Resetting the System

The system is returned to the state before shipping. The power-on option setting is also reset.
The memory data are not reset. To clear the memory data, clear the data individually for each memory No. (p. 66) or clear all data (p. 66).
The temperature unit is not reset, either.



1. **Turn on the power while pressing CLEAR and SHIFT.**
2. **Within 3 seconds, press CLEAR again.**

After [**CLr**] blinks, the system returns to the state before shipping.
If the instrument is not operated for 3 seconds, the system is not reset but the regular display reappears.

Table of default settings

Setting item	Default setting	Display
Filter function	Disabled	
Relative function	Disabled	
Display update	Normal	
Display hold	Disabled	
Range	AUTO	[RANGE:AUTO] is lit.
Auto hold	Disabled	
Maximum/Minimum value	Disabled	
Peak value	Disabled	
Auto power save function	Enabled	[APS] is lit.
Automatic backlight deactivation	Off	
Buzzer	Enabled	[((•))] is lit.
% conversion	4-20 mA	
dBm standard impedance	600Ω	
Temperature display unit	°C	

4.15 Power-on Option Table

The settings in the instrument can be changed or checked.
After changing the setting, the regular display then reappears.

+ Turn on the power while pressing the operation key. (Turn the rotary switch from OFF.)

Setting change	Method	Ref.
Canceling the auto power save function (APS)	HOLD + ([APS] goes off.)	p. 68
Buzzer (ON/OFF)	MAX/MIN + ([((•))] lights up/goes off.)	p. 67
Automatic backlight deactivation setting	☼ + Automatic deactivation disabled: [oFF], [bL-A] Automatic deactivation enabled: [on], [bL-A]	p. 67
Clearing all memory data	CLEAR + → CLEAR Press this within 3 seconds.	p. 66
System reset	CLEAR + SHIFT + → CLEAR Press this within 3 seconds.	p. 73
Standard impedance setting (dBm measurement)	▼ + → ▲/▼ → HOLD Select the desired setting. Confirm the change.	p. 40

Setting change	Method	Ref.
Switching to 4-20 mA/ 0-20 mA	▲ +  →  → HOLD Select the desired setting. Confirm the change.	p. 52
Displaying all indicators	V·A PEAK + 	p. 71
Checking the version	RANGE + 	p. 71
Switching the temperature unit	MAX/MIN + ▲ +  → MAX/MIN → 3 seconds or more  → HOLD Select the desired setting. Confirm the change.	p. 72
Displaying the serial number	READ +  Serial No. display (9 digits) 1st to 4th digits: Main display 5th to 9th digits: Sub display When READ is released, the regular display appears.	

5 Specifications

5.1 Electrical Characteristics

AC measurement system	True RMS measurement
Noise suppression	• NMRR DCV, -60 dB or less (50 Hz/60 Hz) • CMRR DCV, -120 dB or less (DC/50 Hz/60 Hz, 1kΩ unbalance) • CMRR ACV, -60 dB or less (DC/50 Hz/60 Hz, 1kΩ unbalance)
Response time	• Power ON time: within 2 seconds (When the range does not move until the measured value is displayed in the screen)

	*1	*2	
• DCV	Within 1 second	Within 1.5 seconds	(0 V → 100 V auto range operation)
• ACV	Within 3 seconds	Within 8 seconds	(0 V → 100 V auto range operation)
• Ω	Within 2 seconds	Within 3 seconds	(Infinity → 0Ω auto range operation)
• Ω	Within 2 seconds	Within 3 seconds	(0Ω → 30MΩ auto range operation)

*1: Until the value comes in the range of the accuracy specification
*2: Until the displayed value stabilizes (within ±2 counts)

Display update rate	• V, Continuity, Ω, nS, Diodo, Clamp, Frequency, A, dBm, dBV: 5 times/s	
	• Electrostatic capacity	0.05 to 2 times/s (varies depending on the measured value)
	• Temperature	1 time/s (including disconnection check)
	• Peak measurement	Up to 155 times/s when peak value is updated
	• DC+ACV	2.5 times/s
Input impedance	See “Accuracy Table” (p. 79).	

Overload protection

Function	Overload protection
• ACV, dBm, dBV, Hz, AC clamp (DT4281) • DCV • DC+ACV, Hz	1100 V DC/AC (50/60 Hz) or 2×10^7 V • Hz, whichever is the lower value • Voltage applied for 1 minute • Transient overvoltage 8000 V
• Continuity check, diode test • Ω, temperature (K) • Electrostatic capacity • nS (DT4282)	1000 V DC/AC or 2×10^7 V • Hz, whichever is the lower value • Voltage applied for 1 minute • Current steady state under overload 15 mA or less • Current transient state under overload 0.8 A or less
• DCμA, ACμA, Hz	630 mA/1000 V fuse Breaking capacity 50 kA AC/30 kA DC
• DCmA, ACmA, (4-20mA)%, Hz • DCA (DT4282), ACA (DT4282), Hz	11 A/1000 V fuse Breaking capacity 50 kA AC/30 kA DC

5.2 Accuracy Table

Accuracy warranty period	1 year
Regulated power supply range	Until the power shutdown (3.8 V ± 0.2 V)
Accuracy guarantee for temperature and humidity	23°C ± 5°C (73°F ± 9°F), 80%RH or less (non-condensating)
Temperature characteristic	Adds “Measurement accuracy × 0.1/°C” (except 23°C ± 5°C (73°F ± 9°F))

Comply with the temperature characteristic in the applicable accuracy table if individually specified.
Other conditions: For information related to the L4931 extension cable set (coupled 2 cables, 3 m), see the accuracy table.

- rdg. (reading or displayed value): The value currently being measured and displayed on the measuring instrument.
- dgt. (resolution): The smallest displayable unit, i.e., the input value that causes the digital display to show a “1”.

1 AC voltage (V AC, mV AC)

Range	Accuracy					
	20 to below 45 [Hz]	45 to 65 [Hz]	Over 65 to 1 k [Hz]	Over 1 k to 10 k [Hz]	Over 10 k to 20 k [Hz]	Over 20 k to 100 k [Hz]
60.000 mV	±1.3% rdg. ±60 dgt.	±0.4% rdg. ±40 dgt.	±0.6% rdg. ±40 dgt.	±0.9% rdg. ±40 dgt.	±1.5% rdg. ±40 dgt.	±20% rdg. ±80 dgt.
600.00 mV	±1.3% rdg. ±60 dgt.	±0.4% rdg. ±40 dgt.	±0.6% rdg. ±40 dgt.	±0.9% rdg. ±40 dgt.	±1.5% rdg. ±40 dgt.	±8% rdg. ±80 dgt.
6.0000 V	±1% rdg. ±60 dgt.	±0.2% rdg. ±25 dgt.	±0.3% rdg. ±25 dgt.	±0.4% rdg. ±25 dgt.	±0.7% rdg. ±40 dgt.	±3.5% rdg. ±40 dgt.
60.000 V	Not specified	±0.2% rdg. ±25 dgt.	±0.3% rdg. ±25 dgt.	±0.4% rdg. ±25 dgt.	±0.7% rdg. ±40 dgt.	±3.5% rdg. ±40 dgt.
600.00 V	Not specified	±0.2% rdg. ±25 dgt.	±0.3% rdg. ±25 dgt.	±0.4% rdg. ±25 dgt.	Not specified	Not specified
1000.0 V	Not specified	±0.2% rdg. ±25 dgt.	±0.3% rdg. ±25 dgt.	±0.4% rdg. ±25 dgt.	Not specified	Not specified

Input impedance	1MΩ ±4% // 100 pF or less
Crest factor	3 or less (For the 60.000 mV/ 600.00 mV/ 1000.0 V range, 1.5 or less for 100% of the input of the range 3 or less for 50% of the input of the range)
Accuracy specification range	5% or more of each range With the filter ON, the accuracy is specified in 100 Hz or less. Furthermore, 2% rdg. is added. Frequency range: 20 Hz to 100 kHz (A measured value outside of the accuracy guarantee range for frequency is also displayed.)
DC superimposition	• For the superimposition on 200 V DC or less, see the accuracy table. • For the superimposition on over 200 V DC to 500 V DC or less, 2% rdg. is added to the accuracy specification in 1 kHz or less. • For the superimposition on over 500 V DC, 10% rdg. is added to the accuracy specification in 1 kHz or less.

2 DC voltage (V DC, mV DC)

Range	Accuracy	Input impedance
60.000 mV	±0.2% rdg. ±25 dgt.*1	1GΩ or more: 100 pF or less
600.00 mV	±0.025% rdg. ±5 dgt.*1	1GΩ or more: 100 pF or less
6.0000 V	±0.025% rdg. ±2 dgt.	11.0MΩ ±2%: 100 pF or less
60.000 V	±0.025% rdg. ±2 dgt.	10.3MΩ ±2%: 100 pF or less
600.00 V	±0.03% rdg. ±2 dgt.	10.2MΩ ±2%: 100 pF or less
1000.0 V	±0.03% rdg. ±2 dgt.	10.2MΩ ±2%: 100 pF or less

*1: After leaving the instrument in an environment where the ambient air temperature has been stable for at least 30 minutes, allow the input to short circuit and activate the relative value display function (REL). The accuracy is then specified. After activating the REL, the temperature fluctuates within ±5°C.

3 DC+ACV measurement

Range	Accuracy					
	20 to below 45 [Hz]	45 to 65 [Hz]	Over 65 to 1 k [Hz]	Over 1 k to 10 k [Hz]	Over 10 k to 20 k [Hz]	Over 20 k to 100 k [Hz]
6.0000 V	±1.2% rdg. ±65 dgt.	±0.3% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	±1.5% rdg. ±45 dgt.	±3.5% rdg. ±125 dgt.
60.000 V	Not specified	±0.3% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	±1.5% rdg. ±45 dgt.	±3.5% rdg. ±125 dgt.
600.00 V	Not specified	±0.3% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	Not specified	Not specified
1000.0 V	Not specified	±0.3% rdg. ±30 dgt.	±0.4% rdg. ±30 dgt.	±0.4% rdg. ±45 dgt.	Not specified	Not specified

Input impedance	1MΩ ±4%, 100 pF or less
Crest factor	3 or less (For the 1000.0 V range, 1.5 or less for 100% of the input of the range, 3 or less for 50% of the input of the range)
Auto range	The range moves depending on the DC+AC calculation result.
Accuracy specification range	5% or more of each range With the filter ON, the accuracy is specified in 100 Hz or less. Furthermore, 2% rdg. is added. Frequency range: 20 Hz to 100 kHz (A measured values outside of the accuracy guarantee range for frequency is also displayed.)

Accuracy of DCV (main display) and ACV (sub display) when **SHIFT** is pressed during DC+ACV measurement

1. DCV (main display): the accuracy of 45 Hz to 65 Hz in the accuracy table is applied. Note however that 2%rdg. should be added when there is AC voltage superimposition less than 45 Hz.
2. ACV (sub display): according to the accuracy table

4 Peak measurement

(At the time of ACV, DCV, DC+ACV, Clamp, DCμA, DCmA, DCA, ACμA, ACmA, ACA)

Main measurement	Signal width	Accuracy
DCV	4 ms or more (single)	±2.0% rdg. ±40 dgt. *1
	1 ms or more (repeated)	±2.0% rdg. ±100 dgt. *2
Other than DCV	1 ms or more (single)	±2.0% rdg. ±40 dgt. *3, *4
	250 μs or more (repeated)	±2.0% rdg. ±100 dgt. *4, *5

*1: The accuracy is specified via the 5 V/4 ms single signal.
*2: The accuracy is specified at the peak value of 40000 counts/25 Hz sine wave.
*3: The accuracy is specified via the 5 V/1 ms single signal. (ACV, DC+ACV)
*4: The accuracy is specified at the peak value of the Max. counts/100 Hz sine wave in the main measurement range. (AC measurement)
*5: The accuracy is specified at the peak value of 40000 counts/100 Hz sine wave in the main measurement range. (DC measurement, 7 A/100 Hz for the 10 A range)

Maximum input range

Voltage measurement range	Peak measurement range		
	DCV	ACV	DC+ACV
6.0000 V	6.000 V	18.000 V	18.000 V
60.000 V	60.00 V	180.00 V	180.00 V
600.00 V	600.0 V	1500.0 V *1	1500.0 V *1
1000.0 V	1000 V	None	None

*1: Up to 1000 V for the RMS

Current measurement range	Peak measurement range
	DCA/ACA
600.00 µA	1200.0 µA
6000.0 µA	12000 µA
60.000 mA	120.00 mA
600.00 mA	1200.0 mA *2
6.0000 A (DT4282)	12.000 A *3
10.000 A (DT4282)	15.00 A *3

*2: Up to 600 mA for the RMS
*3: Up to 10 A for the RMS

AC clamp measurement range (DT4281)	Peak measurement range
10.00 A	30.00 A
20.00 A	60.00 A
50.00 A	150.0 A
100.0 A	300.0 A
200.0 A	600.0 A
500.0 A	1500 A
1000 A	3000 A

5 Continuity check

Range	Accuracy	Measurement current
600.0Ω	±0.5% rdg. ±5 dgt.	640 µA ±10%

Open circuit voltage	2.5 V DC or less
Continuity threshold	20Ω (default) / 50Ω/ 100Ω/ 500Ω
Threshold setting tolerance	±1% setting±0.5Ω
Response time	Open circuit or short circuit is detected for at least 10 ms.

6 Diode test

Range	Accuracy	Measurement current
3.600 V	±0.1% rdg. ±5 dgt.	1.2 mA or less

Open circuit voltage	4.5 V DC or less

If the reading is lower than the threshold during the forward connection, a buzzer sounds and red backlight comes on.
When the reading exceeds the threshold by 0.01 V or more during the forward connection, the buzzer stops and the red backlight turns off.

Forward threshold	0.15 V/ 0.5 V (default)/ 1 V/ 1.5 V/ 2 V/ 2.5 V/ 3 V)
Threshold setting tolerance	±1% setting±0.005 V

7 Resistance (Ω)

Range	Accuracy	Measurement current
60.000Ω	±0.3% rdg. ±20 dgt. *1	640 µA ±10%
600.00Ω	±0.03% rdg. ±10 dgt. *1	640 µA ±10%
6.0000kΩ	±0.03% rdg. ±2 dgt. *1	96 µA ±10%
60.000kΩ	±0.03% rdg. ±2 dgt. *1	9.3 µA ±10%
600.00kΩ	±0.03% rdg. ±2 dgt.	0.96 µA ±10%
6.0000MΩ	±0.15% rdg. ±4 dgt.	96 nA ±10%
60.00MΩ	±1.5% rdg. ±10 dgt. *2	96 nA ±10%
600.0MΩ	±3.0% rdg. ±20 dgt. *2, *3 ±8.0% rdg. ±20 dgt. *2, *4	96 nA ±10%

*1: Allow the input to short circuit and activate the relative value display function (REL). The accuracy is then specified.
*2: The accuracy is specified for humidity 60%RH or less.
*3: The accuracy is specified for 200.00MΩ or less.
*4: The accuracy is specified for more than 200.00MΩ.

Open circuit voltage	2.5 V DC or less
Maximum capacity load	100 mF
Maximum inductive load	10 H

8 Conductance (nS)

Range	Accuracy	Measurement current
600.00 nS	±1.5% rdg. ±10 dgt.	96 nA ±10%

- The accuracy is specified for humidity 60%RH or less.
- For more than 300 nS, ±20 dgt. is added.
- The accuracy is specified in 20.00 nS or more.

Open circuit voltage	2.5 V DC or less
Maximum capacity load	100 mF
Maximum inductive load	10 H

9 Electrostatic capacity

Range	Accuracy *2	Measurement current	Open circuit voltage
1.000 nF	±1% rdg. ±20 dgt. *1	32 µA ±10%	2.5 V DC or less
10.00 nF	±1% rdg. ±5 dgt. *1	32 µA ±10%	2.5 V DC or less
100.0 nF	±1% rdg. ±5 dgt. *1	32 µA ±10%	2.5 V DC or less
1.000 µF	±1% rdg. ±5 dgt.	32 µA ±10%	2.5 V DC or less
10.00 µF	±2% rdg. ±5 dgt. *3	680 µA ±20%	3.1 V DC or less
100.0 µF	±2% rdg. ±5 dgt. *3	680 µA ±20%	3.1 V DC or less
1.000 mF	±2% rdg. ±5 dgt. *3	680 µA ±20%	2.1 V DC or less
10.00 mF	±2% rdg. ±5 dgt. *3	680 µA ±20%	2.1 V DC or less
100.0 mF	±2% rdg. ±20 dgt. *3	680 µA ±20%	2.1 V DC or less

*1: In the case of the 100 nF range or less, the accuracy is specified after the REL function is activated.
*2: The accuracy is specified in 0.22 nF or more.
*3: Adds “Measurement accuracy × 0.3/°C” (except 23°C ± 5°C)

- When the manual range is set, the accuracy is specified in 1% or more of the range.
- The accuracy is specified for series resistance of 5Ω or less.
- Maximum count for each range: 1100 (excluding 100.0 mF)

10 Temperature (type K thermocouple)

Range	Accuracy [*1]
-40.0 to 800.0°C	±0.5% rdg. ±3°C
-40.0 to 1472.0°F[*2]	±0.5% rdg. ±5.4°F

*1: In an environment where the temperature of the instrument is ±1°C and stable, the accuracy is specified.
*2: Using the power-on option setting, °F display is activated.
Fahrenheit °F = (9/5) × Celsius°C + 32

- The optional type K thermocouple are used.
- The accuracy does not include the error of the type K thermocouple.
- Standard contact temperature compensation stability time
  When the instrument environmental temperature fluctuates ±5°C or more:
  120 minutes
  After current measurement: 30 minutes

11 DC (DCμA, DCmA, DCA)

	Range	Accuracy	Shunt	Fuse resistance
DCμA	600.00 μA	±0.05% rdg. ±5 dgt.[*1]	101Ω	Approx. 1.2Ω
	6000.0 μA	±0.05% rdg. ±5 dgt.	101Ω	
DCmA	60.000 mA	±0.05% rdg. ±5 dgt.[*1]	1Ω	
	600.00 mA	±0.15% rdg. ±5 dgt.	1Ω	
DCA (DT4282)	6.0000 A	±0.2% rdg. ±5 dgt.[*1]	10mΩ	0.1Ω or less
	10.000 A	±0.2% rdg. ±5 dgt.	10mΩ	

*1: Accuracy rule when using the slow display update rate. Add ±20 dgt. when using the normal rate.

12 AC (ACµA, ACmA, ACA)

	Range [A]	Accuracy *1				
		20 to below 45 [Hz]	45 to 65 [Hz]	Over 65 to 1 k [Hz]	Over 1 k to 10 k [Hz]	Over 10 k to 20 k [Hz]
ACµA	600.00 µ	±1.0% rdg. ±20 dgt.	±0.6% rdg. ±20 dgt.	±0.6% rdg. ±20 dgt.	±2% rdg. ±20 dgt.	±4% rdg. ±20 dgt.
	6000.0 µ	±1.0% rdg. ±5 dgt.	±0.6% rdg. ±5 dgt.	±0.6% rdg. ±5 dgt.	±2% rdg. ±5 dgt.	±4% rdg. ±5 dgt.
ACmA	60.000 m	±1.0% rdg. ±20 dgt.	±0.6% rdg. ±20 dgt.	±0.6% rdg. ±20 dgt.	±1% rdg. ±20 dgt.	±2% rdg. ±20 dgt.
	600.00 m	±1.0% rdg. ±5 dgt.	±0.6% rdg. ±5 dgt.	±0.6% rdg. ±5 dgt.	±1.5% rdg. ±10 dgt. *2	Not specified
ACA*3	6.0000	Not specified	±0.8% rdg. ±20 dgt.	±0.8% rdg. ±20 dgt.	Not specified	Not specified
	10.000*4	Not specified	±0.8% rdg. ±5 dgt.	±0.8% rdg. ±5 dgt.	Not specified	Not specified

	Range [A]	Shunt
ACµA	600.00 µA	101Ω
	6.0000 mA	101Ω
ACmA	60.000 mA	1Ω
	600.00 mA	1Ω
ACA*3	6.0000 A	10mΩ
	10.000 A	10mΩ

*1: The accuracy is specified in 5% or more of the range.
*2: For more than 300 mA, the accuracy is specified in 5 kHz or less.
*3: Only the DT4282
*4: The accuracy is specified in 2 A or more.

Crest factor	3 or less (Note that it applies to 1/2 of the range.)

Accuracy guarantee range for frequency	20 Hz to 20 kHz (A measured value outside of the accuracy guarantee range for frequency is also displayed.)

13 AC clamp (DT4281)

Range	Accuracy (only the instrument) The accuracy is specified in 15% or more of the range.		Conversion rate (A/mV)
	40 to 65 [Hz]	Over 65 to 1 k [Hz]	
10.00 A	±0.6% rdg. ±2 dgt.	±0.9% rdg. ±2 dgt.	0.05
20.00 A	±0.6% rdg. ±4 dgt.	±0.9% rdg. ±4 dgt.	0.10
50.00 A	±0.6% rdg. ±10 dgt.	±0.9% rdg. ±10 dgt.	0.25
100.0 A	±0.6% rdg. ±2 dgt.	±0.9% rdg. ±2 dgt.	0.5
200.0 A	±0.6% rdg. ±4 dgt.	±0.9% rdg. ±4 dgt.	1.0
500.0 A	±0.6% rdg. ±10 dgt.	±0.9% rdg. ±10 dgt.	2.5
1000 A	±0.6% rdg. ±2 dgt.	±0.9% rdg. ±2 dgt.	5

- The optional 9010-50, 9018-50, or 9132-50 clamp-on probe is used.
- For accuracy in combination with the clamp, add the accuracy of the clamp-on probe.

Input impedance	1MΩ ±4%, 100 pF or less
Crest factor	3 or less
Accuracy guarantee range for frequency	40 Hz to 1 kHz (A measured value outside of the accuracy guarantee range for frequency is also displayed.)

14 Frequency (Hz)

(In the case of ACV, DC+ACV, ACμA, ACmA, or ACA)

Range	Accuracy
99.999 Hz	±0.005% rdg. ±3 dgt.
999.99 Hz	±0.005% rdg. ±3 dgt.
9.9999 kHz	±0.005% rdg. ±3 dgt.
99.999 kHz	±0.005% rdg. ±3 dgt. *1
500.00 kHz	±0.005% rdg. ±3 dgt. *1

*1: Measurement range where the accuracy is specified in the range of 99.999 kHz/500.00 kHz
Up to 200 kHz for ACV or ACμA
Up to 50 kHz for DC+ACV
Up to 100 kHz for the range from 60.000 mV AC to 600.00 mV AC
Up to 30 kHz for ACmA or ACA

Measurement range	0.5 Hz or more (**[-----]** appears for less than 0.5 Hz.)
Pulse width	1 μs or more (duty ratio: 50%)

- With the filter ON, the accuracy is specified in 100 Hz or less.
- During DC+ACV measurement, it is in accordance with the attenuator range where the input component is large.

Minimum sensitivity voltage (During DC+ACV measurement, it indicates an RMS of the AC component.)

Range [Hz]	AC voltage range (sine wave)					
	60.000 mV	600.00 mV	6.0000 V	60.000 V	600.00 V	1000.0 V
99.999 *2,*3	10.000 mV	100.00 mV	1.0000 V	10.000 V	100.00 V	100.0 V
999.99	10.000 mV	100.00 mV	1.0000 V	10.000 V	100.00 V	100.0 V
9.9999 k	10.000 mV	100.00 mV	1.0000 V	10.000 V	100.00 V	100.0 V
99.999 k	10.000 mV	100.00 mV	1.0000 V	10.000 V	Not specified	Not specified
500.00 k	30.000 mV	150.00 mV	1.5000 V	Not specified	Not specified	Not specified

The maximum input is within each range. (The 1000.0 V range depends on the ACV accuracy table)

*2: The minimum sensitivity voltage which is less than 5 Hz is tripled.
*3: With the filter ON, the minimum sensitivity voltage is multiplied by 0.7.

Minimum sensitivity current

Range [Hz]	AC range (sine wave)					
	600.00 µA	6000.0 µA	60.000 mA	600.00 mA	6.0000 A	10.000 A
99.999 *4	60.00 µA	600.0 µA	6.000 mA	60.00 mA	0.6000 A	4.000 A
999.99	60.00 µA	600.0 µA	6.000 mA	60.00 mA	0.6000 A	4.000 A
9.9999 k	60.00 µA	600.0 µA	6.000 mA	60.00 mA	0.6000 A	4.000 A
99.999 k	60.00 µA	600.0 µA	6.000 mA*6	60.00 mA*6	Not specified	Not specified
500.00 k	100.00 µA*5	1000.0 µA*5	Not specified	Not specified	Not specified	Not specified

The maximum input is within each range.

*4: The minimum sensitivity current which is less than 5 Hz is tripled.
*5: Specified in 200 kHz or less.
*6: Specified in 30 kHz or less.

15 Decibel conversion measurement

Function	Range	Standard	Standard impedance R
dBm	600.00 dBm	Wref = 1 m [W]	4/8/16/32/50/75/93/110/125/135/150/200/250/300/500/600 (default)/800/900 /1000/1200Ω
dBV	60.00 dBV	Vref = 1 [V]	None

Conversion formula (as measured value V (V))

$$dBm = 10\log_{10}\left(\frac{\frac{V^2}{R}}{W_{ref}}\right) = 10\log_{10}\left(\frac{V^2 \times 1{,}000}{R}\right)$$

$$dBV = 20\log_{10}\left(\frac{V}{V_{ref}}\right) = 20\log_{10} V$$

Accuracy: dBm (when standard impedance is 600Ω)

Measurement Range [dBm]	20 to below 45 [Hz]	45 to 65 [Hz]	Over 65 to 1 k [Hz]	Over 1 k to 10 k [Hz]	Over 10 k to 20 k [Hz]	Over 20 k to 100 k [Hz]
-48 to below -21	±0.8 dBm	±0.5 dBm	±0.5 dBm	±0.5 dBm	±0.6 dBm	±3.0 dBm
-21 to below -1	±0.3 dBm	±0.2 dBm	±0.2 dBm	±0.2 dBm	±0.3 dBm	±1.0 dBm
-1 to below 17	±0.3 dBm	±0.2 dBm	±0.2 dBm	±0.2 dBm	±0.2 dBm	±0.5 dBm
17 to below 37	Not specified	±0.2 dBm	±0.2 dBm	±0.2 dBm	±0.2 dBm	±0.5 dBm
37 to below 57	Not specified	±0.2 dBm	±0.2 dBm	±0.2 dBm	Not specified	Not specified
57 to 62	Not specified	±0.2 dBm	±0.2 dBm	±0.2 dBm	Not specified	Not specified

Accuracy: dBV

Measurement Range [dBV]	20 to below 45 [Hz]	45 to 65 [Hz]	Over 65 to 1 k [Hz]	Over 1 k to 10 k [Hz]	Over 10 k to 20 k [Hz]	Over 20 k to 100 k [Hz]
-50 to below -24	±0.8 dBV	±0.5 dBV	±0.5 dBV	±0.5 dBV	±0.6 dBV	±3.0 dBV
-24 to below -4	±0.3 dBV	±0.2 dBV	±0.2 dBV	±0.2 dBV	±0.3 dBV	±1.0 dBV
-4 to below 15	±0.3 dBV	±0.2 dBV	±0.2 dBV	±0.2 dBV	±0.2 dBV	±0.5 dBV
15 to below 35	Not specified	±0.2 dBV	±0.2 dBV	±0.2 dBV	±0.2 dBV	±0.5 dBV
35 to below 55	Not specified	±0.2 dBV	±0.2 dBV	±0.2 dBV	Not specified	Not specified
55 to 60	Not specified	±0.2 dBV	±0.2 dBV	±0.2 dBV	Not specified	Not specified

16 4-20 mA% conversion measurement

Range	Conversion formula	Accuracy
4-20 mA 350.00%	$\frac{\text{Measured value [mA]} - 4\text{ [mA]}}{16\text{ [mA]}} \times 100$	±0.1%rdg. ±20 dgt.
0-20 mA 300.00%	$\frac{\text{Measured value [mA]}}{20\text{ [mA]}} \times 100$	±0.1%rdg. ±20 dgt.

60.000 mA DC range fixed

5.3 General Specifications

Product warranty period	3 years
Accuracy warranty period	1 year
Operating temperature	-15°C to 55°C (5F° to 131°F)
Operating humidity	Up to 40°C (104°F): at 80%RH or less (non-condensating) 40°C to 45°C (104°F to 113°F): at 60%RH or less (non-condensating) 45°C to 55°C (113°F to 131°F): at 50%RH or less (non-condensating)
Storage temperature and humidity	-30°C to 60°C (-22°F to 140°F), at 80%RH or less (non-condensating)
Operating environment	Indoors, pollution degree 2, altitude up to 2000 m (6562-ft.)
Drop-proof distance	1 m on concrete

Power supply	
Batteries	AA size alkaline (LR6) battery or AA size manganese (R6P) battery x 4
Rated power supply voltage	1.5 V DC × 4
Maximum rated power supply voltage	6.8 V
Maximum rated power	0.5 VA (max) supply voltage 6.0 V, Continuity measurement, Input short circuit, Backlight on
Rated power	0.2 VA (typ) supply voltage 6.0 V, DCV measurement, Input short circuit, Backlight off
Power during OFF/ APS	0.1 mVA (max) supply voltage 6.0 V

Continuous operating time
(Representative value: DCV function)

(Using new battery)

AA battery	Backlight	
	off	on
Alkaline	Approx. 100 hours	Approx. 30 hours
Manganese	Approx. 30 hours	Approx. 10 hours

Dielectric strength	Between all measurement terminals and case: 8.54 kV AC (sine wave, 50/60 Hz, 60 seconds)
Maximum rated voltage between terminals	Between the V and COM terminals: 1000 V DC/AC or 2×10^7 V • Hz (whichever is the lower value.)
Maximum rated current between terminals	Between the µA/mA and COM terminals: 600 mA DC/600 mA AC Between the A and COM terminals: 10 A DC/10 A AC (continuous)
Maximum rated voltage between measurement terminals and ground	1000 V (Measurement category III) 600 V (Measurement category IV) Anticipated transient overvoltage: 8000 V

Dimensions	Approx. 93W × 197H × 53D mm (3.66″W × 7.76″H × 2.09″D) (excluding the projection)
Mass	Approx. 650 g (22.9 oz.) (including batteries)
Applicable standards	• Safety: EN61010 • EMC: EN61326 • Dustproof and waterproof: IP40 (EN60529) **IMPORTANT** **To avoid any failure, do not allow the instrument to get wet. If the instrument gets wet, have your authorized Hioki distributor or reseller inspect or repair it, if necessary.**
Accessories	• L9207-10 Test Lead • Instruction Manual • LR6 alkaline battery × 4 (unloaded)
Replacement parts	• μA/mA terminal fuse (DT4281, DT4282) Manufacturer: HOLLYLAND Rating: 630 mA/1000 V Breaking characteristics: Fast-blow type Breaking capacity: 50 kA AC/ 30 kA DC Size: ϕ10.3 mm × 38 mm Resistance: Approx. 1.2Ω Printed color: Blue • A terminal fuse (DT4282 only) Manufacturer: HOLLYLAND Rating: 11 A/1000 V Breaking characteristics: Fast-blow type Breaking capacity: 50 kA AC/ 30 kA DC Size: ϕ10.3 mm × 38 mm Resistance: 0.1Ω or less Printed color: Red
Options	See “Options (sold separately)” (p. 2).

6 Maintenance and Service

6.1 Repair, Inspection, and Cleaning

⚠DANGER

Customers are not allowed to modify, disassemble, or repair the instrument.
Doing so may cause fire, electric shock, or injury.

Calibrations

IMPORTANT
Periodic calibration is necessary in order to ensure that the instrument provides correct measurement results of the specified accuracy.

The calibration frequency varies depending on the status of the instrument or installation environment. We recommend that the calibration frequency is determined in accordance with the status of the instrument or installation environment and that you request that calibration be performed periodically.

Replacement parts and longevity

The longevity of the instrument varies depending on the usage environment and frequency.
Note that operation within the following period of time is not guaranteed. When replacing the part, contact your authorized Hioki distributor or reseller.

Parts	Longevity
Backlight	Approx. 50,000 hours

Cleaning

- To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent.
- Wipe the display gently with a soft, dry cloth.

IMPORTANT
Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.

Disposal

Handle and dispose of the instrument in accordance with local regulations.

6.2 Troubleshooting

- When a malfunction of the instrument is suspected, check the information in “Before sending the instrument for repair” and then, if necessary, contact your authorized Hioki distributor or reseller.
- When sending the instrument for repair, remove the batteries and pack it carefully to prevent damage during transportation. Include cushioning material so the instrument cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during transportation.

Before sending the instrument for repair

Symptom	Check and/or remedy
Nothing appears in the display.	Check that the batteries are not exhausted. Replace with new batteries. (p. 26)
Or the display disappears after a short time.	Check that the auto power save function has not been activated. Check the setting of the auto power save function. (p. 68)
A numerical value appears when nothing is connected.	When the measurement terminal is open during DC voltage (DCV) measurement or AC voltage (ACV) measurement in the 60 mV range or 600 mV, a random value is displayed. This does not indicate a malfunction of the instrument. When the probe is connected to the measurement target, a normal numerical value is displayed. A high-input impedance voltmeter is used in the instrument for highly sensitive measurement. Consequently, external noise, such as inductive noise, appears as a numerical value.

Symptom	Check and/or remedy
(Current measurement) **The measured value does not appear.**	Check that the fuse is not blown. Replace with a new fuse specified by our company. (p. 103)
	Check that the fuse holder is not deformed. When removing the fuse, the holder is deformed if excessive force is applied. Pinch it with needle-nose pliers and restore the shape of the fuse holder.
	Check that the test lead is not broken. Perform the continuity check to confirm the continuity of the test leads. (p. 34) If the test lead is broken, replace the lead.
(Except the current measurement) **The measured value does not appear.** **Even after the connection or measurement, 0 (zero) still appears.**	• Check that the test leads have been inserted at the ends. • Check that the measurement method is correct. • Check that the fuse is not blown. (p. 35) If no problems have been found, the circuit may be malfunctioning. Send the instrument for repair.
Even after short circuit of the probe, the measured value does not appear. **Zero adjustment is impossible.**	The fuse may be blown. Check method: “3 Check that the fuse is not broken.” (p. 35) If the fuse is blown, replace with the specified fuse. (p. 103)
The display does not stabilize and the value fluctuates; it is difficult to read the value.	The display does not stabilize due to the influence of noise and/or input signals. Set the display update slower (press SLOW for 1 second) so that the display fluctuation can be eliminated. (p. 57)
“-----” appears in the display.	“----” appears when the rotary switch position is not confirmed. Set the rotary switch to the proper position.

Symptom	Check and/or remedy
The measured value of the frequency does not stabilize.	The display does not stabilize due to the influence of noise and/or input signals.
The range cannot be changed.	The measurement range cannot be changed when [REL] is lit. To change the range, press **REL** for at least 1 second to reset the REL function.
Turning on the power brings up the error display. **When nothing is connected, the error display appears.**	Reset the instrument. (p. 73) If the same symptom still occurs even after resetting the instrument, send the instrument for repair.

Other inquiries

Question	Solution
Would like to perform zero adjustment.	Using the relative value display function, zero adjustment can be performed. (p. 62)
Would like to replace the fuse. **Would like to know how to obtain the fuse.**	These are available at authorized Hioki distributors or resellers.
Can rechargeable batteries be used?	Rechargeable batteries can be used. However, the discharge characteristic of these batteries is different from that of alkaline batteries. Be aware that the remaining battery power display does not function properly.
Would like to control multiple instruments with 1 PC.	To communicate with the instrument, the optional DT4900-01 Communication Package is required. It is possible to control multiple instruments via USB ports.

Question	Solution
The instrument cannot communicate with the PC.	• Is the communication setting between the instrument and the PC correct? • Are the baud rate and parity check set correctly? (p. 69) • Is the USB cable connected correctly? (p. 69) • Are the light receiving and emitting parts clean?
Would like to know commands. **Would like to perform communication using own software.**	To communicate with the instrument, the optional DT4900-01 Communication Package is required. For details on commands, see the communication specifications in the CD accompanied by the communication package. These can also be downloaded from our Internet website.

6.3 Error Display

Error display	Description	Solution
Err 001	ROM error Program	When the error appears in the display, it is necessary to solve by the actions below. • Replace with new batteries. (p.26) • Reset the instrument. (p.73) If the same symptom still occurs, it is necessary to repair the instrument.
Err 002	ROM error Adjustment data	
Err 004	EEPROM error Memory data	
Err 005	ADC error Hardware malfunction	

For other warning displays, refer to “1.4 Alarm Display and Battery Indicator” (p. 23).

6.4 Replacing Fuses

If a fuse is blown, replace it with a new one as follows.

For details on how to check that the fuse is blown, see “3 Check that the fuse is not broken.” (p. 35).

⚠ WARNING

Replace the fuse only with one of the specified type, characteristics, rated current, and rated voltage. Do not use fuses other than those specified (especially, do not use a fuse with higher-rated current) or do not short circuit and use the fuse holder. Doing so may damage the instrument and result in personal injury.

Specified fuses

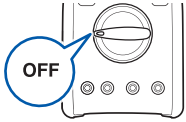
	Rating	Resistance	Specifications
For μA/mA terminal (DT4281, DT4282)	630 mA/ 1000 V	Approx. 1.2Ω	Manufacturer: HOLLYLAND Breaking characteristic: Fast-blow type Breaking capacity: 50 kA AC/ 30 kA DC Size: ϕ10.3 mm × 38 mm
For A terminal (DT4282)	11 A/ 1000 V	0.1Ω or less	

The fuses can be purchased via authorized Hioki distributors or resellers.

When removing the fuse, do not apply excessive force on the fuse holder. If the fuse holder is deformed, the connection becomes poor and the instrument cannot measure the current.

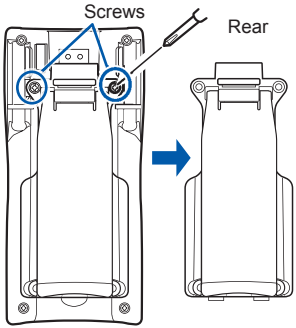
⚠CAUTION

When replacing the fuse, do not allow foreign matter to enter the instrument. It may cause a malfunction.



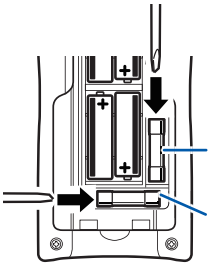
1 **Remove the test leads from the instrument.**

2 **Set the rotary switch to OFF.**



3 **Using a Phillips screwdriver, remove the screws (2 locations) from the battery cover.**

4 **Remove the battery cover.**



5 **Insert a slotted screwdriver or a similar tool (from the direction of the arrow in the left figure), and remove the fuse.**

6 **Attach a new fuse.**

7 **Reattach the battery cover.**

8 **Secure the cover with the screws.**

Appendix

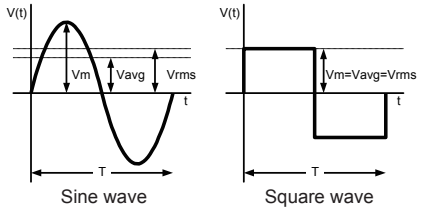
Appx. 1 RMS and Average

Difference between the RMS and Average

When converting AC to RMS, 2 methods are available, “True RMS method (True RMS indication)” and “Average method (Average rectifying RMS indication)”.
In the case of the sine wave where no skew is included, the same values are indicated in both methods. However, if the waveform is skewed, a difference occurs between the 2 methods.

The true RMS method is applied to this instrument.
In the true RMS method, the high frequency component is also included and displayed.
In the average method, the input waveform is handled as a sine wave where no skew is included (only single frequency). The average of the AC signal is obtained, converted to the RMS, and then displayed. If the waveform is skewed, a greater measurement error occurs.

Measurement example	True RMS	Average rectifying
100 V sine wave	100 V	100 V
100 V square wave	100 V	111 V

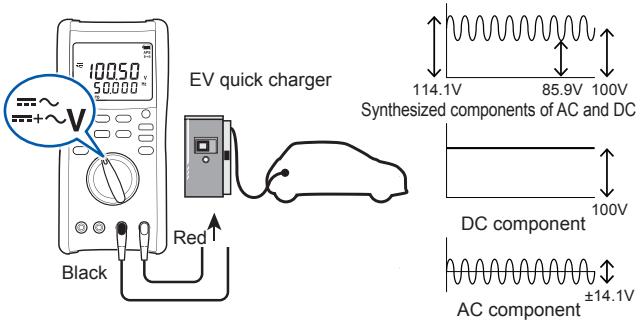


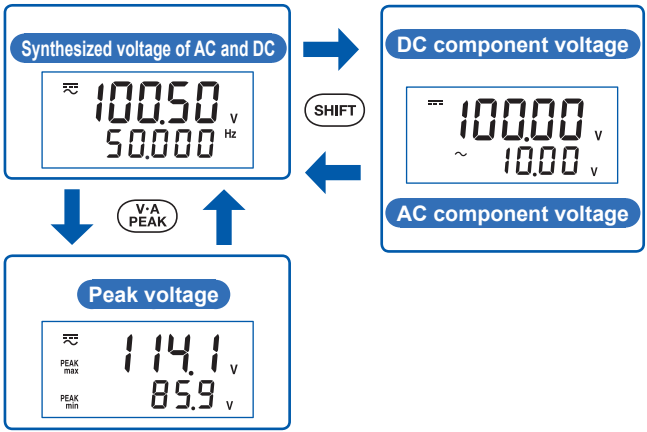
Vm: Maximum value, Vavg: Average value, Vrms: RMS, T: Time period

Appx. 2 Operation Example

Checking the noise of the DC voltage

Measure the AC component voltage, DC component voltage, and peak value.





Appx. 3 Capacitor Capacity Measurement Principle

The instrument measures the capacity using the CR self-excited oscillation method (triangle wave).
R: Instrument internal circuit Varies with each range.
C: Object to be measured Capacitor
When the capacitor to be measured is connected, self-excited oscillation begins. The capacity is calculated based on the measured frequency during self-excited oscillation. The frequencies during self-excited oscillation are shown in the table below.

Measurement range	Resistance of the instrument internal circuit	Reference oscillation frequency
1 nF	100 kΩ	500 Hz to 600 Hz
10 nF	100 kΩ	300 Hz to 600 Hz
100 nF	100 kΩ	60 Hz to 600 Hz
1 µF	100 kΩ	6 Hz to 600 Hz
10 µF	5 kΩ	15 Hz to 5100 Hz
100 µF	5 kΩ	1.5 Hz to 5100 Hz
1 mF	5 kΩ	5 Hz to 9300 Hz
10 mF	5 kΩ	0.5 Hz to 9300 Hz
100 mF	5 kΩ	0.05 Hz to 9300 Hz

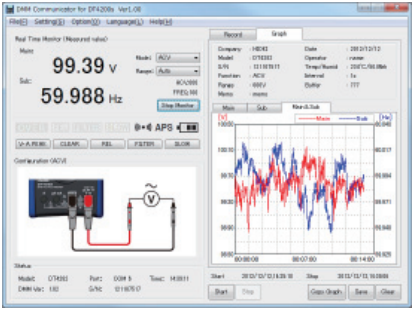
Even when the same capacitor is measured, the capacity may vary depending on the measurement range. This is because the oscillation frequency is different even in the same capacitor since the resistance R of the instrument internal circuit changes for each measurement range. Consequently, the capacity differs as shown in the table below depending on the measurement range when a measurement target that is frequency-dependent, such as an electrolytic capacitor, is measured. The table shows the capacity for each frequency and contains true values.

(Example) Measurement of 100 µF electrolytic capacitor

Measurement range	Oscillation frequency	Instrument displayed value
100 µF	1.369 Hz	101.9 µF
1 mF	50.797 Hz	0.090 mF

Appx. 4 Dedicated Software (DMM Communicator)

The PC application (DMM Communicator) can be used to send measurement data from the instrument to a computer or to configure instrument settings from a computer.
The DT4900-01 Communication Package (USB) dedicated communications adapter is required in order to connect the instrument to a computer.



Specifications

- Display, record, and graph measurement data from the instrument
- Configure instrument settings such as the range
- Display a connection screen based on the instrument's measurement function
- Save recorded measurement data as a CSV-format text file
- Paste measurement data into Excel®
- Load DMM instrument memory data

Microsoft Excel is a registered trademark of Microsoft Corporation in the United States and other countries.

Warranty Certificate

Model	Serial No.	Warranty period Three (3) years from date of purchase (___ / ___)

This product passed a rigorous inspection process at Hioki before being shipped.

In the unlikely event that you experience an issue during use, please contact the distributor from which you purchased the product, which will be repaired free of charge subject to the provisions of this Warranty Certificate. This warranty is valid for a period of three (3) years from the date of purchase. If the date of purchase is unknown, the warranty is considered valid for a period of three (3) years from the product's date of manufacture. Please present this Warranty Certificate when contacting the distributor. Accuracy is guaranteed for the duration of the separately indicated guaranteed accuracy period.

1. Malfunctions occurring during the warranty period under conditions of normal use in conformity with the Instruction Manual, product labeling (including stamped markings), and other precautionary information will be repaired free of charge, up to the original purchase price. Hioki reserves the right to decline to offer repair, calibration, and other services for reasons that include, but are not limited to, passage of time since the product's manufacture, discontinuation of production of parts, or unforeseen circumstances.
2. Malfunctions that are determined by Hioki to have occurred under one or more of the following conditions are considered to be outside the scope of warranty coverage, even if the event in question occurs during the warranty period:
   a. Damage to objects under measurement or other secondary or tertiary damage caused by use of the product or its measurement results
   b. Malfunctions caused by improper handling or use of the product in a manner that does not conform with the provisions of the Instruction Manual
   c. Malfunctions or damage caused by repair, adjustment, or modification of the product by a company, organization, or individual not approved by Hioki
   d. Consumption of product parts, including as described in the Instruction Manual
   e. Malfunctions or damage caused by transport, dropping, or other handling of the product after purchase
   f. Changes in the product's appearance (scratches on its enclosure, etc.)
   g. Malfunctions or damage caused by fire, wind or flood damage, earthquakes, lightning, power supply anomalies (including voltage, frequency, etc.), war or civil disturbances, radioactive contamination, or other acts of God
   h. Damage caused by connecting the product to a network
   i. Failure to present this Warranty Certificate
   j. Failure to notify Hioki in advance if used in special embedded applications (space equipment, aviation equipment, nuclear power equipment, life-critical medical equipment or vehicle control equipment, etc.)
   k. Other malfunctions for which Hioki is not deemed to be responsible

*Requests
- Hioki is not able to reissue this Warranty Certificate, so please store it carefully.
- Please fill in the model, serial number, and date of purchase on this form.

13-09

HIOKI E.E. CORPORATION
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL: +81-268-28-0555
FAX: +81-268-28-0559

- For regional contact information, please go to our website at http://www.hioki.com.
- The Declaration of Conformity for instruments that comply to CE mark requirements may be downloaded from the Hioki website.
- All reasonable care has been taken in the production of this manual, but if you find any points which are unclear or in error, please contact your supplier or the International Sales and Marketing Department at Hioki headquarters.
- In the interests of product development, the contents of this manual are subject to revision without prior notice.
- The content of this manual is protected by copyright. No reproduction, duplication or modification of the content is permitted without the authorization of Hioki E.E. Corporation.

HIOKI

HIOKI E.E. CORPORATION

Headquarters
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp

URL http://www.hioki.com/
(International Sales and Marketing Department)

HIOKI USA CORPORATION
E-mail: hioki@hiokiusa.com URL http://www.hiokiusa.com

HIOKI (Shanghai) Sales & Trading Co., Ltd.
E-mail: info@hioki.com.cn URL http://www.hioki.cn

HIOKI INDIA PRIVATE LIMITED
E-mail: hioki@hioki.in URL http://www.hioki.in

HIOKI SINGAPORE PTE. LTD.
E-mail: info@hioki.com.sg

1305

Edited and published by Hioki E.E. Corporation Printed in Japan