



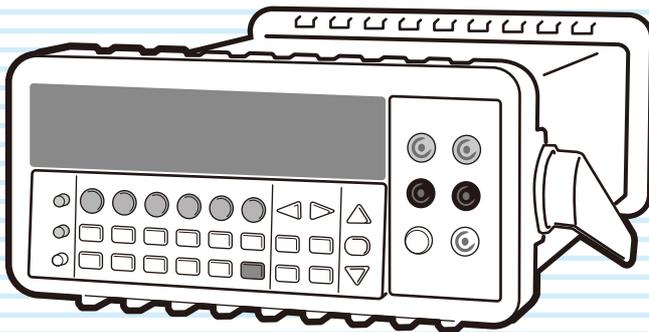
KIKUSUI

Part No. IB022458
Apr. 2017

User's Manual

6-1/2 Digit Multimeter

DME1600



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About the operation manuals

There are two operation manuals for the DME1600: the User's Manual (this manual) and the Remote Interface Manual.

The manuals are intended for users of the DME1600 and their instructors. These manuals assume that the reader has knowledge about electrical aspects of measuring instruments.

- User's manual (this manual)
This manual is intended for first-time users of the DME1600. It gives an overview of the DME1600, connecting procedures, safety precautions, etc. Please read through and understand this guide before operating the product.
- Remote interface manual
This manual explains how to control the DME1600 remotely using SCPI remote interface commands.
The interface manual is written for readers with sufficient basic knowledge of how to control measuring instruments using a PC.

Every effort has been made to ensure the accuracy of this manual. However, if you have any questions or find any errors or omissions, please contact your Kikusui agent or distributor.

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

After reading, always keep the manual nearby so that you may refer to it as needed.

You can download the most recent version of the manuals from the Kikusui Electronics Corporation website (<http://www.kikusui.co.jp/en/download/>).

The product that this manual covers

This user's manual is for the DME1600 6-1/2 Digit Multimeter. When contacting us about the product, please provide us with:
The model (written on the front panel)
The serial number (written on the rear panel)

How to read this manual

This manual is designed to be read from beginning to end. We recommend that you read it thoroughly before using this product for the first time.

Trademarks

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The specifications of this product and the contents of this manual are subject to change without prior notice.

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Notations Used in This Manual

- In this manual, the DME1600 6-1/2 Digit Multimeter is also referred to as the "DME1600."
- This manual denotes key sequences that require you to press the SHIFT key as SHIFT+(the name of the key).
- The following markings are used in the explanations in the text.

WARNING

Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if ignored, may result in damage to the product or other property.

NOTE

Indicates information that you should know.

DESCRIPTION

Explanation of terminology or operation principle.

See

Indicates a reference to detailed information.



Safety Symbols

DANGER

Indicates an imminently hazardous situation which, if ignored, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if ignored, may result in damage to the product and other property.



Indicates a general danger, warning, or caution. When this symbol is marked on the product, see the relevant sections in the operation manual.



Indicates that a high voltage is used here. Touching the part causes a possibly fatal electric shock. If physical contact is required by your work, start work only after you make sure that no voltage is output here.



Indicates a location whose surface can become hot.



Shows that the act indicated is prohibited.



Direct current (DC)



Alternating current (AC)



Direct current (DC) and alternating current (AC)



Protective conductor terminal



Earth (ground) terminal



Chassis (frame) terminal



On (supply)



Off (supply)



On (supply) / standby
This product is not completely disconnected from MAINS when it is in standby mode.



In position of a bi-stable push control



Out position of a bi-stable push control

CAT II*

IEC Measurement Category II

Applies to test and measuring circuits connected directly to utilization points of the low-voltage installation. This category applies to circuits connected to circuits of equipment on the primary side of a transformer. Such pieces of equipment have a power cord connected to a power outlet. Examples are household appliances and portable tools.

CAT III*

IEC Measurement Category III

Applies to test and measuring circuits connected to the distribution part of the building's low-voltage installation. For example, this category applies to circuits connected to distribution boards, circuit breakers, and wiring systems in the fixed distribution installation, and to stationary motors with a permanent connection to the fixed distribution installation.

CAT IV*

IEC Measurement Category IV

Applies to test and measuring circuits connected at the source of the building's low-voltage installation. For example, this category applies to circuits connected to a building's service lines, electricity meters, primary overcurrent protection equipment (switchboards and distribution boards), and their electric circuits.



Indicates that this product conforms to the requirements of the applicable EU directive.



Indicates that this product conforms to the requirements of the Waste Electrical and Electronic Equipment Directive.

In the EU, this product cannot be disposed of as domestic household waste.

When disposing of this product, follow the Waste Electrical and Electronic Equipment (WEEE) Directive.

In areas outside of the EU, dispose of it as per the instructions of the local authorities.

* IEC 61010-2-030:2010 expresses other types of circuits that are not directly connected to MAINS (circuits that do not fall under CAT II to CAT IV) as "O" (Other).

Safety Precautions

The following safety precautions must be observed to avoid fire hazards, electric shock, accidents, and other failures.

Using the product in a manner that is not specified in the operation manual may impair the protection functions provided by the product.



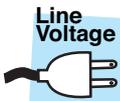
Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If unqualified personnel is to use the product, be sure the product is handled under the supervision of qualified personnel (those who have electrical knowledge). This is to prevent the possibility of personal injury.



Purpose

- Never use the product for purposes other than the product's intended use.
- This product is not designed or manufactured for general home or consumer use.



Input power

- Use the product within the rated input power voltage range.
- For applying power, use the power cord provided. For details, see the respective page in the operation manual.
- This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).



Fuse

- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one. When replacing the fuse, use a fuse of shape, rating, and characteristics that conform to the product. For details, see the respective page in the operation manual.



Cover

- Some parts inside the product may cause physical hazards. Do not remove the external cover.



Grounding

- This product is IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).



Operation

- If a malfunction or abnormality is detected on the product, stop using it immediately, and remove the power plug from the outlet or turn off the circuit breaker of distribution. Make sure the product is not used until it is completely repaired.
- Use cables or wires with sufficiently large current capacity for output wires and load cables.
- Do not disassemble or modify the product. If you need to modify the product, contact your Kikusui distributor/agent.



Maintenance, Inspection and Calibration

- To maintain the performance and safe operation of the product, it is recommended that periodic maintenance, inspection, and cleaning be performed.
- To prevent the possibility of electric shock, remove the power plug from the outlet or turn off the circuit breaker of distribution before carrying out maintenance or inspection.
- Check periodically that there are no tears or breaks in the power cord.
- If the panel needs cleaning, gently wipe it using a soft cloth with water-diluted neutral detergent. Do not use volatile chemicals such as benzene or thinner.
- This product is calibrated before shipment. To maintain the product's performance, we recommend periodic calibration. To have your product calibrated, contact your Kikusui agent/distributor.



Adjustments and Repairs

- Kikusui service engineers will perform internal service on the product. If the product needs adjustment or repairs, contact your Kikusui distributor/agent.

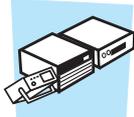


Warning label

- Pay attention to the condition of the warning label attached to the outer surface of this product. If this label tears or falls off, replace with a new label. If you need a new label, contact your Kikusui agent or distributor.



Precautions Concerning Installation Location



Note the following points when installing the product.

- Do not use the product in a flammable atmosphere.
To prevent the possibility of explosion or fire, do not use the product near alcohol, thinner, or other combustible materials, or in an atmosphere containing such vapors.
- Avoid locations where the product is exposed to high temperature or direct sunlight.
Do not install the product near a heater or in areas subject to drastic temperature changes. For the operating and storage temperature range of the product, see the specification table in the operation manual.
- Avoid high humidity.
Do not install the product in high-humidity locations—near a boiler, humidifier, or water supply. For the operating and storage humidity range of the product, see the specification table in the operation manual.
Condensation may occur even within the operating humidity range. In such cases, do not use the product until the condensation dries up completely.
- Be sure to use it indoors.
This product is designed for safe indoor use.
- Do not install the product in a corrosive atmosphere.
Do not install the product in a corrosive atmosphere or in environments containing sulfuric acid mist, etc. This may cause corrosion of various conductors and bad contacts of terminals inside the power supply leading to malfunction and failure, or in the worst case, a fire.
- Do not install the product in a dusty location.
Accumulation of dust can lead to electric shock or fire.
- Do not use the product where ventilation is poor.
On the rear panel of products that use fan-based forced air cooling, heat is expelled from vents. To prevent the heat from building up and causing a fire, keep the vents at least 20 cm away from walls. Also, do not place objects within 20 cm of the rear panel.
For products that do not have fans and use unforced air cooling, air rises from the bottom panel to the top panel, so make sure that the bottom and top panels are not blocked.
- Do not place objects on the product.
Placing objects on top of the product can cause failures (especially heavy objects).
- Do not install the product on an inclined surface or location subject to vibrations.
The product may fall and break or cause personal injury.
- Do not use the product in a location where strong magnetic or electric fields are nearby or a location where large amount of distortion and noise is present on the input power supply waveform.
The product may malfunction.
- Do not use the unit near highly sensitive measuring instruments or transceivers.
The noise generated by the unit may affect them.
- When installing products with casters, be sure to lock the casters.



Precautions to Be Taken When Moving the Product



Note the following points when moving or transporting the product to the installation location.

- Turn off the power switch.
Moving the product while the power is turned on can cause electric shock or damage to it.
- Remove all wiring.
Moving the product with the wires connected can cause wires to break or injuries due to the product falling over.
- Use two or more persons when moving the product which weights more than 18 kg. The weight of the product is indicated on the rear panel of the product and in the specification table in this manual.
- Use extra precautions such as using more people when moving into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- When transporting the product, be sure to use the original packing materials.
Otherwise, damage may result from vibrations or from the product falling during transportation.
- Be sure to include the operation manual.

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6 System Settings

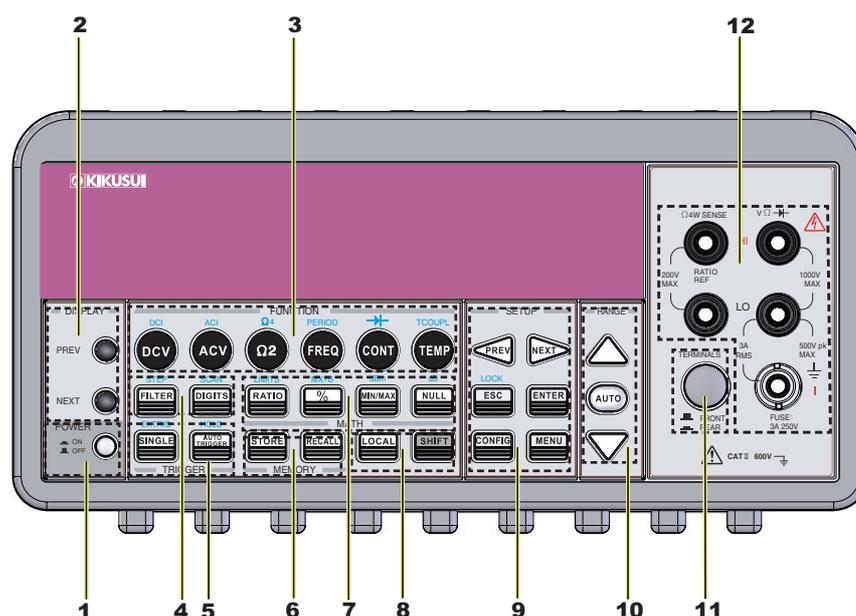
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Front panel



No.	Name	Function	See	
1	POWER	Power switch	Power switch. The power is on when the button is in the “in” position. The power is off when the button is in the “out” position.	p. 24
2	DISPLAY	PREV key	Shows the previous screen. Switches what is displayed in the bottom area of the display (model, version, range, hide).	p. 11
		NEXT key	Shows the next screen (the reverse operation of the PREV key).	p. 11
3	FUNCTION	DCV key	DC voltage measurement.	p. 32
		ACV key	AC voltage measurement.	p. 32
		Ω2 key	2-wire resistance measurement.	p. 36
		FREQ key	Frequency measurement.	p. 38
		CONT key	Continuity test.	p. 39
		TEMP key	RTD temperature measurement.	p. 42
	FUNCTION (SHIFT+)	DCI key	DC current measurement.	p. 34
		ACI key	AC current measurement.	p. 34
		Ω4 key	4-wire resistance measurement.	p. 36
		PERIOD key	Period measurement.	p. 38
		→ (DIODE) key	Diode test.	p. 40
		TCOUPL key	Thermocouple temperature measurement.	p. 42
		FILTER key	Digital filter setup.	p. 53
		DIGITS key	Resolution (displayed digits) setup.	p. 56
4	SHIFT+FILTER	STEP key	Step function setup (when a scanner is installed).	p. 113
	SHIFT+DIGITS	SCAN key	Scan function setup (when a scanner is installed).	p. 111

No.	Name	Function		
5	TRIGGER	SINGLE key	Single trigger measurement.	p. 73
		AUTO TRIGGER key	Auto trigger measurement.	p. 72
	TRIGGER (SHIFT+)	EXTRIG key	External trigger EXT TRIG terminal input.	p. 75
		HOLD key	Holds measured values.	p. 78
6	MEMORY	STORE key	Stores measured values in memory.	p. 99
		RECALL key	Recalls measured values from memory.	p. 99
7	MATH	RATIO key	Calculates the ratio of DC voltage to a reference DC voltage.	p. 82
		% key	Calculates the ratio of measured values to target values as a percentage.	p. 84
		MIN/MAX key	Calculates the minimum and maximum.	p. 85
	MATH (SHIFT+)	NULL key	Calculates the difference between the measured value and the stored null value.	p. 87
		LIMITS key	Tests the upper and lower limits.	p. 88
	MATH (SHIFT+)	MX+B key	Calculates value Y that is linearly proportional to measured value X as defined by slope M and offset B.	p. 90
		dBm key	dBm calculation.	p. 92
		dB key	dB calculation.	p. 93
8	LOCAL key	Switches from remote control mode to local mode.	-	
	SHIFT key	Used to select functions that are marked in blue above the keys (see below for details on how to use this key).	Below	
9	SETUP	PREV key	Shows the previous screen. Scrolls through the buffer during measurement and changes the displayed digits.	-
		NEXT key	Shows the next screen(the reverse operation of the PREV key).	-
		ESC key	Cancels the selection and returns to the measurement display.	Below
		ENTER key	Enters the selection and moves to the next setting or returns to the measurement display.	-
		CONFIG key	Used to set items related to panel key functions.	p. 57
		MENU key	Used to set items not related to panel key functions.	p. 51
	SETUP (SHIFT+)	LOCK key	Enables the key lock. Press ESC to clear the key lock.	-
10	RANGE	The up key	Changes the range to the next higher range.	-
		AUTO key	Auto range.	-
		The down key.	Changes the range to the next lower range.	-

■ How to use the SHIFT key

Press SHIFT to turn on the SHIFT indicator on the display. Then, press a key whose name is written in blue. This key sequence does not mean you hold down the SHIFT key and press another key.

This manual denotes key sequences that require you to press the SHIFT key as SHIFT+(the name of the key).

■ How to use the ESC key

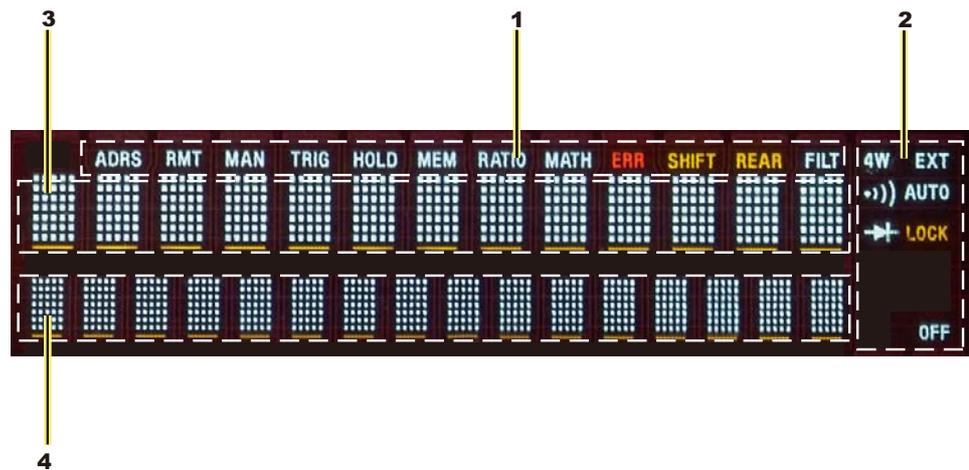
- Press ESC to cancel the previous operation and the DME1600 to the state that it was in before the previous operation.
- Press ESC to unlock the keys.

No.	Name		Function	
11	TERMINALS	TERMINALS switch	Switches the input terminals. Select the front panel or rear panel terminals.	p. 33
12	INPUT	HI-LO (V/ Ω / ) terminal	Input terminal. Used in DCV, ACV, Ω 2, FREQ, PERIOD, CONT,  , and TEMP measurements.	p. 33
		HI-LO (Ω 4W SENSE /RATIO REF) terminal	Input terminal. Used in Ω 4, TEMP, and RATIO measurements.	p. 36
		I-LO terminal	Current input terminal. Used in DCI and ACI measurements.	p. 34
		FUSE 3 A 250 V	I-LO terminal. For protecting the front-panel input circuit (3 A, 250 V).	p. 22

■ Maximum input voltage

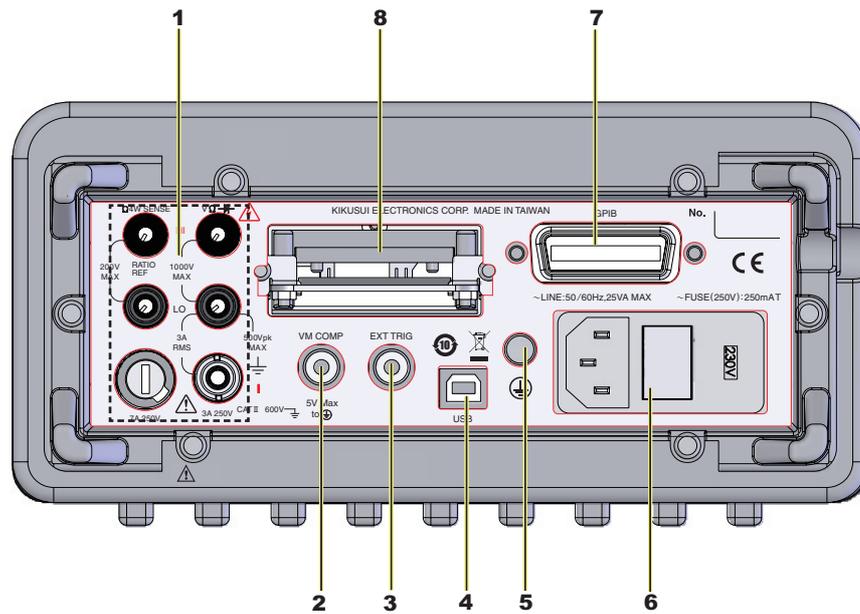
- The LO terminal is marked with 500 Vpk max against ground.
- The SENSE HI to LO terminal is marked with 200 Vpk max.
- The maximum voltage from HI to LO is 1000 Vpk.

Display



No.	Name	Function	See	
1	Top area	ADRS	Indicates that the DME1600 is being controlled through the GPIB interface	p. 69
		RMT	Indicates that the DME1600 is being controlled through the USB interface	p. 69
		MAN	Indicates that the manual range is being used	p. 61
		TRIG	Indicates that single trigger measurement is enabled	p. 73
		HOLD	Indicates that the measured value is being held	p. 78
		MEM	Indicates that measured values are stored in memory	p. 99
		RATIO	Indicates that the ratio of DC voltage to a reference DC voltage is being calculated	p. 82
		MATH	Indicates that the math function is being performed	p. 82
		ERR	Indicates that an error has occurred	p. 104
		SHIFT	Indicates that the SHIFT key has been pressed	p. 9
2	Right area	REAR	Indicates that the rear-panel input terminals are in use	p. 10
		FILT	Indicates that the digital filter is in use	p. 53
		4W	Indicates that 4-wire resistance measurement mode is in use	p. 37
		•)))	Indicates that the continuity test is in use	p. 39
		→	Indicates that the diode test is in use	p. 40
		EXT	Indicates that external trigger mode is in use	p. 75
		LOCK	Indicates that keys are locked	p. 9
3	Measurement display area	Displays measured values and function settings	-	
4	Bottom area	Displays the model, version, range, or nothing	-	

Rear panel



No.	Name	Feature	See
1	INPUT	HI-LO (V/Ω/→) terminal	Input terminal. Used in DCV, ACV, Ω2, FREQ, PERIOD, CONT, →, and TEMP measurements. p. 32
		HI-LO (Ω4W SENSE /RATIO REF) terminal	Input terminal. Used in Ω4, TEMP, and RATIO measurements. p. 36
		I-LO terminal	Current input terminal. Used in DCI and ACI measurements. p. 34
		FUSE 3 A 250 V	I-LO terminal. For protecting the rear-panel input circuit (3 A, 250 V). p. 26
		FUSE 7 A 250 V	I-LO terminal. For protecting the front- and rear-panel input circuits (7 A, 250 V). p. 28
2	VM COMP	Signal output when measurements finish for synchronizing external devices. p. 76	
3	EXT TRIG	External trigger signal input. p. 75	
4	USB	USB port for controlling the DME1600 remotely. p. 69	
5	Protective conductor terminal	A grounding terminal for connecting to a power cord that does not have a three-prong plug. -	
6	Voltage setting selector	Line voltage switch and fuse holder. Switchable between 100 Vac/220 Vac and 120 Vac/240 Vac. p. 20	
7	GPIB	GPIB cable connector for controlling the DME1600 remotely. p. 69	
8	Option slot	For a scanner. p. 107	

■ Maximum input voltage

- The LO terminal is marked with 500 Vpk max against ground.
- The SENSE HI to LO terminal is marked with 200 Vpk max.
- The maximum voltage from HI to LO is 1000 Vpk.



1

General Information

This chapter gives an overview of the DME1600 and explains the options that are available for it.

Product Overview

The DME1600 is a robust, versatile 6-1/2 digit digital multimeter. It has a one-year accuracy of 0.0035% for 10 V range DC voltage measurements and 0.01% for 10 k Ω range resistance measurements.

At the fastest 4-1/2 digit setting, the DME1600 makes 2000 measurements per second. At the 6-1/2 digit setting, it makes 50 measurements per second.

The DME1600 is standard-equipped with a USB interface (the GPIB interface is a factory option).

Features

- **Resolution: 6 1/2 digits**
- **Display: 5x7 dot matrix VFD, three-color dual display**
- **Basic measurement features**

Function	
Voltage measurement	DC voltage: 0.1 V, 1 V, 10 V, 100 V, and 1000 V ranges. AC voltage: 0.1 V, 1 V, 10 V, 100 V, and 750 V ranges.
Current measurement	DC current: 10 mA, 100 mA, 1 A, and 3 A ranges. AC current: 1 A and 3 A ranges.
Resistance measurement	2-wire and 4-wire methods 100 Ω , 1 k Ω , 10 k Ω , 100 k Ω , 1 M Ω , 10 M Ω , and 100 M Ω ranges.
Frequency and period measurement	3 Hz to 300 kHz (333 ms to 3.3 μ s).
Continuity test	The DME1600 beeps when the measured resistance is less than the threshold value.
Diode test	The DME1600 beeps when the measured forward voltage is within the voltage threshold range.
Temperature measurement	Thermocouples and RTDs can be used as temperature sensors.

- **Function settings**

Function	
Auto zero adjustment	Minimizes the effect of internal offset.
Filter	Eliminates noise and performs averaging. Two types of filters are available: AC and digital. The AC filter is used only for AC voltage and AC current measurements. The digital filter averages measured values.
Resolution	You can set the number of digits to display for measured values.
DC input resistance	You can select which input resistance to use in DC voltage measurements.
Threshold resistance for continuity tests	You can set the threshold resistance to a value between 1 Ω and 1000 Ω .
Diode test	You can set the forward voltage to a value between 0.01 V and 1.2 V.
Range	You can select auto or manual range mode.
Integration time	You can set the sampling interval for analog-to-digital conversion. The integration time feature not only eliminates noise and increases measurement accuracy but also optimizes measurement speed or resolution.
Temperature sensor	You can select thermocouples or RTDs.
Remote interface	You can select USB or GPIB.
Input terminal switch	You can select front-panel or rear-panel terminals.
Trigger mode	You can select auto, immediate, or single triggering.
Trigger source	You can select front panel, external trigger input, or remote interface.
Trigger settings	You can set the trigger count, measured value hold, and trigger delay.

- **Math functions**

Function	
Ratio	Ratio of the input DC voltage to the specified reference DC voltage
Percentage	Ratio of the measured value to the specified target value as a percentage
Maximum and minimum	Maximum value, minimum value, average of measured values, and number of measured values
Null	Difference between the measured value and the stored null value
Upper and lower limit tests	Tests the measured value against the specified upper or lower limit
MX+B	Determines value Y that is linearly proportional to measured value X as defined by slope M and offset B
dBm	Measured voltage displayed as a power level (relative to 1 mW), dissipated through a reference resistance
dB	Displays the measured value relative to a reference value in decibels

- **Other functions**

Function	
Display	Display on and off
Beep sound	Beep sound on and off
Measurement memory	Stores 2000 measured values
Hold	Measured value hold
Initial mode	For selecting the mode that the DME1600 starts in when the power switch is turned on
Language	Communication command language
Error indicators	Displays errors
Calibration information display	Previous calibration date and the next calibration date

- **Standard-equipped USB interface (the GPIB interface is a factory option)**

Options

- **10-channel scanner card (DME1600-opt01)**
- **Thermocouple adapter (DME1600-opt02)**
Adapts K type thermocouple cable connector to dual banana plugs.
- **Kelvin probe, for 4-wire resistance measurement (DME1600-opt07)**
- **4-wire test leads (DME1600-opt08)**
- **20-channel scanner card (DME1600-opt09)**
- **K type thermocouple cable (DME1600-opt11)**
To use this option, DME1600-opt02 (Thermocouple adapter) is required.
- **10-channel thermocouple scanner card (DME1600-opt12)**

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2

Preparation

This chapter describes how to unpack and prepare this product before you use it.

Checking the Package Contents

When you receive the product, check that all accessories are included and that the accessories have not been damaged during transportation. If any of the accessories are damaged or missing, contact your Kikusui agent or distributor.

We recommend that all packing materials be saved, in case the product needs to be transported at a later date.

Accessories

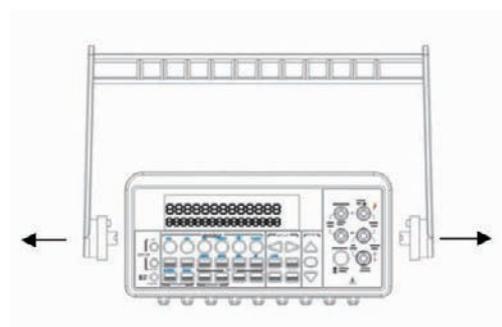
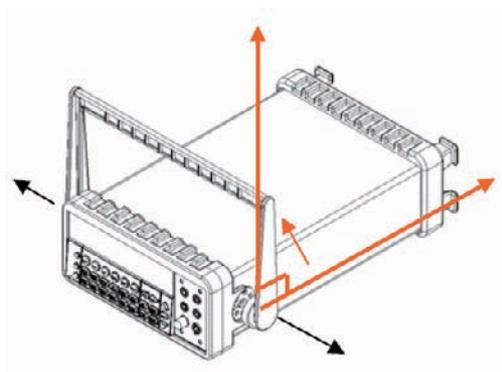
Item	Quantity
Power cord	1 pc.
Standard test leads	1 set
USB cable	1 pc.
Fuse (spare)	1 pc.
CD-ROM (includes a PDF of the operation manual and the application software)	1 pc.
Packing list, safety precautions	1 English, 1 Japanese

Using the Handle

You can remove the handle.

Move the handle to the vertical position above the DME1600 before removing it.

- 1 Hold the left and right parts of the handle that are attached to the DME1600, and pull them outwards.



- 2 Move the handle to the vertical position above the DME1600.
- 3 Pull the left and right parts of the handle that are attached to the DME1600 outwards to detach them.

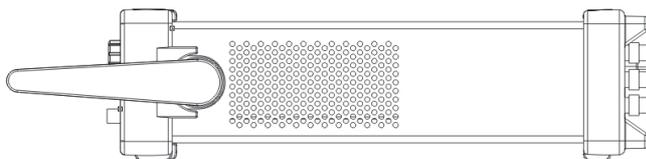
You can adjust the handle angle.

- 1 Hold the left and right parts of the handle that are attached to the DME1600, and pull them outwards.

- 2 Move the handle to the desired position.

If you are going to carry the DME1600 by the handle, move the handle to the position shown below.

When you move the DME1600 using its handle



Setting the Line Voltage

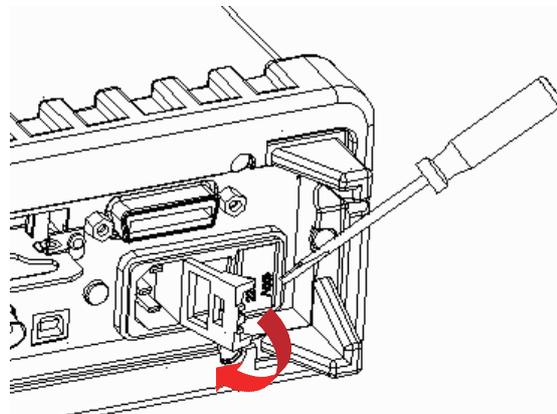
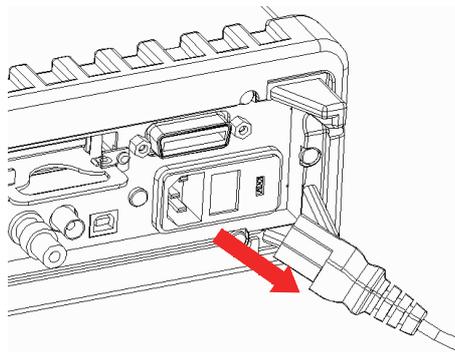
The DME1600's AC input voltage rating is single-phase 100 Vac or 220 Vac. The frequency rating is 50 Hz/60 Hz \pm 10 %.



To avoid electric shock:

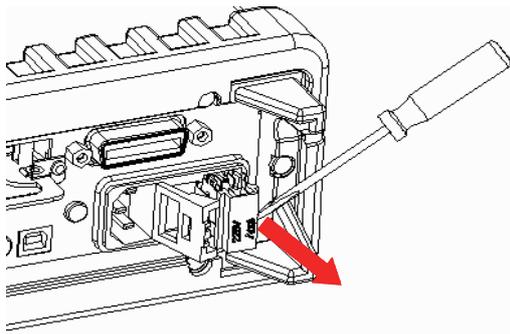
- Before changing the line voltage setting, be sure to disconnect the DME1600 from the AC power line.

- 1 Turn the power switch off.
- 2 Remove the power cord from the rear-panel voltage setting selector.

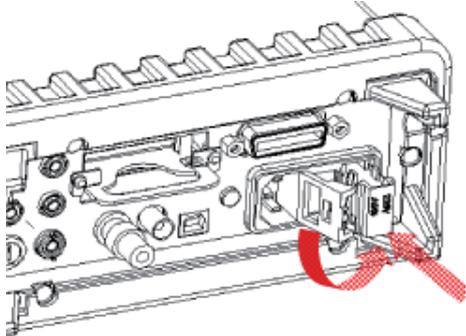
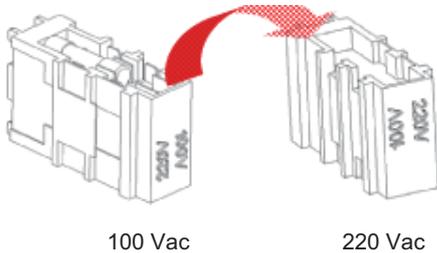


- 3 Using a flat-blade screwdriver, open the voltage setting selector cap.

4 Using a flat-blade screwdriver, pull the red fuse block out.



5 Turn the fuse block upside down.
One orientation is for 100 Vac, and the other is for 220 Vac.



6 Insert the red fuse block, and close the voltage setting selector cap.

Changing the Power Line Fuse

Check the power line fuse. If the fuse is deformed or has melted, change it. The fuse is 250 V 250 mA. The fuse rating is written on the rear panel.



WARNING

To avoid electric shock:

- Before changing the Power Line Fuse, be sure to disconnect the DME1600 from the AC power line.

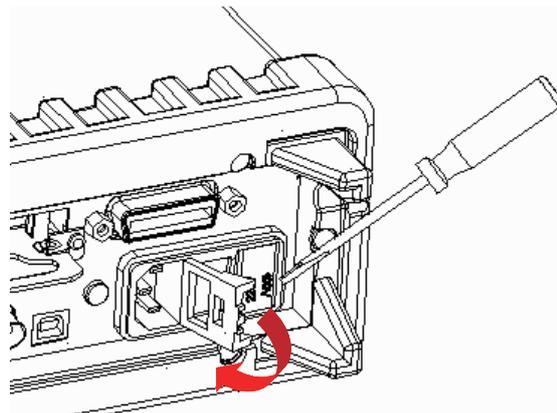
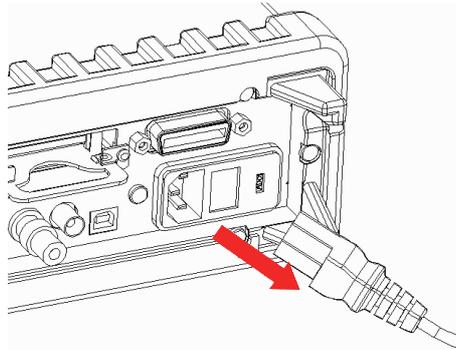


CAUTION

To prevent damage to the DME1600, observe the following:

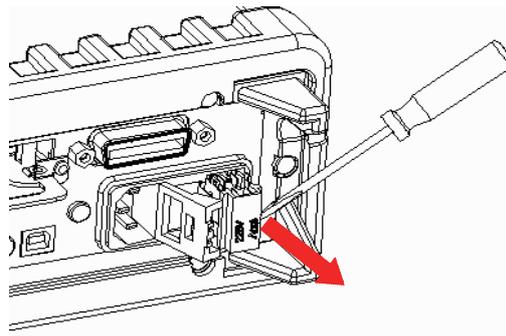
- Check the rating of the Power Line Fuse that you are changing.
- If the fuse melts repeatedly, first determine the cause and fix it. If there is a problem with the DME1600, contact your Kikusui agent or distributor.

- 1 Turn the power switch off.
- 2 Remove the power cord from the rear-panel voltage setting selector.

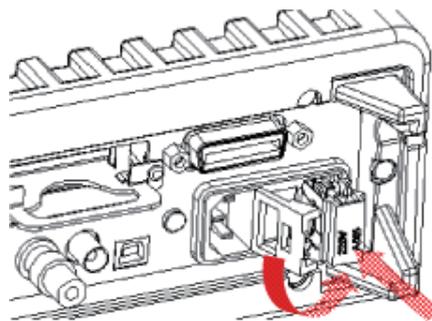
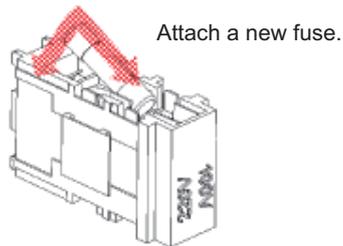
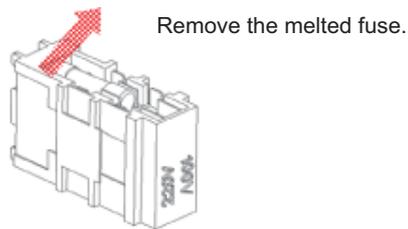


- 3 Using a flat-blade screwdriver, open the voltage setting selector cap.

- 4** Using a flat-blade screwdriver, pull the red fuse block out.



- 5** Change the fuse.



- 6** Insert the red fuse block back in, and close the voltage setting selector cap.

Connecting the Power Cord



WARNING

To avoid electric shock:

- This product is a piece of equipment that conforms to IEC Safety Class I (equipment that has a protective conductor terminal). Be sure to ground (earth) the unit.
- The product is grounded through the power cord ground wire. Connect the protective conductor terminal to earth ground.

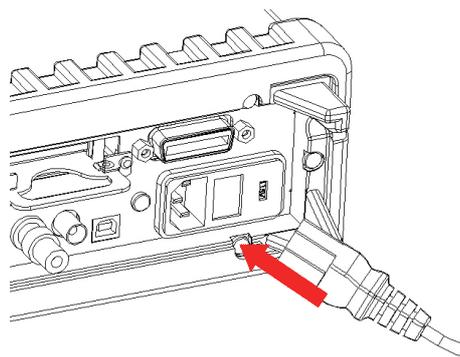
NOTE

- Use the supplied power cord to connect to the AC line. If the supplied power cord cannot be used due to the rated voltage or the plug shape, have a qualified engineer replace it with an appropriate power cord of length 3 m or less. If obtaining a power cord is difficult, contact your Kikusui agent or distributor.
- The power cord with a plug can be used to disconnect the DME1600 from the AC line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time. Be sure to provide adequate clearance around the power outlet.
- Do not use the supplied power cord with other instruments.

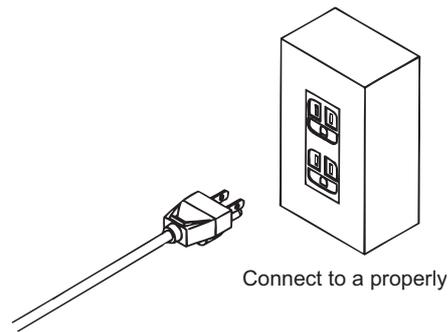
This product is a piece of equipment that conforms to IEC Overvoltage Category II (energy-consuming equipment that is supplied from a fixed installation).

- 1 Turn the power switch off.**
- 2 Check that the AC power supply meets the nominal input rating of the product.**

The DME1600's AC input voltage rating is single-phase 100 Vac to 120 Vac or 220 Vac to 240 Vac. The frequency rating is 50 Hz/60 Hz \pm 10 %.
- 3 Connect the power cord to the AC inlet (the voltage setting selector area) on the rear panel.**



4 Connect the power plug to an outlet with a ground terminal.



■ Turning the power switch on

5 Push the power switch in.

The power is on when the switch is in the “in” position. The DME1600 will start up with the factory default settings. If you notice strange sounds, unusual odors, fire, or smoke around or from inside the DME1600, turn the power switch off.

■ Turning the power switch off

6 Push the power switch again.

The power is off when the button is in the “out” position.

See p.30

Replacing the Current Input Terminal Fuses

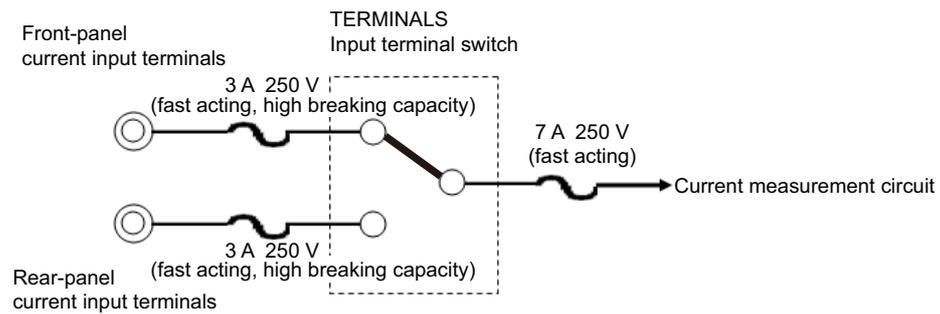
The current input terminals contain the three fuses indicated in the figure below.

⚠ CAUTION

To prevent damage to the DME1600, observe the following:

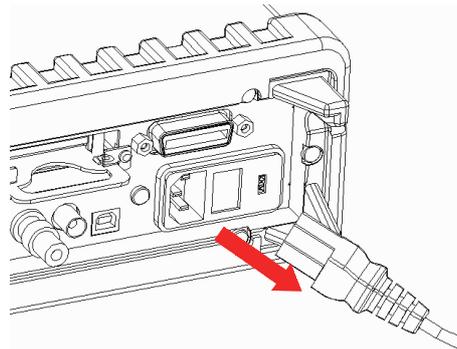
- Check the rating of the fuse that you are changing.
- If the fuse melts repeatedly, first determine the cause and fix it. If there is a problem with the DME1600, contact your Kikusui agent or distributor.

Fuse circuit and fuse rating



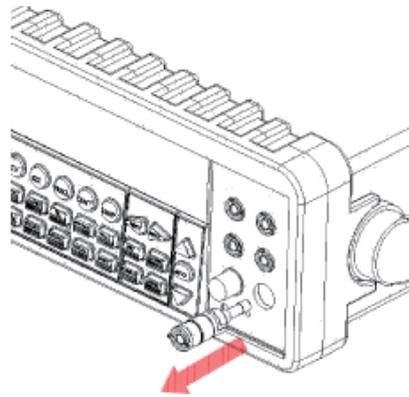
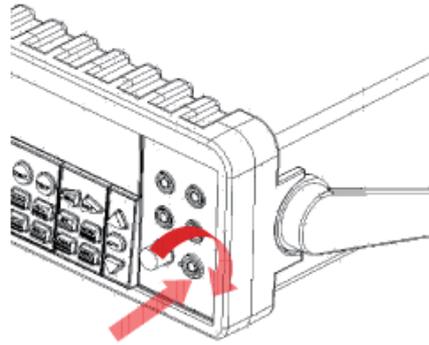
Changing a 3 A fuse (front or rear panel)

- 1 Turn the power switch off.
- 2 Remove the power cord from the rear-panel voltage setting selector.

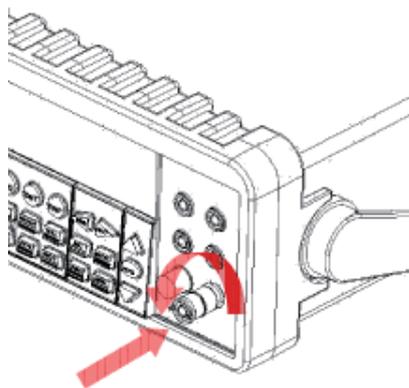
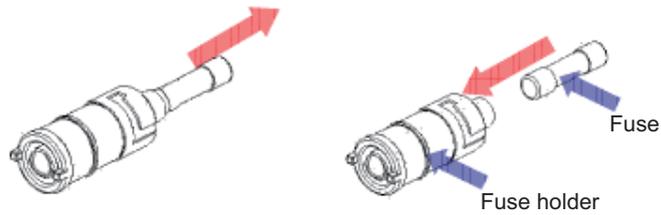


- 3 While pushing the current input terminal, turn it clockwise.

4 Remove the current input terminal and fuse.



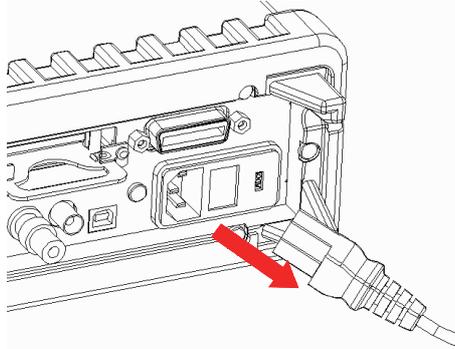
5 Change the fuse.
3 A, 250 V (fast acting, high breaking capacity)



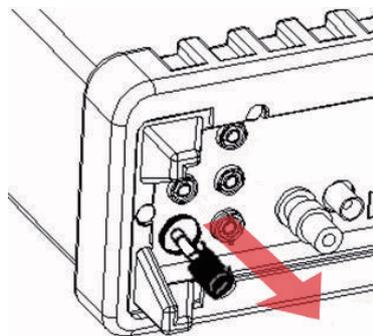
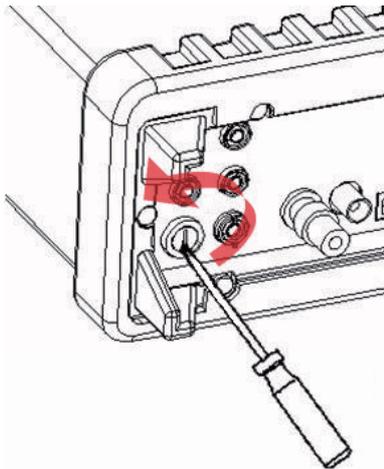
6 Insert the current input terminal and fuse. While pushing the terminal, turn it counterclockwise.

Changing the 7 A fuse (rear panel)

- 1 Turn the power switch off.
- 2 Remove the power cord from the rear-panel voltage setting selector.



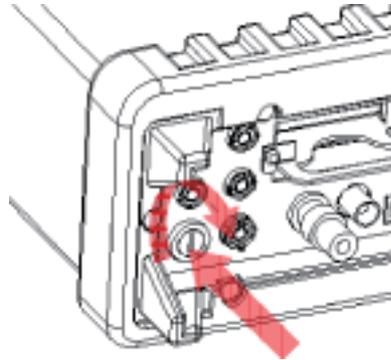
- 3 Using a flat-blade screwdriver, push the fuse holder, and turn it counter-clockwise.



- 4 Remove the fuse holder.

5 Change the fuse.
7 A, 250 V (fast acting)

6 Insert the fuse holder and fuse. Using a flat-blade screwdriver, push the fuse holder, and turn it clockwise.



Factory Default Settings

The factory default settings are indicated below.

Item	Factory default settings	
Measurement function	DCV	
Auto zero	On	
Frequency and period measurement	AC voltage	
Output format	ASCII	
Ratio	Off	
AC bandwidth	Input frequency	
	20 Hz	
Voltage	AC digits	Slow 5 1/2
	DC digits	Slow 5 1/2 (1 PLC) ¹
	Range	Auto
Current	AC digits	Slow 5 1/2
	DC digits	Slow 5 1/2 (1 PLC)
	Range	Auto
Frequency and period	Digits	Slow 5 1/2
	Range	Auto
	Rate	Medium (100 ms)
Diode test	Digits	Slow 5 1/2
	Range	1 mA
	Rate	0.1 PLC
Resistance (2-wire method)	Digits	Slow 6 1/2 (1 PLC)
	Range	Auto
Temperature	Digits	Slow 6 1/2 (10 PLC)
	Thermocouple	Type K, °C
Trigger	Source	Immediate
	Delay	Auto
Input resistance	10 MΩ	

1 PLC (Power Line Cycles)



3

Basic Measurement

This chapter explains the measurement features of the DME1600.

Basic Measurement Feature Overview

The DME1600 contains the following basic measurement functions. To take measurements with the DME1600, connect test leads to the input terminals, and connect the test lead tips to the measurement points. To measure temperature, connect a thermocouple or an RTD to the input terminals.

Function		
Voltage measurement	DC voltage and AC voltage.	p. 32
Current measurement	DC current and AC current.	p. 34
Resistance measurement	2-wire, 4-wire method.	p. 36
Frequency and period measurement	3 Hz to 300 kHz (333 ms to 3.3 μs).	p. 38
Continuity test	The DME1600 beeps when the measured resistance is less than the threshold value.	p. 39
Diode test	The DME1600 beeps when the measured forward voltage is within the threshold range.	p. 40
Temperature measurement	Thermocouples and RTDs can be used as temperature sensors.	p. 42

Voltage Measurement

This section explains how to measure DC voltage and AC voltage. For AC voltage, the DME1600 measures true RMS values.

Measurement ranges and conditions

Item			
DC voltage measurement	Range (resolution)	100 mV (0.1 μV), 1 V (1.0 μV), 10 V (10 μV), 100 V (100 μV), 1000 V (1 mV)	p. 61
	Input resistance (voltage ranges)	10 MΩ (100 V, 1000 V) >10 GΩ (100 mV, 1 V, 10 V)	p. 58
AC voltage measurement*1	Range (resolution)	100 mVrms (0.1 μV), 1 Vrms to 750 Vrms (1.0 μV to 1 mV)	p. 61
	Input impedance	1 MΩ in parallel with <100 pF	-

*1 Maximum input = 750 Vrms, 1000 V, 8×10^7 V·Hz



WARNING

To avoid electric shock:

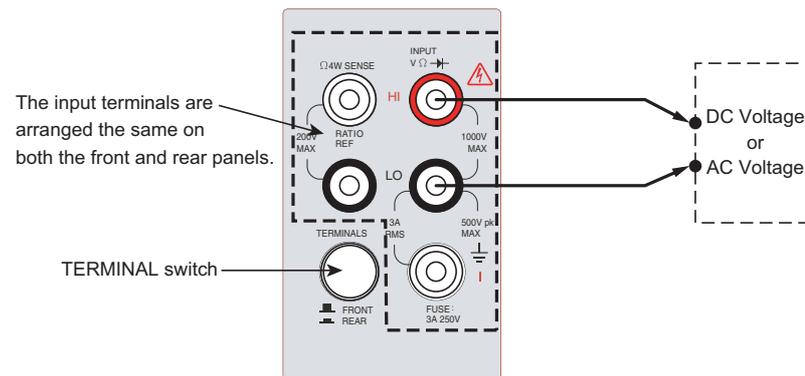
- Do not apply voltages that exceed 1000 V_{peak} to the input terminals. Doing so could damage the DME1600 and cause electric shock.



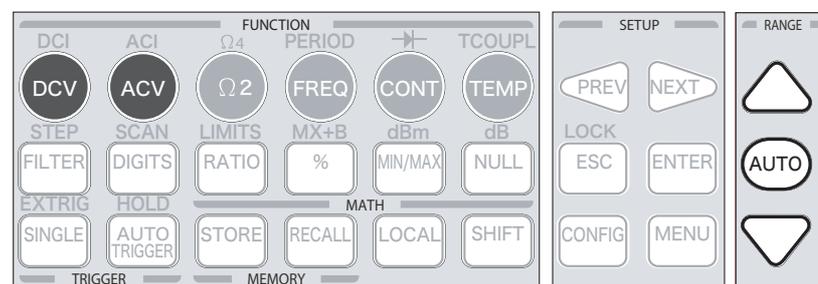
NOTE

- To eliminate the thermal EMFs caused by two different metals making contact, use copper test leads.

Connecting the input terminals



Keys



Procedure



- 1** Press **TERMINALS** to select front-panel or rear-panel input terminals.
- 2** Connect the test leads to the input terminals (**INPUT V HI** and **LO**).
- 3** To measure **DC** voltage, press **DCV**.
To measure **AC** voltage, press **ACV**.
- 4** Use the **RANGE** up, down, and **AUTO** keys to set the range.
There are two range modes: manual and auto.
- 5** Connect the test lead tips to the measurement points.
- 6** Read the measured value on the display.
If the input signal exceeds the measurable range, an overflow message "OVLd" appears.

Current Measurement

This section explains how to measure DC current and AC current. For AC current, the DME1600 measures true RMS values.

Measurement ranges and conditions

Item		
DC current range (resolution)	10 mA (10 nA), 100 mA (100 nA), 1 A (1 μ A), 3 A (10 μ A)	p. 61
Shunt resistance (applicable DC voltage ranges)	5.1 Ω (10 mA, 100 mA); 0.1 Ω (1 A, 3 A)	-
AC current range (resolution)	1 Arms (1 μ A), 3 Arms (10 μ A)	p. 61

CAUTION

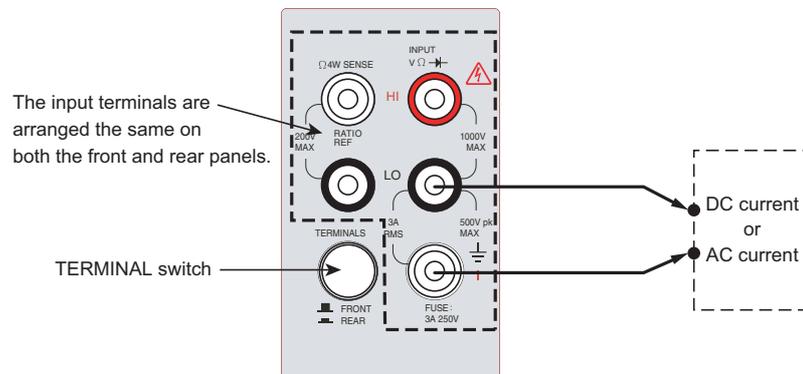
To prevent damage to the DME1600, observe the following:

- The maximum input current is 3 A (250 V). To avoid damage to the fuse, keep the current from exceeding the maximum input current.

NOTE

- To eliminate the thermal EMFs caused by two different metals making contact, use copper test leads.

Connecting the input terminals



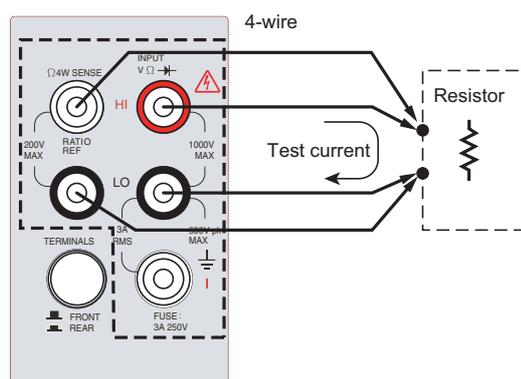
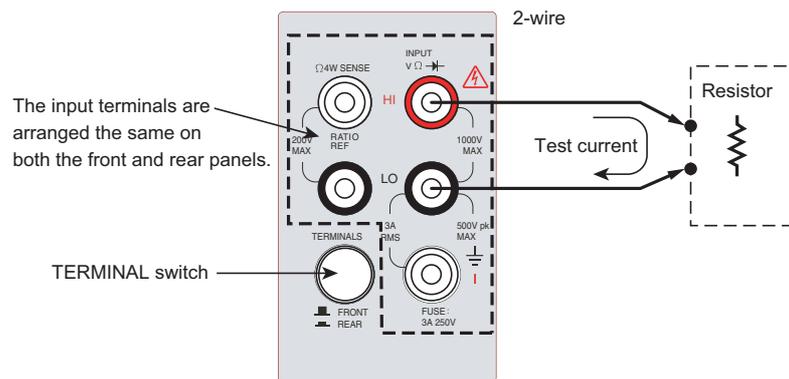
Resistance Measurement

This section describes the 2-wire and 4-wire resistance measurement methods. The 4-wire resistance measurement method uses a pair of test leads for measuring the test current and another pair for measuring the voltage. This method eliminates the test lead resistance, which is not possible with the 2-wire resistance measurement method. As a result, for low resistance measurements, the 4-wire method produces more accurate results than the 2-wire method. The trade-off is the longer settling time for the 4-wire method.

Measurement ranges and conditions

Item	
Resistance range (resolution)	100 Ω (100 $\mu\Omega$), 1 k Ω (1 m Ω), 10 k Ω (10 m Ω), 100 k Ω (100 m Ω), 1 M Ω (1 Ω), 10 M Ω (10 Ω), 100 M Ω (100 Ω)
Resistance test current (resistance range)	1 mA (100 Ω , 1 k Ω), 100 μA (10 k Ω), 10 μA (100 k Ω), 5 μA (1 M Ω), 500 nA (10 M Ω), 500 nA 10 M Ω (100 M Ω) •The resistance test current flows from the HI terminal to the LO terminal.

Connecting the input terminals



Keys



- This manual denotes this key sequence as **SHIFT+(the name of the key)**.

Procedure



■ 2-wire resistance measurement

- 1 Press **TERMINALS** to select front-panel or rear-panel input terminals.
- 2 Connect the test leads to the input terminals (**INPUT Ω HI and LO**).
- 3 Press **Ω2**.
- 4 Use the **RANGE** up, down, and **AUTO** keys to set the range.
There are two range modes: manual and auto.
- 5 Connect the test lead tips to the measurement points.
- 6 Read the measured value on the display.
If the input signal exceeds the measurable range, an overflow message "OVLD" appears.

■ 4-wire resistance measurement

- 1 Press **TERMINALS** to select front-panel or rear-panel input terminals.
- 2 Connect the test leads to the input terminals (**INPUT Ω HI and LO**).
- 3 Connect the test leads to the input terminals (**INPUT Ω4W HI and LO**).
- 4 Press **Ω4 (SHIFT+Ω2)**.
- 5 Connect the test lead tips to the measurement points as shown in the input terminal connection diagram for the 4-wire method.
- 6 Read the measured value on the display.
If the input signal exceeds the measurable range, an overflow message "OVLD" appears.

Frequency and Period Measurement

This section explains how to measure frequency and period.

Measurement ranges and conditions

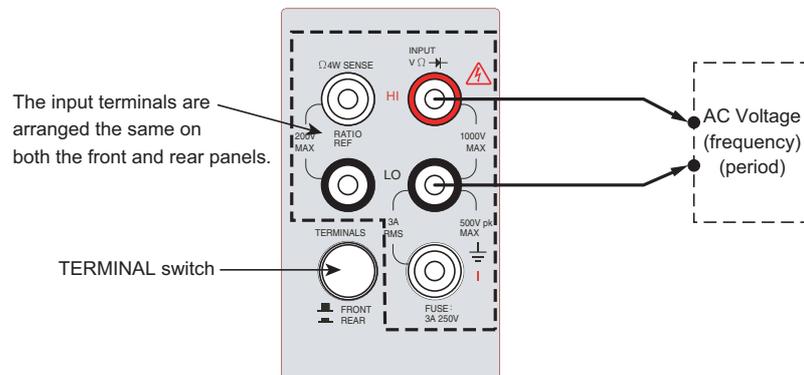
Item	
Frequency (period)	3 Hz to 300 kHz (333 ms to 3.3 μ s)
AC voltage range	100 mVrms to 750 Vrms



To avoid electric shock:

- Do not apply voltages that exceed 1000 Vpeak to the input terminals. Doing so could damage the DME1600 and cause electric shock.

Connecting the input terminals

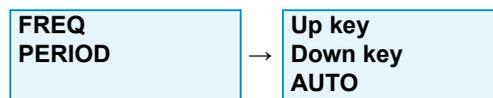


Keys



- This manual denotes this key sequence as **SHIFT+(the name of the key)**.

Procedure



- Press **TERMINALS** to select front-panel or rear-panel input terminals.
- Connect the test leads to the input terminals (**INPUT V HI** and **LO**).

- 3 To measure frequency, press **FREQ**.
To measure period, press **PERIOD (SHIFT+FREQ)**.
- 4 Use the **RANGE up, down, and AUTO** keys to set the range.
There are two range modes: manual and auto.
- 5 Connect the test lead tips to the measurement points.
- 6 Read the measured value on the display.
If the input signal exceeds the measurable range, an overflow message "OVLd" appears.

Continuity Test

The DME1600 performs continuity tests using the resistance measurement's 1 k Ω range. The DME1600 beeps when the measured resistance is less than the threshold value.

Measurement ranges and conditions

Item		
Resistance range (resolution)	1 k Ω (10 m Ω)	-
Test current	1 mA (flows from the HI terminal to the LO terminal)	-
Threshold resistance	You can set the threshold resistance to a value between 1 Ω and 1 k Ω . The specified threshold resistance is cleared when the power switch is turned off. The factory default setting is 10 Ω .	p. 59

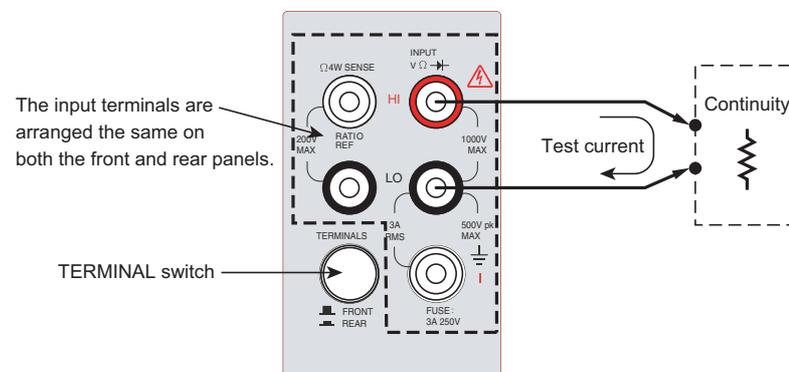


WARNING

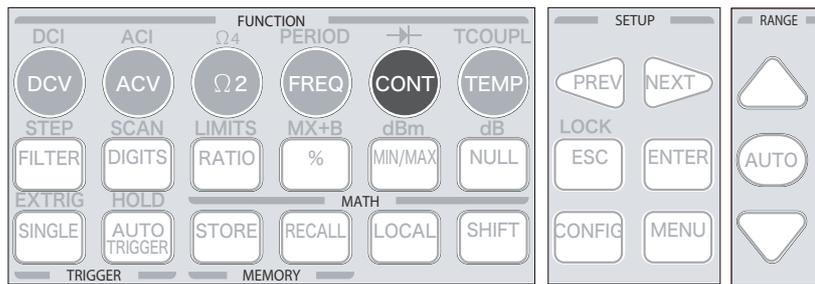
To avoid electric shock:

- Do not apply voltages that exceed 1000 V_{peak} to the input terminals. Doing so could damage the DME1600 and cause electric shock.

Connecting the input terminals



Keys



Procedure

CONT

- 1** Press **TERMINALS** to select front-panel or rear-panel input terminals.
- 2** Connect the test leads to the input terminals (**INPUT Ω HI** and **LO**).
- 3** Press **CONT**.
- 4** Connect the test lead tips to the measurement points.
- 5** Read the measured value on the display.
The DME1600 beeps when the measured resistance is less than the threshold value.

Diode Test

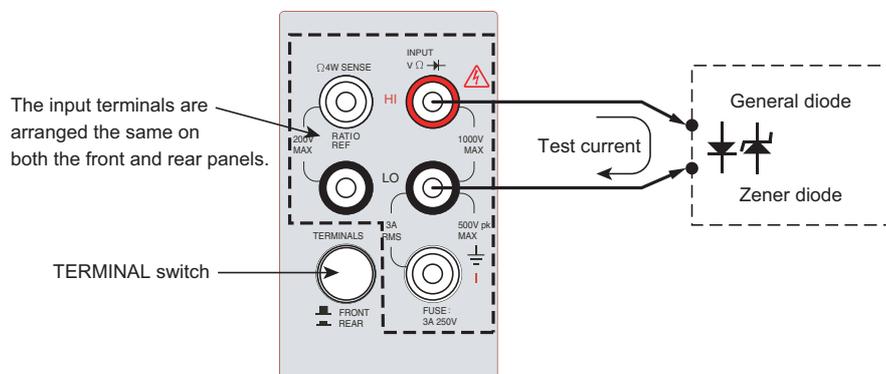
The DME1600 measures the diode forward voltage using a 1 mA test current. The DME1600 beeps when the measured forward voltage is within the threshold range.

Measurement ranges and conditions

Item		
DC voltage range (resolution)	1 V (10 μV)	-
Test current	1 mA (flows from the HI terminal to the LO terminal)	-
Threshold voltages	The factory default lower limit is 0.3 V, and the upper limit is 0.8 V. You can set the threshold resistances to values between 0.01 V and 1.2 V. The set threshold voltages are reset to their factory default values when the power switch is turned off.	p. 60
Sampling response time	0.1 PLC	p. 62
Beeper	The DME1600 beeps when the measured voltage is within the threshold range. If you set this item to OFF in the system settings, the beep sound is disabled.	p. 97

- ⚠ CAUTION • Connect the diode's anode to the HI input terminal and the cathode to the LO input terminal.

Connecting the input terminals



Keys



- This manual denotes this key sequence as **SHIFT+(the name of the key)**.

Procedure



- The following procedure is for a typical forward biased diode.
- 1** Press **TERMINALS** to select front-panel or rear-panel input terminals.
 - 2** Connect the test leads to the input terminals (**INPUT** → **HI** and **LO**).
 - 3** Connect the **HI** input terminal test lead to the diode's anode and the **LO** input terminal test lead to the cathode.
 - 4** Press → **+** (**SHIFT+CONT**).
 - 5** Read the measured value on the display.
The DME1600 beeps when the measured voltage is within the threshold range.

Temperature Measurement

See p. 64

The DME1600 supports thermocouples and RTD (Resistance Temperature Detection) probes. The following methods are available for measuring temperature with RTDs.

- 2-wire
- 3-wire
- 4-wire

In general, RTDs have better accuracy and long-term stability than thermocouples. Before making temperature measurements, you have to set the temperature sensor type. Thermocouples and RTD probes are not included in the package.

Thermocouple measurement

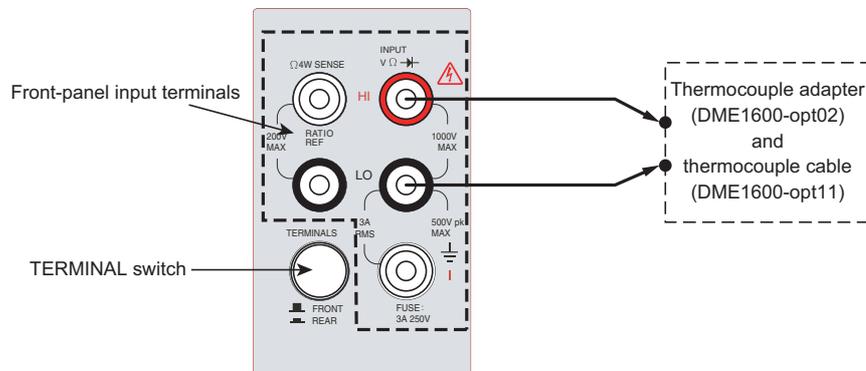
You can use the following seven thermocouple types: E, J, K, N, R, S, and T. The table below contains the temperature range for each type.

Thermocouple type	Temperature range (°C)
E	-250 to 1000
J	-210 to 1200
K	-200 to 1372
N	-200 to 1300
R	0 to 1767
S	0 to 1767
T	-250 to 400

Measurement ranges and conditions

Item	
Factory default setting	K (thermocouple type)

Connecting the input terminals



Keys



- This manual denotes this key sequence as **SHIFT+(the name of the key)**.

Procedure (setting the thermocouple type and displayed unit of measurement)

Setting the thermocouple type

CONFIG → **TCOUP** → **Type** → {E|J|K|N|R|S|T}

Setting the displayed unit of measurement

CONFIG → **TCOUP** → **UNITS** → {°C|°F|K}

■ Setting the thermocouple type

- 1** Press **CONFIG**.
- 2** Press **TCOUP** (**SHIFT+TEMP**).
- 3** Press **PREV** or **NEXT** to select **TYPE**.
- 4** Press **ENTER**.
- 5** Press **PREV** or **NEXT** to select the thermocouple type.
You can select E, J, K, N, R, S, or T.
- 6** Press **ENTER**.

■ Setting the displayed unit of measurement

- 1** Press **CONFIG**.
- 2** Press **TCOUP** (**SHIFT+TEMP**).
- 3** Press **PREV** or **NEXT** to select **UNITS**.
- 4** Press **ENTER**.
- 5** Press **PREV** or **NEXT** to select the unit.
You can select °C, °F, or K.
- 6** Press **ENTER**.

Procedure (starting the measurement)

TCOUP

- 1 Press **TERMINALS** to select the front-panel input terminals.
- 2 Connect the thermocouple adapter and thermocouple cable to the input terminals (**INPUT HI** and **LO**).
- 3 Press **TCOUP** (**SHIFT+TEMP**).
- 4 Connect the thermocouple to the measurement point.
- 5 Read the measured value on the display.

2-wire RTD measurement

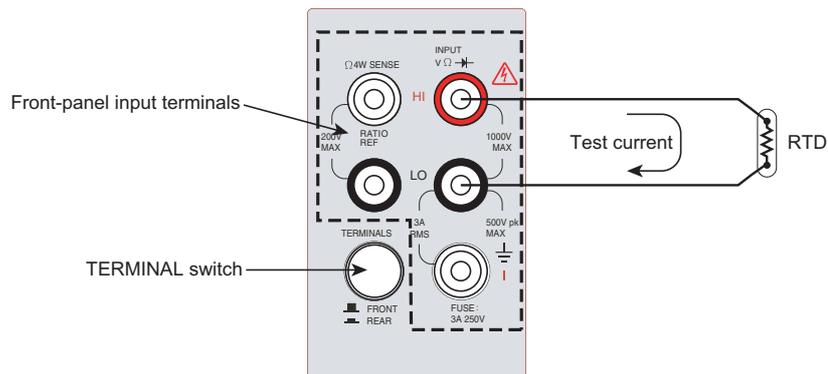
You can use the following RTD types: PT100, D100, F100, PT385, PT3916, user-defined RTD, NTCT (Negative Temperature Coefficient Thermistor), and SPRTD. The table below contains the temperature range for a typical PT100 RTD.

RTD type	Temperature range (°C)	Temperature range (°F)
PT100	-200 to 850	-392 to 1562

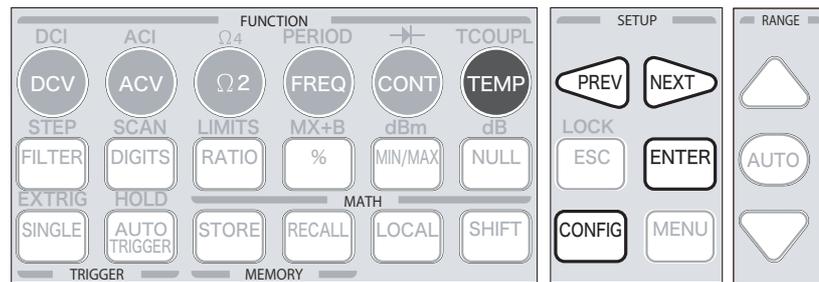
Measurement ranges and conditions

Item	
Factory default setting	PT100

Connecting the input terminals

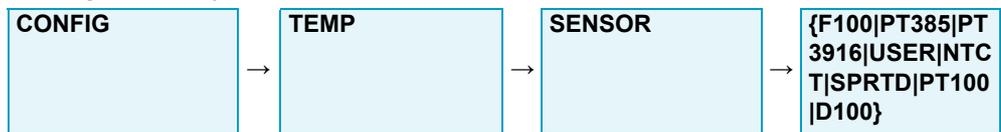


Keys



Procedure (setting the RTD type and displayed unit of measurement)

Setting the RTD type



Setting the displayed unit of measurement



■ Setting the RTD type

- 1 Press **CONFIG**.
- 2 Press **TEMP**.
- 3 Press **PREV** or **NEXT** to select **SENSOR**.
- 4 Press **ENTER**.
- 5 Press **PREV** or **NEXT** to select the **RTD type**.
You can select F100, PT385, PT3916, USER, NTCT, SPRTD, PT100, or D100.
- 6 Press **ENTER**.

■ Setting the displayed unit of measurement

- 1 Press **CONFIG**.
- 2 Press **TEMP**.
- 3 Press **PREV** or **NEXT** to select **UNITS**.
- 4 Press **ENTER**.
- 5 Press **PREV** or **NEXT** to select the **unit**.
You can select °C, °F, or K.
- 6 Press **ENTER**.

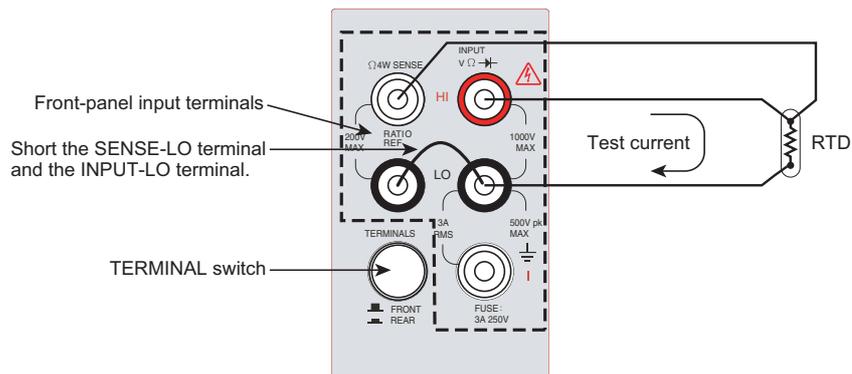
Procedure (starting the measurement)

TEMP

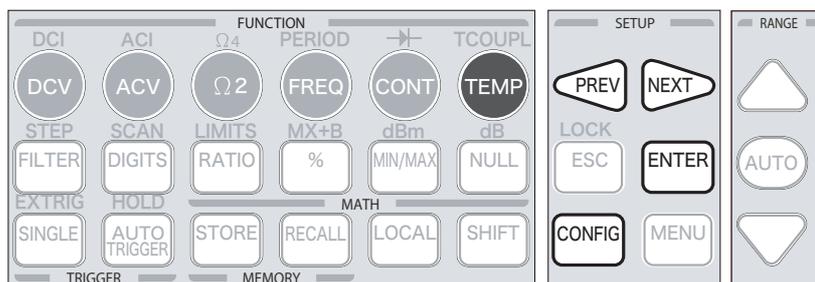
- 1 Press **TERMINALS** to select the front-panel input terminals.
- 2 Connect the RTD to the input terminals (**INPUT HI** and **LO**).
- 3 Press **TEMP**.
- 4 Connect the RTD to the measurement point.
- 5 Read the measured value on the display.

3-wire RTD measurement

Connecting the input terminals

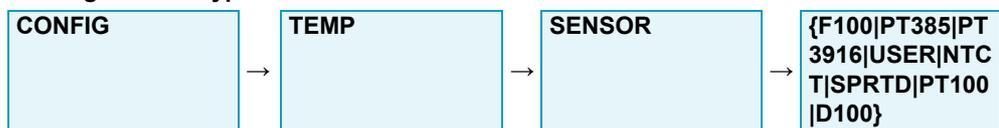


Keys



Procedure (setting the RTD type, displayed unit of measurement, and wiring method)

Setting the RTD type



Setting the displayed unit of measurement

CONFIG → TEMP → UNITS → {°C|°F|K}

Setting the wiring method

CONFIG → TEMP → TRANSDUCER → 4W RTD

■ Setting the RTD type

- 1** Press CONFIG.
- 2** Press TEMP.
- 3** Press PREV or NEXT to select SENSOR.
- 4** Press ENTER.
- 5** Press PREV or NEXT to select the RTD type.
You can select F100, PT385, PT3916, USER, NTCT, SPRTD, PT100, or D100.
- 6** Press ENTER.

■ Setting the displayed unit of measurement

- 1** Press CONFIG.
- 2** Press TEMP.
- 3** Press PREV or NEXT to select UNITS.
- 4** Press ENTER.
- 5** Press PREV or NEXT to select the unit.
You can select °C, °F, or K.
- 6** Press ENTER.

■ Setting the wiring method

- 1** Press CONFIG.
- 2** Press TEMP.
- 3** Press PREV or NEXT to select TRANSDUCER.
- 4** Press ENTER.
- 5** Press PREV or NEXT to select 4W RTD.
- 6** Press ENTER.

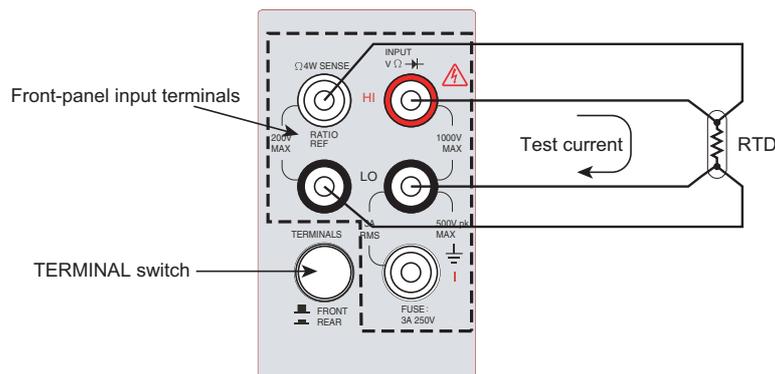
Procedure (starting the measurement)

TEMP

- 1** Press **TERMINALS** to select the front-panel input terminals.
- 2** Connect the RTD to the input terminals (**INPUT HI** and **LO**).
- 3** Short the **SENSE-LO** and the **INPUT-LO** terminals.
- 4** Press **TEMP**.
- 5** Connect the RTD to the measurement point.
- 6** Read the measured value on the display.

4-wire RTD measurement

Connecting the input terminals



Keys



Procedure

Do not short the **SENSE-LO** and the **INPUT-LO** terminals (see the figure above). All other steps are the same as with the 3-wire RTD measurement.

See p. 46



4

Function Settings

This chapter explains the various function settings that can be configured from the front panel.

Function Settings Overview

The following function settings are available.

Function group	Function		
Measurement function settings	Auto zero adjustment	Minimization of the effect of internal offset	p. 50
	Filter	Noise elimination and averaging	p. 52
	Resolution	Number of displayed digits for measured values	p. 56
	DC input resistance	DC voltage measurement, input resistance selection	p. 58
	Threshold resistance for continuity tests	A value between 1 Ω and 1000 Ω	p. 59
	Threshold range for diode tests	A range between 0.01 V and 1.2 V	p. 60
	Range	Auto and manual range settings	p. 61
	Integration time	Sampling interval for analog-to-digital conversion	p. 62
	Temperature sensor	Temperature sensor selection	p. 64
	Remote interface selection	USB or GPIB	p. 69
	Input terminal switch	Front-panel or rear-panel terminals	p. 70
Trigger function settings	Trigger mode	Auto, immediate, single triggering	p. 72
	Trigger source	Front panel, external trigger input, remote interface	p. 74
	Trigger settings	Trigger count, measured value hold, trigger delay	p. 77

ADC (Auto Zero Adjustment)

Use auto zero adjustment to minimize the effects of offset on your measurements. When auto zero adjustment is enabled, the DME1600 samples the input signal as a raw value and then internally disconnects the input signal to measure the offset (the null offset). Then, the DME1600 subtracts the offset from the raw value to obtain the accurate measurement.

Setup conditions

Auto zero adjustment	Displayed measured value = raw value (input signal) - offset.			
Auto zero adjustment enabled	The DME1600 samples the offset for every measurement.			
Auto zero adjustment disabled	The DME1600 samples the offset each time a function setting is changed.			
Effects of the resolution setting	The auto zero adjustment setting is affected by changes in the resolution setting. The following table shows how the resolution setting affects the auto zero adjustment setting.			
		Resolution setting	Auto zero adjustment	Integration time (PLC)
		Fast 4 1/2 digits	OFF	0.02
		Slow 4 1/2 digits	ON	0.1
		Fast 5 1/2 digits	OFF	0.1
		Slow 5 1/2 digits	ON	1
		Fast 6 1/2 digits	ON	1
	Slow 6 1/2 digits	ON	10	
Factory default setting	Enabled (ON). The setting is returned to its factory default value when the power switch is turned off.			

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press **MENU**.
- 2** Press **PREV** or **NEXT** to select **SET ADC**.
- 3** Press **ENTER**.
ZERO appears.
- 4** Press **ENTER**.
AUTO ZERO appears.
- 5** Press **ENTER**.
- 6** Press **PREV** or **NEXT** to select **ON** or **OFF**.
To enable auto zero adjustment, select ON; otherwise select OFF.
- 7** Press **ENTER**.

Remote interface operation

```
SENSe:ZERO:AUTO {OFF|ONCE|ON}
```

The OFF and ONCE parameters have a similar effect. With OFF, a new offset measurement is not performed. However, with ONCE, an offset measurement is performed immediately.

Filter

Filters are used to remove noise from measurement. The DME1600 has two types of filters: AC and digital. The AC filter is used only for AC voltage and AC current measurements and affects the measurement speed. The digital filter stabilizes measurement through averaging.

AC filter

For AC voltage and AC current measurements, you can select one of three AC filters (slow, medium, or fast) to prioritize accuracy in low frequency measurements or faster setting time.

Setup conditions

	Speed	Bandwidth	Settling time (seconds/measurement)
Speed, bandwidth	Slow	3 Hz to 300 kHz	7
	Medium	20 Hz to 300 kHz	1
	Fast	200 Hz to 300 kHz	0.1
Factory default setting	20 Hz (medium)The setting is returned to its factory default value when the power switch is turned off.		

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press **CONFIG**.
- 2** To measure AC voltage, press **ACV**.
To measure AC current, press **ACI (SHIFT+ACV)**.
BANDWIDTH appears.
- 3** Press **ENTER**.
- 4** Press **PREV** or **NEXT** to set the bandwidth.
The options are 3 Hz, 20 Hz, and 200 Hz.
- 5** Press **ENTER**.

Remote interface operation

```
DETECTOR: BANDwidth: {3 | 20 | 200 | MIN | MAX}
```

Digital filter

The DME1600 produces measured results by applying an averaging digital filter to 2 to 100 measured values. You can set the digital filter to one of two modes: moving average and repeating average.

- **Moving average mode**

In moving average mode, the filter averages the specified number of measured values in first-in, first-out order. To produce measured values for reading, the filter averages the stacked values each time a new value is sampled and removes the oldest value from the stack.

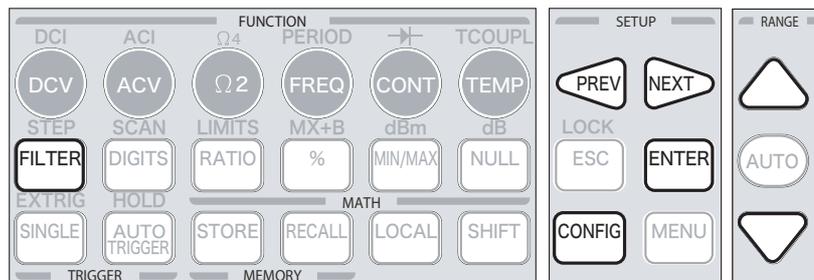
- **Repeating average mode**

In repeating average mode, the DME1600 waits until the stack is filled with the specified number of sampled values, calculates the average, and produces the measured value for reading. Then, the DME1600 flushes the stack and starts over with an empty stack. This means that in repeating average mode, the DME1600 produces a measured value each time the specified number of values are sampled.

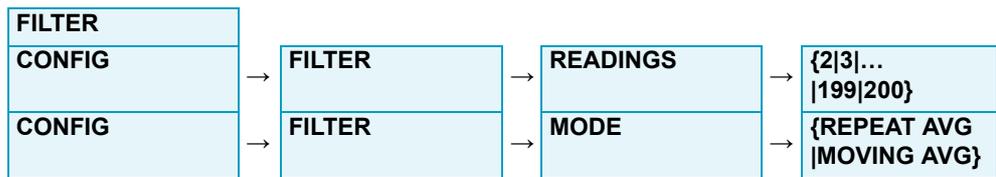
Setup conditions

Factory default setting	The DME1600 is set to moving average mode and configured to use the most recent 10 sampled values.
Limitations	The digital filter cannot be used for diode tests, continuity tests, and frequency and period measurements.

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

■ Enabling or disabling the digital filter

1 Press FILTER to enable the filter.

The FILT indicator in the top area of the display lights.

If you press FILTER again, the filter is disabled, and the FILT indicator turns off.

■ Setting the number of stack entries

1 Press CONFIG.

2 Press FILTER.

3 Press PREV or NEXT to select the READINGS submenu.

4 Press ENTER.

5 Press PREV or NEXT to move between digits and the up and down keys to set the number of stack entries to a value between 2 and 100.

6 Press ENTER.

■ Setting the filter mode

1 Press CONFIG.

2 Press FILTER.

3 Press PREV or NEXT to select MODE.

4 Press ENTER.

5 Press PREV or NEXT to select MOVING AVG or REPEAT AVG.

6 Press ENTER to apply the settings.

Remote interface operation

```
SENSe:AVERAge:TCONtrol {MOVing|REPeat}
SENSe:AVERAge:TCONtrol?
SENSe:AVERAge:COUNt {<value>|MINimum|MAXimum}
SENSe:AVERAge:COUNt? [MINimum|MAXimum]
SENSe:AVERAge:STATe {OFF|ON}
SENSe:AVERAge:STATe
```

Resolution Setting

The resolution is the number of digits that the DME1600 can measure. You can select from the following six resolution options.

- FAST 4 1/2 (for fast measurements)
- SLOW 4 1/2
- FAST 5 1/2
- SLOW 5 1/2
- FAST 6 1/2
- SLOW 6 1/2 (for high measurement accuracy)

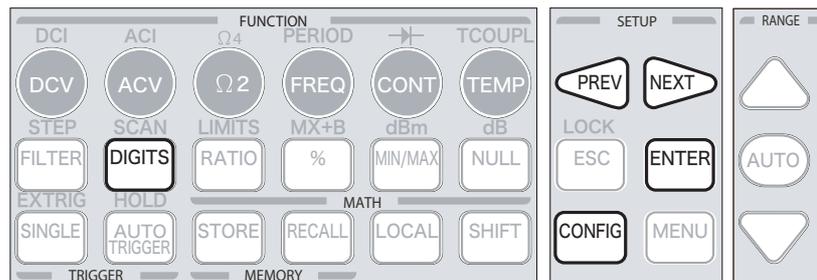
The resolution setting applies to all computations performed under the selected measurement function. The selected value is stored and applied only to the current measurement function. You can set different resolutions for different measurement functions.

Under frequency and period measurements, the way of the Aperture Time and the Gate Time are similar to the integration time's. You can set 0.01 s at 4 1/2, 0.1 s at 5 1/2, and 1 s at 6 1/2.

Setup conditions

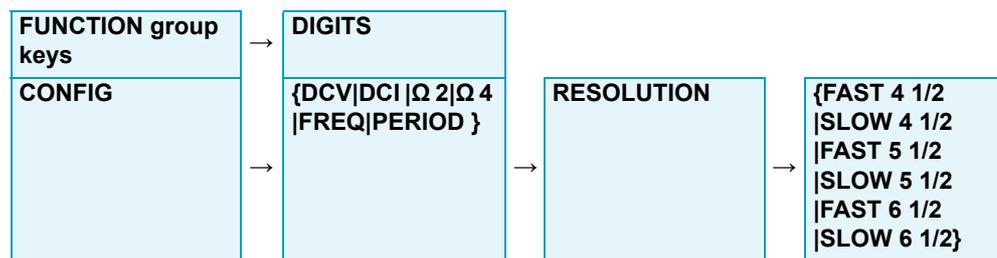
DC and resistance measurement	By using the DIGITS key, you can select the resolution from all the options listed above. By using the CONFIG key, you can select 4 1/2 (slow), 5 1/2 (slow), or 6 1/2 (fast).
AC measurement	You can set the resolution by using the DIGITS key. The default setting is 5 1/2 digits. The extra digits are masked.
Frequency and period measurement	You can select 4 1/2 (slow), 5 1/2 (slow), or 6 1/2 (slow).
Factory default setting	The default setting is SLOW 5 1/2. The setting is returned to its factory default value when you turn the power switch off or reset the DME1600 through the remote interface.

Keys



Procedure

There are two ways to set the resolution.



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

■ Using the DIGITS key

When you use the DIGITS key, you can select 4 1/2 (slow), 5 1/2 (slow), or 6 1/2 (fast).

1 Press a FUNCTION key to set the measurement function.

2 Press DIGITS to select the resolution.

Each time you press DIGITS, the resolution setting changes between 4 1/2, 5 1/2, and 6 1/2.

■ Using the CONFIG key

1 Press CONFIG.

2 Press DCV, DCI (SHIFT+DCV), Ω 2, Ω 4 (SHIFT+Ω 2), FREQ, or PERIOD (SHIFT+FREQ) to select the function.

3 Press PREV or NEXT to select RESOLUTION.

4 Press ENTER.

5 Press PREV or NEXT to select the resolution.

You can select FAST 4 1/2, SLOW 4 1/2, FAST 5 1/2, SLOW 5 1/2, FAST 6 1/2, or SLOW 6 1/2.

6 Press ENTER.

Remote interface operation

```

CONFigure:<function> <range>,<resolution>
MEASure:<function>? <range>,<resolution>
SENSe:<function>:RESolution <resolution>
FREQuency:APERTure {0.01|0.1|1|MIN|MAX}
PERiod:APERTure {0.01|0.1|1|MIN|MAX}

```

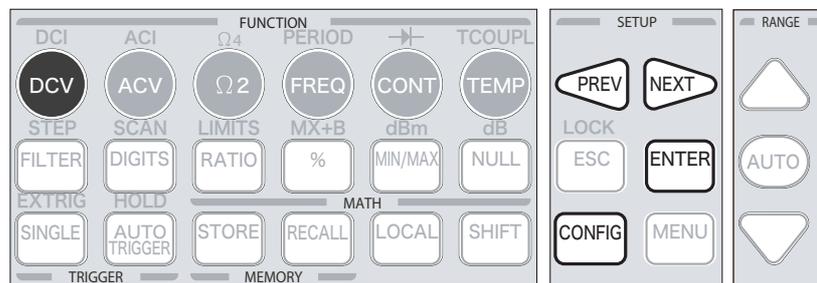
DC Input Resistance

For low input DC voltage (100 mV, 1 V, and 10 V range) measurements, you can select a large input resistance ($> 10 \text{ G}\Omega$) to reduce the loading effect of the DME1600 input resistance. For 100 V DCV and 1000 V DCV measurements and other measurement functions, the input resistance is fixed at $10 \text{ M}\Omega$. This feature can only be used for DC voltage measurements (it cannot be used for other measurement functions).

Setup conditions

Factory default setting	The resistance is set to $10 \text{ M}\Omega$ for all measurement functions. The setting is returned to its factory default value when you turn the power switch off or reset the DME1600 through the remote interface.
-------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press **CONFIG**.
- 2 Press **DCV**.
- 3 Press **PREV** or **NEXT** to select **INPUT R**.
- 4 Press **ENTER**.
- 5 Press **PREV** or **NEXT** to select the input resistance.
You can select $10 \text{ M}\Omega$ or $> 10 \text{ G}\Omega$.
- 6 Press **ENTER**.

Remote interface operation

INPut: IMPedance: AUTO {OFF|ON}

Set the auto input resistance mode to AUTO ON or AUTO OFF to switch the input resistance. The factory default value is AUTO OFF, and the input resistance is fixed at $10 \text{ M}\Omega$ for all ranges. When set to AUTO ON, the input resistance is set to $>10 \text{ G}\Omega$ for the 100 mV, 1 V, and 10 V DC voltage ranges.

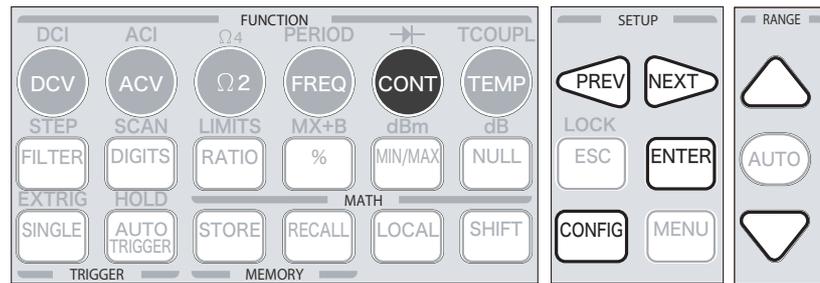
Threshold Resistance for Continuity Tests

When testing continuity, the DME1600 beeps when the measured resistance is less than the threshold value. You can set the threshold value to a value between 1 Ω and 1000 Ω .

Setup conditions

Factory default settings	The default value is 10 Ω . The setting is returned to its factory default value when the power switch is turned off.
--------------------------	------------------------------------------------------------------------------------------------------------------------------

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3|...|option n}.

- 1 Press **CONFIG**.
- 2 Press **CONT**.
- 3 Press **PREV** or **NEXT** to move between digits and the up and down keys to set the value.
- 4 Press **ENTER**.

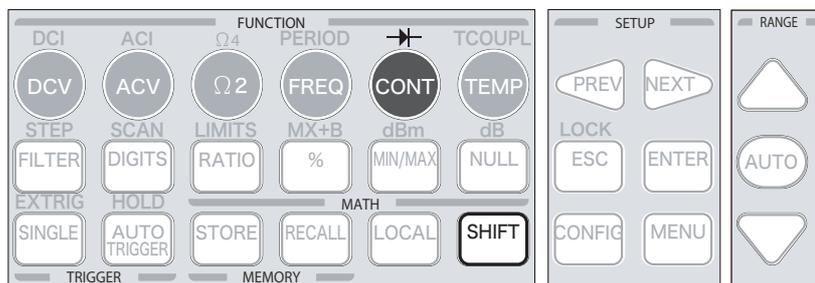
Threshold Range for Diode Tests

The DME1600 measures the diode forward voltage using a 1 mA test current. The DME1600 beeps when the measured forward voltage is within the threshold range.

Setup conditions

Threshold voltages	You can set the threshold voltages to values between 0.01 V and 1.2 V. The set threshold voltages are reset to their factory default values when the power switch is turned off.
Factory default setting	The lower limit is 0.3 V, and the upper limit is 0.8 V.

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press **CONFIG**.
- 2** Press **→+ key** (**SHIFT+CONT**).
BOUND appears.
- 3** Press **ENTER**.
VFLow appears.
- 4** Press **ENTER**.
- 5** Press **PREV** or **NEXT** to move between digits and the up and down keys to set the value.
- 6** Press **ENTER**.
VFHi appears.
- 7** Press **ENTER**.
- 8** Press **PREV** or **NEXT** to move between digits and the up and down keys to set the value.
- 9** Press **ENTER**.

Range (Auto and Manual)

The DME1600 can automatically select measurement ranges (this feature cannot be used in continuity tests, diode tests, and temperature measurements). You can also select the range manually to reduce the settling time. When the input signal exceeds the measurable range, an OVLD message appears on the display.

Setup conditions

Range of the auto range feature	10 % to 120 %. When the input signal exceeds 120 % of the range that is in use, the next higher range is selected. When the input signal falls below 10 % of the range that is in use, the next lower range is selected.
Factory default setting	The factory default value is auto range. The setting is returned to its factory default value when the power switch is turned off.

Keys



Procedure

AUTO
The up key
The down key

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Select the measurement function to use.
- 2** Press **AUTO** to select the auto range feature or the up and down keys to select the range manually.

If the selected range does not appear in the bottom area of the display, press PREV or NEXT under DISPLAY until the range information appears.

See p. 8

Remote interface operation

```

CONFigure:<function> <range>,<resolution>
MEASure:<function>? <range>,<resolution>
SENSe:<function>:RANGe <range>
SENSe:<function>:RANGe:AUTO {OFF|ON}
    
```

Integration Time

The integration time is the interval at which the analog-to-digital converter samples the input signal. The integration time feature not only eliminates noise and increases measurement accuracy but also optimizes measurement speed or resolution. The unit of integration time is PLC (Power Line Cycles). One PLC is 16.67 ms for 60 Hz and 20 ms for 50 Hz.

You can set the integration time to 0.02 PLC, 0.1 PLC, 1 PLC, or 10 PLC.

Setup conditions

Integration time selection	You can set the integration time to 0.02 PLC, 0.1 PLC, 1 PLC, or 10 PLC.
Factory default setting	The factory default integration time for DCV, DCI, and resistance measurements is 1 PLC. The setting is returned to its factory default value when the power switch is turned off.

Keys



Procedure

See p. 56

The integration time is set automatically when you select the measurement resolution. For details on how to set the resolution or the number of digits, see “Resolution Setting.”

Remote interface operation

■ Resolution setting

```
CONFigure:<function> <range>, <resolution>  
MEASure:<function>? <range>, <resolution>  
SENSe:<function>:RESolution <resolution>
```

■ Integration time setting

```
SENSe:VOLTage:DC:NPLCycles {0.02|0.1|1|10|MINimum|MAXimum}  
SENSe:VOLTage:DC:NPLCycles? [MINimum|MAXimum]  
SENSe:CURRent:DC:NPLCycles {0.02|0.1|1|10|MINimum|MAXimum}  
SENSe:CURRent:DC:NPLCycles? [MINimum|MAXimum]  
SENSe:RESistance:NPLCycles {0.02|0.1|1|10|MINimum|MAXimum}  
SENSe:RESistance:NPLCycles? [MINimum|MAXimum]  
SENSe:FRESistance:DC:NPLCycles  
    {0.02|0.1|1|10|MINimum|MAXimum}  
SENSe:FRESistance:DC:NPLCycles? [MINimum|MAXimum]
```

■ For frequency and period measurements

There is a setting called aperture time (or gate time), which is analogous to the integration time.

```
SENSe:FREQuency:APERTure {0.01|0.1|1|MINimum|MAXimum}
```

```
SENSe:FREQuency:APERTure? [MINimum|MAXimum]
```

```
SENSe:PERiod:APERTure {0.01|0.1|1|MINimum|MAXimum}
```

```
SENSe:PERiod:APERTure? [MINimum|MAXimum]
```

Aperture time (or gate time) setting

0.01 s (4 1/2 digits), 0.1 s (factory default: 5 1/2 digits), or 1 s (6 1/2 digits)

Temperature Sensor

The temperature sensors that you can use with the DME1600 are RTDs and thermocouples. Before making temperature measurements, you have to set the temperature sensor type.

RTD

The RTDs that you can use are PT100, D100, F100, PT385, PT3916, user-defined RTD, and SPRTD. If you need to change the RTD factors that are used to calculate the temperature, select the user-defined RTD, which lets you change the factors as necessary.

Setup conditions

Factory default setting PT100

● Factory default RTD factors

Type	α	β	δ	R-zero
PT100	0.003850	0.10863	1.49990	100 Ω
D100	0.003920	0.10630	1.49710	100 Ω
F100	0.003900	0.11000	1.49589	100 Ω
PT385	0.003850	0.11100	1.50700	100 Ω
PT3916	0.003916	0.11600	1.50594	100 Ω
NTCT	0.003850	0.10863	1.49990	100 Ω

Below is the temperature equation that is used to determine the RTD temperature:

When $t < 0$ °C,

$$R_t = R_0 [1 + At + Bt^2 + Ct^3(t - 100)]$$

When 0 °C $< t < 630$ °C,

$$R_t = R_0 (1 + At + Bt^2)$$

where

$$A = \alpha(1 + \delta/100),$$

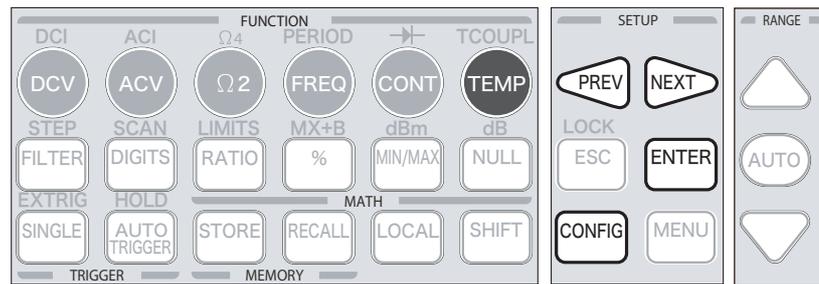
$$B = -\alpha\delta \cdot 10^{-4},$$

$$C = -\alpha\beta \cdot 10^{-8}.$$

If you are using an SPRTD (Standard Platinum RTD), select SPRTD, and specify the seven coefficients under the SPRTD submenu.

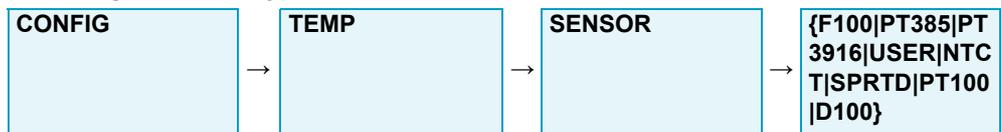
The ITS (International Temperature Scale) -90 standard provides two reference equations for Standard Platinum Thermometers that cover a temperature range from 18.8033K to 1234.93K. However, one SPRTD usually cannot cover the entire range, so the temperature range is broken up into subranges. These subranges depend on the calibration point of the temperature scale and are based on the melting or triple points of various pure substances. For an exact list of the elements needed and the details of RTD calibration, see NIST Technical Note 1265 "Guidelines for Realizing the International Temperature Scale of 1990." In each subrange, the calibration constants required for that subrange are listed.

Keys

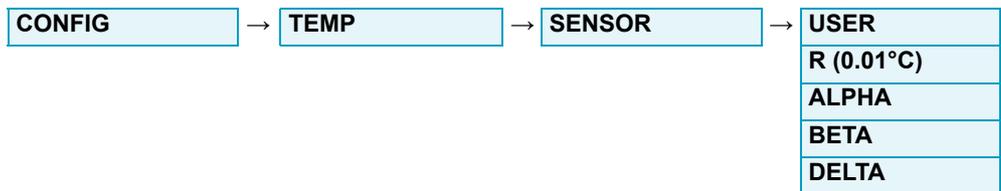


Procedure

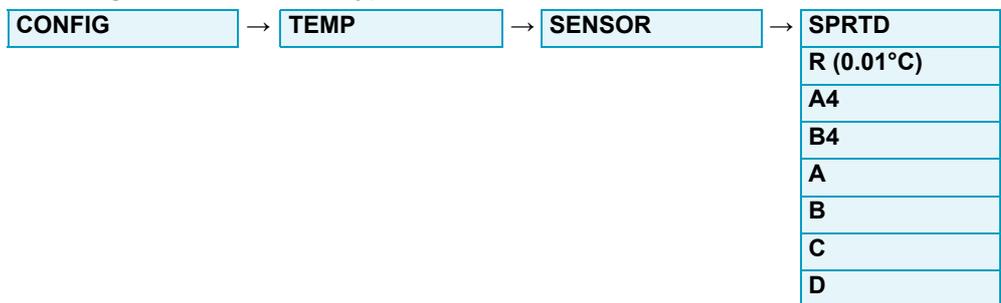
Selecting the sensor type



Selecting the USER sensor type



Selecting the SPRTD sensor type



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press CONFIG.
- 2 Press TEMP.
- 3 Press PREV or NEXT to select SENSOR.
- 4 Press ENTER.
- 5 Press PREV or NEXT to select the sensor type.
- 6 Press ENTER.

■ **To select USER**

Steps 1 to 4 are the same as those for selecting the sensor type.

- 5 Press PREV or NEXT to select USER.**
A menu for specifying factors, which are used in the equation to determine the temperature, appears.
- 6 Press ENTER.**
R (0.01°C) appears (for setting the first factor).
- 7 Press ENTER.**
A prompt for entering the factor appears.
- 8 Press PREV or NEXT to move between digits and the up and down keys to set the value.**
- 9 Press ENTER to enter the value.**
ALPHA appears (for setting the second factor). Return to step 8, and enter the constant.
BETA appears (for setting the third factor). Return to step 8, and enter the constant.
DELTA appears (for setting the fourth factor).
When you finish entering all the constants, the menu automatically closes.

■ **To select SPRTD**

Steps 1 to 4 are the same as those for selecting the sensor type.

- 5 Press PREV or NEXT to select SPRTD.**
A menu for specifying seven factors, which are used in the equation to determine the temperature, appears.
- 6 Press ENTER.**
R (0.01°C) appears (for setting the first factor).
- 7 Press ENTER.**
A prompt for entering the factor appears.
- 8 Press PREV or NEXT to move between digits and the up and down keys to set the value.**
- 9 Press ENTER to enter the value.**
A4 appears (for setting the second factor). Return to step 8, and enter the constant.
B4 appears (for setting the third factor). Return to step 8, and enter the constant.
A appears (for setting the fourth factor). Return to step 8, and enter the constant.
B appears (for setting the fifth factor). Return to step 8, and enter the constant.
C appears (for setting the sixth factor). Return to step 8, and enter the constant.
D appears (for setting the seventh factor).
When you finish entering all the constants, the menu automatically closes.

Remote interface operation

```

SENSe:TEMPerature:RTD:TYPE{PT100|D100|F100|PT385|PT3916|USER
|SPRTD}
SENSe:UNIT {Cel|Far|K}
SENSe:UNIT?
SENSe:TEMPerature:RTD:RZERO {<value>|MINimum|MAXimum}
SENSe:TEMPerature:RTD:ALPHA {<value>|MINimum|MAXimum}
SENSe:TEMPerature:RTD:BETA {<value>|MINimum|MAXimum}
SENSe:TEMPerature:RTD:DELTA {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:RZERO {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:A4 {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:B4 {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:AX {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:BX {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:CX {<value>|MINimum|MAXimum}
SENSe:TEMPerature:SPRTD:DX {<value>|MINimum|MAXimum}

```

Thermocouple

You can use the following thermocouple types: E, J, K, N, R, S, and T. For each thermocouple type, set the reference junction temperature. Typical reference junction temperatures are 0 °C and 23 °C.

Setup conditions

Factory default setting	K (thermocouple type)
-------------------------	-----------------------

NOTE

- The DME1600 measures the temperature difference between the ends of the thermocouple and displays the sum of this difference and the specified reference junction temperature as the measured temperature. Thus, the displayed temperature values are relative, which are different from values measured on a normal thermometer. To make the values displayed on the DME1600 the same as those on a thermometer, you have to measure the ambient temperature with a separate thermometer and set the reference junction temperature to the ambient temperature.
- Displayed temperature = reference junction temperature (set value) + temperature difference between the ends of the thermocouple (measured value)
- A 10-channel thermocouple scanner card (DME1600-opt12) option is also available.

Keys



Procedure

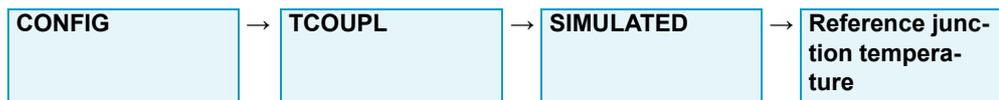


The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

■ Setting the thermocouple type

- 1** Press CONFIG.
- 2** Press TCOUPL (SHIFT+TEMP).
- 3** Press PREV or NEXT to select TYPE.
- 4** Press ENTER.
- 5** Press PREV or NEXT to select the thermocouple type.
- 6** Press ENTER.

Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

■ Setting the reference junction temperature

- 1** Press CONFIG.
- 2** Press TCOUPL (SHIFT+TEMP).
- 3** Press PREV or NEXT to select SIMULATED.
- 4** Press ENTER.
- 5** Press PREV or NEXT to move between digits and the up and down keys to set the value.
- 6** Press ENTER.

Remote interface operation

```

SENSe:UNIT {Cel|Far|K}
SENSe:UNIT?
SENSe:TCouple:TYPE {E|J|K|N|R|S|T}
SENSe:TCouple:RJUNction:SIMulated {<value>|MINimum|MAXimum}
  
```

Selecting the Remote Interface

The DME1600 has USB and GPIB remote interfaces. You can use either interface but not both at the same time. The GPIB interface is a factory option.

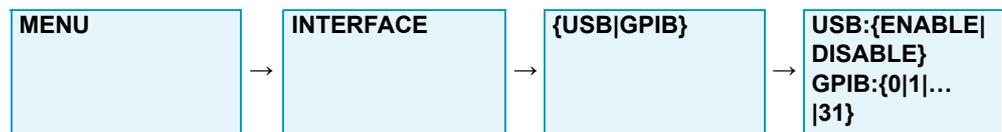
Setup conditions

Factory default settings	The default value is USB. The GPIB address is 22.
--------------------------	------------------------------------------------------

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3} . . . |option n}.

■ Configuring the USB settings

- 1 Press MENU.
- 2 Press PREV or NEXT to select INTERFACE.
- 3 Press ENTER.
- 4 Press PREV or NEXT to select USB.
- 5 Press ENTER.
- 6 Press PREV or NEXT to select ENABLE or DISABLE.

■ Configuring the GPIB settings

Carry out steps 1 to 3 shown above.

- 4 Press PREV or NEXT to select GPIB.
- 5 Press ENTER.
- 6 Press PREV or NEXT to move between digits and the up and down keys to set the GPIB address.
- 7 Press ENTER to enter the GPIB address.

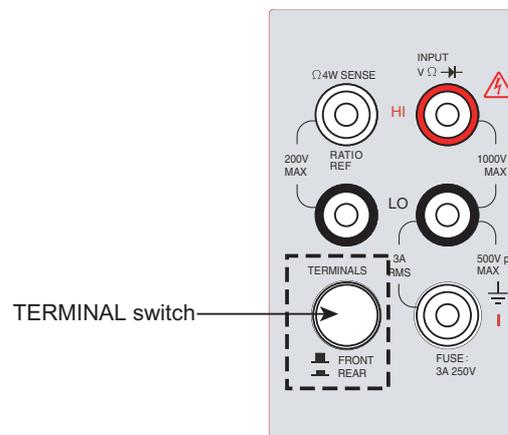
Switching between Input Terminals

The DME1600 has input terminals on both the front and rear panels. When you select the rear-panel input terminals, the REAR indicator in the top area of the panel display lights.

Setup conditions

Factory default setting	Front-panel input terminals
-------------------------	-----------------------------

Switch



Procedure

■ Selecting the rear-panel input terminals

- 1 Press TERMINALS so that the switch is in its “in” position.

■ Selecting the front-panel input terminals

- 1 Press TERMINALS so that the switch is in its “out” position.

Triggering

The DME1600 has a variety of trigger features. For each measurement function, you can set the trigger mode, trigger source, and trigger settings.

- **Trigger mode**

You can set the trigger mode to auto, immediate, or single.

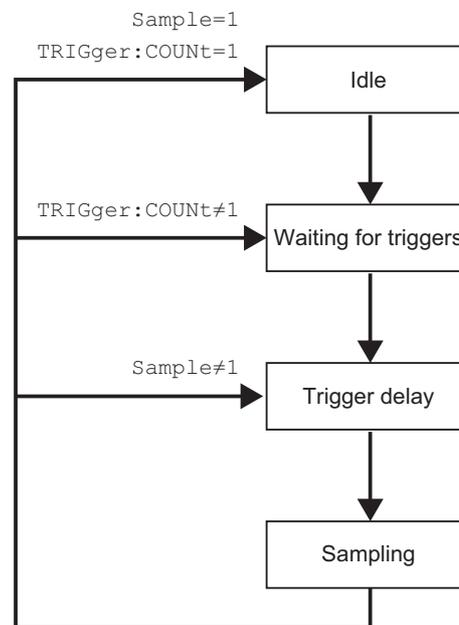
- **Trigger source**

You can set the trigger source to front panel, external trigger input, or remote interface.

- **Trigger settings**

You can set the number of samples per trigger, the number of triggers per event, the measured value hold setting, the trigger delay setting for making measurements, and so on.

Trigger operation



Trigger Mode

On the DME1600, you can set the trigger mode to auto, immediate, or single.

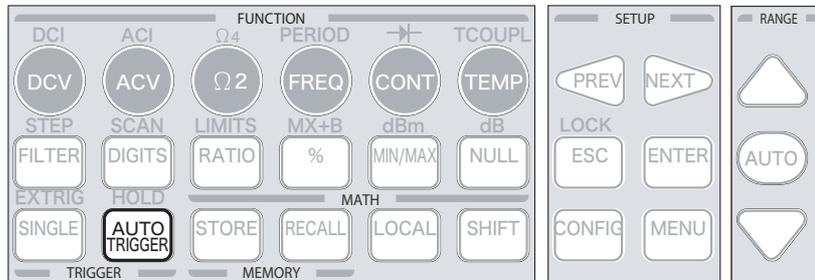
Auto trigger mode (front panel operation only)

In auto trigger mode, the DME1600 continuously takes samples at the fastest rate possible (the rate depends on the current settings).

Setup conditions

Factory default settings	The default values are auto trigger for front-panel operation and immediate for remote interface operation.
--------------------------	-------------------------------------------------------------------------------------------------------------

Keys



Procedure

AUTO TRIGGER

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press AUTO TRIGGER.**
Auto trigger mode is enabled.
- 2 Press AUTO TRIGGER.**
Auto trigger mode is disabled (this key is a toggle key).

Immediate trigger mode (remote interface operation only)

Immediate trigger mode can only be used during remote interface operation. In immediate trigger mode, the DME1600 triggers immediately when it enters the trigger-wait state.

Setup conditions

Factory default settings	The default values are auto trigger for front-panel operation and immediate for remote interface operation.
--------------------------	-------------------------------------------------------------------------------------------------------------

Remote interface operation

TRIGger:SOURce IMMEDIATE

Single trigger mode (front panel operation only)

In single trigger mode, the DME1600 takes a single measurement (or the specified number of measurements) each time you press SINGLE. When the TRIG indicator is lit on the display, the DME1600 is ready for the next trigger event. Single trigger mode can only be used during front panel operation.

Setup conditions

Factory default settings The default values are auto trigger for front-panel operation and immediate for remote interface operation.

Keys



Procedure

SINGLE

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3|...|option n}.

- 1 Press **SINGLE**.

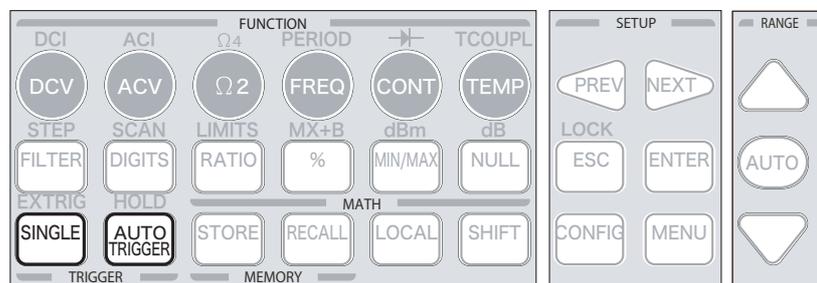
Trigger Source

On the DME1600, you can set the trigger source to front panel, external trigger input, or remote interface.

Front panel operation

For auto trigger, use the AUTO TRIGGER key. For single trigger, use the SINGLE key.

Keys



Procedure

AUTO TRIGGER

SINGLE

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

■ Auto trigger

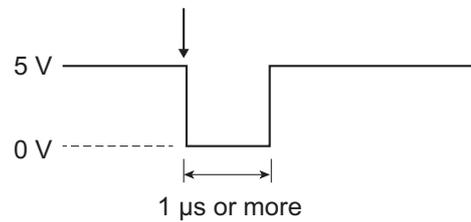
1 Press **AUTO TRIGGER**.

■ Simple trigger

1 Press **SINGLE**.

External trigger input

You can use external trigger pulses applied to the rear-panel EXT TRIG (BNC) terminal as a trigger source. When an external trigger signal is received, the DME1600 starts a single measurement or the specified number of measurements.



Setup conditions

Timing	Falling edge of the pulse signal
--------	----------------------------------

Keys



Procedure

EXTRIG

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3} . . . |option n}.

- 1 **Press EXTRIG (SHIFT+SINGLE).**
The EXT indicator in the top area of the display lights.

Triggering through the remote interface

Software trigger

In software triggering, a command is sent from a PC to the DME1600. The DME1600 starts measuring when it receives the command.

```
TRIGger:SOURce BUS
```

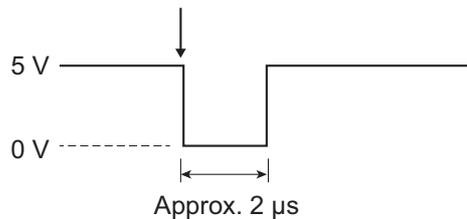
Internal trigger

Internal trigger is the default trigger mode for remote interface operation. In internal trigger mode, the DME1600 triggers immediately when it enters the trigger-wait state.

```
TRIGger:SOURce IMMEDIATE
```

Pulse output for external devices when measurements finish

The rear-panel VM COMP (BNC) terminal transmits a signal to external devices each time a measurement is finished. This is indicated by the falling edge of the pulse signal.



Other Trigger Settings

On the DME1600, you can set the number of samples per trigger, the number of triggers per event, the measured value hold setting, the trigger delay setting for making measurements, and so on.

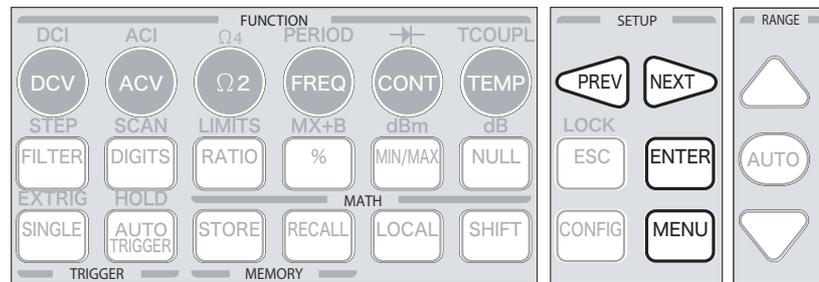
Number of samples per trigger

You can configure the DME1600 so that it samples the specified number of times (up to 50000) each time it receives a trigger. The specified number is stored. This setting is cleared when the power switch is turned off.

Setup conditions

Factory default setting One sample per trigger

Keys



Procedure

MENU → **TRIG** → **N SAMPLE** → **{1|2|... |50000}**

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press **MENU**.
- 2** Press **PREV** or **NEXT** to select **TRIG**.
- 3** Press **ENTER**.
- 4** Press **PREV** or **NEXT** to select **N SAMPLE**.
- 5** Press **ENTER**.
- 6** Press **PREV** or **NEXT** to move between digits and the up and down keys to set the value.
You can specify a value between 1 and 50000.
- 7** Press **ENTER**.

Remote interface operation

SAMPle:COUNT <value>

Number of triggers (remote interface operation only)

Normally, the DME1600 returns to the idle state upon receiving a trigger. You can set the number of triggers that the DME1600 receives before it returns to the idle state. You can only set this number through the remote interface.

To set the number of triggers during the idle state, send the following command.

Remote interface operation

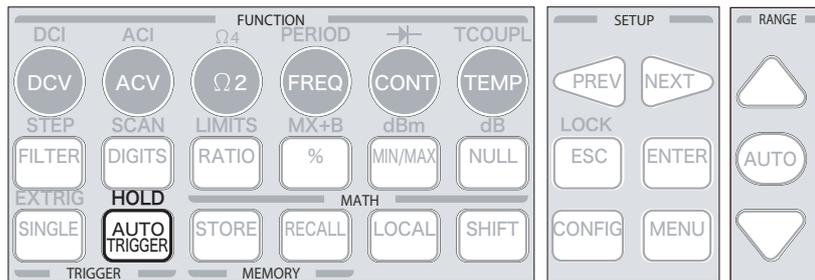
```
TRIGger:COUNT <value>
```

Measured value hold

See p. 101

The measured value hold feature checks that measured values are stable and displays the measured value. If this feature is enabled, when the measured value stabilizes within a specified range, the measured value is held, and a beep sound is generated.

Keys



Procedure

HOLD

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press HOLD (SHIFT+AUTO TRIGGER).**
The measured value hold feature is enabled.
- 2 Press HOLD (SHIFT+AUTO TRIGGER).**
The measured value hold feature is disabled (this key is a toggle key).

Trigger delay

This feature is useful when a long delay is needed for the system to stabilize. The time needed for a measurement system to stabilize is called the “settling time.” The settling time depends on the measurement range, cable properties and signal source. You can set the trigger delay to a value between 0 seconds and 3600 seconds. The selected delay is stored. It is returned to its factory default value when the power switch is turned off.

- **Internal settings of the auto trigger delay**

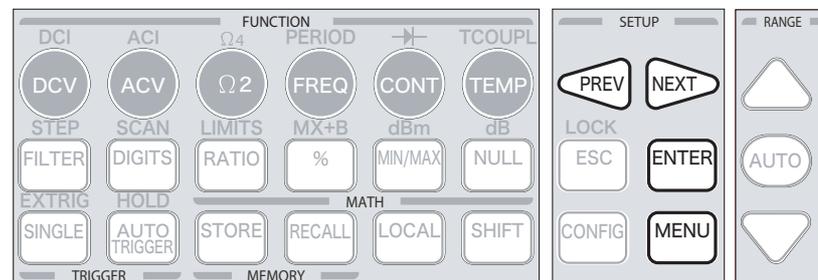
The auto trigger delay value is determined by the selected measurement function, range, integration time, and AC filter speed.

Setup conditions

If a delay value is not specified, the factory default value is automatically applied. The delay value is selected automatically according to the measurement function settings. The factory default trigger delay values are shown in the following table.

Measurement function	Setting	Trigger delay
DCV/DCI	PLC \geq 1	1.5 ms
	PLC $<$ 1	1.0 ms
Ω 2 and Ω 4 (PLC \geq 1)	100 Ω to 100 k Ω	1.5 ms
	1 M Ω	15 ms
	10 M Ω to 100 M Ω	100 ms
Ω 2 and Ω 4 (PLC $<$ 1)	100 Ω to 100 k Ω	1.0 ms
	1 M Ω	10 ms
	10 M Ω to 100 M Ω	100 ms
ACV / ACI (remote interface, external trigger, single trigger)	3 Hz	7.0 s
	20 Hz	1 s
	200 Hz	600 ms
ACV / ACI (front panel; auto trigger enabled)	3 Hz	1.5 s
	20 Hz	200 ms
	200 Hz	100 ms
Frequency, period	Remote interface, external	1 s
	(front panel; auto trigger enabled)	0 s

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press MENU.
- 2** Press PREV or NEXT to select TRIG.
- 3** Press ENTER.
- 4** Press PREV or NEXT to select DELAY.
- 5** Press ENTER.
- 6** Press PREV or NEXT to move between digits and the up and down keys to set the value.
You can set the trigger delay to a value between 0 seconds and 3600 seconds.
- 7** Press ENTER.

Remote interface operation

TRIGger:DELay {<seconds>|MINimum|MAXimum}

TRIGger:DELay:AUTO {OFF|ON}

Delay setting

Auto trigger delay operation setting



5

Math Functions

This chapter explains the math functions.

Math Function Overview

The DME1600 can perform the math operations shown in the table below. Data that has been acquired through measurement is either stored for later use or used in mathematical operations. These math functions are available to all measurement functions except for continuity and diode testing.

When math functions (excluding the ratio function) are in use, the MATH indicator lights on the display. When the ratio function is in use, the RATIO indicator lights. To disable a math function, press the same key again.

Function group	Function		
Math function settings	Ratio	Ratio of the input DC voltage to the reference DC voltage	p. 82
	Percentage	Ratio of the measured value to the specified target value as a percentage	p. 84
	Maximum and minimum	Maximum value, minimum value, average of measured values, and number of measured values	p. 85
	Null	Difference between the measured value and the stored null value	p. 87
	Upper and lower limit test	Tests the measured value against the specified upper and lower limits	p. 88
	MX+B	Determines value Y that is linearly proportional to measured value X as defined by slope M and offset B	p. 90
	dBm	Measured voltage displayed as a power level (relative to 1 mW), dissipated through a reference resistance	p. 92
	dB	Displays the measured value relative to a reference value in decibels	p. 93

Ratio

The ratio function calculates the ratio of the input DC voltage to the specified reference DC voltage using the following equation.

$$\text{Ratio} = \frac{\text{Input DC voltage}}{\text{Reference DC voltage}}$$

Keys



Procedure (setting the resolution)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press CONFIG.**
- 2 Press RATIO.**
RESOLUTION appears.
- 3 Press ENTER.**
- 4 Press PREV or NEXT to select the resolution.**
You can select FAST 4 1/2, SLOW 4 1/2, FAST 5 1/2, SLOW 5 1/2, FAST 6 1/2, or SLOW 6 1/2.
- 5 Press ENTER.**

Procedure (starting the measurement)

RATIO

- 1 Connect the DC input signal to the input terminals (INPUT HI and LOW).**
- 2 Connect the reference signal to the input terminals (SENSE HI and LOW).**
- 3 Connect the SENSE LO terminal to the INPUT LO terminal.**
- 4 Press RATIO.**
- 5 Read the measured value on the display.**

NOTE

- To stop using this function, press any measurement function key.
- The max. DC input voltage is 1000 V, and the max. DC reference voltage is 200 V.
- At the SENSE terminals, DC voltage is always there while using the reference voltage measurement function which has a maximum measurable input of ± 1.2 Vdc.
- The INPUT LO and SENSE LO terminals, having a common reference, can not have a voltage difference greater than ± 0.2 V.
- The specified measurement range is used only for the signal connected to the input terminals. And the signal on the input terminals can be any dc voltage up to 1000 V.

Remote interface operation

```
CONFigure:VOLTage:DC:RATio{<range>|MIN|MAX|DEF}, {<resolution>|MIN|MAX|DEF}
```

% (Percentage)

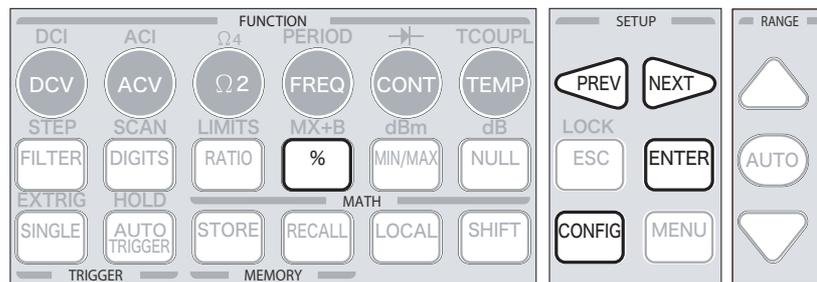
The percentage function expresses the ratio of the measured value to the specified target value as a percentage.

The equation is shown below.

$$\text{Percentage (\%)} = \frac{\text{Measured value}}{\text{Target value}}$$

The specified target value is stored. The setting is cleared when you turn the power switch off or reset the DME1600 through the remote interface.

Keys



Procedure (setting the target value)

Setting the target value

CONFIG	→	%	→	Target value	
--------	---	---	---	--------------	--

Starting the measurement

%

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press CONFIG.
- 2 Press %.
- 3 Press ENTER.
- 4 Press PREV or NEXT to move between digits and the up and down keys to set the value.
- 5 Press ENTER.

Procedure (starting the measurement)

- 6 Select the measurement function to use.
- 7 Press %.
The MATH indicator in the top area of the display lights.
- 8 Read the measured value on the display.
 - Press % again to disable this function.

Remote interface operation

```

CALCulate:FUNCTION PERCent
CALCulate:STATE {OFF|ON}
CALCulate:STATE?
CALCulate:PERCent:TARGet {<value> | MINimum | MAXimum}
CALCulate:PERCent:TARGet? [MINimum | MAXimum]

```

Maximum and Minimum

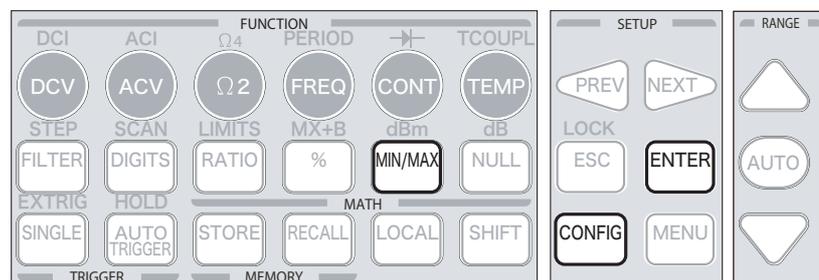
5

Math Functions

The maximum and minimum function stores the maximum and minimum values among a series of measured values and then calculates the average of all the measured values. The function also stores the number of measured values that have been acquired since the function was enabled. Whenever a new maximum or minimum value is acquired, the DME1600 beeps.

The stored data is cleared when you turn the power switch off, enable the maximum and minimum function, or reset the DME1600 through the remote interface.

Keys



Procedure (starting the measurement)

MIN/MAX

- 1** Select the measurement function to use.
 - 2** Press **MIN/MAX**.
The MATH indicator in the top area of the display lights.
- Press **MIN/MAX** again to disable this function.

Procedure (reading the maximum, minimum, average, and the number of measured values)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press CONFIG.**
- 2 Press MIN/MAX.**
The minimum value (MIN) appears.
- 3 Press NEXT.**
The maximum value (MAX) appears.
- 4 Press NEXT.**
The average value (AVERAGE) appears.
- 5 Press NEXT.**
The number of measured values (COUNT) appears.

Remote interface operation

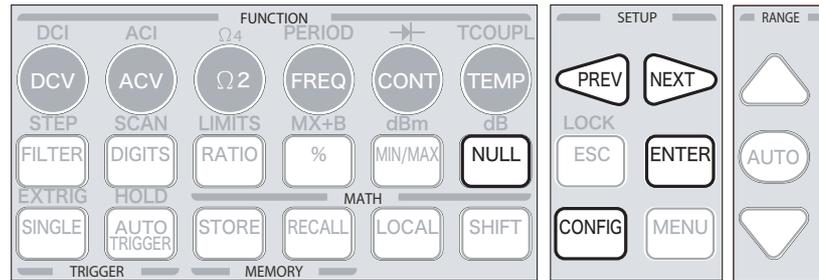
```

CALCulate:FUNCTION AVERAge
CALCulate:STATe {OFF|ON}
CALCulate:STATe?
CALCulate:AVERAge:MINimum?
CALCulate:AVERAge:MAXimum?
CALCulate:AVERAge:AVERAge?
CALCulate:AVERAge:COUNT?
  
```

Null

The null function displays the difference between the measured value and the stored null value. The null function can be enabled or disabled for each measurement function separately. You can also specify the null value. The null function is available to all functions except for continuity and diode testing. The null value is stored in memory but is cleared when the power switch is turned off.

Keys



5

Math Functions

Procedure (starting the measurement)

NULL

- To cancel the test leads' resistive components in 2-wire resistance measurement

- 1 Press **TERMINALS** to select front-panel or rear-panel input terminals.
- 2 Connect the test leads to the input terminals (INPUT Ω HI and LO).
- 3 Press **$\Omega 2$** .
- 4 Use the **RANGE** up, down, and **AUTO** keys to set the range.
There are two range modes: manual and auto.
- 5 Short the test lead tips.
- 6 Press **NULL**.
The **MATH** indicator in the top area of the display lights. The old value in the null register is replaced with the new measured value.
- 7 Connect the test lead tips to the measurement points.
- 8 Read the measured value on the display.
 - Press **NULL** again to disable this function.

Procedure (setting the null value)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press CONFIG.
- 2 Press NULL.
- 3 Press PREV or NEXT to move between digits and the up and down keys to set the value.
- 4 Press ENTER.

Remote interface operation

```

CALCulate:FUNCTION
NULLCALCulate:STATE {OFF|ON}
CALCulate:STATE?
CALCulate:NULL:OFFSet {<value>|MAXimum|MINimum}
  
```

Upper and Lower Limit Test

The upper and lower limit test function tests the measured value against the specified upper and lower limits. When the measured value exceeds the upper limit or falls below the lower limit, the DME1600 beeps and displays “HI” or “LO.” The function is available to all functions except for continuity and diode testing.

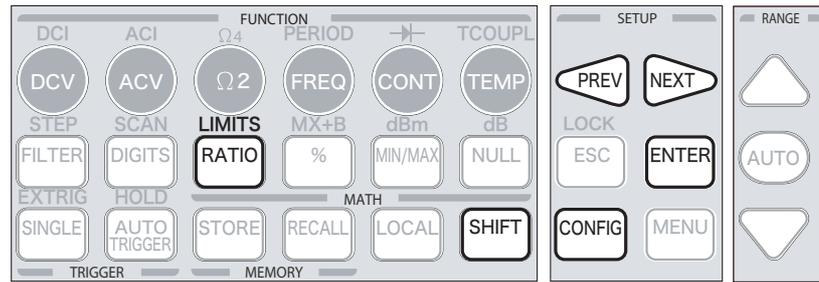
NOTE

You can also use this HI/LO measurement as a Pass/Fail application through the USB interface’s pin 2 and pin3. But you cannot use USB for remote control. For details, refer to “Pass/Fail Output from the USB Connector” to the Remote Interface Manual.

Setup conditions

Factory default settings The upper and lower limits are both set to zero.

Keys



Procedure (setting the upper and lower limits)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press CONFIG.
- 2 Press LIMITS (SHIFT+RATIO).
- 3 Press PREV or NEXT to select MIN or MAX.
- 4 Press ENTER.
- 5 Press PREV or NEXT to move between digits and the up and down keys to set the value.
- 6 Press ENTER.

Procedure (starting the measurement)

LIMITS

- 1 Select the measurement function to use.
The continuity test and diode test cannot be selected.
- 2 Press LIMITS (SHIFT+RATIO).
The MATH indicator in the top area of the display lights.
- 3 Read the measured value on the display.
 - Press LIMITS (SHIFT+RATIO) again to disable this function.

Remote interface operation

```

CALCulate:FUNCTION
LIMitCALCulate:STATe {OFF|ON}
CALCulate:STATe?
CALCulate:LIMit:LOWer {<value>|MINimum|MAXimum}
CALCulate:LIMit:UPPer {<value>|MINimum|MAXimum}
  
```

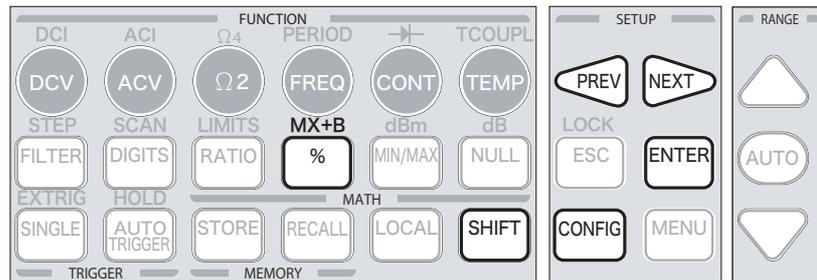
This function multiplies measured value X by M and adds offset B. The result—Y, which is based on the following equation—appears on the display.

$$Y = MX + B$$

This function determines value Y that is linearly proportional to measured value X as defined by slope M and offset B. You can set constants M and B.

Constants M and B are cleared when you turn the power switch off or reset the DME1600 through the remote interface.

Keys



Procedure (setting constants M and B)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press CONFIG.
- 2** Press MX+B (SHIFT+%).
- 3** Press PREV or NEXT to select M or B.
- 4** Press ENTER.
- 5** Press PREV or NEXT to move between digits and the up and down keys to set the value.
- 6** Press ENTER.

Procedure (starting the measurement)

MX+B

- 1** Select the measurement function to use.
- 2** Press **MX+B (SHIFT+%)**.
The MATH indicator in the top area of the display lights.
- 3** Read the measured value on the display.
 - Press **MX+B (SHIFT+%)** again to disable this function.

Remote interface operation

```

CALCulate:FUNctIon MXB
CALCulate:STATe {OFF|ON}
CALCulate:STATe?
CALCulate:MXB:MMFactor {<value>|MINimum|MAXimum}
CALCulate:MXB:MMFactor? [MINimum|MAXimum]
CALCulate:MXB:MBFactor {<value>|MINimum|MAXimum}
CALCulate:MXB:MBFactor? [MINimum|MAXimum]

```

dBm

The dBm function displays the measured voltage as a power level (relative to 1 mW), dissipated through a reference resistance. You can only use this function in DC voltage measurement and AC voltage measurement. The dBm value is calculated using the following equation.

$$\text{dBm} = 10 \times \log((\text{square of the measured value}/\text{reference resistance})/1 \text{ mW})$$

You can set the reference resistance to a value between 50 Ω and 8 000 Ω .

Even if you change the reference resistance, the stored reference value is not affected. The reference resistance is cleared when you turn the power switch off or reset the DME1600 through the remote interface.

Setup conditions

Factory default setting	Reference resistance 600 Ω
-------------------------	-----------------------------------

Keys



Procedure (setting the reference resistance)

CONFIG → **dBm** → **{50|... |8000}**

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press **CONFIG**.
- 2 Press **dBm** (**SHIFT+MIN/MAX**).
- 3 Press **PREV** or **NEXT** to move between digits and the up and down keys to set the value.
- 4 Press **ENTER**.

Procedure (starting the measurement)

dBm

- 1 Press **DCV** or **ACV**.
- 2 Press **dBm** (**SHIFT+MIN/MAX**).
The MATH indicator in the top area of the display lights.

3 Read the measured value on the display.

- Press dBm (SHIFT+MIN/MAX) again to disable this function.

Remote interface operation

```
CALCulate:FUNCTION DBM
CALCulate:STATE {OFF|ON}
CALCulate:STATE?
CALCulate:DBM:REFERENCE {<value>|MINimum|MAXimum}
```

dB

5

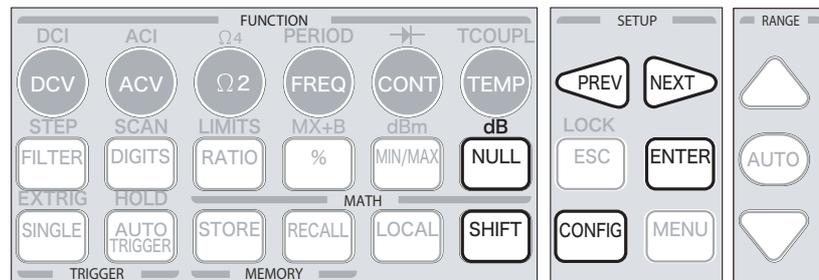
The dB function displays the measured value relative to a reference value in decibels. Both the measured value and the reference value are converted to dBm values, and the difference between them is displayed. You can only use this function in DC voltage measurement and AC voltage measurement. The dB value is calculated using the following equation.

$$\text{dB} = \text{measured value (dBm)} - \text{reference value (dBm)}$$

You can set the reference value manually or assign the first measured value to it. You can manually set the reference value to a value in the range of 0 dBm \pm 200 dBm.

The reference value is cleared when you turn the power switch off or reset the DME1600 through the remote interface.

Keys



Procedure (setting the reference value manually)

CONFIG → **dB** → **{-200|...|+200}**

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press DCV or ACV.
- 2 Press CONFIG.
- 3 Press dB (SHIFT+NULL).

- 4** Press PREV or NEXT to move between digits and the up and down keys to set the value.
- 5** Press ENTER.

Procedure (setting the reference value to the first measured value)

dB

- 1** Press DCV or ACV.
- 2** Check that a measured value is being displayed.
- 3** Press dB (SHIFT+NULL).
The MATH indicator in the top area of the display lights. The measured value is assigned to the relative reference level (0 dB).
- 4** Read the measured value on the display.
 - Press dB (SHIFT+NULL) again to disable this function.

Remote interface operation

```
CALCulate:FUNction DB
CALCulate:STATe {OFF|ON}
CALCulate:STATe?
CALCulate:DB:REFerence {<value>|MINimum|MAXimum}
```



6

System Settings

This chapter explains the system settings.

Overview of the System Settings

The following system settings are available.

Function group	Function		See
Other function settings	Display	Display on and off	p. 96
	Beeper	Beep sound on and off	p. 97
	Measurement memory	Stores 2000 measured values	p. 99
	Hold	Measured value hold	p. 101
	Initial mode	For selecting the mode that the DME1600 starts in when the power switch is turned on	p. 102
	Language	Communication command language	p. 103
	Error indicators	Displays errors	p. 104
	Firmware version check	Three microprocessors	p. 105
	Calibration information display	Previous calibration date	p. 106
	Scan function	10-channel scanner option	p. 107

Display

The DME1600 display consists of a 13-digit, 5x7 dot matrix measurement display area and a 16-digit, 5x7 dot matrix bottom information display area. The display shows three colors (white, red, and yellow).

The display also consists of top and right information display areas where a variety of status information is displayed.

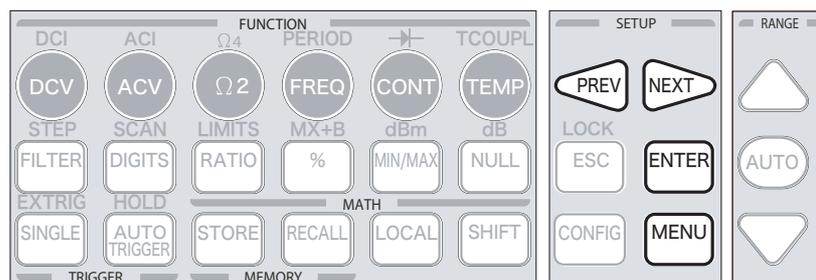
The display can be turned off to perform fast measurements through the remote interface. When the display is turned off, the OFF indicator lights in the right information display area. This enables fast measurements because there is no I/O delay. Even when the display is turned off, information related to the front-panel RECALL, MENU, and CONFIG keys is displayed.

You can display messages that are received through the remote interface (from a PC for example) in the bottom information display area.

Setup conditions

Factory default settings	The display is on. The setting is cleared when you turn the power switch off or reset the DME1600 through the remote interface.
--------------------------	---------------------------------------------------------------------------------------------------------------------------------

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press MENU.
- 2** Press PREV or NEXT to select SYSTEM.
- 3** Press ENTER.
- 4** Press PREV or NEXT to select DISPLAY.
- 5** Press ENTER.
- 6** Press PREV or NEXT to select ON or OFF.
- 7** Press ENTER.

Remote interface operation

Messages from the remote interface take precedence over messages received from the front panel.

```

DISPlay {OFF|ON}
DISPlay:TEXT <quoted string>
DISPlay:TEXT:CLear

```

Turns the display on and off
 Displays the entered character string
 Clears the displayed message

Beeper

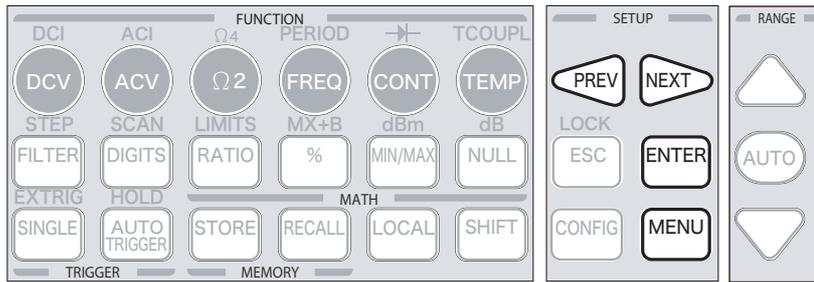
The DME1600 beeps under certain conditions and when errors occur. If you do not want the DME1600 to beep, you can this feature off. You cannot turn off the click sounds that are produced when you press keys.

The beep on/off setting returns to its factory default value when you turn the power switch off or reset the DME1600 through the remote interface.

Setup conditions

Events that do not cause the DME1600 to beep when the beep is turned off	A new maximum or minimum value is detected by the maximum and minimum math function.
	A stable measured value is detected and is put on hold.
	The test voltage is within the limits in diode tests.
	A failure occurs in upper and lower limit tests.
Events that cause the DME1600 to beep even when the beep is turned off	An error occurs.
	A front-panel key is pressed.
	The threshold value is exceeded in continuity tests.
Factory default setting	On.

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press MENU.
- 2** Press PREV or NEXT to select SYSTEM.
- 3** Press ENTER.
- 4** Press PREV or NEXT to select BEEP.
- 5** Press ENTER.
- 6** Press PREV or NEXT to select ON or OFF.
- 7** Press ENTER.

Remote interface operation

```

SYSTEM:BEEPer
SYSTEM:BEEPer:STATE {OFF|ON}
  
```

Measurement memory

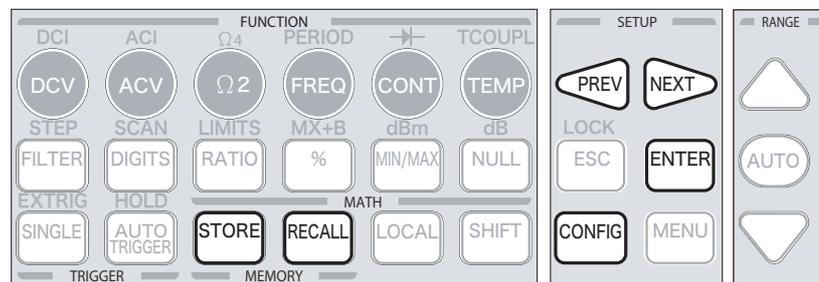
The DME1600 has a memory area that can store 2000 measured values. Measured values are stored to volatile memory in first-in, first-out order. The stored values are cleared when the power switch is turned off.

The memory can be used for all measurement functions, math operations, trigger operations, and the measured value hold feature.

Setup conditions

Number of measured values to store	Up to 2000 values. The specified number of values to store is reset to its factory default value when the power switch is turned off.
Factory default setting	The number of measured values to store is 100.

Keys



Procedure (setting the number of measured values to store)

CONFIG → **STORE** → **{1|... |2000}**

The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- You can set the number of values to store only from the front panel.
- 1 Press **CONFIG**.
 - 2 Press **STORE**.
 - 3 Press **PREV** or **NEXT** to move between digits and the up and down keys to set the value.
 - 4 Press **ENTER**.

Procedure (saving measured values)

STORE

See p. 72

- To use the measurement memory, you have to select the measurement function (this includes math functions) and the trigger mode before you press STORE.

1 Press STORE.

The MEM indicator in the top area of the display lights. The DME1600 starts storing measured values to memory and keeps doing so until the specified number is reached. When the specified number is reached, the MEM indicator turns off.

Procedure (recalling measured values)

RECALL

1 Press RECALL.

The first stored measured value appears.

2 Press PREV or NEXT to move between digits and the up and down keys to select the measured value.

The measured values that are stored are displayed one by one.

Remote interface operation

The measured values are transmitted in the first-in, first-out order from the remote interface.

INITiate

FETCh?

DATA: POINTs?

Sets the DME1600 to the trigger-wait state. When the DME1600 performs a measurement, the measured value is stored in memory.

To retrieve the stored measured value, use this command.

To retrieve the number of stored measured values, use this command.

Hold Feature

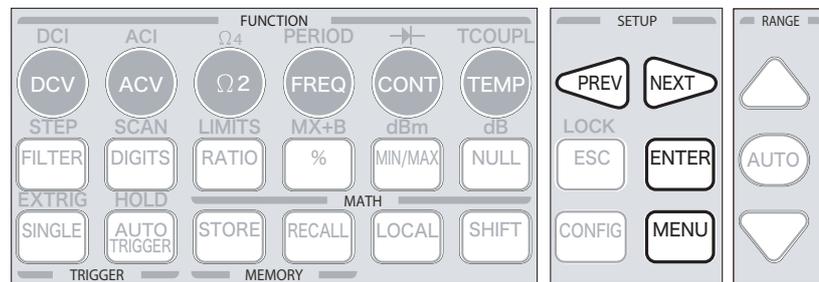
The measured value hold feature checks that measured values are stable and displays the measured value. If this feature is enabled, when the measured value stabilizes within a specified range, the measured value is held, and a beep sound is generated.

Set the sensitivity band that is used to determine whether the measured values are sufficiently stable. The sensitivity band is expressed as a percentage of the measured value in the selected range. When three consecutive measurements are within the sensitivity band, the DME1600 considers the measured values to be stable.

Setup conditions

Factory default setting	The default sensitivity band is 0.1 %. The setting is saved, but it is cleared when the power switch is turned off.
-------------------------	---------------------------------------------------------------------------------------------------------------------

Keys



Procedure (setting the sensitivity band)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press MENU.
- 2 Press PREV or NEXT to select TRIG.
- 3 Press ENTER.
- 4 Press PREV or NEXT to select READ HOLD.
- 5 Press ENTER.
- 6 Press PREV or NEXT to select the sensitivity band.
- 7 Press ENTER.

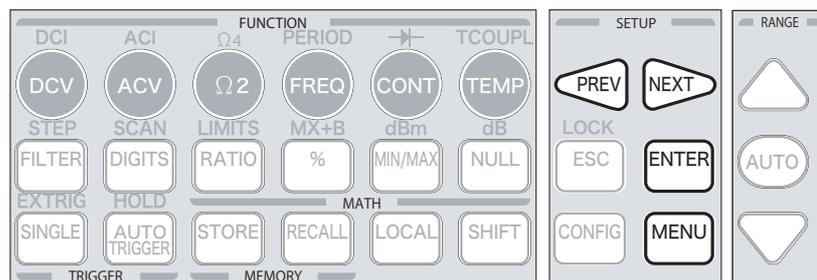
Initial Mode

You can select the initial mode, which is the mode that the DME1600 starts in when the power switch is turned on. There are two modes: SAVE DATA and DEFAULT. In SAVE DATA mode, the DME1600 starts with the stored conditions for the items indicated in the table below. In DEFAULT mode, the DME1600 starts with factory default conditions.

Setup conditions

Stored items for SAVE DATA mode	Continuity test	Threshold resistance
	Diode test	Threshold forward voltage
	Temperature measurement (RTD)	Type, unit, user defined, SPRTD
	Temperature measurement (thermocouple)	Type, unit
	Scan, step features	Count and interval for scan and step
	dBm math function	Reference resistance
	MX+B math function	M and B values
	Hold feature	Sensitivity band
	Input resistance	DC input resistance
	Interface	USB, GPIB address
	System settings	Language, beep

Keys



Procedure



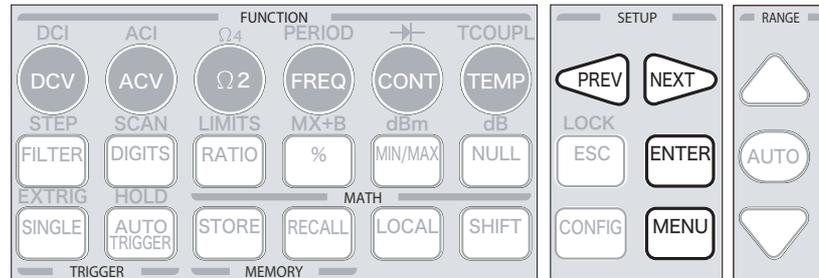
The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press MENU.
- 2 Press PREV or NEXT to select SYSTEM.
- 3 Press ENTER.
- 4 Press PREV or NEXT to select INIT MODE.
- 5 Press ENTER.
- 6 Press PREV or NEXT to select SAVE DATA or DEFAULT.
- 7 Press ENTER.

Language

The DME1600 supports two communication command languages: DEFAULT (the factory default setting) and COMPATIBLE (compatible with the 34401A multimeter by Agilent Technologies).

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press MENU.
- 2 Press PREV or NEXT to select SYSTEM.
- 3 Press ENTER.
- 4 Press PREV or NEXT to select LANGUAGE.
- 5 Press ENTER.
- 6 Press PREV or NEXT to select DEFAULT or COMPATIBLE.
- 7 Press ENTER.

Error Indicator

The error indicator on the display warns you that an error has occurred on the DME1600. If a command syntax error or hardware error is found, the ERR indicator in the top area of the display lights.

Errors are stored in first in, first out (FIFO) order. Up to 20 errors are stored. The error that was detected first is displayed first.

NOTE

- The ERR indicator turns off when all the stored errors are read from memory.
- If no errors are found, "NO ERRORS" is displayed.
- If more than 20 errors are found, the last error will be replaced with "-350" to indicate that there are too many errors.
- Errors are cleared when the power switch is turned off or when the DME1600 receives a *CLS command.

Keys



Procedure



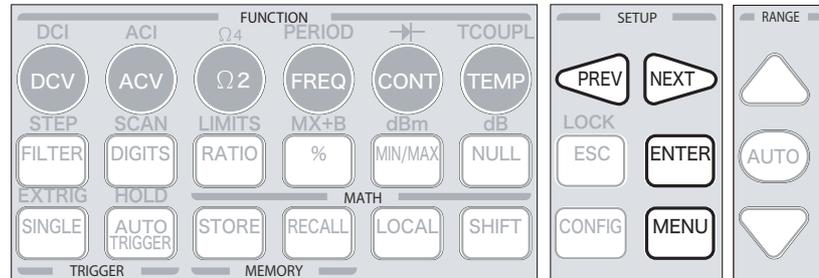
The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press MENU.**
- 2 Press PREV or NEXT to select SYSTEM.**
- 3 Press ENTER.**
- 4 Press PREV or NEXT to select ERROR.**
- 5 Press ENTER.**
The error message appears.

Viewing the Firmware Versions

The DME1600 has three microprocessors. For each processor, you can view the installed firmware version.

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press MENU.**
- 2 Press PREV or NEXT to select SYSTEM.**
- 3 Press ENTER.**
- 4 Press PREV or NEXT to select SYSTEM VER.**
- 5 Press ENTER.**

The firmware versions appear.

The version is displayed in the following format: xx-xx-xx. The first number is the measurement microprocessor firmware version. The second is the I/O microprocessor firmware version. The third is the front-panel microprocessor firmware version.

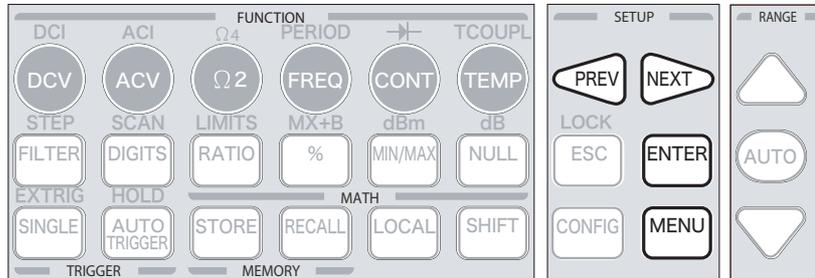
NOTE

- To use the 10-channel thermocouple scanner card (DME1600-opt12), the measurement microprocessor's firmware version must be 1.03 or later. For information about firmware updating, contact your Kikusui agent or distributor.

Calibration Information Display

The DME1600 can display the previous calibration date.

Keys



Procedure



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press MENU.**
- 2 Press PREV or NEXT to select CAL MENU.**
- 3 Press ENTER.**
- 4 Press PREV or NEXT to select DATE.**
- 5 Press ENTER.**
The previous calibration date appears.

Scan Function (Option)

Installing a scanner card option adds a scan function to the DME1600. The following three types of scanner cards are available.

- 10-channel scanner card (DME1600-opt01)
- 20-channel scanner card (DME1600-opt09)
- 10-channel thermocouple scanner card (DME1600-opt12)

With the scanner card, you can set the measurement function separately for each channel. The DME1600 measures the specified channels in order, and when the number of measurements reaches the scan count, the DME1600 stops measurement.

The scan function can operate in one of two modes: scan or step. In scan mode, set the scan interval. The scanning of 10 or 20 channels is considered one scan operation. In step mode, set the step interval, which is the interval between measurements of different channels.

The set scan interval and step interval are cleared when the power switch is turned off.

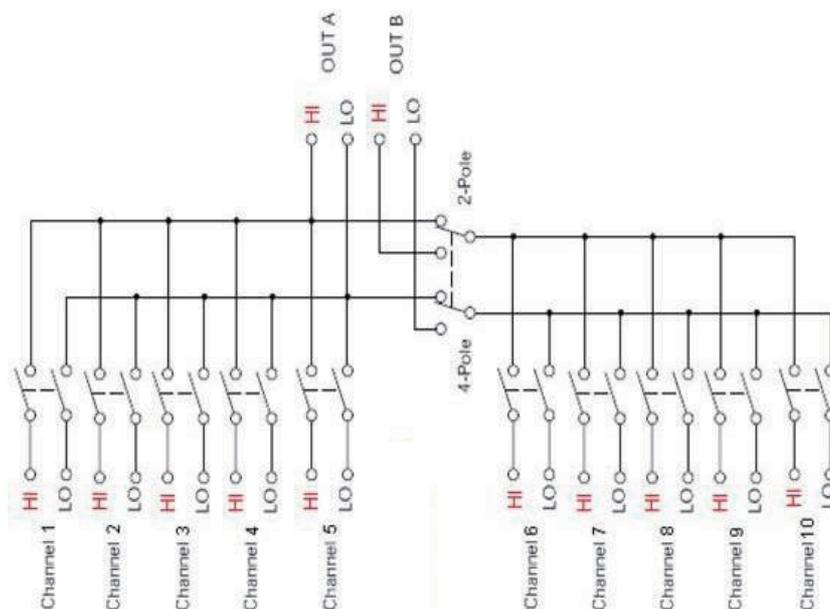
To use these options, use the TERMINALS switch on the front panel to select the rear panel terminals.

Configuration and specifications of a scanner card (DME1600-opt01)

This section describes the 10-channel scanner card (DME1600-opt01). For information about other scanner cards, see the user's guide for the relevant card.

• Switch configuration

There are HI and LO input terminals for Channel 1 through Channel 10. Relay contacts are used to switch between inputs. There are two outputs, OUT A and OUT B. When the scanner is used in a 2-wire input (2W 10-channel) configuration, the output (4-Pole, 2-Pole) switch switches to the 2-Pole side, and OUT A is enabled. When the scanner is used in a 4-wire input (4W 5-channel) configuration, the output (4-Pole, 2-Pole) switch switches to the 4-Pole side, and both OUT A and OUT B are enabled.



● **Scanner card ratings**

Item	Ratings
Maximum AC input	125 Vrms, 175 Vpeak, 100 kHz, 1 A (switched), 62.5 VA (resistive load)
Maximum DC input	110 V, 1 A (switched), 30 VA (resistive load)
Contact life	> 100000 operations (under rated load), > 100000000 operations (cold switching)
Actuation time	5 ms maximum on/off
Contact potential	±500 nV typical, 1 μV maximum
Signal terminal	Screw terminal block, AWG22 wire size
Isolation	Between channels: ≥ 10 GΩ, ≤ 75 pF Between any channel and earth: ≥ 10 GΩ, ≤ 150 pF
Maximum common mode voltage	350 Vpeak between any channel and earth
Maximum voltage between input terminals	Between channels: 200 Vpk Between any channel and LO input terminal: 200 Vpk

● **Scanner card measurement speed**

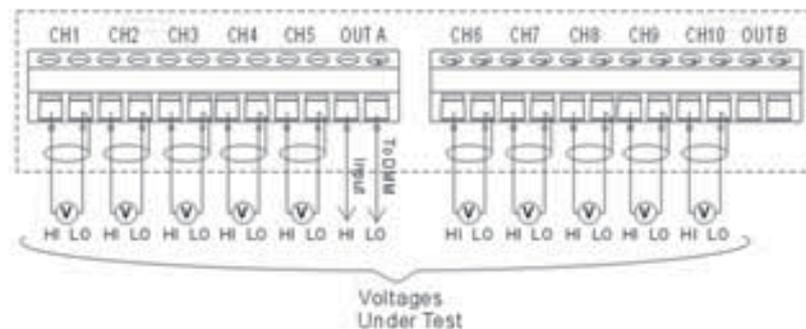
Measurement function	Integration time (PLC)	Resolution	Number of scanned channels per second ¹
Single function (DCV)	0.02	Fast 4 1/2	29.4
	0.1	Slow 4 1/2, Fast 5 1/2	27.0
	1	Slow 5 1/2, Fast 6 1/2	19.0
	10	Slow 6 1/2	4.9
Mixed functions (DCV+2W)	0.02	Fast 4 1/2	6.5
	0.1	Slow 4 1/2, Fast 5 1/2	6.3
	1	Slow 5 1/2, Fast 6 1/2	4.5
	10	Slow 6 1/2	1.2

1 Auto zero adjustment off, auto gain off, auto range off, scan interval 0, line frequency 60 Hz

Scanner card wiring

10-channel voltage measurement

This section gives an example of a 10-channel voltage measurement. Input channels CH1 to CH10 are used. Connect OUT A to the DME1600's rear-panel INPUT terminals.



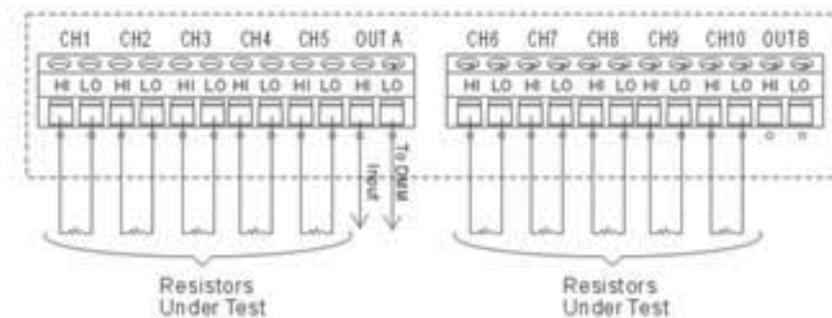
10-channel and 5-channel resistance measurement

This section gives examples for 2-wire resistance measurement (10 channels) and 4-wire resistance measurement (5 channels).

- **2-wire resistance measurement (10 channels)**

For 2-wire resistance measurement, input terminals CH1 to CH10 are used. Connect OUT A to the DME1600's rear-panel INPUT terminals.

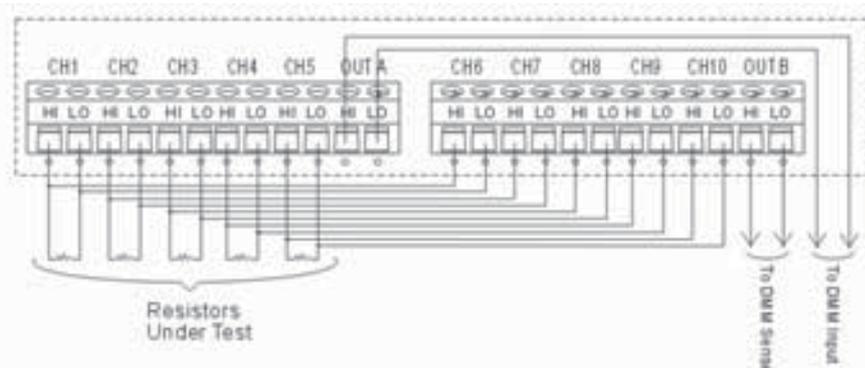
2-wire resistance measurement



- **4-wire resistance measurement (5 channels)**

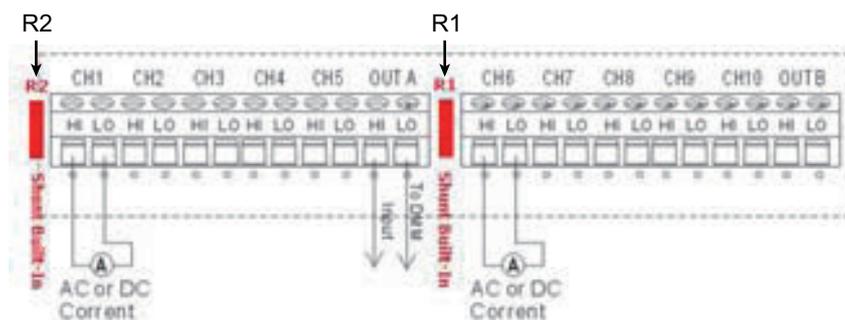
For 4-wire resistance measurement, the input terminal combinations are CH1-CH6, CH2-CH7, CH3-CH8, CH4-CH9, and CH5-CH10. Connect OUT A to the DME1600's rear-panel INPUT terminals. Connect OUT B to the DME1600's rear-panel SENSE input terminals.

4-wire resistance measurement



2-channel current measurement

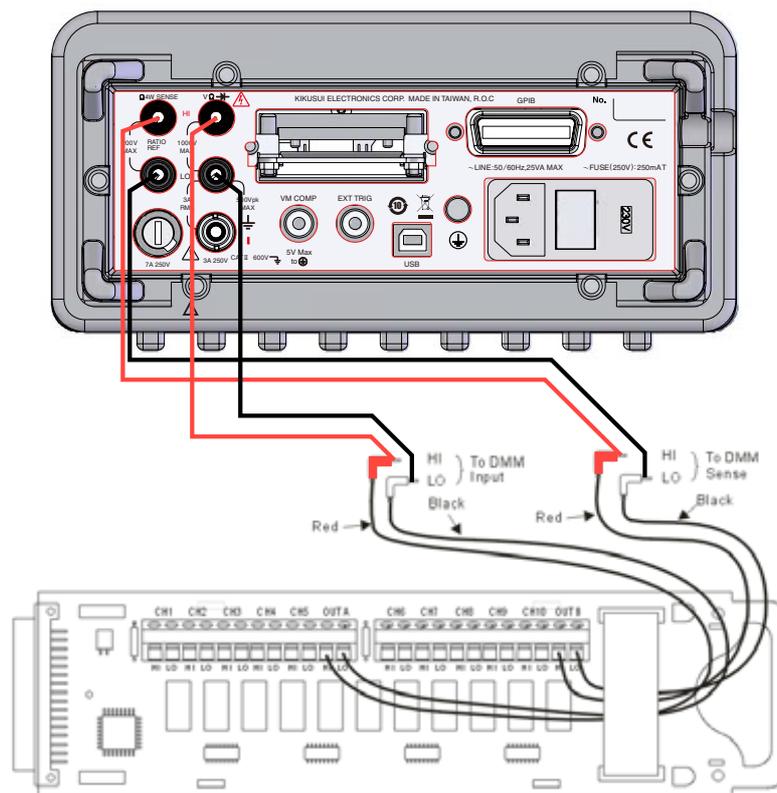
This section gives an example of a 2-channel current measurement. Connect shunt resistors to R1 and R2 of the scanner card. R1 and R2 must be of the same resistance. Input channels CH1 and CH6 are used. Connect OUT A to the DME1600's rear-panel INPUT terminals.



Connecting the scanner card

See p. 108

- 1 Open the scanner card cover.**
With your fingertips, remove the two cover locks that are inserted into the printed circuit board.
- 2 Wire the scanner card.**
- 3 Close the scanner card cover.**
- 4 Insert the scanner card connector into the DME1600's option slot.**
- 5 Fix the scanner card in place.**
Screw the scanner card to the rear panel. If the screws are not securely fastened, it can result in erroneous measurements.
- 6 Wire the DME1600's rear-panel input terminals.**
Connect the scanner card's OUT A to the DME1600's rear-panel INPUT terminals. Connect OUT B to the DME1600's rear-panel SENSE input terminals.



- 7 Press TERMINALS to select the rear-panel input terminals.**
The rear-panel input terminals are selected when the button is in the "in" position.

Configuring the scan function

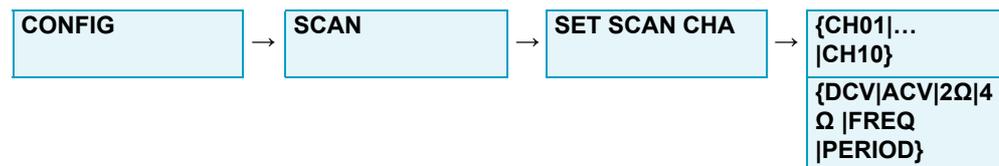
There are the following three scan function settings.

- Each channel's measurement function (DCV, ACV, 2Ω, 4Ω, FREQ, PERIOD)
- Scan count and scan interval
- Each channel's open/close state

Keys



Procedure (setting each channel's measurement function)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1 Press **CONFIG**.
- 2 Press **SCAN (SHIFT+DIGITS)**.
- 3 Press **PREV** or **NEXT** to select **SET SCAN CHA**.
- 4 Press **ENTER**.
- 5 Press **PREV** or **NEXT** to select the channel.
Select a channel from CH01 to CH10. Select "----" for channels that you are not going to use.
- 6 Press **ENTER**.
- 7 Press **PREV** or **NEXT** to select the measurement function.
Select DCV, ACV, 2Ω, 4Ω, FREQ, or PERIOD.
- 8 Press **ENTER**.
- 9 Repeat steps 5 to 8 to set all the channels.

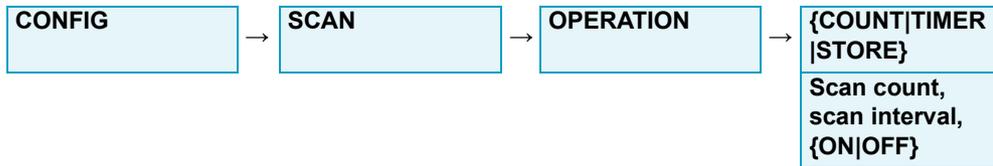
See p. 109

● **Current measurement settings**

For current measurement, connect shunt resistors to R1 and R2 of the scanner card. You can only measure current when these resistors are connected.

Channels CH1 and CH6 are used. Depending on the signal, set the measurement function to DCV or ACV. The MX+B math function is useful during these measurements. Set M to the reciprocal of the shunt resistor resistance and B to zero.

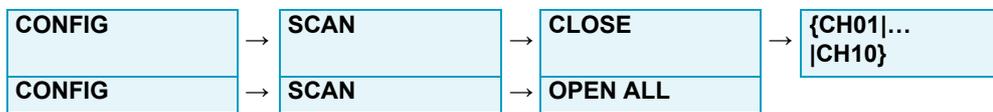
Procedure (setting the scan count and scan interval)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

- 1** Press CONFIG.
 - 2** Press SCAN (SHIFT+DIGITS).
 - 3** Press PREV or NEXT to select OPERATION.
 - 4** Press ENTER.
COUNT appears.
 - 5** Press PREV or NEXT to move between digits and the up and down keys to set the appropriate number.
 - 6** Press ENTER to enter the value.
TIMER appears. Return to step 5, and enter the constant.
STORE appears. Return to step 5, and enter ON or OFF.
 - 7** Press ENTER.
- If you set STORE to ON, measured results appear on the display after scan measurements. Press the up and down keys to select the result to display.

Procedure (opening or closing each channel)



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

■ Closing a specific channel

- 1 Press **CONFIG**.
- 2 Press **SCAN (SHIFT+DIGITS)**.
- 3 Press **PREV** or **NEXT** to select **CLOSE**.
- 4 Press **ENTER**.
CHANNEL appears.
- 5 Press **ENTER**.
- 6 Press **PREV** or **NEXT** to move between digits and the up and down keys to set the channel number.
- 7 Press **ENTER**.

■ Opening all channels

- 1 Press **CONFIG**.
- 2 Press **SCAN (SHIFT+DIGITS)**.
- 3 Press **PREV** or **NEXT** to select **OPEN ALL**.
- 4 Press **ENTER**.
All channels are opened.

Setting the step function

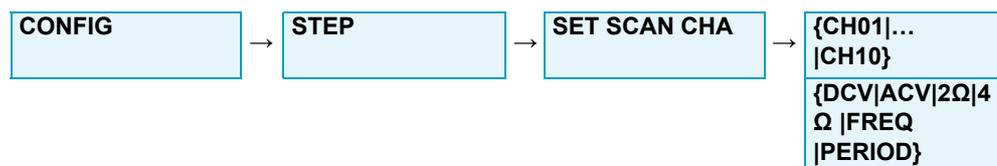
There are the following three step function settings.

- Each channel's measurement function
- Step count and step interval
- Each channel's open/close state

Procedure (setting each channel's measurement function)

See p. 111

The procedure is the same as with the scan function except that you need to press **STEP** instead of **SCAN**.

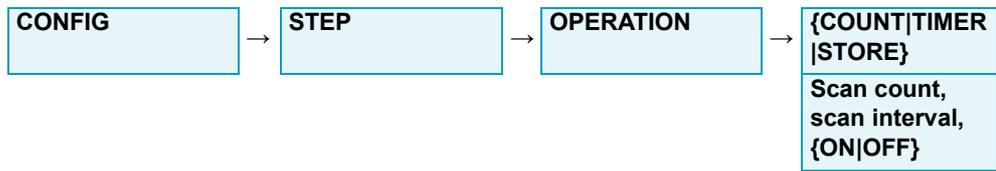


The **ENTER** key and keys for selecting the display items (**PREV**, **NEXT**, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

See p. 112

Procedure (setting the step count and step interval)

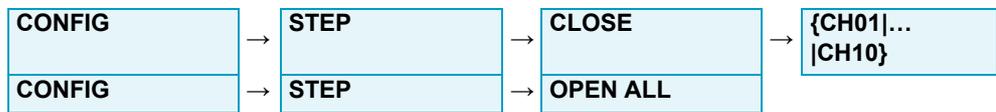
The procedure is the same as with the scan function except that you need to press STEP instead of SCAN. Read “scan count” as “scan interval” and “step count” as “step interval.”



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.

Procedure (opening or closing each channel)

The procedure is the same as with the scan function except that you need to press STEP instead of SCAN.



The ENTER key and keys for selecting the display items (PREV, NEXT, up, and down keys) have been omitted. Options are indicated as {option 1|option 2|option 3| . . . |option n}.



7

Specifications

This chapter contains the specifications of the DME1600.

DC characteristics

Accuracy

- \pm (% of reading + % of range)
- The specifications are for the following conditions: 6 1/2 digit resolution, minimum two-hour warm up, and auto trigger mode.
- Use the null function for the 2-wire / 4-wire resistance measurement method.

■ DC voltage

Range	Resolution	Input resistance	1 year (23 °C \pm 5 °C)
100.0000 mV	0.1 μ V	> 10 G Ω	0.0050+0.0035
1.000000 V	1.0 μ V	> 10 G Ω	0.0040+0.0007
10.00000 V	10 μ V	> 10 G Ω	0.0035+0.0005
100.0000 V	100 μ V	10 M Ω	0.0045+0.0006
1000.000 V	1 mV	10 M Ω	0.0045+0.0010

■ DC current

Range	Resolution	Shunt resistance	1 year (23 °C \pm 5 °C)
10.00000 mA	10 nA	5.1 Ω	0.050+0.020
100.0000 mA	100 nA	5.1 Ω	0.050+0.005
1.000000 A	1 μ A	0.1 Ω	0.100+0.010
3.000000 A	10 μ A	0.1 Ω	0.120+0.020

■ Resistance

Range	Resolution	Test current	1 year (23 °C \pm 5 °C)
100.0000 Ω	100 $\mu\Omega$	1 mA	0.010+0.004
1.000000 k Ω	1 m Ω	1 mA	0.010+0.001
10.00000 k Ω	10 m Ω	100 μ A	0.010+0.001
100.0000 k Ω	100 m Ω	10 μ A	0.010+0.001
1.000000 M Ω	1 Ω	5 μ A	0.010+0.001
10.00000 M Ω	10 Ω	500 nA	0.040+0.001
100.0000 M Ω	100 Ω	500 nA 10 M Ω	0.800+0.010

■ Diode test

Range	Resolution	Test current	1 year (23 °C \pm 5 °C)
1.0000 V	10 μ V	1 mA	0.010+0.020

■ Continuity test

Range	Resolution	Test current	1 year (23 °C \pm 5 °C)
1 k Ω	10 m Ω	1 mA	0.010+0.030

Measurement characteristics

Item		Specification
DC voltage measurement	Overrange	Permits voltages that are up to 20 % over the range except when the 1000 V range is in use
	Input bias current	Less than 30 pA (at 25 °C)
	Input voltage protection	1000 V for all ranges
DC current measurement	Overrange	Permits currents that are up to 20 % over the range except when the 3 A range is in use
Resistance measurement	Maximum test lead resistance	10 Ω (100 Ω range), 100 Ω (1 kΩ range), 1 kΩ (other ranges)
	Input voltage protection	1000 V for all ranges

Frequency and period characteristics

Accuracy

- \pm (% of reading)
- The specifications are for the following conditions: 6 1/2 digit resolution and minimum two-hour warm up.

Range	Frequency	1 year (23 °C \pm 5 °C)
100 mVrms to 750 Vrms	3 Hz to 5 Hz	0.10
	5 Hz to 10 Hz	0.05
	10 Hz to 40 Hz	0.03
	40 Hz to 300 kHz	0.01

Measurement characteristics

Item	Specification
Overrange	Permits voltages that are up to 20 % over the range except when the 750 Vrms range is in use
Measurement frequency	The maximum frequency for the 750 Vrms range is 100 kHz.

AC characteristics

Accuracy

- \pm (% of reading + % of range)
- The specifications are for the following conditions: 6 1/2 digit resolution, minimum two-hour warm up, and slow AC filter (3 Hz to 300 kHz bandwidth).
- Measured using a sine wave input whose amplitude is greater than 5% of range.

■ AC voltage (true rms value)

Range	Resolution	Frequency	1 year (23 °C \pm 5 °C)
100.0000 mV	0.1 μ V	3 Hz to 5 Hz	1.00+0.04
		5 Hz to 10 Hz	0.35+0.04
		10 Hz to 20 kHz	0.06+0.04
		20 kHz to 50 kHz	0.12+0.05
		50 kHz to 100 kHz	0.60+0.08
		100 kHz to 300 kHz	4.00+0.50
1.000000 V to 750.000 V	1.0 μ V to 1 mV	3 Hz to 5 Hz	1.00+0.03
		5 Hz to 10 Hz	0.35+0.03
		10 Hz to 20 kHz	0.06+0.03
		20 kHz to 50 kHz	0.12+0.05
		50 kHz to 100 kHz	0.60+0.08
		100 kHz to 300 kHz	4.00+0.50

■ AC current (true rms value)

Range	Resolution	Frequency	1 year (23 °C \pm 5 °C)
1.000000 A	1 μ A	3 Hz to 5 Hz	1.00+0.04
		5 Hz to 10 Hz	0.30+0.04
		10 Hz to 5 kHz	0.10+0.04
3.000000 A	10 μ A	3 Hz to 5 Hz	1.10+0.06
		5 Hz to 10 Hz	0.35+0.06
		10 Hz to 5 kHz	0.15+0.06

Measurement characteristics

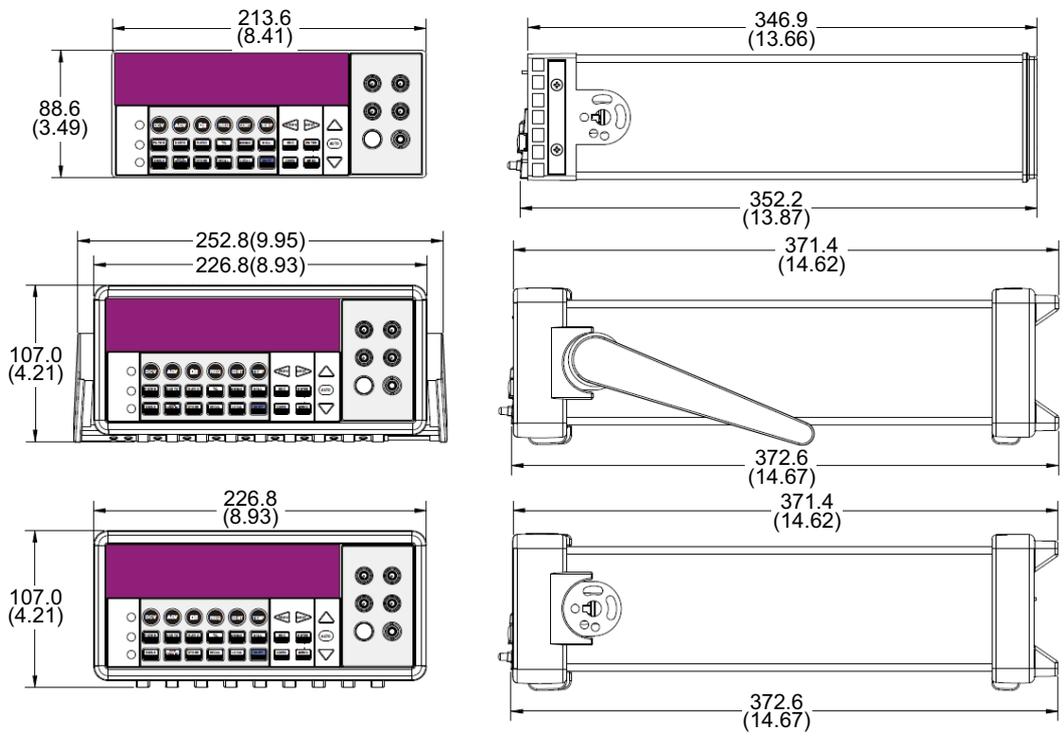
Item		Specification
AC voltage measurement	Addition of range	For input that is between 1 % and 5 % of range, add 0.1 % of range when the input frequency is less than 50 kHz, or add 0.13 % range when the input frequency is between 50 kHz and 100 kHz.
	Overrange	Permits voltages that are up to 20 % over the range except when the 750 Vrms range is in use
	Measurement frequency	The maximum frequency for the 750 Vrms range is 100 kHz.
AC current measurement	Overrange	Permits voltages that are up to 20 % over the range except when the 750 Vrms range is in use

General specifications

Item	Specification	
Input voltage range	100 Vac/120 Vac/220 Vac/240 Vac \pm 10 %, single phase	
Input frequency range	50 Hz/60 Hz \pm 10 %	
Power consumption	25 VAm _{ax}	
Operating temperature range	0 °C to 50 °C	
Operating humidity range	80 %rh or less (0 °C to 31 °C, no condensation)	
Storage temperature range	-40 °C to 70 °C (80 %rh or less, no condensation)	
Operating altitude	Up to 2000 m	
Dimensions	See Outline drawing.	
Weight	Approx. 3.7 kg (8.2 lb)	
Interface	USB 2.0, GPIB (factory option)	
Safety ¹	Complies with the requirements of the following directive and standard. Low Voltage Directive 2014/35/EU ² EN 61010-1 (Class I ³ , Pollution degree 2 ⁴) EN 61010-2-030	
Electromagnetic compatibility (EMC) ^{1 2}	Complies with the requirements of the following directive and standard. EMC Directive 2014/30/EU EN 61326-1 (Class B) EN 55011 (Class B, Group 1 ⁵) EN 61000-3-2 EN 61000-3-3	
Accessories	Power cord	1 pc. (with three-pronged plug)
	Standard test leads	1 red, 1 black
	USB cable	1 pc.
	Fuse (spare)	1 pc.
	CD-ROM ⁶	1 pc.
	Packing list, safety precautions	1 English, 1 Japanese

- 1 Does not apply to specially made or modified DME1600s.
- 2 Limited to products that have the CE mark on their panels.
- 3 This is a Class I equipment. Be sure to ground this product's protective conductor terminal. The safety of this product is only guaranteed when the product is properly grounded.
- 4 Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.
- 5 This is a Group 1 equipment. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.
- 6 Contains the User's Manual and the Remote Interface Manual.

Outline drawing



Unit: mm (inch)

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