



User Manual

Multimeter PCE-ITM 20



User manuals in various languages (français, italiano, español, português, nederlands, türk, polski, русский, 中文) can be found by using our product search on: www.pce-instruments.com

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1 Safety notes

Please read this manual carefully and completely before you use the device for the first time. The device may only be used by qualified personnel and repaired by PCE Instruments personnel. Damage or injuries caused by non-observance of the manual are excluded from our liability and not covered by our warranty.

- The device must only be used as described in this instruction manual. If used otherwise, this can cause dangerous situations for the user and damage to the meter.
- The instrument may only be used if the environmental conditions (temperature, relative humidity, ...) are within the ranges stated in the technical specifications. Do not expose the device to extreme temperatures, direct sunlight, extreme humidity or moisture.
- Do not expose the device to shocks or strong vibrations.
- The case should only be opened by qualified PCE Instruments personnel.
- Never use the instrument when your hands are wet.
- You must not make any technical changes to the device.
- The appliance should only be cleaned with a damp cloth. Use only pH-neutral cleaner, no abrasives or solvents.
- The device must only be used with accessories from PCE Instruments or equivalent.
- Before each use, inspect the case for visible damage. If any damage is visible, do not use the device.
- Do not use the instrument in explosive atmospheres.
- The measurement range as stated in the specifications must not be exceeded under any circumstances.
- NEVER apply voltage or current to the meter that exceeds the specified maximum:

Input Protection Limits	
Function	Maximum input
V DC or V AC	1000 VDC/AC RMS
mA AC/DC	500 mA 1000 V fast acting fuse
A AC/DC	10 A 1000 V fast acting fuse (20 A for 30 seconds max. every 15 min)
Frequency, resistance, capacitance, duty cycle, diode test, continuity	1000 VDC/AC rms
Temperature	1000 VDC/AC RMS
Surge protection	8 kV peak in line with IEC 61010

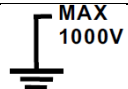
- USE EXTREME CAUTION when working with high voltages.
- DO NOT measure voltage if the voltage on the "COM" input jack exceeds 1000 V above earth ground.
- NEVER connect the meter leads across a voltage source while the function switch is in the current, resistance, or diode mode. Doing so can damage the meter.
- ALWAYS discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.
- ALWAYS turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.
- NEVER operate the meter unless the back cover and the battery and fuse covers are in place and fastened securely.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Do not use the meter or test leads if they look damaged. Use extreme caution when working around bare conductors or bus bars.
- Accidental contact with the conductor could result in electric shock.
- Be careful when working with voltages above 60 V DC or 30 V AC RMS. Such voltages pose a shock hazard.

- Before making resistance measurements or testing acoustic continuity, disconnect the circuit from the main power supply and all loads from the circuit.
- Non-observance of the safety notes can cause damage to the device and injuries to the user.

We do not assume liability for printing errors or any other mistakes in this manual.

We expressly point to our general guarantee terms which can be found in our general terms of business.

1.1 Safety symbols

	This symbol can appear next to another symbol, device or connection and indicates the user must refer to the manual for important safety information.
	This WARNING symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	This CAUTION symbol indicates a potentially hazardous situation which, if not avoided, may result in damage to the product.
	Indicates the terminal(s) so marked must not be connected to a circuit where the voltage with respect to earth ground exceeds 1000 VAC or VDC.
	This symbol adjacent to one or more terminals identifies them as being associated with ranges that may, in normal use, be subject to particularly hazardous voltages. For maximum safety, the meter and its test leads should not be handled when these terminals are energized.
	Equipment is protected by double or reinforced insulation.

1.2 IEC1010 overvoltage installation categories

OVERVOLTAGE CATEGORY I

Equipment of **OVERVOLTAGE CATEGORY I** is equipment for connection to circuits in which measures are taken to limit the transient overvoltages to an appropriate low level.

Note-Examples include protected electronic circuits.

OVERVOLTAGE CATEGORY II

Equipment of **OVERVOLTAGE CATEGORY II** is energy-consuming equipment to be supplied from the fixed installation.

Note-Examples include household, office, and laboratory appliances.

OVERVOLTAGE CATEGORY III

Equipment of **OVERVOLTAGE CATEGORY III** is equipment in fixed installations.

Note-Examples include switches in the fixed installations and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY IV

Equipment of **OVERVOLTAGE CATEGORY IV** is for use at the origin of the installation.

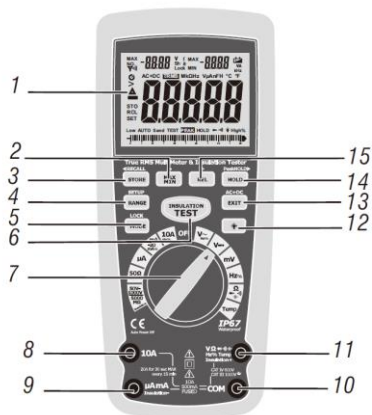
Note-Examples include electricity meters and primary over-current protection equipment.

2 Device description

Device / keys

- 1 - 50,000 count LCD
- 2 - MAX/MIN (-) button
- 3 - STORE (<RECALL) button
- 4 - RANGE (SETUP) button
- 5 - MODE (LOCK) button
- 6 - INSULATION TEST button
- 7 - Function switch
- 8 - 10 A input jacks
- 9 - mA, μ A and insulation input jacks
- 10 - COM input jack
- 11 - Positive input jack
- 12 - Backlight button
- 13 - EXIT (AC+DC) button
- 14 - HOLD (PeakHOLD>) button
- 15 - REL (+) button

The tilt stand and battery compartment are on the rear side of the unit.



Display



Continuity



Diode test



Battery status

n

nano (10^{-9}) (capacitance)

μ

micro (10^{-6}) (amps, cap)

m

milli (10^{-3}) (volts, amps)

A

Amps

k

kilo (10^3) (ohms)

F

Farads (capacitance)

M

mega (10^6) (ohms)

Ω

Ohms

PEAK

Peak Hold

Hz

Hertz (frequency)

V

Volts

%

Per cent (duty ratio)

Δ

Relative

AC

Alternating current

AUTO

Autoranging

DC

Direct current

HOLD

Display hold

$^{\circ}$ F

Degrees Fahrenheit

$^{\circ}$ C

Degrees Centigrade

MAX

Maximum

MIN

Minimum

No.

Serial number

S

Second

SET

Setup parameter

AC + DC

Alternating current
+ direct current

TRMS

True RMS

STO

Store

RCL

Recall



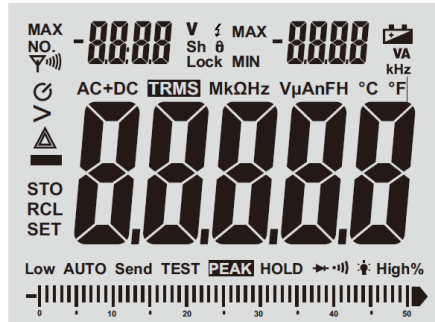
Auto Power Off enabled



Backlight



RF transmitter active



Other symbols

: While testing the insulation resistance, the symbol "" flashes frequently if the voltage is over 30 V.

: While testing the insulation resistance, the symbol "" flashes frequently and the buzzer warns continually if the outside voltage is over 30 V. The symbol "" is indicated while $LO\Omega \leq 35\Omega$ and the buzzer warns continuously.

LOCK: Push down the "LOCK" button while you are testing the insulation resistance. The meter will enter insulation resistance status and the symbol "" is indicated.

LOBAT: The display shows "LOBAT" when the voltage drops below 7.5 V.

HOLD: The current value is held.

V, M Ω , Ω : The measured dimension units

3 Operation

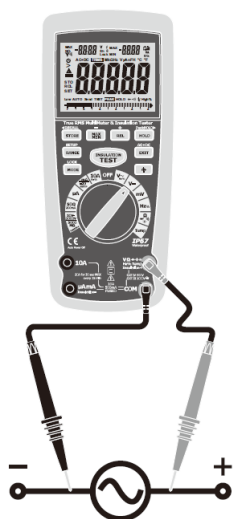
WARNING Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

- ALWAYS turn the function switch to the OFF position when the meter is not in use.
- If "OL" appears in the display during a measurement, the value exceeds the range you have selected. Change to a higher range.

3.1 DC Voltage Measurements

CAUTION Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the green VDC position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive V jack.
- Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
- Read the voltage in the display.



3.2 AC Voltage (Frequency, Duty Cycle) Measurements

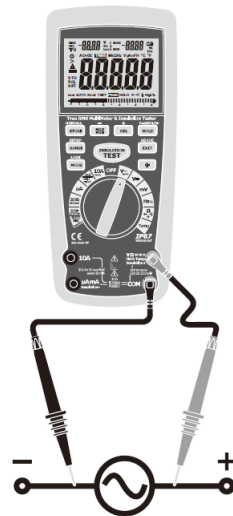
WARNING

Risk of Electrocutation. The probe tips may not be long enough to contact the live parts inside some 240 V outlets for appliances because the contacts are recessed deep in the outlets. As a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are touching the metal contacts inside the outlet before assuming that no voltage is present.

CAUTION

Do not measure AC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the green VAC/Hz/% position.
- Insert the black test lead banana plug into the negative COM jack. Insert red test lead banana plug into the positive V jack.
- Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the “hot” side of the circuit.
- Read the voltage in the main display and the frequency in the right auxiliary display.
- Press the MODE button to indicate “Hz”.
- Read the frequency in the main display.
- Press the MODE button again to indicate “%”.
- Read the % of duty cycle in the main display.
- Press EXIT for 2 seconds into the function of AC+DC. Test DC and AC TRUE RMS.
- When the voltage of VAC>0.2V, the frequency of VAC can be read synchronously in the right auxiliary display.

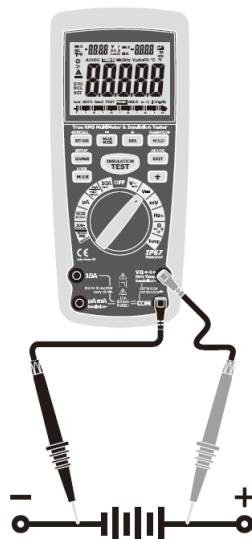


3.3 mV Voltage Measurements

CAUTION

Do not measure mV voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the green mV position.
- Press the MODE button to indicate "DC" or "AC", or in AC range press EXIT for two seconds and choose "AC+DC".
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive V jack.
- Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
- Read the mV voltage in the main display.
- When mVac>2mV, the frequency of mVac can be read synchronously in the right auxiliary display.

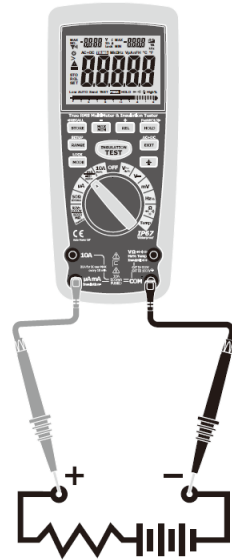


3.4 DC Current Measurements

CAUTION

Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

- Insert the black test lead banana plug into the negative COM jack.
- For current measurements up to 5000 μA DC, set the function switch to the yellow μA position and insert the red test lead banana plug into the $\mu\text{A}/\text{mA}$ jack.
- For current measurements up to 500 mA DC, set the function switch to the yellow mA position and insert the red test lead banana plug into the mA jack.
- For current measurements up to 20 A DC, set the function switch to the yellow 10A/HZ/% position and insert the red test lead banana plug into the 10 A jack.
- Press the MODE button to indicate "DC" on the display.
- Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
- Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
- Apply power to the circuit.
- Read the current in the display.

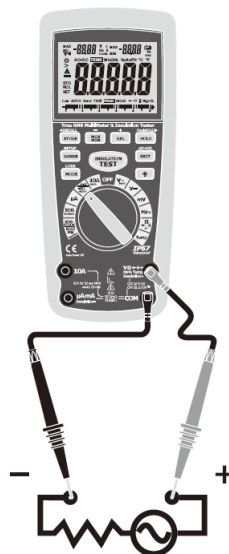


3.5 AC Current (Frequency, Duty Cycle) Measurements

CAUTION

Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

- Insert the black test lead banana plug into the negative COM jack.
- For current measurements up to $5000\mu\text{A}$ AC, set the function switch to the yellow μA position and insert the red test lead banana plug into the $\mu\text{A}/\text{mA}$ jack.
- For current measurements up to 500mA AC, set the function switch to the yellow mA position and insert the red test lead banana plug into the $\mu\text{A}/\text{mA}$ jack.
- For current measurements up to 20A AC, set the function switch to the yellow $10\text{A}/\text{HZ}/\%$ position and insert the red test lead banana plug into the 10A jack.
- Press the MODE button to indicate "AC" on the display.
- Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
- Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the "hot" side of the circuit.
- Apply power to the circuit.
- Read the current in the display. In the 10A AC range, the right auxiliary displays frequency.
- Press and hold the MODE button to indicate "Hz".
- Read the frequency in the display.
- Momentarily press the MODE button again to indicate "%".
- Read the % duty cycle in the display.
- Press and hold the MODE button to return to current measurement.
- Press EXIT for 2 seconds into the function of AC+DC. Test DC and AC TRUE Rms.
- When $\mu\text{A}_{\text{ac}} > 2\text{mA}$, $\text{mA}_{\text{ac}} > 2\text{mA}$, $10\text{A}_{\text{ac}} > 0.2\text{A}$, the current frequency can be read synchronously in the right auxiliary display.

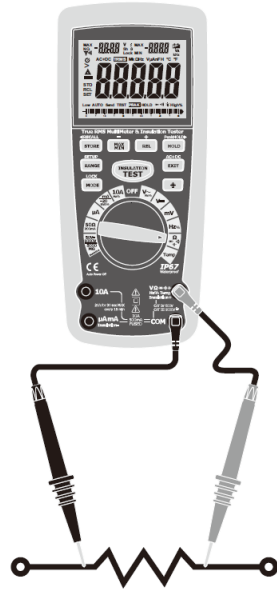


3.6 Resistance Measurements

WARNING

WARNING To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. Remove the batteries and unplug the line cords.

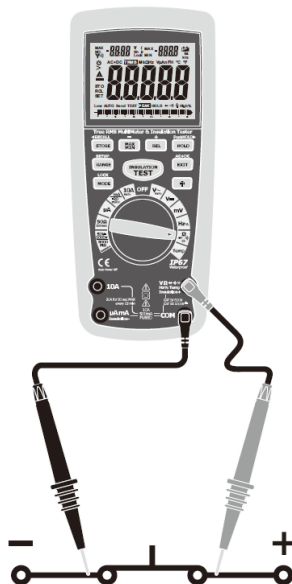
- Set the function switch to the green Ω CAP  position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive Ω jack.
- Press the MODE button to indicate " Ω " on the display.
- Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
- Read the resistance in the display.



3.7 Continuity Check

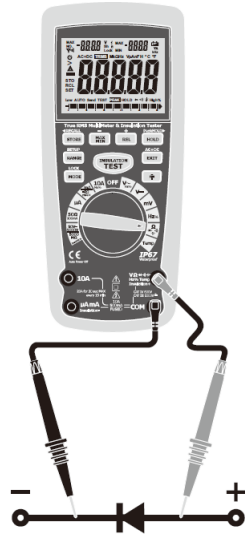
WARNING To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

- Set the function switch to the green Ω CAP $\rightarrow + \cdot \cdot \cdot \cdot$ position.
- Insert the black lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive Ω jack.
- Press the MODE button to indicate “ $\cdot \cdot \cdot \cdot$ ” and “ Ω ” on the display.
- Touch the test probe tips to the circuit or wire you wish to check.
- If the resistance is less than approximately 35Ω , the audible signal will sound. If the circuit is open, the display will indicate “OL”.



3.8 Diode Test

- Set the function switch to the green Ω CAP $\rightarrow \rightarrow \rightarrow$ position.
- Insert the black test lead banana plug into the negative COM jack and the red test lead banana plug into the positive V jack.
- Press the MODE button to indicate " $\rightarrow \rightarrow \rightarrow$ " and "V" on the display.
- Touch the test probes to the diode under test. Forward voltage will typically indicate 0.400 ... 0.700V. Reverse voltage will indicate "OL". Shorted devices will indicate near 0V and an open device will indicate "OL" in both polarities.

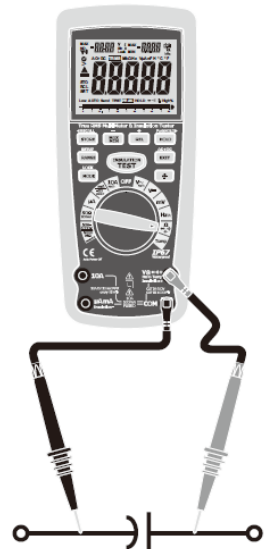


3.9 Capacitance Measurements

WARNING

To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

- Set the rotary function switch to the green Ω CAP $\rightarrow \rightarrow \rightarrow$ position.
- Insert the black test lead banana plug into the negative COM jack.
- Insert the red test lead banana plug into the positive V jack.
- Press the MODE button to indicate "F"
- Touch the test leads to the capacitor to be tested.
- Read the capacitance value in the display



3.10 Temperature Measurements

- Set the function switch to the green Temp position.
- Insert the Temperature Probe into the input jacks, making sure to observe the correct polarity.
- Press the MODE button to indicate "°F" or "°C".
- Touch the Temperature Probe head to the part whose temperature you wish to measure. Keeps the probe touching the part under test until the reading stabilizes (about 30 seconds).
- Read the temperature in the display.

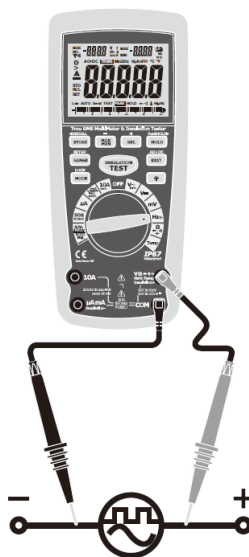
Note:

The temperature probe is fitted with a K-type mini connector. A mini connector to banana connector adaptor is supplied for connection to the input banana jacks.



3.11 Frequency (Duty Cycle) Measurements (electronic)

- Set the rotary function switch to the green H z/% position.
- Insert the black lead banana plug into the negative COM jack and the red test lead banana plug into the positive Hz jack.
- Touch the test probe tips to the circuit under test.
- Read the frequency on the display.
- Press the MODE button to indicate "%".
- Read the % duty cycle in the display.



3.12 % 4 – 20mA Measurements

- Set up and connect as described for DC mA measurements.
- Set the rotary function switch to the 4-20mA% position. Press and hold the MODE button to indicate “%4-20mA”.
- The meter will display loop current as a % with 0mA=-25%, 4mA=0%, 20mA=100%, and 24mA=125%.

3.13 LO Measurements

- Set the function switch to the green 50Ω/200mA position.
- Insert the black test lead banana plug into the negative INSULATION- jack. Insert the red test lead banana plug into the positive jack.
- Connect the tips of the test leads to both ends of the circuit under test. read resistance in Ω on the LCD. The two ranges (50.000/500.00Ω) can be switched automatically; the primary display of the resistance in Ω, flashes synchronously with the analog bar.
- When the impedance on circuit is below approximately ≤35Ω. It will indicate by a continuous beeper.
- The current is from 200 to 220mA while the tested resistance is 0Ω.

3.14 Insulation Resistance Measurements

- Set the function switch to the green 50~1000V/5000MΩ position.
- Press the RANGE key to step through the available voltages until you select the voltage you want. You can choose 50V, 125V, 250V, 500V or 1000V. There are 4 ranges: 4MΩ, 40MΩ, 400MΩ, 4000MΩ, can be switched automatically for every voltage block.
- Primary display shows insulation resistance and unit is MΩ, synchronized with analog bar. The left auxiliary display shows current insulation voltage outpour measurement, the right auxiliary display shows setting insulation voltage outpour measurement, unit V.
- Before measurement check the voltage range of tested device is applicable to the requirement of insulation measurement voltage. Please ensure there are no parts that will be damaged by insulation measurement voltage. Many parts will be damaged under 1000V (and other ranges). For example, power factor capacitor, low voltage insulation cable, electronic dimmer and common electronic parts are all possible to be damaged under 1000V (and other ranges). Turn to related voltage range after confirming the voltage.
- Connect two measurement leads to tested device; Push down and hold the “TEST” button /or press the “LOCK” key first and then the “TEST” button, if the tested is electriferous and its voltage (AC/DC) is over 30V, it will refuse work and no high-voltage testing occurs, simultaneity, it shows “>30V” on the LCD, the symbol “” flashes, and the buzzer warns frequently. If the tested is diselectriferous or its voltage is lower than 30V, it will enter into the formal testing process and brings the high-voltage. On the primary display, the insulation resistance in MΩ is indicated in-phase with analog bar; on the secondary display, the tested insulation voltage in V (DC) is indicated, the symbol “” flashes and the buzzer warns frequently.
- Being free from the “TEST” button or pushing down the “TEST” button in the “LOCK” status can exit from the “LOCK” status and shutoff the high-voltage, synchronously, the resistance values is indicated in the primary display will be held, and the secondary display still be in the status of monitoring the insulation voltage for the tested. Measurement is over. Subsequently, both ends of the wire insulation voltage measurement by instrument internal electronic switch release voltage.
- Turning the function switch can exit automatically from testing status during the process.
- Absorptance & Polarize measurement mode: In the insulation test condition, press the MAX/MIN key to activate the Absorptance & Polarize measurement mode. The left auxiliary display shows Absorptance measurement, the right auxiliary display shows Polarize measurement.

3.15 Application Example

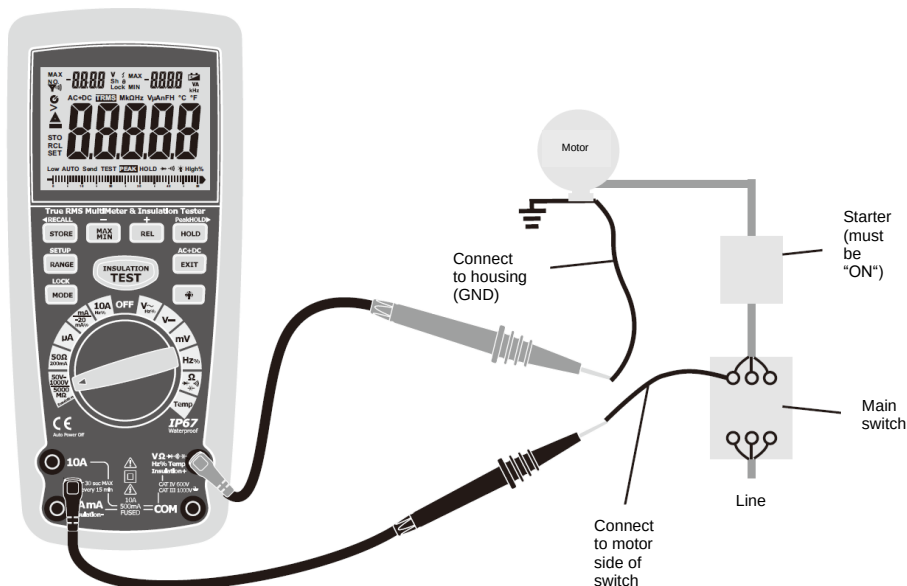
Power tools and small appliances

This test would also apply to other similar equipment that has a line cord. For double insulated power tools, the megohmmeter lead shown connected to the housing would be connected to some metal part of the tool (e. g. chuck, blade).

Note: The switch of the device must be in the "ON" position and the main power should be disconnected.

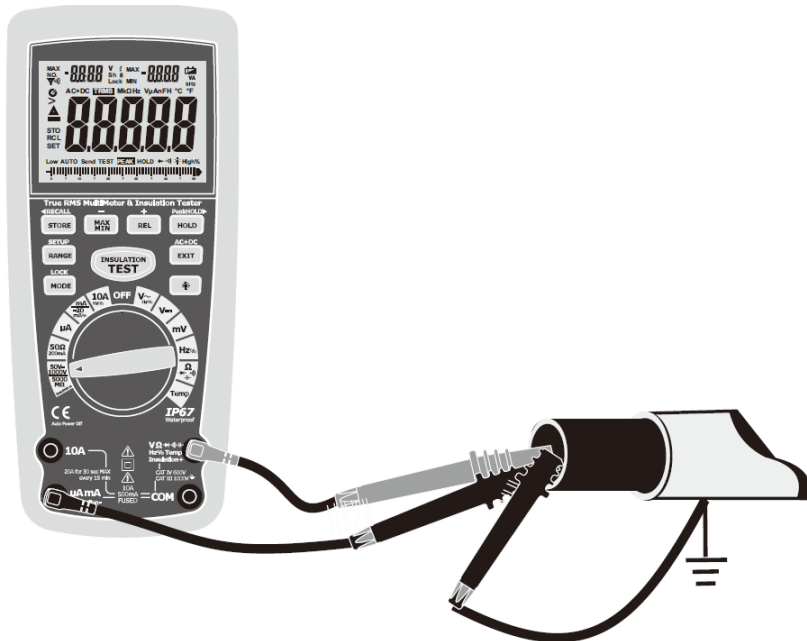
Motors

AC-Disconnect the motor from the line by disconnecting the wires at the motor terminals or by opening the main switch. If the main switch is used and the motor also has a starter then the starter must be held, by some means, in the "ON" position. In the latter case, the measured resistance will include the resistance of the motor, wire and all other components between the motor and the main switch. If a weakness is indicated, the motor and other components should be checked individually. If the motor is disconnected at the motor terminals, connect one megohmmeter lead to the grounded motor housing and the other lead to one of the motor leads. DC-Disconnect the motor from the line. To test the brush rigging, field coils and armature, connect one megohmmeter lead to the grounded motor housing and the other lead to the brush on the commutator. If the resistance measurement indicates a weakness, raise the brushes off the commutator and separately test the armature, field coils and brush rigging by connecting one megohmmeter lead to each of them individually, leaving the other connected to the grounded motor housing. The above also applies to DC generators.



Cables

Disconnect the cable from the line. Also disconnect opposite end to avoid errors due to leakage from other equipment. Check each conductor to ground and /or lead sheath by connecting one megohmmeter lead to a ground and /or lead sheath and the other megohmmeter lead to each of the conductors in turn. Check insulation resistance between conductors by connecting megohmmeter leads to conductors in pairs.



3.16 Autoranging/Manual Range Selection

When the meter is first turned on, it automatically goes into Autoranging. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For measurement situations requiring that a range be manually selected, perform the following:

1. Press the RANGE key. The "AUTO" display indicator will turn off.
2. Press the RANGE key to step through the available ranges until you select the range you want.
3. To exit the Manual Ranging mode and return to Autoranging, press EXIT

Note: Manual ranging does not apply for the Temperature functions.

3.17 MAX/MIN

1. Press the MAX/MIN key to activate the MAX/MIN recording mode. The display icon "MAX" will appear. The meter left auxiliary display will display and hold the maximum reading and will update only when a new "max" occurs. The display icon "MIN" will appear. The right auxiliary display meter will display and hold the minimum reading and will update only when a new "min" occurs.
2. To exit MAX/MIN mode, press EXIT.

3.18 Relative Mode

The relative measurement feature allows you to make measurements relative to a stored reference value. A reference voltage, current, etc. can be stored and measurements made in comparison to that value. The displayed value is the difference between the reference value and the measured value. Note: Relative mode does not operate in the 4-20mA function.

1. Perform the measurement as described in the operating instructions.
2. Press the REL button to store the reading in the display and the "REL" indicator will appear on the display.
3. Left auxiliary display displays the margin of initial value and the current value. Right auxiliary display displays the initial reading. Main display the reading after REL TEST.
4. Press the EXIT button to exit the relative mode.

3.19 Display Backlight

Press the  key to turn the backlight on. The backlight will automatically turn off after SET time. Press the EXIT button to exit the backlight on mode.

3.20 HOLD

The hold function freezes the reading in the display. Press the HOLD key momentarily to activate or to exit the HOLD function.

3.21 PEAK HOLD

The Peak Hold function captures the peak AC or DC voltage or current. The meter can capture negative or positive peaks as fast as 1 millisecond in duration. Momentarily press the PEAK button, "PEAK" and "MAX" will display in left auxiliary display. "MIN" will display in right auxiliary display. The meter will update the display each time a lower negative peak occurs. Press the EXIT button to exit the PEAK HOLD mode. Auto Power Off feature will be disabled automatically in this mode.

3.22 Data Record (Store/Recall)

1. STORE function

In the current testing mode, press STORE button one time, enter into STORE function. On the left upper corner of LCD shows NO XXXX., which states current storage serial number. Then, press button PEAKHOLD to change into the initial serial number 0000. (Press again it will change back). On the right upper corner of LCD shows XXXX, which states how many current storage is used. Press STORE button again, enter into recording interval time set up function. On the left upper shows 0000 S, which states recording interval time; using button + & - to select, the range is 0~255 seconds. When the recording interval time is 0000 S, then press STORE button again to change into manual recording. Press the STORE button again to record once. When the recording interval time is 1~255 S, then press STORE button again to start recording automatically from 0000. Recording times is showed on the left upper corner, data is showed on the right upper corner (Due to digital limitation, there is only display preceding four numbers) To finish above STORE function, press EXIT button shortly. If you expect to clear all memory data: While power on, hold EXIT button, and switch from OFF to random and then release EXIT button, the LCD will flash thrice and buzzer thrice too, which means all memory data is cleared.

2. RECALL function

Press STORE button two seconds to enter into RECALL function. On the left upper corner shows XXXX, which states current storage serial number. On the right upper corner shows XXXX, which states how many current storage is used. Press button PEAKHOLD shortly once to scan data from 0000 to XXXX continuously. Press again then scan again. Use button + & — button to select serial number XXXX on the left upper corner and record data on the right upper corner. To finish above RECALL function, press EXIT button.

3.23 Parameter setting up (SET)

1. Press the RANGE button for seconds to enter into SET function. Then press once shortly, change the setting content.

Setting content includes (in sequence): A: upper limit buzzer alarm

B: lower limit buzzer alarm

C: auto power off time

D: turn off phonating

E: back lit time

Use ←, +, -, → buttons to select the parameter

2. Press SET button continuously to switch to setting content, till exiting set up to testing mode. So the updated setting content is saved. If press EXIT button in this period, all setting cannot be saved.

3.24 AC+DC

In all the measuring mode VAC, mV(AC), 10A(AC), mA(AC), uA(AC), press button EXIT for 2 seconds to enter into AC+DC testing. The precision is the same as AC measurement. LCD shows AC+DC signal. Press button EXIT to exit.

3.25 Low Battery Indication

When the  icon appears alone in the display, the battery should be replaced.

3.26 Calibration Method

There is one method to use MCU calibration: manual panel keyboard method. (Only for manufacturing, measurement and calibration, operation method is described in another document).

4 Maintenance

WARNING

To avoid electric shock, disconnect the test leads from any source of voltage before removing the back cover or the battery or fuse covers.

WARNING

To avoid electric shock, do not operate your meter until the battery and fuse covers are in place and fastened securely.

This multimeter is designed to provide years of dependable service, if the following care instructions are observed:

- KEEP THE METER DRY. If it gets wet, wipe it off.
- USE AND STORE THE METER IN NORMAL TEMPERATURES. Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.
- HANDLE THE METER GENTLY AND CAREFULLY. Dropping it can damage the electronic parts or the case.
- KEEP THE METER CLEAN. Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents or detergents.
- USE ONLY FRESH BATTERIES OF THE RECOMMENDED SIZE AND TYPE. Remove old or weak batteries so they do not leak and damage the unit.
- IF THE METER IS TO BE STORED FOR A LONG PERIOD OF TIME, the batteries should be removed to prevent damage to the unit.

4.1 Battery Installation

WARNING

To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery cover.

- Turn power off and disconnect the test leads from the meter.
- Open the rear battery cover by removing two screws (B) using a Phillips head screwdriver.
- Insert the battery into battery holder, observing the correct polarity.
- Put the battery cover back in place. Secure with the screws.

WARNING

To avoid electric shock, do not operate the meter until the battery cover is in place and fastened securely.

Note:

If your meter does not work properly, check the fuses and batteries to make sure that they are still good and that they are properly inserted.

4.2 Replacing the Fuses

WARNING To avoid electric shock, disconnect the test leads from any source of voltage before removing the meter cover.

- Disconnect the test leads from the meter.
- Remove the protective rubber holster.
- Remove the battery cover (two "B" screws) and the battery.
- Remove the six "A" screws securing the rear cover.
- Gently remove the old fuse and install the new fuse into the holder.
- Always use a fuse of the proper size and value (0.5A/1000V fast blow for the 500mA range, 10A/1000V fast blow for the 20A range)
- Replace and secure the rear cover, battery and battery cover.

WARNING To avoid electric shock, do not operate your meter until the fuse cover is in place and fastened securely.

5 Technical specifications

Test voltage / test current	Measuring range	Resolution	Accuracy
50V 1-mA @ 50 kΩ	0.01 ... 5 MΩ	0.0001 MΩ	± (4 % + 20 digits)
	5 ... 50 MΩ	0.001 MΩ	± (4 % + 20 digits)
	50 ... 500 MΩ	0.01 MΩ	± (4 % + 20 digits)
	500 ... 1000 MΩ	0.1 MΩ	not specified
125V / 1-mA @ 125 kΩ	0.01 ... 5 MΩ	0.001 MΩ	± (2 % + 20 digits)
	5 ... 50 MΩ	0.001 MΩ	± (2 % + 20 digits)
	50 ... 500 MΩ	0.01 MΩ	± (3 % + 20 digits)
	500 ... 5000 MΩ	0.1 MΩ	± (4 % + 20 digits)
250V / 1-mA @ 250 kΩ	0.01 ... 5 MΩ	0.0001 MΩ	± (2 % + 20 digits)
	5 ... 50 MΩ	0.001 MΩ	± (2 % + 20 digits)
	50 ... 500 MΩ	0.01 MΩ	± (3 % + 20 digits)
	500 ... 5000 MΩ	0.1 MΩ	± (4 % + 20 digits)
500V / 1-mA @ 500 kΩ	0.01 ... 5 MΩ	0.0001 MΩ	± (2 % + 20 digits)
	5 ... 50 MΩ	0.001 MΩ	± (2 % + 20 digits)
	50 ... 500 MΩ	0.01 MΩ	± (3 % + 20 digits)
	500 ... 5000 MΩ	0.1 MΩ	± (4 % + 20 digits)
1000V / 1-mA @ 1000 kΩ	0.01 ... 5 MΩ	0.0001 MΩ	± (2 % + 20 digits)
	5 ... 50 MΩ	0.001 MΩ	± (2 % + 20 digits)
	50 ... 500 MΩ	0.01 MΩ	± (3 % + 20 digits)
	500 ... 5000 MΩ	0.1 MΩ	± (4 % + 20 digits)
Short circuit current	<1.5-mA		

Multimeter	Measuring range	Resolution	Accuracy
Measuring parameters	50 mV	0.001 mV	± (0.06 % + 20 digits)
DC	500 mV	0.01 mV	± (0.06 % + 6 digits)
	5 V	0.0001 V	± (0.06 % + 4 digits)
	50 V	0.001 V	± (0.06 % + 4 digits)
	500 V	0.01 V	± (0.06 % + 4 digits)
	1000 V	0.1 V	± (0.1 % + 3 digits)
AC	50 mV	0.001 mV	± (1 % + 50 digits)
AC + DC	500 mV	0.01 mV	± (1 % + 50 digits)
50 1000 Hz	5 V	0.0001 V	± (1 % + 30 digits)
	50 V	0.001 V	± (1 % + 30 digits)
	500 V	0.01 V	± (1 % + 30 digits)
	1000 V	0.1 V	± (1 % + 30 digits)
The specified accuracy for alternating voltage refers to 5 ... 100% of the measuring range			
Direct current	Measuring range	Resolution	Accuracy
	500 µA	0.01 µA	± (0.5 % + 3 digits)
	5000 µA	0.1 µA	± (0.5 % + 3 digits)
	50 mA	0.001 mA	± (0.5 % + 3 digits)
	500 mA	0.01 A	± (0.5 % + 3 digits)
	10 A	0.001 A	± (0.5 % + 3 digits)
Alternating current AC + DC 50 1000 Hz	500 µA	0.01 µA	± (1% + 30 digits)
	5000 µA	0.1 µA	± (1% + 30 digits)
	50 mA	0.001 mA	± (1% + 30 digits)
	500 mA	0.01 A	± (1% + 30 digits)
	10 A	0.001 A	± (1% + 30 digits)
The specified accuracy for alternating current refers to 5 ... 100% of the measuring range			

Resistance	Measuring range	Resolution	Accuracy
	50 Ω	0.01 Ω	$\pm (0.2 \% + 20 \text{ digits})$
	500 Ω	0.1 Ω	$\pm (0.1 \% + 10 \text{ digits})$
	5 k Ω	0.0001 k Ω	$\pm (0.1 \% + 3 \text{ digits})$
	50 k Ω	0.001 k Ω	$\pm (0.1 \% + 3 \text{ digits})$
	500 k Ω	0.01 k Ω	$\pm (0.1 \% + 3 \text{ digits})$
	5 M Ω	0.001 M Ω	$\pm (1 \% + 10 \text{ digits})$
	50M Ω	0.001 M Ω	$\pm (1.5 \% + 50 \text{ digits})$
Capacitance	Measuring range	Resolution	Accuracy
	50 nF	0.001 nF	$\pm (1.5 \% + 50 \text{ digits})$
	50 nF	0.01nF	$\pm (1.5 \% + 10 \text{ digits})$
	500 nF	0.1 nF	$\pm (1.5 \% + 10 \text{ digits})$
	5 μ F	0.001 μ F	$\pm (1.5 \% + 5 \text{ digits})$
	50 μ F	0.01 μ F	$\pm (1.5 \% + 5 \text{ digits})$
	500 μ F	0.1 μ F	$\pm (1.5 \% + 5 \text{ digits})$
	5 mF	0.001 mF	$\pm (3 \% + 30 \text{ digits})$
	10 mF	0.01 mF	$\pm (3 \% + 30 \text{ digits})$
Frequency (Electronics)	Measuring range	Resolution	Accuracy
	50 Hz	0.001 Hz	$\pm (0.02 \% + 3 \text{ digits})$
	500 Hz	0.01 Hz	$\pm (0.02 \% + 3 \text{ digits})$
	5 kHz	0.0001 kHz	$\pm (0.02 \% + 3 \text{ digits})$
	50 kHz	0.001 kHz	$\pm (0.02 \% + 3 \text{ digits})$
	500 kHz	0.01 kHz	$\pm (0.02 \% + 3 \text{ digits})$
	5 MHz	0.0001 MHz	$\pm (0.02 \% + 3 \text{ digits})$
	50 MHz	0.001 MHz	$\pm (0.02 \% + 3 \text{ digits})$
	100 MHz	0.01 MHz	not specified
Sensitivity: 0.8 VRMS min @ 20% ... 80% duty cycle <100 kHz 5 V RMS min @ 20% ... 80% > 100 kHz			
	Measuring range	Resolution	Accuracy
Frequency (Electronics)	40 Hz ... 10 kHz	0.01 1 Hz ... 0.001 kHz	$\pm (0.1\%)$
Duty Cycle	0.1 ... 99.9%	0.01%	$\pm (1.2\% + 2 \text{ digits})$
Pulse width	100 μ S ... 100 ms; Frequency: 5 Hz ... 150 kHz		
Temperature -	58 ... 2462°F	0.1°F	$\pm (0.5 \% + 7^\circ\text{F})$
Type K Thermoelement	-50 ... 13350 °C	0.1°C	$\pm (0.5 \% + 3.5^\circ\text{C})$
4 ... 20 mA%	-25 ... 125%	0.01%	$\pm 50 \text{ digits}$
Resistance 50 Ω range	50 Ω	0.001 Ω	$\pm (1 \% + 20 \text{ digits})$
	500 Ω	0.01 Ω	$\pm (1 \% + 20 \text{ digits})$
Open circuit voltage: 5V; Overload protection 250V			

General information	
Memory	9999 memory points
Housing	Double moulded housing, IP67 (waterproof and dustproof)
Drop test	2 m / 6ft, 6in
Diode test	Test current 0.9-mA Open circuit voltage 2.8-mA
Continuity test	Acoustic signal at resistance < 35 Ω / Test current < 0.35-mA
Peak detection	> 1ms
Temperature sensor	Thermoelement Type K
Input impedance	DC: > 10 M Ω AC: > 9 M Ω
AC coupling	TRMS
Bandwidth AC voltage	50 Hz ... 1 kHz
Crest factor	<3 at 500V < 1.5 at 1000V
Display	50000 digit LCD illuminated with bargraph
Automatic shutdown	after 15 minutes
Measurement rate / update display	10 Hz
Power supply	6 x 1.5V AA batteries
Interface	Wireless USB
Fuses	mA, μ A: 0.5 A / 1000V fast ceramic A: 10 A / 1000V fast ceramic
Operating conditions	5 ... 40°C / 41 ... 104°F, max 80% r.H.
Storage conditions	-20 ... 60°C / -4 ... 140°F, max. 80% r.H.
Operating altitude	Max. 2000 m / 6561 feet
Weight	ca. 720 g / 1.6 lbs
Dimensions	220 x 95 x 50 mm / 8.6 x 3.7 x 1.9 in
Safety standards	EN61010-1
	IEC 61010-1 Part 2 (2001)
	CAT IV 600V, CAT III 1000V
	UL 61010-1 Part 2 (2004)
	CAN/CSA C22.2 No 6110-1 Part 2 (2004)
	UL 61010B-2-031 Part 1 (2003)

6 Test method of DAR and PI

Firstly, short press MAX/MIN in the Insulation switch, then press LOCK button. Secondly, press INSULATION TEST button to start the test of DAR and PI. One minute later, the test results of DAR will show on the screen. PI test results will show on the screen after 10 minutes. The reference value of DAR and PI are as following:

PI Standard

PI Value	2 ... 4 (typically 3)	1 ... 1.5	1	1.0 or less
Tested material status	Considered as good insulation (older types)	Not acceptable (older types)	(very high insulation resistance) Modern type of (good) insulation system	Fail

Example:

If the reading of B-class insulation material is 100M in 1minute, 110MΩ in 10 minutes, polarization index is 1.1(110MΩ/100MΩ=1.1). As the insulating material contains too much water or seriously polluted, the polarization index is below the minimum acceptable value, you need to repair or replace parts.

DAR Standard

DAR Value	1.6 or more	1.25-1.6	<1.25 OR less
Tested material status	Excellent	Pass	Fail

7 Contact

If you have any questions, suggestions or technical problems, please do not hesitate to contact us. You will find the relevant contact information at the end of this user manual.

8 Disposal

For the disposal of batteries in the EU, the 2006/66/EC directive of the European Parliament applies. Due to the contained pollutants, batteries must not be disposed of as household waste. They must be given to collection points designed for that purpose.

In order to comply with the EU directive 2012/19/EU we take our devices back. We either re-use them or give them to a recycling company which disposes of the devices in line with law.

For countries outside the EU, batteries and devices should be disposed of in accordance with your local waste regulations.

If you have any questions, please contact PCE Instruments.



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