

User's Guide

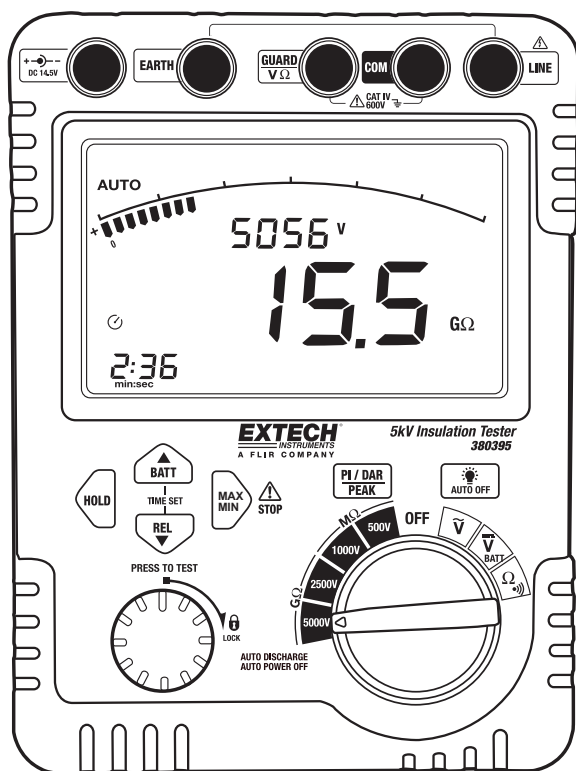
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INSTRUMENTS
A FLIR COMPANY

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Digital High Voltage Insulation Tester

Model 380395 or 380396



Introduction

Congratulations on your purchase of the Extech 380395 (120V) or 380396 (220V) High Voltage Insulation Tester. This meter provides four Insulation Resistance test ranges plus Continuity, AC/DC Voltage, Polarization Index and Dielectric Absorption Ratio measurements. This meter is shipped fully tested and calibrated and, with proper care and use, will provide years of reliable service.

Features

- Auto ranging 6000 count LCD display with bargraph
- Selectable LCD backlight level function facilitates working in dimly illuminated areas.
- MAX/MIN, PEAK, Relative, and Data hold functions for DC/AC voltage measurements.
- Designed to the following safety standards:
 - IEC 61010-1 (CAT IV 600V Pollution degree 2)
 - IEC 61010-031 (Requirements for hand-held probes)
- Insulation test range: 0.1M Ω to 60G Ω .
- Insulation test voltages: 500V, 1000V, 1500V, and 5000V.
- AC/DC voltage: 0.5 V to 600 V.
- 200mA Continuity.
- Resistance: 0.1 Ω to 6k Ω .
- Auto-discharge function & voltage output warning function.
- Electric charges stored in capacitive circuits are automatically discharged after measurements. Discharge status can be checked using the real time voltage bargraph.
- LIVE circuit warning symbols plus audible warning.
- Live circuit detection prevents insulation test if voltage > 30 V is detected.
- Auto-power off function and battery check.
- Programmable Test Timer measurement function.
- Polarization Index measurement (PI).
- Dielectric Absorption Ratio measurement (DAR).
- Power source: Eight (8) 1.5V 'C' Cell Batteries.

Safety

International Safety Symbols



This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.



This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present.



Danger: identifies conditions and actions that pose hazard(s) to the user.



Warning: alerts the user to avoid electric shock.



Caution: identifies conditions and actions that may damage the Insulation Resistance tester.



Operating Caution: identifies conditions where the user needs to take extra care during the operation of the Insulation resistance tester



Danger: Use of this instrument in a manner not specified by the manufacturer may impair safety features/protection provided by the equipment. Read all of the safety information carefully before using or servicing the instrument.



This symbol indicates that the meter uses double or reinforced insulation.

Safety Notes

- Do not exceed the maximum allowable input range for any of the meter's functions.
- Set the function switch OFF when the meter is not in use.
- Remove the batteries if the meter is to be stored for longer than 60 days.



Warnings

- Set the function switch to the appropriate position before measuring.
- Do not measure current on a circuit whose voltage exceeds 600V.
- When changing ranges always disconnect the test leads from the circuit under test.
- Do not use the Insulation resistance tester if it is damaged or if metal parts are exposed. Also, check the meter for cracks or missing plastic.
- Be careful when working above 30V AC rms or 30V DC. Such voltages pose a shock hazard. Discharge all circuit loads under test after measuring high voltage.
- Do not replace the batteries with the tester in a wet environment.
- Place the test leads in the proper input terminals. Ensure that the test leads are firmly connected to the Insulation Resistance tester's input terminals.
- Ensure that the Insulation Resistance tester is switched off when opening the battery compartment.



Cautions

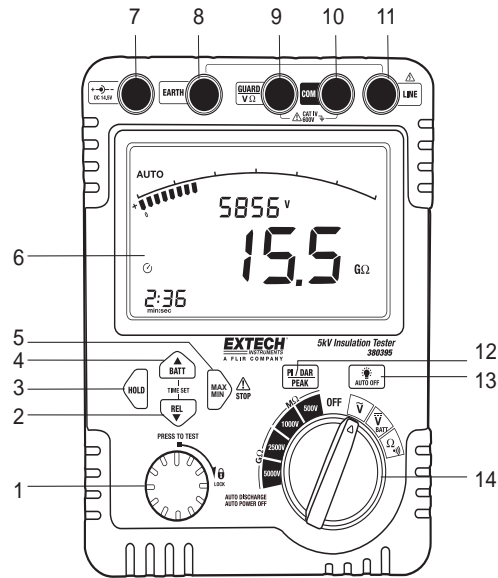
- Improper use of this meter can cause damage, shock, injury or death. Read and understand this user manual before operating the meter.
- Always remove the test leads before replacing the batteries.
- Inspect the condition of the test leads and the meter itself for any damage before operating the meter. Repair or replace any damage before use.
- Voltage checks on electrical outlets can be difficult and misleading because of the uncertainty of a definitive connection to the recessed electrical contacts. Other means should be used to ensure that the outlet terminals are not "live".
- 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 Insulation resistance tester near explosive gas, vapor or dust.
- When using the test leads, keep fingers away from the lead contacts. Keep fingers behind the test lead finger guards.
- Do not use the tester if its cover or any of its parts are removed.
- When performing resistance tests, remove all power from the circuit under test.
- When servicing the Insulation Resistance tester, use only the supplied test leads and power adaptor.
- Do not use the Insulation resistance tester if the battery indicator shows a low battery.
- Do not use or store the meter in areas of high humidity, high temperature, potentially explosive or flammable environments, or in strong magnetic fields.
- Soft cloth and mild detergent should be used to clean the surface of the Insulation resistance tester when servicing. Do not use abrasives or solvents.
- Dry the Insulation resistance tester before storing if it is wet.
- Remove the test leads and set the Range selector switch to the OFF position after use.

Safety Category Information

This Insulation resistance tester complies with IEC61010 standard safety measurement requirements: pollution degree 2, over-voltage category (CAT. IV) 600V, with double insulation.

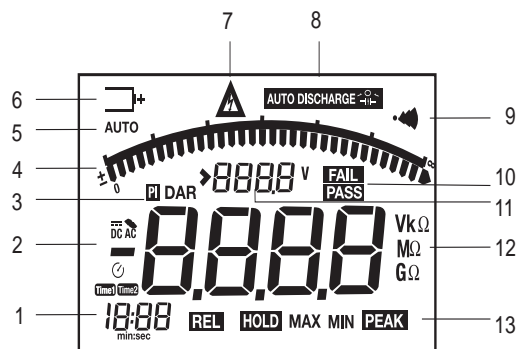
Meter Description

1. Insulation resistance Test/Lock switch
2. REL /down button
3. HOLD button
4. BATT /up button
5. MAX /MIN /STOP button
6. LCD Display
7. DC power adaptor Input
8. EARTH Input
9. V Ω input and IR GUARD terminal
10. V Ω COM input and High voltage shielding terminal
11. LINE: 500V to 5000V High Voltage Output
12. PI /DAR /PEAK button
13. Backlight /AUTO OFF button
14. Function Selector Switch



Display Description

1. Timed Test Indicators
2. AC/DC Indicators
3. Polarization Index and Dielectric Absorption Ratio Indicators
4. Analog Bargraph
5. Auto Range Indicator
6. Low Battery Indicator
7. High Voltage Indicator
8. Auto discharge Indicator
9. Continuity Buzzer Indicator
10. PASS /FAIL Indicator
11. Live Circuit Voltage Indicator
12. Units Indicator
13. Function Indicators




Insulation Resistance Testing



CAUTIONS:

- Ensure that no electrical charge exists on the circuit under test.
- Insulated gloves should be worn while testing.
- Use extreme caution to avoid touching the tips of the test leads or the circuit under test when the PRESS TO TEST button is pressed; High Voltage is present.
- Do not make measurements when the battery cover is removed.
- Always connect the Earth Cord (black) to the Earth terminal of the circuit under test.



CAUTION: When the live circuit warning indicates ">30V" or the warning buzzer sounds and the **AUTO DISCHARGE**  display flashes, the measurement cannot be made even if the "Press to Test" button is pressed.



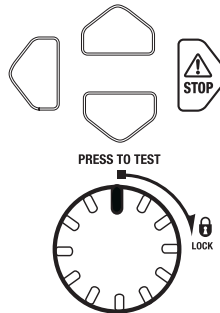
DANGER

- Do not touch the circuit under test immediately after testing. Voltage stored in the circuit may cause electric shock.
- Leave the test leads connected to the circuit under test and never touch the circuit until the discharge is complete.

PRESS TO TEST Knob

All insulation resistance tests are initiated with the **PRESS TO TEST** knob.

1. Press and HOLD the knob to perform a test. Release the knob to end the test.
2. Press and TURN the knob 90 degrees clockwise to the LOCK position to lock the meter in the continuous test mode. To end a test, either rotate the knob 90 degrees counterclockwise or press the **STOP** button.
3. Always return the knob to the vertical position before beginning a test.



Emergency Stop

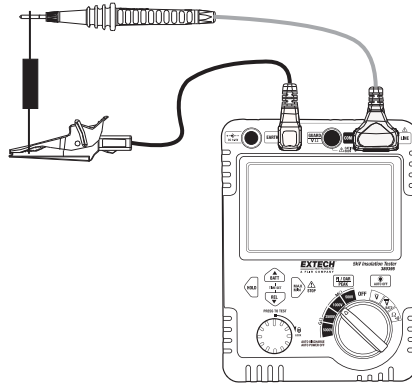
To stop a test at any time, press the **STOP** button or rotate the **PRESS TO TEST** knob in a counter-clockwise direction.

The STOP button also clears the display and beeper after a discharge is complete.

Insulation Resistance Test

Manual Test

1. Connect the Black Earth test lead to the Earth connector and the Red test lead to the LINE and COM connectors.
2. Set the Function Selector switch to the desired insulation test voltage.
3. Connect the test leads to the device under test.
4. Press and hold the PRESS TO TEST button to run the test. The buzzer will beep during the test.
5. Read the measured value on the LCD display.
6. Release the button to end the test and discharge the device. While the circuit is discharging, the **AUTO DISCHARGE** icon will flash. The measured value, HOLD and the measurement time will remain in the display.
7. Press the STOP button to clear the display.
8. Set the Function Selector switch to OFF position and remove the test leads from the circuit.




Locked Test

1. Repeat steps 1 to 3 as above.
2. Press and turn the PRESS TO TEST button to the lock position to run the test. The buzzer will beep during the test.
3. Read the measured value on the LCD display.
4. Rotate the PRESS TO TEST button to the PRESS TO TEST position to end the test and discharge the device. While the circuit is discharging, the **AUTO DISCHARGE** icon will flash. The measured value, HOLD and the measurement time will remain in the display.
5. Press the STOP button to clear the display.
6. Set the Function Selector switch to OFF position and remove the test leads from the circuit.

Timed Insulation Test


The timed insulation test feature allows the user to specify the period of time the test will run. The run time can be set from 1 to 15 minutes in 1 minute increments.

1. Connect the Black Earth test lead to the Earth connector and the Red test lead to the LINE and COM connectors.
2. Connect the test leads to the device under test.
3. Set the Function Selector switch to the desired insulation test voltage.
4. Use the Time Set ▲ and ▼ arrow buttons to select the desired run time for the insulation test. The selected time will be shown in the lower left corner of the LCD.
5. Press and hold the PRESS TO TEST knob (or lock it). The beeper will sound and the voltage warning icon will flash at one second intervals during the test.
6. At the end of the timed period, keep the test leads connected the meter will **AUTO DISCHARGE**  the device and the results will be held in the display
7. Release or unlock the PRESS TO TEST knob and press the STOP button to clear the display.
8. Set the Function Selector switch to the OFF position and remove the test leads from the circuit.

Polarization Index (PI)

The polarization index Test calculates the ratio of the resistance measurement after 10 minutes to the resistance measurement after 1 minute: Results are determined by the type, age and condition of the insulation material tested. Established standards and test procedures should be used to establish pass/fail criteria for each application.

Polarization Index = Resistance after 10 minutes / Resistance after 1 minute

1. Connect the Black Earth test lead to the Earth connector and the Red test lead to the LINE and COM connectors.
2. Connect the test leads to the device under test.
3. Set the Function Selector switch to the desired insulation test voltage.
4. Use the PI/DAR button to select TIME 1 (1:00) for the Polarization Index (PI) function.
5. Press and hold the PRESS TO TEST button and turn it clockwise to the LOCK position. The beeper will sound during the test.
6. When the test has completed, the LCD will display PASS if the Polarization Index is greater than 1. FAIL will be displayed if the Polarization Index is below 1.
7. Keep the test leads connected to the equipment under test and release the PRESS TO TEST button. The circuit will discharge through the meter. While the circuit is discharging, the **AUTO DISCHARGE**  icon will flash.
8. Press the STOP button to clear the results

Dielectric Absorption Ratio (DAR)

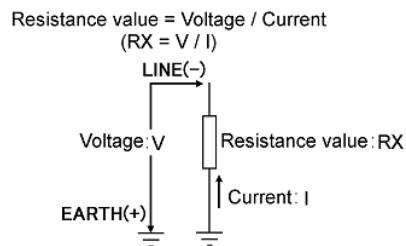
The dielectric absorption test calculates the ratio of the resistance measurement after one minute to the resistance measurement after 30 seconds: Results are determined by the type, age and condition of the insulation material tested. Established standards and test procedures should be used to establish pass/fail criteria for each application.

Dielectric Absorption Ratio = Resistance after 1 minute / Resistance after 30 seconds

1. Connect the Black Earth test lead to the Earth connector and the Red test lead to the LINE and COM connectors.
2. Connect the test leads to the device under test.
3. Set the Function Selector switch to the desired insulation test voltage.
4. Use the PI/DAR button to select the Dielectric Absorption Ratio function (DAR) for TIME1.
5. Press and hold the PRESS TO TEST button and turn it clockwise to the LOCK position. The beeper will sound during the test.
6. When the test has completed, the LCD will display PASS if the Dielectric Absorption Ratio is greater than 1. FAIL will be displayed if the Dielectric Absorption Ratio is below 1.
7. Keep the test leads connected to the device under test and release the PRESS TO TEST button. The circuit will discharge through the meter. While the circuit is discharging, the **AUTO DISCHARGE** icon will flash.
8. Press the STOP button to clear the results

Insulation Resistance Measurement Considerations

The Resistance of an insulator is determined by applying a test voltage to the insulator and then measuring the subsequent current flow.

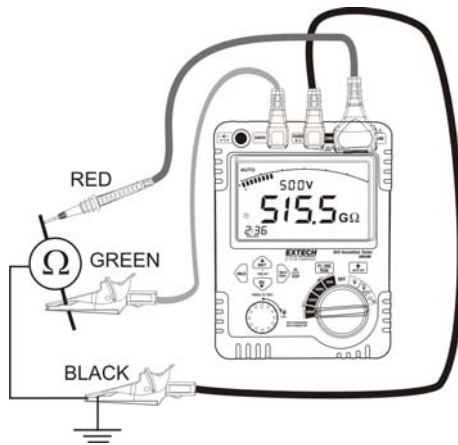
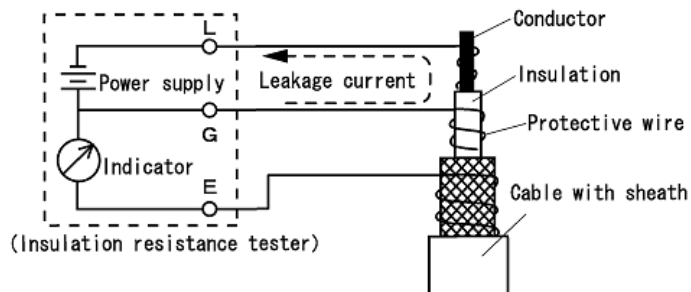


Notes:

- The insulation resistance of a device may not be stable therefore the readings supplied by the meter may vary.
- An audible beep will be heard while a test is in progress, this is normal.
- Measurements taken on a capacitive load may take some time to complete.
- Insulation Resistance tests output a positive (+) voltage from the Earth terminal and a negative (-) voltage from the Line terminal.

Use of the Guard Terminal

When measuring a cable, leakage current flowing on the surface of cable's jacket and the current flowing inside the cable's insulator combine and may cause measurement errors. In order to prevent such errors, a conductive wire should be wound around the point where leakage current flows. The conductive wire should then be connected to the Guard terminal as shown in accompanying figure. Be sure to use only the Guard cable supplied with this instrument to connect the instrument to the Guard terminal.



Data Hold

1. Press the HOLD button to freeze the displayed reading on the LCD display. The HOLD display icon will switch ON in this mode.
2. Press the HOLD button again to return the meter to the normal operation mode. The HOLD display icon will switch OFF.

Backlight

1. Press the backlight button to switch on the LCD display backlight.
2. Press the backlight button a second time to increase the brightness.
3. Press the backlight button a third time to switch off the backlight.
4. The backlight will turn off automatically after 60 seconds.

Auto Power Off

The auto-power off function extends the battery life of the unit. The unit will automatically power off after 20 minutes of inactivity.

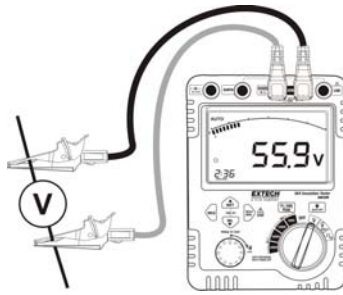
Battery Check

1. Disconnect the test leads from the unit.
2. Set the Function Selector Switch to the " $\overline{\text{V}}$ BATT" DCV position.
3. Press the BATT button. The "*batt*" (batt) icon will appear on the LCD display.
4. Read the battery voltage level on the LCD. A reading of 12V or greater indicates good batteries. A reading of 10V or less indicates the remaining battery life is limited.
5. Press the BATT button again to exit the Battery Check mode. The unit will also automatically exit the Battery Check mode after 5 seconds.

AC/DC Voltage and Resistance Testing

AC/DC Voltage Measurements

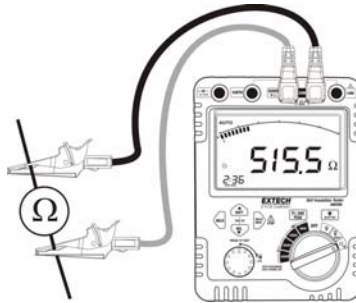
1. Connect the red test lead to the $V\Omega$ terminal and the black test lead to the COM input terminal.
2. Set the Function Selector Switch to the “ \tilde{V} ” VAC or the “ \bar{V} ” VDC position.
3. Connect the test leads to the circuit under test.
4. Note the voltage reading on the LCD display



Low Resistance and Continuity Measurements

⚠ **WARNING:** Do not perform this test unless ACV/DCV = 0. Do not use this mode to check diodes.

1. Connect the red test lead to the $V\Omega$ terminal and the black test lead to the COM input terminal.
2. Set the Function Selector Switch to the Ω position.
3. Connect the test leads to the circuit under test.
4. Note the resistance reading on the LCD display. If the resistance measured is less than 50Ω the audible alarm will sound and the $\cdot\cdot\cdot$ icon will display.



MAX/MIN Function (AC/DC Voltage measurements only)

1. Press the MAX/MIN button to enter the MAX/MIN mode. The 'MIN' icon will appear on the LCD display and the meter will display and hold only the minimum value. The value will be held until a new minimum value is measured.
2. Press the MAX/MIN button again and 'MAX' will appear on the LCD display. The meter will display and hold only the maximum value. The value will be held until a new maximum value is measured.
3. Press the MAX/MIN button a 3rd time, MAX/MIN will appear on the LCD display. In this mode the meter will display the real time readings but will continue to store maximum and minimum values for later recall. Use the MAX/MIN button to check the MIN and MAX values.
4. To exit MAX/MIN mode entirely, press and hold the MAX/MIN button for at least 2 seconds.

Peak Hold Function (AC/DC Voltage measurements only)

The PEAK HOLD function is used with the MAX/MIN function to capture voltage max and min peaks in the range of 10 to 100mS (milliseconds). The voltage range is 0.5V to 600V AC or DC.

1. Press the MAX/MIN button. MIN will appear on the LCD display.
2. Press the PEAK button. MIN/PEAK will appear on the LCD display. The meter will now capture minimum readings.
3. Press the MAX/MIN button again to display the MAX/PEAK icon. The meter will now capture maximum readings.
4. Press and hold the MAX/MIN button for at least 2 seconds to exit the PEAK hold mode.

Relative Mode (AC/DC Voltage measurements only)

The relative mode displays the difference between the measured value and a stored reference value.

1. Press REL to store the reading presently indicated on the display as the reference value; the "REL" indicator will appear.
2. Subsequent readings will represent the difference between the stored reference value and the measured value.
3. Press the REL button again to return to normal operation

Maintenance

Battery Replacement




WARNING: To avoid electric shock, disconnect all of the test leads from the unit before replacing the batteries.



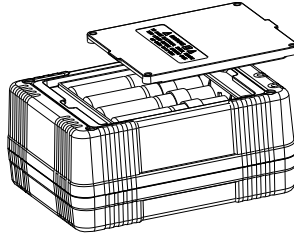
Operating Caution

Do not mix old and new batteries.

Make sure the polarity is correct when installing batteries. Do not take measurements with the battery compartment open.

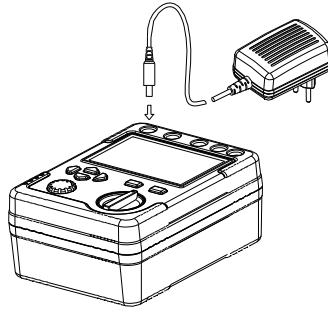
Replace the batteries as soon as the low battery indication appears.  Do not use the tester in a low battery condition.

1. Switch the meter off and disconnect all of the test leads.
2. Remove the four screws that hold the battery compartment cover in place.
3. Remove the battery compartment cover.
4. Replace the eight (8) 1.5V batteries.
5. Replace the battery compartment cover and screws.



Power Adaptor

1. The power adaptor input terminal is located at the top left of the tester.
2. Ensure that the meter is powered off before inserting the power adaptor into the input terminal.
3. It is highly recommended that all of the batteries be removed from the meter before using the power adaptor.
4. Ensure that the meter is powered off when the power adaptor is disconnected from the meter.



Cleaning and Care



Warning: This device must be repaired, calibrated, or otherwise serviced by qualified personnel only

- Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents to clean the instrument.
- Periodically clean the terminals with a cotton swab and detergent; grit or debris in the terminals can affect readings.
- Moisture in the terminals can affect the reading. Keep the instrument dry and clean.
- Switch the Insulation resistance tester OFF when it is not in use.
- Remove the batteries when the meter is removed from service for long periods.
- Do not use or store the meter in areas of high humidity, high temperature, potentially explosive or flammable environments, or in strong magnetic fields.

Specifications

General Specifications

Display	6000 count LCD display with bargraph
Sampling Rate	2.5 times per second
Over range indication	"OL" appears on the LCD
Short Circuit Current	$\geq 200\text{mA}$
Open Circuit Test Voltage	$\geq 4.5\text{V}$
Low battery indication	Battery symbol appears on the LCD
Power supply	Eight (8) 1.5V 'C' Cell Batteries or 13.5V 1Amp AC adaptor
Fuse	500mA/600V (6 x 32mm) ceramic 3AG fast blow
Auto Power Off	After approximately 20 minutes of inactivity
Operating Temperature	32 to 104°F (0 to 40°C)
Operating Humidity	< 80% RH
Altitude	Up to 2000 meters
Storage Temperature	14 to 140°F (-10 to 60°C)
Storage Humidity	< 80% RH
Dimensions	7.8 x 5.8 x 3.4" (198 x 148 x 86mm)
Weight	Approx. 50.7 oz. (1438g) with battery
Safety Standards/Ratings	Pollution degree 2, Meets IEC 61010-1 and IEC 61010-031
Category Rating	CAT IV 600V

Insulation Resistance Measurement Specifications

Test Voltages	500V	1000V	2500V	5000V *
Measurement Range (Auto-ranging)	0.005~6.000MΩ	0.005~6.000MΩ	0.05~60.00MΩ	0.05~60.00MΩ
	6.01~60.00MΩ	6.01~60.00MΩ	60.1~600.0MΩ	60.1~600.0MΩ
	60.1~600.0MΩ	60.1~600.0MΩ	0.61~6.00GΩ	0.61~6.00GΩ
	0.61~6.00GΩ	0.61~6.00GΩ	6.1~60.0GΩ	6.1~60.0GΩ
Open circuit Voltage	DC 500V +20%,-0%	DC 1000V +20%,-0%	DC 2500V +20%,-0%	DC 5000V +20%,-0%
Rated current	1~1.2mA (0.5 MΩ load)	1~1.2mA (1 MΩ load)	1~1.2mA (2.5 MΩ load)	1~1.2mA (5 MΩ load)
Short-circuit current	Approx.1mA			
Accuracy	0.005~600.0MΩ	±2.5% reading ±15 digits		
	0.61~6.00GΩ	±3% reading ±15 digits		
	6.1~60.0GΩ	±4% reading ±15 digits		
	5~6000VDC	±1.5%reading ±5 digits		
Note on voltage display in IR test mode	In Insulation Resistance test mode, this device is used to check whether or not the electric charge stored in the equipment under test has been discharged. During an Insulation Resistance test, the voltage value displayed on the LCD above the resistance measurement is the test reference voltage value.			

* NOTE: For 5000V IR measurements, use of the ac adapter to power the unit is recommended.

AC/DC Voltage Specifications

Range	Resolution	Accuracy
0.5 to 600 VAC (40 to 400Hz)	0.1V	±1% of rdg + 5d (40 to 60 Hz) ±2.5% of rdg + 10d (61 to 400 Hz)
0.5 to 600 VDC		±1% of reading + 5 digits

Low Resistance Measurement and Continuity Specifications

Range	Resolution	Accuracy
0.1 to 600Ω	0.1Ω	±1.5% rdg + 10d
601 to 6.00kΩ	0.001kΩ	±1.5% rdg + 15d
Continuity Buzzer	Triggers if the resistance is 50Ω or lower	
Open Circuit Voltage	4.5V minimum	
Short Circuit Current	200mA minimum	

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