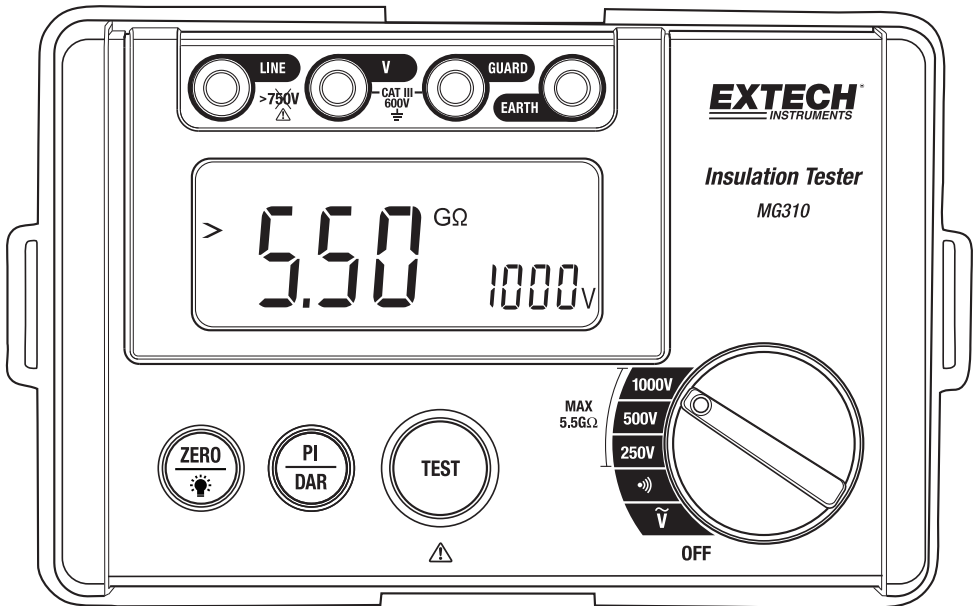


Insulation Resistance Tester

With Continuity and AC Voltage modes

Model MG310



Introduction

Thank you for selecting the MG310 Insulation Resistance Tester. This meter measures insulation resistance, continuity, and AC Voltage. The MG310 is CAT III 600V AC and ideal for measuring insulating materials and electrical equipment such as transformers, cables, switches, and appliances. Applications include maintenance, testing, and inspection. Proper use and care of this meter will provide many years of reliable service.

Safety

This tester is designed and manufactured in compliance with the IEC61010 standard. This user manual includes detailed information related to the safe operation and care of this instrument. Please read carefully before using the instrument.

- Please read and understand this user manual before using the device.
- Always use the device as specified in the user manual, retain the manual for future use and check the www.extech.com website for newer versions of the user manual.
- Misuse of this device may cause personal injury and damage to the instrument and connected equipment.
- This symbol on the instrument indicates that for safe operation the user must use the instrument as described in the user manual.
- **Danger icons:** Alert to conditions and actions that may cause serious or fatal injury.
- **Warning icons:** Alert the user to the potential of electric shock.
- **Caution icons:** Alert to conditions and actions that may cause damage to the instrument or that may affect the instrument accuracy.



Danger

- Do not measure circuits with voltages greater than 750V AC.
- Do not use this instrument in areas where flammable conditions exist.
- Do not use this instrument in areas of high humidity. Do not operate this instrument with wet hands.
- Do not touch conductive sections of the test leads when taking measurements.
- When test leads are shorted and connected to the instruments do not press the TEST button.
- Do not open the battery cover during tests.
- Do not touch the tested circuits or wires during insulation measurements.



Warning





- If the instrument exhibits faulty operation please discontinue use and have the instrument serviced.
- Be extremely careful when the instruments is measuring voltages that exceed 33V AC rms, 46.7V AC rms, or 70VDC; electrical shock is possible.
- When high resistance measurements are conducted, stray electrical in circuits under test must be discharged.
- Do not replace the batteries when the instrument is wet.
- Ensure secure connections with the test leads and the instrument's test lead terminals.
- Shut the instrument down before opening the battery compartment.



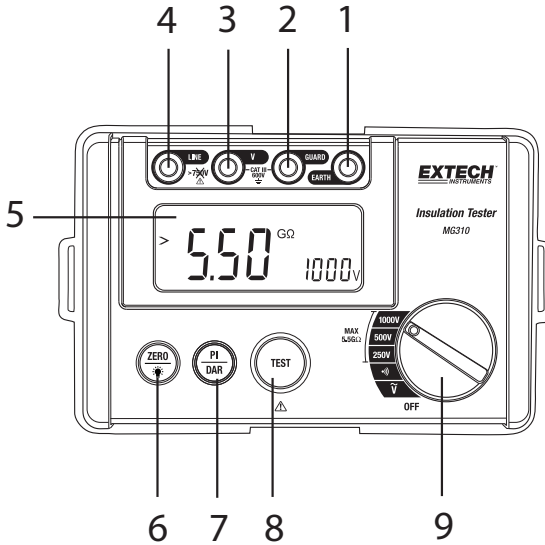
Caution

- Circuits under test must be completely discharged and isolated from power circuits before taking resistance measurements.
- If the test leads or adaptors need to be replaced due to damage, replace with test leads or adaptors of the same model or electrical specifications.
- Do not use the instrument if low battery indicator shows the low battery indicator. If the instrument will not be used for a long period, please remove the battery and store safely.
- Do not store or operate the instrument in areas of high temperature, high humidity, flame or explosive potentials, or where strong electromagnetic fields exist.
- Clean the instrument housing with a damp cloth and mild cleaning agent; do not use abrasives or solvents.
- If the instrument is wet, please dry before storing.

Electrical Safety Symbols

| | |
|---|--|
|  | Risk of electrical shock |
|  | Double insulation or reinforced insulation |
|  | AC Measurement |
|  | Ground |

Meter Description



1. **EARTH** terminal for Insulation Resistance and Continuity testing.
2. **GUARD** terminal for ACV and Continuity testing.
3. **V** terminal for ACV testing and Self-Test mode.
4. **LINE** Terminal for Insulation Resistance testing and Self-Test mode.
5. Backlit LCD Display
6. **ZERO** button (short press) and LCD Backlight ON/OFF button (long press)
7. **PI/DAR** Testing selection button
8. **TEST** button
9. Rotary function select switch

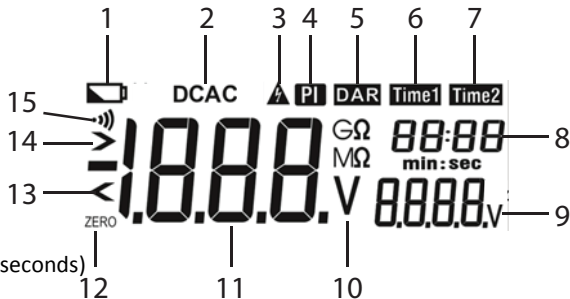
Note: Secure battery compartment located on rear of unit.

Control Buttons

1. **PI/DAR** button: Press to select **PI** polarization index and **DAR** dielectric absorption ratio test modes.
2. **ZERO/Backlight** button: Long press to enable/disable LCD backlight or short press to reset the display to zero for low resistance measurements.
3. **TEST** button: Engage/disengage testing for IR, Continuity, and AC Voltage tests.
4. **Rotary function switch**: Select an IR output test voltage (250V/500V/1000V), measure low resistance (Continuity), or measure AC Voltage (ACV).

Display Description

1. Battery strength indicator
2. DC/AC Voltage modes
3. Voltage present alert
4. PI test mode
5. DAR test mode
6. Time1 for PI/DAR tests
7. Time2 for PI/DAR tests
8. PI/DAR Test timer (minutes and seconds)
9. Test voltage output [V]
10. Units [G: Gigaohm; M: Megaohm] and Voltage [V] and Resistance [Ω] mode symbols
11. Main measurement display
12. ZERO function
13. Under Range <
14. Over Range >
15. Audible continuity alert beeper



Operating Instructions

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

1. ALWAYS turn the function switch to the **OFF** position when the meter is not in use.
2. If “OL” appears in the display during a measurement, the value exceeds the meter’s range.
3. If the batteries are weak replace them before performing tests. The battery indicator on the upper left alerts the user when battery power is low. The battery compartment is accessed through the back of the meter secured by one Phillips head screw.


DISPLAY BACKLIGHT

Press and hold the backlight button for 2 seconds to switch the backlight on or off. For best battery efficiency use the backlight only when needed.

HOLD

The automatic hold function freezes the insulation resistance reading in the display for a short period of time for convenience.

LOW BATTERY INDICATION

When the  icon appears in the display, the batteries should be replaced. Refer to the battery replacement section of this user manual.

INSULATION RESISTANCE MEASUREMENTS

CAUTION

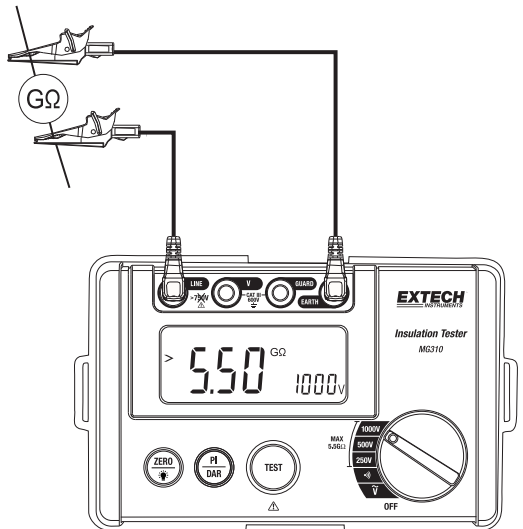
- Before taking measurements disconnect the unit under test from all power sources and isolate it from any stray resistance.
- Do not short circuit the test leads when voltage is output from the meter.
- Allow sufficient time between tests for devices under test to stabilize.
- When red and black clips are connected to the circuit under test, high voltage is output from the LINE jack and current from the EARTH jack.
- At the completion of a test, do not touch any parts of the circuit under test. Components may have become charged during the test and could discharge when touched.

1. Select the desired test voltage using the rotary function switch. Select the 250V, 500V, or 1000V switch position for the corresponding output test voltage.
2. Connect the red test lead to the meter's **LINE** (4) jack and the black test lead to the **EARTH** (1) jack. Connect the probe end of the test leads to the circuit under test.

3. Press the **TEST** button to test. The button will self-lock and the button lamp will light.

Note: If the circuit under test is live and has a voltage potential (AC/DC) over 30V, the meter will not test (the display will show the ">" icon and the ⚡ symbol will flash; the buzzer will also sound). If the circuit under test is not live or if its voltage is less than 30V, the meter will begin applying high-voltage to the circuit under test.

4. The primary display will show the insulation resistance in MΩ (megaohms) or GΩ (gigaohms).
 5. The test voltage (VDC) value will be indicated in the right-most auxiliary display, the ⚡ symbol will flash and the caution buzzer will sound.
 6. Press to release the TEST button to stop the test. The high voltage will switch off and the resistance value indicated in the primary display will hold.
 7. Subsequently, the meter will internally discharge the balance of the insulation test voltage.
- Note:** Turning the function switch to another test position will abort the test.
8. A reading of **>5.50 GΩ** indicates that the meter reading is above the resistance threshold of that measurement range.



POLARIZATION INDEX (PI) TESTING

Read and understand all operations and safety information contained in the Insulation Resistance (IR) measurement section above and the Safety section before continuing.

1. Connect the meter to the device under test as shown in the test section above.
2. Select the desired output test voltage using the rotary function switch (250/500/1000V).
3. Use the PI/DAR button to access the PI test mode.
4. The display will show the PI icon when the PI mode is successfully accessed.
5. The two test times (Time1 and Time2) will alternately show on the upper right.
6. The first test will run for 1 minute (Time1) when the TEST button is pressed. If the test fails (**no** is displayed) the second test will not automatically run and testing is now complete. If the test passes (**YES** is displayed) the Time2 test will run for 10 minutes.
7. The test result will display after the 10-minute Time2 interval
8. Press the TEST button to stop the test and to begin discharging the device under test.

DIELECTRIC ABSORPTION RATIO (DAR) TESTING

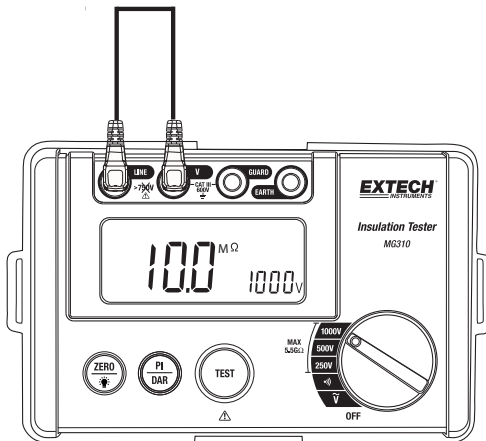
Read and understand all operations and safety information in the Insulation Resistance (IR) measurement section above and in the Safety section before continuing.

1. Connect the meter to the device under test as shown in the IR test section above.
2. Select the desired output test voltage using the rotary function switch (250/500/1000V).
3. Use the PI/DAR button to access the DAR test mode.
4. The display will show the DAR icon when the DAR mode is successfully accessed.
5. The first two test times (Time1 and Time2) will alternately show on the upper right.
6. The first test will run for 30 seconds (Time1) when the TEST button is pressed. If the test fails (**no** is displayed) the second test will not automatically run and testing is now complete. If the test passes (**YES** is displayed) the Time2 test will run for 1 minute. The test result will display after the 1-minute Time2 interval
7. To access the second set of Time1 and Time2 tests press the DAR button three times and repeat the same steps above in this section. For the 2nd set of tests the times are 15 seconds (Time1) and 1 minute (Time2).
8. When completed press the TEST button to stop the test and to begin discharging

ACCURACY SELF-TEST FUNCTION

The MG310 features a 10M Ω accuracy check feature for the Insulation Resistance mode. To verify the accuracy:

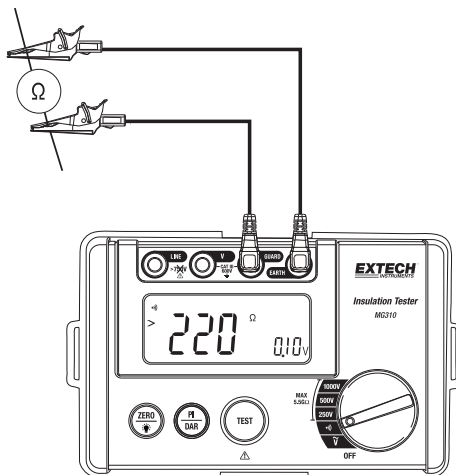
1. Connect a wire jumper to the meter between the **LINE** (4) and **V** (3) terminals as shown in the accompanying illustration.
2. Select one of the three test voltage (250/500/100V) switch positions.
3. Press the **TEST** button to begin the test.
4. When testing is complete, the meter will display 10.0M Ω (\pm 0.1M Ω). If the meter does not show an accurate reading please have it serviced.



LOW RESISTANCE CONTINUITY TESTING

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

1. Set the function switch to the Ω (continuity) position.
2. Insert the black test lead banana plug into the **GUARD** (2) jack. Insert the red test lead banana plug into the **EARTH** (1) jack.
3. Press the **TEST** button. The button lamp will light indicating that testing can begin.
4. Touch the test probe tips to the circuit or wire you wish to check.
5. If the resistance is less than approximately 20 Ω , the audible signal will sound and the audio icon will be displayed. If the circuit is open, the display will indicate **> 220 Ω** .



6. Press the **TEST** button again to disengage the test mode (the lamp will switch off) before removing the test leads from the circuit under test and from the meter.

AC VOLTAGE MEASUREMENTS

WARNING: Risk of Electrocutation. The probe tips may not be long enough to contact the live parts inside some 240V 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.

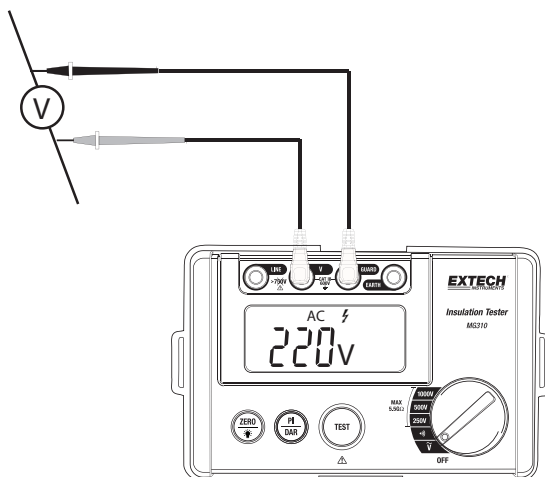
CAUTION:

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.

Do not measure voltage higher than 750V AC.

Please use extreme caution to avoid high voltage electrical shock while operating this instrument.

Disconnect test leads from tested circuits and meter terminals after testing.



1. Set the function switch to the **V** (ACV) position.
2. Insert the black test lead banana plug into the **GUARD** jack (2).
Insert red test lead banana plug into the **V** jack (3).
3. Press the **TEST** button to engage the testing mode (the button lamp will light).
4. Touch the black test probe tip to the one side of the circuit.
Touch the red test probe tip to the other side of the circuit.
5. Read the voltage in the main display.
6. Press the **TEST** button again to disengage the test mode (the lamp will switch off) before removing the test leads from the circuit under test and from the meter.

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 the meter until the battery cover is in place and fastened securely.

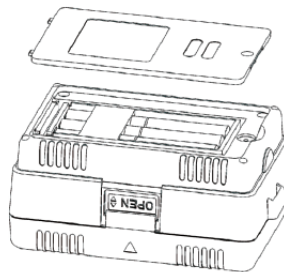
This instrument is designed to provide years of dependable service, if the following care instructions are performed:

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

BATTERY INSTALLATION

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

1. Turn power off and disconnect the test leads from the meter.
2. Open the rear battery cover by removing the screw using a Phillips head screwdriver.
3. Insert the 6 x 1.5V 'AA' batteries into the battery holder, observing correct polarity.
4. Put the battery cover back in place. Secure with the screw.



You, as the end user, are legally bound (**EU Battery ordinance**) to return all used batteries; **disposal in the household garbage is prohibited!** Dispose of used batteries / accumulators at collection points in your community or wherever batteries / accumulators are sold!

Disposal: Follow the valid legal stipulations in respect of the disposal of the device at the end of its lifecycle

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


Specifications

| Function | Range | Resolution | Accuracy | |
|--|--|----------------------|---|------------|
| AC Voltage | 30 to 600V | 1V | $\pm(2.0\% \text{ reading} + 3 \text{ digits})$ | |
| | AC voltage specified from 5% of range to 100% of range | | | |
| Continuity | 0.00~220 Ω | 0.01 Ω | $\pm(2.0\% \text{ reading} + 3 \text{ digits})$ | |
| | <p>< 20Ω (approx.) the buzzer will sound</p> <p>If the circuit is open >220 is displayed</p> <p>Open-circuit voltage: 5V approx.</p> | | | |
| Insulation Resistance | | | | |
| Rated voltage | 250V Output | 500V Output | 1000V Output | |
| Range | 0.00M~5.5G Ω | 0.00M~5.5G Ω | 0.00M~5.5G Ω | |
| Open-circuit | 250V DC +10% | 500V DC +10% | 1000V DC +10% | |
| Rated current | < 250K 1.00mA~1.10mA | < 500K 1.00mA~1.10mA | < 1M 1.00mA~1.10mA | |
| Short-circuit Current | Approx. 2mA | | | |
| Accuracy | 0.00M Ω ~99.9M Ω $\pm(3.0\% + 5 \text{ digits})$ | | | |
| | 100M Ω ~5.5G Ω $\pm(5.0\% + 5 \text{ digits})$ | | | |
| Polarization Index (PI) / Dielectric Absorption Ratio (DAR) | | | | |
| PI measurement | 1 minute : 10 minute insulation resistance test | | | |
| PI Value | ≥ 4 | 4~2 | 2.0~1.0 | ≤ 1.0 |
| Criterion | Best | Good | Warning | Bad |
| DAR measurement <i>Set one</i> | 30 second : 1 minute insulation resistance ratio test | | | |
| DAR measurement <i>Set two</i> | 15 second : 1 minute insulation resistance ratio test | | | |
| DAR value | ≥ 1.4 | 1.25~1 | ≤ 1.0 | |
| Criterion | Best | Good | Bad | |

Note: Accuracy is stated at 73.4°F (23°C) and 40~75% RH.

Note: Accuracy specifications consist of two elements:

- (% reading) – This is the accuracy of the measurement circuit.
- (+ digits) – This is the accuracy of the analog to digital converter.

| | |
|-------------------------|--|
| Display | Backlit LCD (max. reading 1999) |
| Low battery indication | Battery icon  appears when batteries need to be replaced. |
| Overload indication | Insulation resistance testing > 5.5G displayed when the meter range has been exceeded. |
| Range selection | Automatic |
| Units of measure format | Functions and units of measure are shown simultaneously. |
| Testing controls | For Insulation Resistance testing: Manual start and Automatic stop. |
| Test button | Red lamp on TEST button indicates that test is in progress. |
| Self-Test | 10MΩ (±1%) |
| Continuity Check | Audible signal when resistance is < 20Ω (approx.). |
| Battery | Six (6) 1.5V 'AA' batteries |
| Current Consumption | 200mA approx. with maximum output (10mA under normal conditions). |
| Operating Temperature | 0°C to 40°C (32°F to 104°F) |
| Storage Temperature | -20°C to 60°C (-4°F to 140°F) |
| Operating Humidity | < 85% RH |
| Storage Humidity | < 90% RH |
| Operating Altitude | 2000m (7000 ft.) maximum |
| Weight | 0.7kg. (1.5 lbs.) |
| Size | 150 x 100 x 71mm (6.0 x 4.0 x 2.8 in.) |
| Safety | This meter is intended for origin of installation use and protected by double insulation per EN61010-1 and IEC61010-1 2 nd Edition (2001) to Category III 600V; Pollution Degree 2. |

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