OPERATING INSTRUCTIONS

INSULATION - CONTINUITY TESTER

MODEL 3021

A.W. SPERRY INSTRUMENTS INC.
The Professional's Choice®

2150 Joshua's Path, Suite 302, Hauppauge, NY 11788
Phone: 1-800-645-5398 or 631-231-7050
Fax: 631-434-3128 • Email: cat@awsperry.com
www.awsperry.com
1. Safety warnings

- This instrument has been designed, manufactured and tested according to IEC 61010-1: Safety requirements for Electronic Measuring apparatus, and delivered in the best condition after passed the inspection. This Instruction manual contains warnings and safety rules which must be observed by the user to ensure safe operation of the instrument and retain it in safe condition. Therefore, read through these operating instructions before using the instrument.

![WARNING]

- Read through and understand the instructions contained in this manual before using the instrument.
- Keep the manual at hand to enable quick reference whenever necessary.
- The instrument is to be used only in its intended applications.
- Understand and follow all the safety instructions contained in the manual.
- It is essential that the above instructions are adhered to failure to follow the above instructions may cause injury, instrument damage and/or damage to equipment under test.

- The symbol △ indicated on the instrument, means that the user must refer to the related parts in the manual for safe operation of the instrument. It is essential to read the instructions wherever the △ symbol appears in the manual.

![DANGER]

- is reserved for conditions and actions that are likely to cause serious or fatal injury.
- WARNING: is reserved for conditions and actions that can cause serious or fatal injury.
- CAUTION: is reserved for conditions and actions that can cause injury or instrument damage.

- Never make measurement on a circuit in which the electrical potential exceeds AC/DC600V (Measurement CAT III 600V).
- Do not attempt to make measurement in the presence of flammable gasses. Otherwise, the use of the instrument may cause sparking, which can lead to an explosion.
- Never attempt to use the instrument if it’s surface or your hand are wet.
- Be careful not to short-circuit the power line with the metal part of the test leads when measuring a voltage. It may cause personal injury.
- Do not exceed the maximum allowable input of any measuring range.
- Never open the Battery cover during a measurement.


Advising

- Never attempt to make any measurement if any abnormal conditions, such as a broken case or exposed metal parts are present on the instrument and test leads.
- Never press the Test button when connecting the test leads to the instrument.
- Never rotate the Range selector switch with the test leads connected to the equipment under test.
- Do not install substitute parts or make any modification to the instrument. Return the instrument to your local A.W.Sperry distributor for repair or re-calibration in case of suspected faulty operation.
- Never touch the circuit under test during/ immediately after the insulation resistance measurement. The test voltage may cause electrical shock.
- Do not replace batteries if the instrument is wet.
- Ensure that the test leads are firmly inserted into the terminal.
- Set the Range selector switch to OFF position when opening the Battery cover for battery replacement.

Caution

- Always set the Range selector switch to the appropriate position before making measurement.
- Set the Range selector switch to "OFF" position after use and remove the test leads. The instrument consume small current at any range other than OFF, and it shortens the battery life. Remove the batteries if the instrument is to be stored and will not be in use for a long period.
- Do not expose the instrument to direct sunlight, high temperatures, humidity or dew.
- Use a damp cloth with neutral detergent for cleaning the instrument. Do not use abrasives or solvents.
- Do not store the instrument if it is wet. Store it after it dries.

Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Danger of possible electric shock</td>
</tr>
<tr>
<td>⚡️</td>
<td>Instrument with double or reinforced insulation</td>
</tr>
<tr>
<td>~</td>
<td>AC</td>
</tr>
<tr>
<td>👇</td>
<td>Earth terminal</td>
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</tbody>
</table>

2. Features

MODEL3021 is four-range digital insulation resistance testers for testing low-voltage installation below 600V. Resistance measurement with audible Continuity check function is also available.

- Designed to following safety standards:
  - IEC61010-1(CAT.III 600V Pollution degree 2)
  - IEC61010-031 (Requirements for hand-held probes)
- Small and light weight.
- Auto-discharge function
When insulation resistance like a capacitive load is measured, electric charges stored in capacitive circuits are automatically discharged after measuring. Discharge can be checked with the LED & ⚠️ mark on LCD.
- Two resistance ranges: 40Ω and 400Ω (2-range auto) are also available. Buzzer sounds when a measured current exceeds 200mA.
- This instrument has 0Ω ADJ. function to null the resistance of test lead or fuse at resistance measurement.
- Measured value is held for about 5 sec. after insulation/ resistance measurement of the Test button is released.
- Backlight function to facilitate work at night or dimly lit locations.
- Bar-graph to indicate measured results.
- Max. 99 data can be saved to the internal memory at the insulation resistance range.
- Visible and audible warning (FAIL or PASS is indicated and buzzer sounds) when the measured insulation resistance exceeds the preset value.
- Live circuit warning indication, LED and buzzer.
- The Safety key must be kept pressed down to select 500V or 1000V range. Otherwise, neither 500V or 1000V range can be selected.
- Auto-power off function
To prevent the instrument being left powered on and conserve battery power, the instrument automatically turns off approx. 15 min. after the last switch operation.
- The CAT mark flickers when the battery voltage drops to the lower limit.
- Test leads with remote control switch (voltage won't be outputted when the test lead is not connected.)
- Robust housing case
- Neck strap for both hand's operation
- User-changeable test prod
3. Specification

- Applicable standards
  IEC 61557
  IEC 61010-1 Measurement CAT.III 600V Pollution degree 2
  (Location for use: altitude 2000m or less)
  IEC 61010-031
  IEC 60529  IP40

- Measuring range and accuracy

<table>
<thead>
<tr>
<th>Insulation resistance range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
</tr>
<tr>
<td>Auto-range</td>
</tr>
<tr>
<td>Open circuit voltage</td>
</tr>
<tr>
<td>Short circuit current</td>
</tr>
<tr>
<td>Nominal test current</td>
</tr>
<tr>
<td>1st effective measurement range</td>
</tr>
<tr>
<td>Center scale range</td>
</tr>
<tr>
<td>Accuracy</td>
</tr>
</tbody>
</table>

- Operating error

Operating error (B) is an error obtained under the nominal operating conditions, and calculated with the intrinsic error (A), which is an error of the instrument used, and the error (En) due to variations. According to IEC61557, the maximum operating error should be within ±30%.

\[
B = |A| + 1.15 \times \sqrt{(E_1^2 + E_2^2 + E_3^2)}
\]

- Resistor for test
- Possible number of measurement

<table>
<thead>
<tr>
<th>Range</th>
<th>Resistor for test</th>
<th>Possible number of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>125V</td>
<td>0.125MΩ</td>
<td>at least 1200 times</td>
</tr>
<tr>
<td>250V</td>
<td>0.25MΩ</td>
<td>at least 1000 times</td>
</tr>
<tr>
<td>500V</td>
<td>0.5MΩ</td>
<td>at least 1000 times</td>
</tr>
<tr>
<td>1000V</td>
<td>1MΩ</td>
<td>at least 400 times</td>
</tr>
</tbody>
</table>

- Contiuity 1Ω at least 1300 times

Temperature & humidity range: 0°C ~ 40°C (RH: 90% or less)
Stoarge temperature & humidity range: -20°C ~ 60°C (RH: 75% or less)
Response time: Indicated value at each insulation resistance range comes within accuracy within 5 sec. after a resistance corresponding to the mid-value and 0Ω is suddenly applied across the measuring terminals. (It may take time when measuring a capacitive load.)
Withstand voltage: AC5,320V (50/60Hz) for 5s, between the electrical circuit and the enclosure.
Overload protection: The instrument operates properly after each of the voltage shown in the table below is applied for 10 sec.
4. Instrument layout

Fig. 2 Instrument layout

<table>
<thead>
<tr>
<th>① Test button</th>
<th>② Range selector switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>③ ENTER key</td>
<td>④ MEM key</td>
</tr>
<tr>
<td>⑤ DOWN key</td>
<td>⑥ UP key</td>
</tr>
<tr>
<td>⑦ Comp key</td>
<td>⑧ 0.0 ADJ. key</td>
</tr>
<tr>
<td>⑨ Safety key</td>
<td>⑩ Backlight key</td>
</tr>
<tr>
<td>⑪ LIVE LED</td>
<td>⑫ Display</td>
</tr>
<tr>
<td>⑬ Probe socket</td>
<td>⑭ Test lead with remote control switch MODEL7103</td>
</tr>
<tr>
<td>⑮ Line probe</td>
<td>⑮ Remote control switch</td>
</tr>
<tr>
<td>⑯ Standard prod (MODEL8072)</td>
<td>⑰ Earth code</td>
</tr>
<tr>
<td>⑱ Probe connector</td>
<td>⑱ Test bar (MODEL7161)</td>
</tr>
<tr>
<td>⑲ Safety alligator clip (MODEL7131)</td>
<td>⑲ Extension prod (MODEL8017)</td>
</tr>
</tbody>
</table>

Auto-ranging:
- Range shifts to upper range: when a reading goes over 4200
- Range shifts to lower range: when a reading goes to less than 320

Dimension: approx. 105(L) x 158(W) x 70(D)mm
Weight: approx. 600g (including batteries)
Power source: R6P or LR6 size AA x 6pcs
Nominal power: 2.7VA

Accessories
- MODEL7103 Test lead with remote control switch 1 set
- MODEL7161 test bar 1 pce
- MODEL7131 Safety alligator clip 1 pce
- MODEL8017 Extension prod 1 pce
- Neck strap 1 pce
- Cord cas 1 pce
- R6P (SUM-3), size AA 6 pcs
- Instruction manual 1 pce

Optional
- MODEL7115 Extension probe
- MODEL8016 Pickle type prod
5. Preparation for measurement

5-1 Test lead connection

Insert the Probe connector into the Probe socket on the instrument correctly as shown below.

![Probe connector and socket](image)

5-2 Checks on Test lead and Fuse

1. Set the Range selector switch on the instrument to the Ω (CONTINUITY) position.
2. Break in test lead or fuse is suspected if "OL" is displayed on the LCD when shorting the LINE (red) and EARTH (black).
3. Test lead or instrument itself may have troubles when "OL" is displayed on the LCD after replacing the fuse. In this case, send the instrument to your local KYORITSU distributor for repair.

**DANGER**
- When the Test button or the Remote control switch is pressed while the Range selector switch set to an insulation resistance range, take care not to touch the tip of the Test probe where a high voltage is present in order to avoid possible shock hazard.
- Test lead and fuse must be inspected prior to measurement according to Clause 5-2 indicated in this manual in order to avoid possible electrical shock hazard. Voltage cannot be measured if a break is present on the fuse.

6. Measurement

6-1 Voltage measurement (Mains disconnection check)

1. Connect the Earth probe to the earth of the circuit under test and Line probe to the other side. If the circuit is not earthed, connect Earth probe to any appropriate conductor.
2. Take the reading on the LCD without pressing the Test button or Remote control switch. The mark "~" is displayed when measuring AC voltage. The mark "— (minus)" displayed when the LINE probe is connected to the negative side of the conductor under test to measure DC voltage. "Lo" is displayed on the LCD when the measured voltage is under 20V.

![Voltage measurement setup](image)

**DANGER**
- Test lead and fuse must be inspected prior to measurement according to Clause 5-2 indicated in this manual in order to avoid possible electrical shock hazard. Voltage cannot be measured if a break is present on the fuse.
- Never make measurement on a circuit in which the electrical potential exceeds AC/DC600V in order to avoid possible shock hazard. (Refer to "3. Specification, AC voltage measurement.")
- When testing installation that has a large current capacity, such as a power line, be sure to make measurement on the secondary side of a circuit breaker in order to avoid personal injury.
- Do not press the Test button or Remote control switch during voltage measurement.
- Never short live conductors with the tip of a probe to avoid personal injury.
- Do not make measurement with the Battery cover removed.

6-2 Insulation resistance measurement

Before performing any insulation test, check the maximum voltage that may be applied to the circuit under test.
Note:
- Some circuits have an unstable insulation resistance, which causes the reading to vary during measurement.
- The instrument may generate a high pitch tone during measurement. This is not a failure.
- If the circuit under test has a large capacitive load, it may take some time before the final reading can be obtained.
- On insulation resistance range, DC voltage is supplied through earth and Line probes, with earth probe having positive polarity. Earth probe should be connected to the earth conductor in the circuit under test. Such connection is known to be more suitable for insulation tests since an insulation resistance value measured with the positive side connected to earth is typically less than that taken through the reversed connection.

⚠️ DANGER
- When the Test button or Remote control switch is pressed with the Range selector switch set to an insulation resistance range position, take care not to touch the tip of the test probe or the circuit under test where a high voltage is present in order to avoid possible shock hazard.
- Do not make measurement with the Battery cover removed.

⚠️ CAUTION
- Ensure that the circuit under test is de-energized prior to any insulation testing.

1. Check the maximum voltage that may be applied to the circuit under test. Set the Range selector switch to a desired insulation resistance range. Keep the Safety key pressed down when turning the Range selector switch to 500V and 1000V position. The message "no" is displayed on the LCD when turning the Range selector switch without pressing the Safety key.
- Buzzer sounds when the Safety key is pressed down. Keep the Safety key pressed down when switching 500V and 1000V.
2. Connect the Earth probe to the earth terminal of the circuit under test. If the circuit is not earthed, connect the Earth probe to any appropriate conductor.
3. Connect the Line probe to the circuit under test and press the Test button or Remote control switch.
4. Take the reading on the LCD.

(1) Check the maximum voltage that may be applied to the circuit under test. Set the Range selector switch to a desired insulation resistance range. Keep the Safety key pressed down when turning the Range selector switch to 500V and 1000V position. The message "no" is displayed on the LCD when turning the Range selector switch without pressing the Safety key.
- Buzzer sounds when the Safety key is pressed down. Keep the Safety key pressed down when switching 500V and 1000V.
2. Connect the Earth probe to the earth terminal of the circuit under test. If the circuit is not earthed, connect the Earth probe to any appropriate conductor.
3. Connect the Line probe to the circuit under test and press the Test button or Remote control switch.
4. Take the reading on the LCD.

<Auto discharge function>
This function allows electric charges stored in the capacitance of the circuit under test to be automatically discharged after testing. Set the Range selector switch to the OFF position or turn the Remote control switch off with the test lead connected. Discharge can be monitored by the LIVE LED  and  mark.
6-5 Measurement of resistance (Continuity check)

**DANGER**
- Do not apply voltage to the resistance range. Always test the circuit or equipment to ensure it is surely de-energized before measurement.

Zero Ω ADJ. function

This is a function to null the resistance of the test lead or fuse in order to display the resistance of the equipment under test only.

**Setting:**
1. Set the Range selector switch to the Ω (Continuity) position.
2. Short the test leads: LINE (red) and EARTH (black).
3. Press the Zero Ω ADJ. key with the Test button locked or with the Remote control switch pressed. Then the mark is lit up and a value of 0.00 Ω is displayed on the LCD. This value is saved in the memory of the instrument and won’t be cleared after turning off the instrument.

**Releasing:**
1. Set the Range selector switch to the Ω (Continuity) position.
2. Open the test leads: LINE (red) and EARTH (black).
3. Press the Zero Ω ADJ. key to release this function when "OL" is displayed on the LCD while the Test button is locked or the Remote control switch is pressed down.

**Measurement:**
1. Set the Range selector switch to the Ω (Continuity) position.
2. Connect the test leads to the equipment under test, and press the Test button or Remote control switch.

**Principle of operation:**
Resistance = Voltage / Current

\[ RX = \frac{V}{I} \]

![Graph](image)
7. Functions keys

7-1 Comparator function
Set a reference resistance value at the insulation resistance range. The measured value is compared to the pre-set reference value, and the mark of PASS or FAIL is displayed on the LCD and buzzer.

Settable reference value:
- 0.1/0.2/0.25/0.4/0.5/1/2/2.5/5/10/20/30/50/100/Any : Unit [MΩ]
- The upper limit of "Any" varies depending on output voltage:
  - 125 V : 0.000 to 199.9 : Unit [MΩ]
  - 250/500/1000 V : 0.000 to 999.9 : Unit [MΩ]
This function can be set at each range.

Setting procedure
1. Set the Range selector switch to any desired insulation resistance range with the [Range] key pressed down.
   In this case, there is no need to press the Safety key to set the range selector switch to 500V or 1000V range.
2. Press the UP or DOWN key to select PASS or FAIL and then press the [Enter] key.
   Select PASS to sound when the measured value exceeds the pre-set value.
   Select FAIL to sound when the measured value is under the pre-set value.
3. The number displayed at the lower left on the LCD starts flickering. Press the UP or DOWN key to select the reference value, and press the [Enter] key.
4. The message [Any] and the set value are displayed on the LCD once the setting completes.
5. Press the [Clear] key to release this function.

Setting for Any
1. The decimal point displayed at the lower left on the LCD starts flickering when "Any" is selected. Press the UP or DOWN key to select the desired decimal position, and then press the [Enter] key.
2. The four-digit start flickering from the left. Press the UP or DOWN key and set it to the desired value, and press the [Enter] key.
   e.g.: in case 0.5MΩ is set.

\[
\begin{array}{cccc}
1 & 2 \\
\ast & \rightarrow & 0.5 & \rightarrow 0.50 & \rightarrow 0.500
\end{array}
\]

Fig. 12. Change of sub-indication
7-2 Memory (save) function

Measured insulation resistance can be saved to the internal memory up to 99 data.

Saving method:
(1) Measure the insulation resistance, and press the MEM key while the message MEM is displayed on the LCD. Then a memory number displayed at the lower left flickers. Select any memory number with the UP or DOWN key, and press the MEM key.
(2) Then, the measurement result displayed at the middle on the LCD flickers. Press the MEM key to save the result. It will be saved to the internal memory, and the memory number is increased by 1. Press the MEM key to delete the result.

Recalling the memory data
(1) Set the Range selector switch to any desired Insulation resistance range, and press the MEM key.
(2) Press the UP or DOWN key to switch the memory number. The measured voltage and value are displayed on the LCD.

Deleting all memory data
(1) To delete all memory, rotate the Range selector switch from OFF to Ω (CONTINUITY) position with the MEM key pressed down. Then release the MEM key.
(2) The message "clr" is displayed on the LCD. It flickers and buzzer sounds when the MEM key key is being pressed down again. The deletion is completed once "Ω" is displayed on the LCD.

Note:
• The mark "---" is displayed on the LCD when no data is saved with the selected memory No.
• Resistance value is displayed on the LCD when data is saved with the selected memory No.
• Old data is overwritten with new when a new data is saved with the same memory No.

8. Fuse & Battery replacement

⚠️ DANGER
• Never open the Battery cover during a measurement. Dispose of the used batteries according to the rules, which is defined by each community.

⚠️ WARNING
• To avoid possible electric shock, remove test leads before opening the Battery cover. After replacing batteries, be sure to tighten up the screws for Battery cover.

⚠️ CAUTION
• Do not mix new and old batteries. Install batteries in correct polarity as marked inside the Battery compartment.

8-1 Battery Replacement
(1) Disconnect the test probe from the instrument.
(2) Open the battery compartment cover by unscrewing the metal captive screw to reveal battery compartment.
(3) Always replace all six batteries with new ones at the same time.
(4) Screw the battery compartment lid back on before using the instrument.

8-2 Fuse Replacement
(1) Disconnect the test probe from the instrument.
(2) Open the battery compartment cover by unscrewing the metal captive screw to reveal battery compartment and replace the fuse.
Fuse type: 500mA/600V (F) quick acting ceramic fuse 6.35 x 32mm.
(3) Screw the battery compartment lid back on before using the instrument.
9. Notes on Housing case and accessories

9-1 Case lid
Case lid can be fit under the Housing case while making measurement.

(1) Unhook and open the Case lid.
(2) Turn it 180 degrees.
   Put the Case lid under the Housing case.
(3) Hook it on to the Housing case.

9-2 Neck strap and Cord case
This instrument is equipped with a strap to suspend from the neck to allow both hands to be used freely for easy and safe operation.

9-3 Test prods and replacement

1. Types of Test prods
   MODEL8072: Standard Test prod
      Used for ordinary measurement.
      (Attached to the Line probe at the time of purchase.)
   MODEL8017: Extension probe
      Used in difficult-to-reach situations.
   MODEL8016: Pickle prod (Optional)
      Used to hook the probe on a conductor.

2. How to replace Test prod
   To remove the Test prod, turn the cap of LINE probe counterclockwise. Insert the threaded end of another prod into the hexagonal hole on the probe cap as shown. Then, turn the probe cap clockwise to secure it on the body of the probe.

9-4 Adaptors for the Earth cord and replacement

1. Adaptors
   MODEL7131: Safety alligator clip
      Connected to the Earth terminal of the Earth terminal board.
   MODEL7161: Test bar
      Connected to the earth side of the outlet.

2. How to replace Adaptors
   To remove the adaptors, pull them out. Then firmly attach the adaptor as desired to the tip of the Earth cord.

⚠️ DANGER
   • Disconnect the test leads from the instrument before replacing the test prods of the Line probe or the adaptors of the Earth cord in order to avoid a possible electric hazard.
10. Cleaning of the instrument

Cleaning Meter cover

- When cleaning the instrument, wipe it with a silicon cloth or soft cloth to remove dust or dirt.
- When it is hard to remove the dirt, wipe it with a cloth wet with water and dry the instrument completely after cleaning.

⚠️ CAUTION ⚠️
- Never use any solvent which may transmute plastics, for example, organic solvent such as benzene, acetone, etc.

11. Servicing

If this tester should fail to operate correctly, return it to your nearest distributors stating the exact nature of the fault.

Before returning the instrument, make sure that:
- a) Operating instructions have been followed.
- b) Test Leads have been inspected.
- c) Fuse has been checked.
- d) Battery has been checked.
- e) The unit is returned with all accessory leads.

Remember, the more information written about the fault, the quicker it will be serviced.

Lifetime Limited Warranty

The attention to detail of this fine snap-around instrument is further enhanced by the application of A.W. Sperry's unmatched service and concern for detail and reliability. These A.W. Sperry snap-arounds are internationally accepted by craftsmen and servicemen for their unmatched performance. All A.W. Sperry's snap-around instruments are unconditionally warranted against defects in material and workmanship under normal conditions of use and service; our obligation under this warranty being limited to repairing or replacing free of charge, at A.W. Sperry snap-around instrument that malfunctions under normal operating conditions at rated use. ¹

Replacement procedure

Securely wrap the instrument and its accessories in a box or mailing bag and ship prepaid to the address below. Be sure to include your name and address, as well the name of the distributor, with a copy of your invoice from whom the unit was purchased, clearly identifying the model number and date of purchase.

A.W.SPERRY INSTRUMENTS INC.
ATT: Customer service dept.
2150 Joshua's Path, Suite 302,
Hauppauge, NY 11788

¹The warranty is not applicable if the instrument has been: misused, abused, subjected to loads in excess of specifications, has had unauthorized repair or has been improperly assembled or used.

*Note: Recommended calibration interval should not exceed one year. Calibration service charges are not covered terms and conditions of warranty.