

Operating Instructions
DIGITAL MEGOHM
INSULATION/CONTINUITY TESTER
MODEL 3001B



CAUTION

Please read this Manual thoroughly and completely before putting instrument into use. Failure to do so might result in injury and/or damage to equipment. Observe all standard industry safety rules.

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Table of Contents

1. Safety Precautions.....	2
2. Features.....	5
3. Specification	6
4. Instrument Layout.....	7
5. The Nature of Insulation Resistance.....	8
6. Preparation for Measurements.....	11
7. Insulation Resistance Measurements	13
8. The Nature of Low Resistance Circuits	16
9. Low Resistance (Continuity) Measurements ...	17
10. Battery Testing & Replacement	18
11. Using the Carrying Case.....	19

1. Safety Precautions

To avoid possible electric shock, instrument damage and/or damage to the equipment under test, read these operating instructions thoroughly and completely before operating your meter. Pay particular attention to all WARNINGS which will inform you of potentially dangerous procedures. The instructions in these warnings must be followed for maximum personal safety.

- 1) Insulation tests are to be performed on de-energized (DEAD) circuits and equipment only. Do not perform tests on energized (LIVE) circuits!
- 2) Always test the circuit or equipment for the presence of voltage to insure it is de-energized. Make sure that you can visually see that the circuit or equipment is disconnected before proceeding with an insulation test. Do not proceed with any tests if you are not sure the circuit is DEAD!
- 3) Consult the manufacturer of the equipment you are going to test if you are not sure how to test it with a High Voltage Insulation Tester. Some equipment may contain sensitive electronic components which may be damaged during a test by applying a high DC Voltage. Consult the manufacturer for precautions that should be followed to avoid equipment damage.
- 4) This insulation tester will produce a High DC Voltage of 500V DC or 1000V DC in open circuit state. The current output is limited to less than 2mA DC under full load which may pose a shock hazard to some individuals. Do Not touch the test leads during an Insulation Test. Do Not attempt to stimulate or shock anyone else with this tester.

Horse play and fooling around can result in electric shock causing Ventricular Fibrillation.

- 5) Always inspect your meter, test leads and accessories for any sign of damage or abnormality before every use. If any abnormal conditions exist (eg. broken test leads, cracked cases, display not reading, etc.), do not attempt to take any measurements.
- 6) Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.
- 7) To avoid electric shock use CAUTION when working with voltages above 40V DC or 20V AC. Such voltages pose a shock hazard.
- 8) Never exceed the maximum allowable input value of any function on this measuring instrument when taking a measurement.
- 9) Never touch exposed wiring, connections or any live circuit when attempting to take electrical measurements. Treat the circuit as if it is energized (LIVE).
- 10) Do not attempt to operate this instrument in an explosive atmosphere (i.e. in the presence of flammable gases or fumes, vapor or dust).
- 11) When testing for the presence of voltage, make sure the voltage function is operating properly by reading a known voltage in that function before assuming that a zero reading indicates a no-voltage condition. Always test your voltage meter before and after taking measurements on a known live circuit.

- 2) Calibration and repair of any instrument should only be performed by qualified and trained service technicians. Do not attempt calibration or service unless trained and another person, capable of rendering first aid and resuscitation is present.
- 3) Do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to your distributor authorized service center for service and repair to insure that safety features are maintained.
- 4) The instrument must be used by a competent, trained person and operated in strict accordance with the instructions. A.W. Sperry will not accept liability for any damage or injury caused by misuse or non-compliance with the instructions or safety procedures. It is essential to read and understand the safety rules contained in the instructions. They must be observed when using the instrument.

2. Features

- High power digital insulation tester permitting accurate measurements.
- Insulation tester reading to 200M Ω at 500V for general purpose testing or where electronic components may be present in the circuits under test.
- Insulation tester reading to 200M Ω at 1000V for special high voltage testing.
- Continuity and low resistance tester suitable for cable resistance measurements.
- Live circuit neon indicator plus audible warning signal indicates for live circuits between 70V AC to 550V AC.
- Press to test button with lock down feature. Releasing the press to test button will automatically discharge the capacitance of the circuit under test.
- Compact, lightweight and portable.
- Front panel zero adjust.
- Ever-Ready carrying case — Instrument can be used without removing it from the case.
- Convenient neck strap for two hands free operation with easy display viewing.

3. Specification

Insulation Resistance Tester	Test voltage	500V	1000V
	Measuring ranges	0—200M Ω (2/20/200M Ω) (autoranging)	0—200M Ω (2/20/200M Ω) (autoranging)
	Terminal voltage	500V \pm 5% from 0.5M Ω to ∞	1000V \pm 5% from 1M Ω to ∞
	Output short circuit current	1.5mA max.	
	Accuracy	\pm 1.5% of rdg \pm 1 dgt	
Ohmmeter	Overload protection	550V for all ranges	
	Measuring range	0—200 Ω (20/200 Ω autoranging)	
	Output voltage on open circuit	150mV approx.	
	Output short circuit current	10mA approx.	
	Accuracy	\pm 1% of rdg \pm 0.1 Ω \pm 1 dgt	
	Overload protection	Electronic protection no fuse	
	Live circuit warning lamp	70V AC to 550V AC operating voltage	
Dimensions LWD		144 (5.66") \times 93 (3.66") \times 61 (2.40") mm	
Weight		460g (16 oz.) approx.	
Batteries		8 \times 1.5V SUM 3 battery or HP 7, size AA or equivalent	
Accessories		Test Leads TL-61/ Carrying Case C-58	

Note: M Ω = 1,000,000 Ω = 10⁶ Ω

4. Instrument Layout

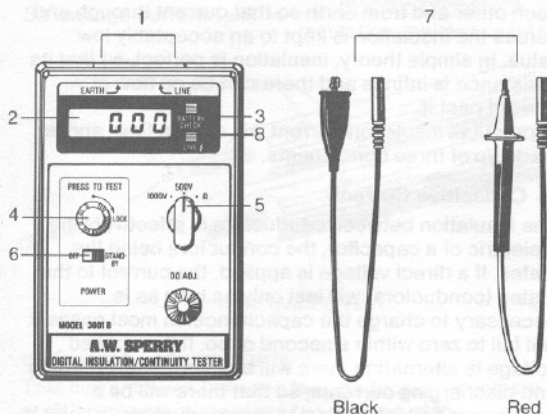


Fig. 1

- | | |
|---|---|
| 1. Terminals | 2. Digital Display |
| 3. Battery Check Lamp | 4. Press to Test Button
with Lock Down Feature |
| 5. Range Switch Knob | 7. Test Leads |
| 6. Off — Stand-By Button | |
| 8. Live Circuit Warning Lamp
70V AC to 550V AC | |

5. The Nature of Insulation Resistance

Insulation is used to separate live conductors from each other and from earth so that current through and across the insulation is kept to an acceptably low value. In simple theory, insulation is perfect, so that its resistance is infinite and there can be no flow of current past it.

In practice, insulation current will always flow, and is made up of three components.

a) Capacitive Current

The insulation between conductors is effectively the dielectric of a capacitor, the conductors being the plates. If a direct voltage is applied, the current to the plates (conductors) will last only as long as is necessary to charge the capacitance. In most cases it will fall to zero within a second or so. If the applied voltage is alternating there will be alternating charging and discharging currents, so that there will be a continuous flow of current to the conductors.

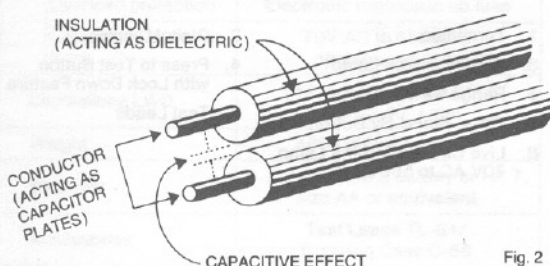


Fig. 2

b) Conduction Current

This is current flowing through the insulation itself because the insulation resistance is not infinite. Ohm's law applies.

$$\text{So leakage current } (\mu\text{A}) = \frac{\text{applied voltage (V)}}{\text{insulation resistance (M}\Omega\text{)}}$$

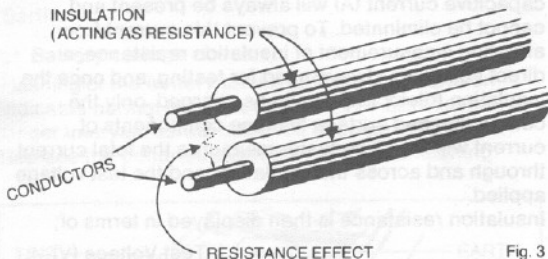


Fig. 3

c) Surface Leakage Current

This current flows between the conductors which are at different potentials along the surface of the insulation where there is dirt and/or moisture present. It occurs only where the continuous insulation is removed, i.e. where conductors are connected together or into terminals.

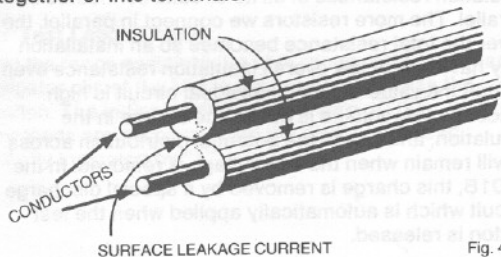


Fig. 4

Effectively, the total current flowing between conductors or from live conductors to earthed metal is the sum of the three components a, b & c explained above. All three currents, and thus their total, are affected by factors such as temperature, humidity and applied voltage.

In a circuit where alternating voltages are used, the capacitive current (A) will always be present and cannot be eliminated. To prevent this current from affecting measurement of insulation resistance, a direct voltage is always used for testing, and once the insulation (dielectric) becomes charged, only the conduction and surface leakage components of current will flow. The tester measures the total current through and across the insulation, and the test voltage applied.

Insulation resistance is then displayed in terms of:

$$\text{Insulation resistance (M}\Omega\text{)} = \frac{\text{Test Voltage (V)}}{\text{Insulation current } (\mu\text{A})}$$

In the event of an otherwise healthy system having wet and dirty connections, the surface leakage current will be high and the insulation resistance correspondingly low.

Similarly, if a very large installation is tested, the overall insulation resistance will be made up of the insulation resistances of all its circuits connected in parallel. The more resistors we connect in parallel, the lower the total resistance becomes so an installation may have a very low overall insulation resistance even though the value for each individual circuit is high.

Since the test voltage is direct, the charge in the insulation, and hence the potential distribution across it, will remain when the test voltage is removed. In the 3001B, this charge is removed by a special discharge circuit which is automatically applied when the test button is released.

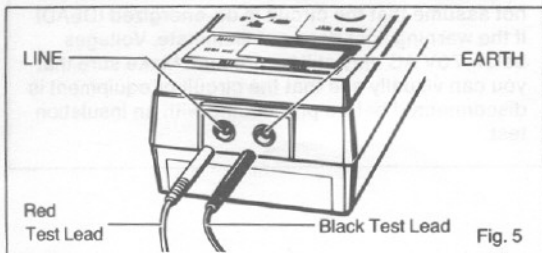
6. Preparation for Measurements

a) How to connect test leads

Connect the red test lead into the terminal marked 'Line' and the black lead into the terminal marked 'Earth'.

b) Battery voltage check

Flashing of the battery check LED during operation indicates normal battery condition. The LED flashes at longer intervals as the batteries become exhausted. Replace the batteries when the LED stops flashing.



c) Test Leads Check

Set the range switch to the ohm range. With the tip and alligator clip of the test leads connected press the test button. The indicator should read zero **0.00**. When the leads are not connected the display will read infinity indicated by "1".

d) Disconnection and check of power source of circuit under test

Turn off the power source of the circuit under test and connect the test leads to it. Make certain that the live circuit warning lamp is not on and the audible warning is not present. If the lamp lights up and the beeper sounds recheck that the power source is disconnected before proceeding.

WARNING

The "Live Circuit Warning Lamp" and "Warning Buzzer" will light up and sound for voltages between 70V AC and 550V AC. Voltages as low as 40V DC and 20V AC may pose a shock hazard. Do not assume that the circuit is de-energized (DEAD) if the warning light does not illuminate. Voltages below 70V AC may still be present. Make sure that you can visually see that the circuit or equipment is disconnected before proceeding with an insulation test.

7. Insulation Resistance Measurements

WARNING

To avoid possible electric shock, instrument damage and/or damage to the equipment under test, insulation tests are to be performed on de-energized (DEAD) circuits and equipment only. Do not perform tests on energized (LIVE) circuits! Always test the circuit or equipment to insure it is de-energized. Make sure that you can visually see that the circuit or equipment is disconnected before proceeding with an insulation test. Do not proceed with any tests if you are not sure the circuit is DEAD!

Some equipment may contain sensitive electronic components which may be damaged during an insulation test when applying a HIGH DC Voltage. Consult the manufacturer of the equipment under test for precautions that should be followed to avoid equipment damage.

a) Measurements at 500V

This is the voltage used for the majority of insulation resistance tests on normal installations.

- 1) First, set the range switch to 500V, and attach the test leads to the instrument. Connect the alligator clip on the black lead to one side of the circuit to be tested (for example, to earth) and place the probe on the red lead in contact with the other side (for example, phase, or neutral). Should the "live circuit" lamp on the instrument scale light up and the audible warning sound, the circuit under test is live. Make sure that the test button is not pressed, and carefully remove the test connections to the circuit. Switch off the circuit under test, and start again.

- 2) To measure insulation resistance, press the test button. The "power on" lamp will light and the insulation resistance will be displayed.
- 3) For hands free operation a lock down feature is incorporated on the press to test button. Pressing and turning clockwise locks the button in the operating position. The button is released by turning it counterclockwise.
- 4) The charge stored in the insulation of the equipment under test will be automatically discharged when the test button is released. If the equipment under test has a large amount of capacitance the discharge time will be increased. Should the "Live Circuit Warning Lamp" illuminate after the test button is released, this indicates that the circuit is still discharging. Wait for the "Live Circuit Warning Lamp" to go out before removing the test leads from the circuit under test.

WARNING

Voltage below 70V AC may still be present after the "Live Circuit Warning Lamp" goes out. Do not touch the electrical connections when removing the test leads. Voltages as low as 40V DC and 20V AC may pose a shock hazard.

CAUTION: Turning the range switch knob while the test button is in the on position will damage the insulation tester.

b) Measurements at 1000V

First, set the range switch to 1000V and then proceed as indicated in a) above for 500V testing. The above note also applies to testing at 1000V. In addition the following applies.

CAUTION: Make sure that the circuit under test does not include components which will be damaged by the 1000V applied. Many normal components of an installation are likely to be damaged if tested at 1000V. Examples are power factor correction capacitors, low voltage mineral-insulated cables, electronic light dimmers, electronic ballasts and starters for fluorescent lamps etc. etc.

This voltage may be selected where the supply voltage is between 500 and 1000V AC and recommended by the manufacturer of the equipment under test. Always consult the manufacturer of the equipment under test for the proper precautions that should be followed to avoid equipment damage.

8. The Nature of Low Resistance Circuits

Traditionally the installation electrician has been concerned with continuity tests which simply confirmed the presence of a closed circuit with no actual resistance measurement value obtained. With the two low resistance ranges on this model the electrician can not only confirm the continuity, he can also obtain a digital resistance reading. This reading has a 1/100 ohm resolution from 0.01 to 19.99 ohms on one range and 1/10 ohm resolution from 20.00 to 199.9 ohms on the other. This meter can now be used for applications requiring these low resistance continuity measurements. Some of these include, motor winding resistance measurements, electronic circuits test measurements, earth-fault loop impedance testing, etc.

Note: When testing electronic circuits, the voltage between the test prods on the low resistance range is about 0.15V, which will often be insufficient to turn on a forward — biased silicon-diode. In any case, the forward resistance of such a diode is often of the order of 1000 Ω , which is beyond the range of the resistance scale. For this reason, resistance-measuring instruments are usually unsuitable for testing circuits which contain non-linear (electronic) components.

9. Low Resistance (Continuity) Measurements

WARNING

To avoid possible electric shock, instrument damage and/or damage to the equipment under test, do not perform resistance/continuity tests on an energized (LIVE) circuit.

All resistance/continuity measurements must be performed on de-energized (DEAD) circuits to insure safe and accurate readings. Electronic solid state protection is provided for misapplications of up to 400V AC with no fuse blow or recalibration necessary. It is not recommended that voltages below 400V AC be intentionally applied to this instrument.

Do not Proceed without first disconnecting and de-energizing the circuit under test!

- a) Set the range switch to Ω position.
- b) Connect the tips of the test leads to both ends of the circuit under test. Press the test button and read resistance in Ω on the Ω scale.

Zero Adjustment

A convenient front panel zero adjust feature is incorporated.

Check and adjust the zero position on the Ω scale as follows:

Short the tips of the test leads and press the test button. If the display does not read zero **0.00** turn the zero adjust to obtain a zero reading.

10. Battery Testing and Replacement

Flashing of battery check LED during operation indicates normal battery condition. The LED flashes at longer intervals as the batteries become exhausted. Replace the batteries when LED stops flashing. Replace with 8 × 1.5 V SUM-3 (AA) size batteries.

11. Using the Carrying Case

MEMO

The carrying case cover may be stored beneath the case. This permits the instrument to be used without removal from its case. The strap can be put round the neck of the user so that the case and instrument are horizontal, leaving both hands free for testing.

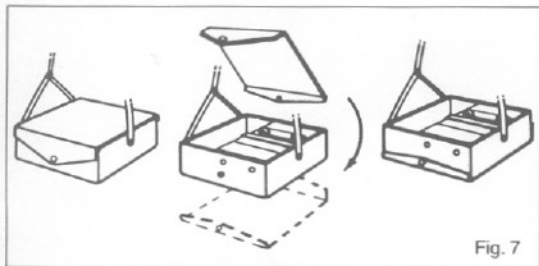


Fig. 7

ONE YEAR LIMITED WARRANTY

A.W. Sperry Instruments, Inc., warrants that this AWS instrument has been carefully tested, inspected, and warranted for one (1) year from the date of purchase by the original end user purchaser provided the completed warranty card is returned within ten (10) days after purchase and the instrument has not been misused, damaged due to negligence, neglect or unauthorized repair, abused or used contrary to the operating instructions. Instruments and proof of purchase in the form of a legible copy or original of the sales receipt clearly identifying the distributor, model number and date of purchase must be returned to A.W. Sperry Instruments Inc., Attention: Customer Service Center, 245 Marcus Boulevard, Hauppauge, New York 11788, postage prepaid for examination and verification of manufacturing defect under warranty. A.W. Sperry Instruments Inc., shall be the sole judge of such defect. The liability of A.W. Sperry Instruments Inc., shall be limited to the repair or replacement at its sole option of any defective product.

THIS WARRANTY AND THE OBLIGATIONS AND LIABILITIES OF SELLER THEREUNDER ARE EXCLUSIVE AND IN LIEU OF AND BUYER HEREBY WAIVES ALL OTHER REMEDIES, EXPRESS WARRANTIES, GUARANTEES OR LIABILITIES, OF AND FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR WHETHER OR NOT OCCASIONED BY SELLER'S NEGLIGENCE. THIS WARRANTY SHALL NOT BE EXTENDED, ALTERED OR VARIED EXCEPT BY A WRITTEN INSTRUMENT SIGNED BY SELLER AND BUYER. SOME STATES ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIED LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

WARRANTY REGISTRATION

To validate warranty, please complete the warranty registration card enclosed with your instrument and return to A.W. Sperry Instruments Inc., 245 Marcus Blvd., Hauppauge, N.Y. 11788 within 10 days of purchase. No postage required.

WARRANTY RETURN

Refer to section "Return for Repairs" for complete instructions. All warranty returns must include a legible copy or original of the sales receipt clearly identifying the model number, serial number and date of purchase.

A. W. Sperry reserves the right to change specifications and designs described in this manual without notice and without obligations.