

OPERATING INSTRUCTIONS MODELS DM-210A, 220A, 230A DIGITAL MULTIMETER

PLEASE READ THESE OPERATING INSTRUCTIONS CAREFULLY

Misuse and or abuse of these instruments cannot be prevented by any printed word and may cause injury and or equipment damage. Please follow all these instructions and measurement procedures faithfully and adhere to all standard industry safety rules and practices.



A.W. SPERRY INSTRUMENTS INC.

The Professional's Choice™

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WARRANTY

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, 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, NY 11788, Postage prepaid for examination of verification of manufacturing defect under warranty. A.W. Sperry Instruments, Inc. shall be the sole judge of such defect. Liability of A.W. Sperry Instruments, Inc. shall be limited to the repair or replacement at its sole option of any defective product.

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.

Sec. 1 DESCRIPTION

These DMMs offer a powerhouse of measurement capability in a small self-contained housing. It is designed for the professional at work in the field or in the laboratory, yet simple enough to operate making it perfect for the hobbyist too.

Safety was a prime consideration in the design of this DMM. Housed in shock resistant ABS plastic, this instrument stands up to the use and abuse of everyday

service, and electrically insulates the user from potential shock hazards. Electronic overload protection against accidental application of voltage to resistance and continuity circuits, combined with its rugged construction make it durable and reliable instrument.

Sec. 2 FEATURES

- UL listed to both US and Canadian standards
- Designed to Cat. II 600V
- Pocket-size
- Simple operation
- Recessed safety designed input terminals
- Overload protection on all ranges
- Diode test function
- Continuity

Sec. 3 SPECIFICATIONS

Display: 3-1/2 digit LCD, 0.625" numerals, maximum reading 1999 with automatic sign.

Overrange Indication: "1" most significant digit shows.

Sampling Rate: 3 times per second.

Operating Environment: 0° to 50°C (32° to 122°F), Max RH 80% to 31°C decreasing linear to 50% RH at 40°C.

Storage Environment: -20° to 60°C (-4° to 140°F) at <80% relative humidity.

Power Source: One (1) 9V Transistor Type Battery AWS Part #B-4 (NEDA #1604).

Power Consumption: 30mW typical.

Battery Life: 200 hours typical with zinc carbon.

Fuse: Part F-14; 0.2A, 250V, 5x20mm, fast acting.

Dimensions: 5.1"H x 2.8"W x 1.1"D (130 x 72 x 28 mm).

Weight: Approximately 5.0 oz. (146g) including battery.

Instrument complies with insulation category (over voltage category) II. Industrial use. Pollution degree 2 in accordance with IEC-664. Altitude up to 2000M. Indoor use. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

DOUBLE INSULATION



WARNING: TO AVOID ELECTRIC SHOCK DISCONNECT MEASURING TERMINALS BEFORE REMOVING BATTERY COVER.



CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH FUSE OF THE SPECIFIED VOLTAGE, CURRENT AND RUPTURE SPEED RATINGS.

DC Voltage

	19 Range, 6 Function DM-230A	15 Range, 6 Function DM-220A	11 Range, 4 Function DM-210A
Range	200mV/2/20/ 200/600V	2/20/200/600V	2/20/200V
Basic Accuracy	0.50%	1.50%	1.50%
Resolution	100 uV	1mV	1mV
Input Impedance	10 Mohm	10 Mohm	10 Mohm
Overload Protection	600VDC or peak AC on all ranges		

AC Voltage

	19 Range, 6 Function DM-230A	15 Range, 6 Function DM-220A	11 Range, 4 Function DM-210A
Range	200/600V	200/600V	200/600V
Basic Accuracy	1.50%	1.50%	1.50%
Resolution	100mV	100mV	100mV
Input Impedance	10 Mohm	10 Mohm	10 Mohm
Response			
Frequency Response	50-60 Hz	50-60 Hz	50-60 Hz
Overload Protection	600VDC or peak AC on all ranges		

DC Current

	19 Range, 6 Function DM-230A	15 Range, 6 Function DM-220A	11 Range, 4 Function DM-210A
Range	0-20u/200uA/2m/ 20m/200mA		
Basic Accuracy	1.50%		
Resolution	10nA		
Overload Protection	200mA/250V fuse glass fuse		

Resistance

	19 Range, 6 Function DM-230A	15 Range, 6 Function DM-220A	11 Range, 4 Function DM-210A
Range	0-200/2K/20K/ 200K/2M	0-200/2K/20K/ 200K/2M	0-200/2K/20K/ 200K/2M
Basic Accuracy	1.50%	1.50%	1.50%
Resolution	0.1 ohm	0.1 ohm	0.1ohm
Overload Protection	250 VDC or Peak AC on all ranges		

Diode Test

	DM-230A	DM-220A	DM-210A
Test Current	1 +/- .6 mA	1 +/- .6 mA	1 +/- .6 mA
Test Voltage	6V (MICROWAVE DIODE)	3.2V	3.2V

Battery Test

	DM-230A	DM-220A	DM-210A
Battery Test		DM220A 1.5V/9V	

Sec. 4 SAFETY RULES

1. Read these operating instructions thoroughly and completely before operating your DMM. Pay particular attention to WARNINGS and CAUTIONS which will inform you of potentially dangerous procedures. These instructions must be followed.
2. Always inspect your DMM, test leads and accessories for any sign of damage or abnormally before every use. If any abnormal conditions exist (e.g. broken test leads, cracked cases, display not reading, etc.), do not attempt to take any measurements. Refer to section 12 Return for Repair.
3. 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.
4. Never touch exposed wiring, connections or any live circuit conductors when attempting to take measurements.
5. Never replace the protective fuse inside the DMM with any other than the AWS Part number specified or approved equal.

6. Remember: Think Safety and Act Safely.
7. When testing for the presence of voltage, make sure the voltage function is operating properly by reading a known voltage in that range before assuming that a zero reading indicates a no-voltage condition.
8. Calibration and repair should be performed by qualified maintenance personnel only.
9. Do not attempt calibration or service unless another person, capable of rendering first aid and resuscitation is present.
10. Do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to A.W. Sperry Instruments for service and repair to insure that safety features are maintained.
11. To avoid electric shock use CAUTION when working with voltages above 40Vdc or 20Vac. Such voltages pose a shock hazard.
12. Do not operate this instrument in an explosive atmosphere (i.e. in the presence of flammable gases or fumes, vapor or dust).

Sec. 5 PREPARATION FOR USE

Sec. 5.1 UNPACKING AND CONTENTS CHECK

The DMM's come complete and ready to use. Check the following contents list when unpacking. If any pieces are missing notify the distributor you purchased the instrument from or A.W. Sperry Instruments, Inc.

- Operating Instructions #314
- Test Leads TL-76 (one black, one red)
- 9V Transistor Type Battery (AWS Part #B-4)
- One Fuse installed

Sec. 5.2 PRE-OPERATION PROCEDURE

1. Install the 9V transistor type battery.
2. Inspect the instrument for any external defects by comparing with the diagram on page 1. If any abnormal conditions exist, do not attempt to take any measurements. Refer to sections 9 (Maintenance) and 12 (Return for Repairs).
3. Insert the test leads into the "COM" and "V- Ω " jacks. Connect the two ends of the test leads together.
4. Place the range selector switch into the off position. Nothing will appear on the display. Place the range selector switch into the following ranges shown in the chart below. Check for the appropriate meter response.

Range	Display	Reading
600DCV	000	+/-4 digits
200DCV	00.0	"
20DCV	0.00	"
2DCV	.000	
200	1__.	
2K	1.	
20K	1_.	
200K	1__.	

5. As you can see, the decimal point moves as the ranges are changed. The maximum display reading is 1999. The 200DCV range will actually only read 199.9Vdc. We call this the 200DCV range for convenience only.
6. You can now check the decimal point on each range by referring to sec. 3 Specifications where the ranges are all listed. Refer to the Range and Resolution columns to compute the decimal point location.
7. If any abnormal conditions exist, do not attempt to take any electrical measurements. Instead refer to sec. 12 Return for Repairs.

Sec. 6 BATTERY REPLACEMENT

The DMM's have a self-contained power supply consisting of One 9V Transistor Type Battery (NEDA #1604, AWS Part #B-4).

WARNING

Before attempting to replace the battery, first disconnect the test leads from any energized circuit and then disconnect the test leads from the instrument.

1. Disconnect the test leads from any energized circuit and then from the instrument.
2. Turn the range switch to the "OFF" position.
3. Remove screws and open the back case.
4. Remove the battery from the compartment and unsnap the battery connector.
5. Replace the battery with a 9V transistor type battery (NEDA #1604), AWS Part #B-4. For maximum battery life, alkaline cells are recommended.
6. Reverse the above procedure to complete battery replacement.

Sec. 7 FUSE REPLACEMENT

A 0.2A, 250V, 5 x 20mm fast acting fuse, AWS Part #F-14 is installed in the instrument and used to protect the ampere ranges along with other solid state components.

WARNING

Before attempting to replace the fuse, disconnect the test leads from any energized circuit and then disconnect the test leads from the instrument. Replace the fuse the AWS Part F-14 or approved equal only. Always use fast acting, high interrupting type fuses

1. Disconnect the test leads from any energized circuit and then from the instrument.
2. Turn the range selector switch to the "OFF" position.
3. Remove screws and open the back case.

4. Remove the fuse from the clip on the end of the PCB.
5. Install the replacement fuse being certain it meets the AWS Part F-14 specifications.
6. Replace the back case.

Sec. 8 OPERATION

Before making any measurements always examine the instrument and accessories used with the instrument for damage, contamination (excessive dirt, grease, etc.) and defects. Examine the test leads for cracked or frayed insulation and make sure the lead plugs fit snugly into the instrument jacks. If any abnormal conditions exist do not attempt to make any measurements. Instead refer to sec.14 Return for Repairs.

Sec. 8.1 VOLTAGE MEASUREMENTS

1. Insert the black and red test leads into the respective "COM" and "V-Ω" jacks.
2. Place the range selector switch into the 600DCV/600ACV position if a dc voltage is to be measured or into the position if an ac voltage is to be measured. Always start in the highest range of the function to be measured.

CAUTION

To avoid possible electric shock, instrument damage and/or equipment damage, do not attempt to take any voltage measurements if the voltage is above 600Vdc or if the voltage is unknown. 600Vdc is the maximum voltages that this instrument is designed to measure. The "COM" terminal potential should not exceed 600V measured to ground.

3. Apply the test leads to the two points at which the voltage reading is to be taken. Be careful not to touch any energized conductors with any parts of your body.
4. Turn the range selector switch to the next lower range for a more accurate reading only if the reading is within that next lower range.

- When measurements are completed, disconnect the test leads from the circuit under test. Remove the test leads from the instrument.

Sec. 8.2 CURRENT MEASUREMENTS

- Insert the black and red test leads into the respective "COM" and "mA" terminals.
- Place the function switch to the 200mA position. Always start with the highest range of the function to be measured.

CAUTION

Do not attempt to take a current measurement if the current is unknown or above 200mA. The "COM" terminal potential should not exceed 500V measured to ground.

- Completely de-energize the circuit in which the current is to be measured. Place the DMM in series with the conductor carrying the current which is to be measured. Energize the circuit.

CAUTION

Before changing ranges, always de-energize the circuit completely. An open circuit exists between the test leads during range change on the DMM.

CAUTION

The mA ranges are fuse protected. To avoid possible electrical shock, instrument damage and/or equipment damage do not:

- Attempt to take mA current readings on circuits having more than 200mA current flow.
- Impress a voltage between the "COM" and "mA" terminals exceeding 250Vac/dc. Some circuit damage may result for voltages below 250Vac/dc.
- Raise the "COM" terminal potential above 500V to ground.
- Energize the circuit. If the reading is within the next lower range, switch to that range after completely de-energizing the circuit under test. Continue changing to lower ranges if the reading is within the next lowest

range to obtain the best accuracy.

- Completely de-energize the circuit before removing the test leads.

Sec. 8.3 RESISTANCE AND DIODE MEASUREMENTS

- Insert the black and red test leads into the respective "COM" and "V- Ω " terminals.
- Place the range selector switch into the Ω range desired for a measurement. (The test range measures resistance from 000 up to 1999 and is used to test the forward resistance value of diodes. The diode check entails injecting a given current into the diode junction to be tested and reading the voltage drop across the diode.

CAUTION

All resistance and diode measurements should be taken on de-energized circuits only. To avoid possible electrical shock, instrument damage and/or equipment damage do not connect the "COM" and "V- Ω " terminals to circuits having a potential difference exceeding 250Vdc/ac. Do not connect the "COM" terminal to potentials exceeding 500V to ground.

- Completely de-energize the circuit or device which is to be measured. Connect the test leads to the device (the red test lead is positive with respect to the black test lead). When measuring a diode, connect the "V- Ω " terminal to the anode. A reading of indicates an overrange condition. This will occur with the test leads open on all resistance ranges. If overrange occurs when taking a reading, switch to the next highest range.

NOTE: On the diode test range, a [1] reading indicates a resistance greater than 2K which normally means a defective open circuit diode. Be certain the diode anode is connected to the V- Ω terminal.

Sec. 8.4 BATTERY TEST MEASUREMENTS

- Insert the black and red test leads into the respective

"COM" and "V" terminals for 1.5Vdc and 9Vdc.

- Place the range selector switch into the 1.5V or 9V battery test range.

CAUTION

To avoid electric shock, instrument damage and/or equipment damage, do not exceed 10Vdc while set to take measurements in the battery test range.

- Connect the test leads to the 1.5Vdc battery under test. Normally a good 1.5Vdc battery will read above 80.0mA. Normally a good 9Vdc battery will read above 22.0mA. Consult the battery manufacturer for complete battery specifications to determine actual battery life remaining and condition of battery.

Sec. 9 MAINTENANCE

Maintenance consists of periodic cleaning, battery replacement, fuse replacement and recalibration.

Sec. 9.1 CLEANING

The exterior of the instrument can be cleaned with a soft clean dry cloth to remove any oil, grease or grime from the exterior of the instrument. Never use liquid solvents or detergents. If the instrument gets wet for any reason, dry the instrument using low pressure "clean" air at less than 25 PSI. Use care and caution around the LCD display protector and areas where water or air could enter the interior of the instrument while drying.

Sec. 10 ACCESSORIES

The following accessory is available C-37 Carrying Case

Sec. 11 CALIBRATION

Calibration on these meters should be performed every year. This can be done by sending the instruments prepaid to:

A.W. Sperry Instruments, Inc.
Customer Service Department
245 Marcus Blvd.
Hauppauge, NY 11788

Specify in writing that calibration is necessary. The instrument will be returned to you normally within one week. Estimates will be furnished upon request.

CAUTION

The following procedures should be performed by persons trained and qualified in electronics and electronic equipment service. DO NOT attempt this procedure if not qualified.

WARNING

Do not attempt calibration or service unless another person capable of rendering first aid and resuscitation is present.

Sec. 12 RETURN FOR REPAIRS

Before returning your digital multimeter for repair be sure to check that the failure to operate properly is not due to the following:

- Weak battery
- Open fuse
- Open, loose or intermittent test leads

If these conditions do not exist and the instrument fails to operate properly, return the instrument and accessories prepaid to:

A.W. Sperry Instruments, Inc.
Customer Service Department
245 Marcus Blvd.
Hauppauge, NY 11788

State in writing what is wrong with the instrument. All warranty repairs must include proof of purchase in the form of a legible original copy of the sales receipt clearly identifying the distributor, model number and date of purchase. Repair estimate will be furnished if requested for out of warranty instruments. Be sure to include all accessories which may be related to the problem and a note describing the malfunction you observed.