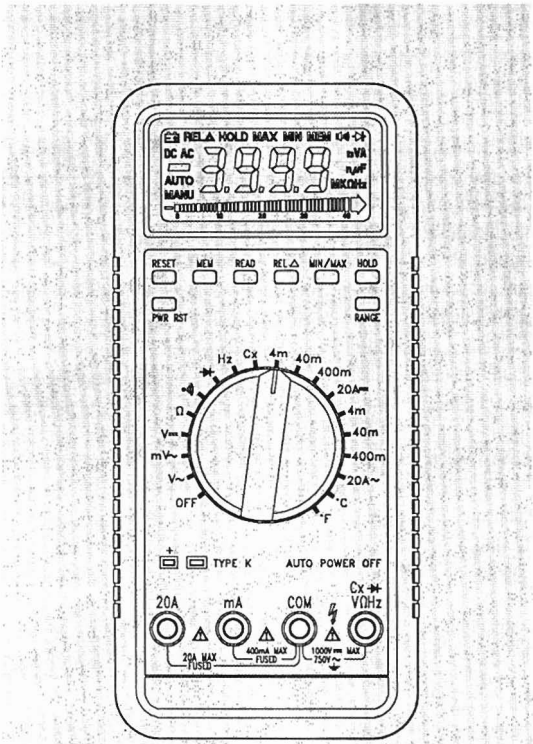
OPERATING INSTRUCTIONS
Model 872
DIGITAL MULTIMETER



CONTENTS

INTRODUCTION

This manual contains information and warnings which must be followed to ensure safe operation and retain the meter in safe condition.

WARNING

READ "SAFETY INFORMATION" BEFORE USING THE METER.

This multimeter is a handheld, 4000-count instrument that is designed for use in the laboratory, field servicing, and at home. The meter combines the precision of a digital multimeter with the high speed and versatility of a analog display. This meter features compact design with rounded corners for easy handling and has a rugged case in shock resistant and fire-retardant. Electronic overload protection for all functions and ranges. The Protective Holster (optional accessory) combined with rugged case make it a durable and reliable instrument.

UNPACKING AND INSPECTION

Upon removing your new Digital Multimeter (DMM) from its packing, you should have the following items:

1. Digital Multimeter
2. Test Lead Set (one black, one red)
3. 9-Volt Battery (installed in meter)
4. Beaded Thermocouple Wire
5. Instruction Manual
6. One Spare Fuse (500mA/600V, 6.3mm x 25mm, fast acting)

If any of the above items are missing or are received in a damaged condition, please contact the distributor from whom you purchased the unit.

SAFETY INFORMATION

Injury or death can occur even with low voltages and low currents. It is extremely important that you read these safety information before using your multimeter. Follow all safety practices and proper operating procedures for equipment being tested.

1. Exercise extreme caution when:
   Measuring voltage above 20 volts, measuring current greater than 10mA, measuring AC power line with inductive loads, measuring AC power line during electrical storms.

2. Always inspect your DMM, test leads and accessories for any sign of damage or abnormality before every use. If any abnormal conditions exist (i.e., broken or damaged test leads, cracked case, display not reading, etc.), do not attempt to take any measurements.

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, test probe tips, or any live circuit conductors when attempting to make measurements.

5. Never replace the protective fuse inside the DMM with a fuse other than the specified or approved equal fuse.

6. Do not operate this instrument in an explosive atmosphere (i.e., in the presence of flammable gases or fumes, vapor or dust.)

7. Measuring voltage which exceeds the limits of the multimeter may damage the meter and expose the operator to a shock hazard. Always recognize the meter voltage limits as stated on the front of the meter.

8. Never apply more than 500VDC between the COM jack and earth ground.

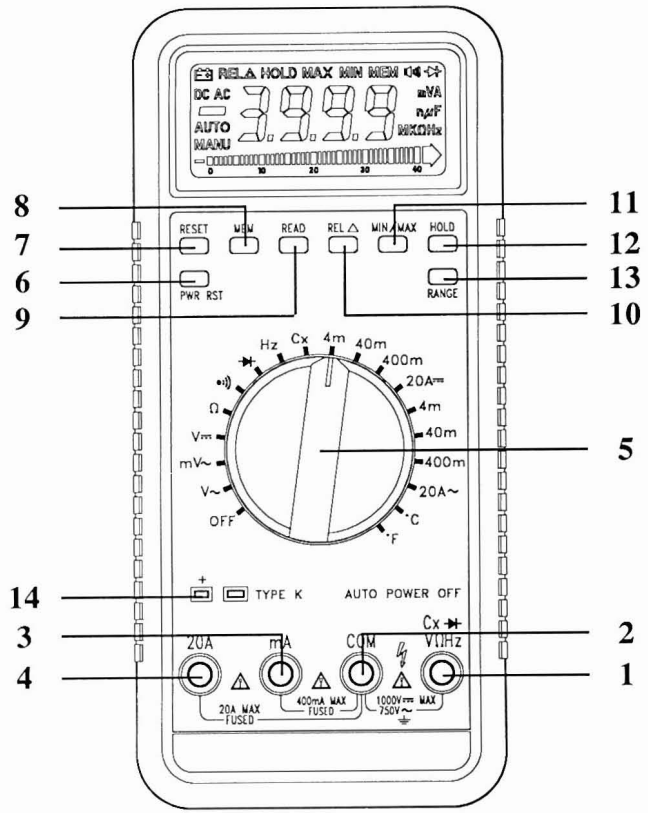
9. Never touch a voltage source when the test leads are plugged into a current jack.

10. When testing for the presence of voltage or current, make sure the voltage or current ranges are functioning correctly. Take a reading of a known voltage or current before assuming a zero reading indicates no current or voltage.

SYMBOL EXPLANATION

	Attention! Refer to the Operating Instructions
	Dangerous Voltage May Be Present at terminals
	Ground
	AC - Alternating Current
	DC - Direct Current
	Diode
	Audible Continuity
	Double Insulation

INSTRUMENT LAYOUT



1 V Ω Hz Cx ⊣⊢ Volt, Ohms, Frequency, Capacitance, Diode, Input Terminal

This is the positive input terminal for all functions except current measurements. Connection is made to it using the Red test lead.

2 COM Common Terminal

This is the negative (ground) input terminal for all measurement modes. Connection is made to it using the Black test lead.

3 mA Milliamp Input Terminal

This is the positive input terminal for current measurement (ac or dc) up to 400 mA. Connection is made to it using the Red test lead.

4 20A 20 Amperes Input Terminal

This is the positive input terminal for current measurement (ac or dc) up to 20A. Connection is made to it using the Red test lead.

5 Function / Range Selector Rotary Switch

This rotary switch selects function and range needed. Each time the rotary switch is moved from OFF to a function setting, all LCD segments will turn on for one second.

6 PWR-RST Button

When the meter is automatic power-off, press the button to turns meter back on.

Note: Disable Automatic Power-off

If you press and hold down the (PWR-RST) button while turning the meter from OFF to on and select a function, the automatic power-off feature is disabled.

7 RESET Button

Press (RESET) button to erase the stored reading, and all LCD segments will turn on for one second.

8 MEM Button

When (MEM) button is pressed, the "MEM" annunciator is displayed and the last reading is stored on the meter. If the meter power down automatically and the power back on by pressing (PWR-RST) button, these stored readings will remain in memory.

9 READ Button

Press (READ) button to recall the data you stored in memory, the readings will be displayed on the LCD, the "HOLD" annunciator turns on, and the "MEM" annunciator will be displayed with a blink. The automatic power-off feature is disabled. Press (HOLD) button to exit the READ mode.

10 REL △ Button

Press (REL) button to enter the Relative mode, the "REL△ " annunciator turns on, zero the display, and store the displayed readindg as a reference value. Press and hold down the (REL) button for 2 seconds to exit the relative mode.

In the Relative mode, the value shown on the LCD is always the difference between the stored reference value and the present reading. For example, if the reference value is 24.00V and the present reading is 12.50V, the display will indicate -11.50V. If the new reading is the same as the reference value, the display will be zero.

11 MIN / MAX Button

Press (MIN / MAX) button to enter the MIN MAX Recording mode. The minimum, maximum values are then reset to the present input, the readings are stored in memory, and the "HOLD" annunciator turns on. Push the button to cycle through the minimum (MIN), maximum (MAX), and present readings. The MIN or MAX annunciator turns on to indicate what value is being displayed.

In the MIN MAX Recording mode, press (HOLD) button to stop the recording of readings, press again to restart recording. If recording is stopped, the minimum, maximum, or present values and analog display are frozen. In the MIN MAX Recording mode, when a new minimum value is exceed the actual minimum readings or a new maximum value is overload, the minimum or maximum value will held on the display, but the analog display continues to be active.

12 HOLD Button

Press (HOLD) button to toggle in and out of the Data Hold mode, except if you are already in the MIN MAX Recording mode.

In the Data Hold mode, the "HOLD" annunciator is displayed and the last reading is held on the display, the beeper emits a tone, and the automatic power-off feature is disabled. Pressing (MIN / MAX) button when you are in the Data Hold mode causes you to exit Data Hold and enter the MIN MAX Recording mode.

13 RANGE Button

Press (RANGE) button to select the Manual Range mode and turn off the "AUTO" annunciator. (The meter remains in the range it was in when manual ranging was selected).

In the Manual Range mode, each time you press (RANGE) button, the range (and the input range annunciator) increments, and a new value is displayed. To exit the Manual Range mode and return to autoranging, press and hold down (RANGE) button for 2 seconds. The "AUTO" annunciator turns back on.

14 Temperature Jack

The temperature jack is located in the lower left-hand corner of the front panel. To measure a wide range of temperature (-30°C to +1300°C), plug in a K-type thermocouple and take the reading direct from the digital display.

HOW TO MAKE MEASUREMENTS

Before making any measurements always examine the instrument and accessories used with the instrument for damage, contamination (excessive dirt, grease, ect.) 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.

VOLTAGE MEASUREMENTS

1. Insert the black and red test leads into the COM and V-Ω input terminals respectively.
2. Select the desired AC voltage range (V~),(mV~) or DC voltage range (V⎓).

WARNING

To avoid possible electric shock, instrument damage and / or equipment damage, do not attempt to take any voltage measurements if the voltage is above 1000Vdc / 750Vac. 1000Vdc and 750Vac are the maximum voltages that this instrument is designed to measure. The "COM" terminal potential should not exceed 500V measured to ground.

3. Connect the test lead tips in parallel with the circuit to be measured (e.g. across a load or power supply). Be careful not to touch any energised conductors. Note the reading.
4. When all measurements are completed, disconnect the test leads from the circuit under test. Remove test leads from the multimeter.

For DC voltage readings, the RED lead tip should be connected to the positive side of the circuit, the BLACK lead to the negative side.

A minus sign on the left hand side of the LCD will appear if the leads are connected the other way round.

CURRENT MEASUREMENTS

These are made in series with the test circuit. All the current to be measured flows through the multimeter.

WARNING

Do not attempt to measure currents in high energy circuits capable of delivering greater than 600V. Since the fuse is rated at 600V damage or injury could occur. The 20A input terminal is protected by a 20A/600V high energy, fast blow fuse. The mA input terminal is protected by a 500mA/600V fast blow fuse.

Do not exceed the limits of each current input terminal. This is 20A (maximum time limit of 30 seconds for currents greater than 10A) for the 20A terminal and 400mA for the mA terminal.

All current ranges are fused. If a current greater than 20A on the 20A range or greater than 500mA on all other ranges flows, the fuse will blow causing an open circuit between the current measuring terminals.

1. Insert the BLACK test lead in the COM input terminal.
2. For measuring currents less than 400mA, connect the RED test lead to the mA input terminal. For measuring currents between 400mA and 20A connect the RED test lead to the 20A terminal.
3. Select the desired AC current range (A~) or DC current range (A⎓).

   NOTE: If the 20A range is selected then the 20A input terminal must be selected in step 2. If the 4mA, 40mA or 400mA range is selected the mA input terminal must be selected in step 2.
4. Switch OFF or disconnect the circuit to be measured from all power sources, connect the multimeter in series with the conductor in which the current to be measured flows.
5. Switch ON the circuit. Note the reading.
6. Switch OFF or disconnect the circuit and remove the test leads from multimeter.

CAUTION

A common abuse of multimeters is to attempt to measure a voltage while the test leads are still plugged into the current input terminals. This basically puts a short circuit across the voltage source since current ranges have a low impedance. If the voltage source is typically 240VAC or a 3-phase industrial voltage (415V), very high fault currents can result. This is why all current input terminal are fused. If the fuses blow they must only be replaced by the equivalent ones otherwise the safety of the instrument may be impaired.

7. Never apply a voltage between the COM terminal and current terminals.
8. When switching between current ranges to obtain greater accuracy and better resolution, completely de-energise the circuit to be measured before changing the range.

RESISTANCE MEASUREMENTS

CAUTION

Turn off power on the test circuit and discharge all capacitors before attempting in-circuit resistance measurements. If an external voltage is present across a component, it will be impossible to take an accurate measurement of the resistance of that component.

1. Insert the BLACK and RED test leads into the COM and VΩ input terminals respectively.
2. Set the rotary selector switch to the (Ω) position.
3. Connect the BLACK and RED test probe tips to the circuit or device under test, making sure it is de-energised first.
4. The resistance in the test leads can diminish accuracy on the lowest (400Ω) range. The error is usually 0.1 to 0.2Ω for a standard pair of test leads. To determine the error, short the test leads together and then use the (REL) Relative mode to automatically subtract the lead resistance from resistance measurements.

CONTINUITY TESTING

1. Select the ( ) position by turning the rotary selector switch.
2. Follow steps 1 and 3 as for resistance measurements.
   An audible tone will sound for resistance less than approximately 40Ω. After all measurements are completed, disconnect the test leads from the circuit and from the multimeter input terminals.

DIODE TESTING

CAUTION

Measurements must only be made with the circuit power OFF.

1. Set the rotary selector switch to the ( ) position.
2. Follow steps 1 and 3 as for resistance measurements.
3. The RED lead should be connected to the anode and the BLACK lead to the cathode. For a silicon diode, the typical forward voltage should be about 0.6V.
4. If the diode is reverse biased or there is an open circuit the reading displayed will be between 2.600V and 3.200V.

FREQUENCY MEASUREMENTS

1. Set the rotary selector switch to the (Hz) position.
2. Insert the BLACK and RED test leads into the "COM" and "VΩ" input terminals respectively.
3. Apply the test prods to the points across which the frequency is to be measured, and read the result directly from the display.

NOTE: For frequencies below 100Hz and greater than 100KHz, the display may not be stable. For frequencies below 1Hz, the display shows 00.00Hz.

CAPACITANCE MEASUREMENTS

CAUTION

Turn off power and discharge the capacitor before attempting a capacitance measurement. Use the DCV function to confirm that the capacitor is discharged.

1. Set the rotary selector switch to the (Cx) position.
2. Insert the BLACK and RED test leads into the "COM" and "VΩ" input terminals respectively.
3. Connect the test probe tips to the circuit or device under test. Note the reading displayed.
4. The measurement accuracy of capacitors can be improved by first using the "REL" (Relative mode) to zero the display and automatically subtract the residul meter and test lead capacitance. Since the Relative mode also selects manual ranging,
5. Residual voltage charges on the capacitor, or capacitors with poor insulation resistance or poor dielectric absorption may cause measurement errors.

TEMPERATURE MEASUREMENTS

1. Select the required temperature range and unit of measurement (°C or °F) by turning the rotary selector dial to one of the "TEMP" positions.
2. Connect a type K thermocouple to the thermocouple input terminal (yellow terminal) on the left hand side of the front panel.
3. Place the thermocouple junction tip at the point where the temperature is to be measured.

NOTE: for very high temperatures the multimeter must be kept far enough away from the source of temperature to avoid heat damage. At high temperatures, the life of the temperature probe will be reduced.

INPUT WARNING BEEPER

The Input Warning Beeper is a feature to protect the meter and you from unintentional misuse. If the DMM is set to measure a voltage while the test leads are plugged into a current jack, very high current could result when the test lead tips are placed to the voltage test point.

This feature warns you that the test lead needs to be changed from a current jack to the voltage jack.

All current ranges are fused with fast acting ceramic fuses as an added protection.

SPECIFICATIONS

- **Display:** 3¾ digit(4000 counts), 9999 counts(Frequency mode),42 segments analog bar graph and function/units sign annunciators.
- **Polarity:** Automatic, (-) negative polarity indication.
- **Overrange Indication:** MSD (Most Significant Digit) blinks.
- **Measurement Rate:** 2/sec, nominal. 1/sec, Capacitance and Frequency mode. 20/sec, Analog Display.
- **Operating Environment:** 0°C to 50°C at < 70% R.H.
- **Storage Environment:** -20°C to 60°C at < 80% R.H.
- **Temperature Coefficient:** 0.1 x (specified accuracy) / °C (<18°C or >28°C).
- **Auto Power off:** 30 minutes after rotary switch or mode changes.
- **Battery:** Single 9Volt battery, NEDA 1604, IEC 6F22, JIS 006P.
- **Battery Life:** 500 hours typical with alkaline battery.
- **Size (HxWxL):** 1.5 in x 3.4 in x 7.5 in (37 mm x 87 mm x 189 mm). With holster 2 in x 3.8 in x 7.9 in (52 mm x 96 mm x 200mm).
- **Weight:** Approx. 320g. With holster 435g.

* Accuracy is given as ±([% of reading]+[number of least significant digits]) at 18°C to 28°C, with relative humidity up to 70%.

DC Volts

Range	Resolution	Accuracy	Input Impedance
400mV	100μV	±(0.1% rdg+2d)	>1000MΩ
4V	1mV	±(0.1% rdg+2d)	11MΩ
40V	10mV	±(0.1% rdg+2d)	10MΩ
400V	100mV	±(0.1% rdg+2d)	10MΩ
1000V	1V	±(0.1% rdg+2d)	10MΩ

Overload Protection: 1000VDC or 750VAC rms

AC Volts (Average sensing RMS indicating)

Range	Resolution	Accuracy(50Hz to 500Hz)	(500Hz to 1KHz)
400mV	100μV	* ±(0.8% rdg+5d)	Unspecified
4V	1mV	±(0.5% rdg+3d)	±(1.2% rdg+5d)
40V	10mV	±(0.5% rdg+3d)	±(1.0% rdg+5d)
400V	100mV	±(0.5% rdg+3d)	±(1.0% rdg+5d)
750V	1V	±(0.5% rdg+3d)	±(1.2% rdg+5d)

* The frequency response for 400mV range are 50Hz to 100Hz only
Input Impedance: Same as DCV function with less than 100pF
Overload Protection: 1000VDC or 750VAC rms

DC Current

Range	Resolution	Accuracy	Burden Voltage
4mA	1μA	±(0.8% rdg+2d)	450mV
40mA	10μA	±(0.8% rdg+2d)	450mV
400mA	100μA	±(0.8% rdg+2d)	650mV
20A**	10mA	±(1.2% rdg+4d)	650mV

Overload Protection: 500mA/600V fuse on mA inputs (fast blow ceramic fuse). 20A/600V fuse on 20A inputs(fast blow ceramic fuse).
**10A continuous, 20A for 30 seconds maximum.

AC Current (Average sensing RMS indicating)

Range	Resolution	Accuracy (50Hz to 1KHz)	Burden Voltage
4mA	1μA	±(1.2% rdg+4d)	450mV
40mA	10μA	±(1.2% rdg+4d)	450mV
400mA	100μA	±(1.2% rdg+4d)	650mV
20A**	10mA	±(1.5% rdg+5d)	650mV

Overload Protection: 500mA/600V fuse on mA inputs (fast blow ceramic fuse). 20A/600V fuse on 20A inputs(fast blow ceramic fuse).
**10A continuous, 20A for 30 seconds maximum.

Resistance

Range	Resolution	Accuracy	Open Circuit Volts
400Ω	0.1Ω	±(0.5% rdg+4d)	0.4Vdc
4KΩ	1Ω	±(0.4% rdg+2d)	0.4Vdc
40KΩ	10Ω	±(0.4% rdg+2d)	0.4Vdc
400KΩ	100Ω	±(0.4% rdg+2d)	0.4Vdc
4000KΩ	1KΩ	±(0.7% rdg+4d)	0.4Vdc
40MΩ	10KΩ	±(1.2% rdg+4d)	0.4Vdc

Overload Protection: 500V DC or RMS AC

Continuity Test

Range	Audible Threshold	Response Time	Open Circuit Volts
400Ω	Less than 40Ω	Approx. 100ms	0.4Vdc

Overload Protection: 500V DC or RMS AC

Diode Test

Range	Resolution	Accuracy	Test Current	Open Circuit Volts
4V	1mV	±(1.0% rdg+1d)	0.6mA	3.2Vdc typical

Overload Protection: 500V DC or RMS AC

Capacitance

Range	Resolution	Accuracy (With film capacitor or better)	
4 nF	0.001 nF	±(2.0% rdg+20d)	in Relative mode
40 nF	0.01 nF	±(2.0% rdg+4d)	in Relative mode
400 nF	0.1 nF	±(2.0% rdg+4d)	
4 μF	0.001 μF	±(2.0% rdg+4d)	
40 μF	0.01 μF	±(2.0% rdg+4d)	at < 20 μF
		±(5.0% rdg+4d)	at > 20 μF

Overload Protection: 500V DC or RMS AC

Frequency

Range	Resolution	Accuracy	Trigger Level
100Hz	0.01Hz	±(0.1% rdg+10d)	40 mV
1KHz	0.1Hz	±(0.1% rdg+4d)	40 mV
10KHz	1Hz	±(0.1% rdg+4d)	40 mV
100KHz	10Hz	±(0.1% rdg+8d)	400 mV
400KHz	100Hz	±(0.1% rdg+20d)	400 mV

Overload protection: 500VDC or RMS AC

NOTE: For frequencies below 100Hz and greater than 100KHz, the display may not be stable. For frequencies below 1Hz, the display shows 00.00Hz.

Temperature

Range	Resolution	Accuracy	Sensor type
-50°C to 400°C	1°C	±(0.8% rdg+2°C)	K-type Thermocouple
1300°C	1°C	±(1.0% rdg+2°C)	
-58°F to 400°F	1°F	±(0.8% rdg+4°F)	
2372°F	1°F	±(1.0% rdg+4°F)	

Overload Protection: 60VDC or 24VAC rms

MAINTENANCE

Repairs or servicing not covered in this manual should only be performed by qualified personnel.

REPLACING THE BATTERY

WARNING

TO AVOID ELECTRICAL SHOCK, DISCONNECT THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE BATTERY. REPLACE ONLY WITH SAME TYPE OF BATTERY.

This meter is powered by a NEDA type 1604 or equivalent 9-volt battery.
When the multimeter displays the " ⊟ " the battery must be replaced to maintain proper operation. Use the following procedure to replacing the battery:

1. Disconnect test leads from any live source, turn the rotary switch to OFF, and remove the test leads from the input terminals.
2. The case bottom is secured to the case top by three screws and two internal snaps (at the LCD end). Using a Phillips-head screwdriver, remove the three screws from the case bottom and turn the case over.
3. Lift the input terminal end of the case bottom until it gently unsnaps from the case top at the end nearest the LCD.
4. Remove battery and replace with a new equivalent 9-volt battery.
5. Replace the case bottom, ensuring that the two snaps on the case top (at the end near the LCD) are engaged. Reinstall the three screws.

REPLACING THE FUSE

WARNING

TO AVOID ELECTRICAL SHOCK, DISCONNECT THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE FUSES. REPLACE ONLY WITH SAME TYPE OF FUSES. THE 20A INPUT TERMINAL IS PROTECTED BY A F20A,600V HIGH ENERGY, FAST ACTING. THE mA INPUT TERMINAL IS PROTECTED BY A F500mA,600V FAST ACTING FUSE.

Use the following procedure to examine or replace the meter's fuses:

1. Disconnect test leads from any live source, turn the rotary switch to OFF, and remove the test leads from the input terminals.
2. The case bottom is secured to the case top by three screws and two internal snaps (at the LCD end). Using a Phillips-head screwdriver, remove the three screws from the case bottom and turn the case over.
3. Lift the input terminal end of the case bottom until it gently unsnaps from the case top at the end nearest the LCD.
4. Remove blown fuse, replace with fuse of the same size and rating. Make sure the new fuse is centered in the fuse holder.
5. Replace the case bottom, ensuring that the two snaps on the case top (at the end near the LCD) are engaged. Reinstall the three screws.

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