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Introduction

The DM397 is an advanced full-featured digital multimeter designed for engineers, HVAC and electrical technicians, whose work demands greater accuracy and resolution. The RS232 data logging kit and software (included) allows any measured parameter to be monitored or recorded to a PC for further analysis. The 50,000 count dual display shows two parameters simultaneously eliminating the need to toggle between selections. The DM397 stands alone as the best value in high-end multimeters.

Features include

- True RMS
- 1000 AC/DC & AC+DC Volts
- 1000 AC/DC & AC+DC Amps
- dBm & dBV
- High Resolution Resistance & Conductance
- Frequency / Duty Cycle
- Pulse Width
- Temperature / Capacitance / Continuity
- Relative Mode and (RELA) mode
- Data logging kit with software
- Data Storage & Recall
- MIN/MAX/AVG
- 1mS Peak Capture
- Audible & Visual input warning
- Backlit dual displays with analog bar-graph
- All input, ranges, & functions protected to 1000 V CAT III
- Closed case calibration
- Access to battery and fuses without breaking calibration seals
- Open fuse detection

Safety Notes

Before using this meter, read all safety information carefully. In this manual the word "**WARNING**" is used to indicate conditions or actions that may pose physical hazards to the user. The word "**CAUTION**" is used to indicate conditions or actions that may damage this instrument.

- Always follow industry standard safety practices including protective clothing, gloves and safety glasses when appropriate
- Do not attempt to measure any voltage that exceeds the category-based rating of this meter
- Do not attempt to use this meter if either the meter or the test leads have been damaged. Turn it in for repair at a qualified repair facility
- Ensure meter leads are fully seated by making a quick continuity check of the leads prior to making voltage measurements
- Keep your fingers away from the test lead's metal probe contacts when making measurements. Always grip the leads behind the finger guards molded into the probes
- Use a current clamp adapter when measuring current that may exceed 10 amps. See the accessories in UEI's full-line catalog
- Do not open the meter to replace batteries or fuses while the probes are connected

WARNING!

Exceeding the specified limits of this meter is dangerous and can expose the user to serious or possibly fatal injury.

- Voltages above 60 volts DC or 25 volts AC may constitute a serious shock hazard
- Always turn off power to a circuit (or assembly) under test before cutting, unsoldering, or breaking the current path - Even small amounts of current can be dangerous
- Always disconnect the live test lead before disconnecting the common test lead from a circuit
- In the event of electrical shock, ALWAYS bring the victim to the emergency room for evaluation, regardless of the victim's apparent recovery - Electrical shock can cause an unstable heart rhythm that may need medical attention
- Higher voltages and currents require greater awareness of physical safety hazards - Before connecting the test leads; turn off power to the circuit under test; set the meter to the desired function and range; connect the test leads to the meter first, then to the circuit under test. Reapply power
- If any of the following indications occur during testing, turn off the power source to the circuit under test:
 - Arcing
 - Flame
 - Smoke
 - Extreme Heat
 - Smell of Burning Materials
 - Discoloration or Melting of Components

CAUTION!

Do not attempt to remove the meter leads from the circuit under test. The leads, the meter, or the circuit under test may have degraded to the point that they no longer provide protection from the voltage and current applied. If any of these erroneous readings are observed, disconnect power immediately and recheck all settings and connections











Compliance

The DM397 complies with IEC 1010-1 (1995), UL 3111-1 (6.1995), EN 61010-1 (1995), CSA C 22.2 No. 1010-1 - 92; Overvoltage 1000V CAT III.

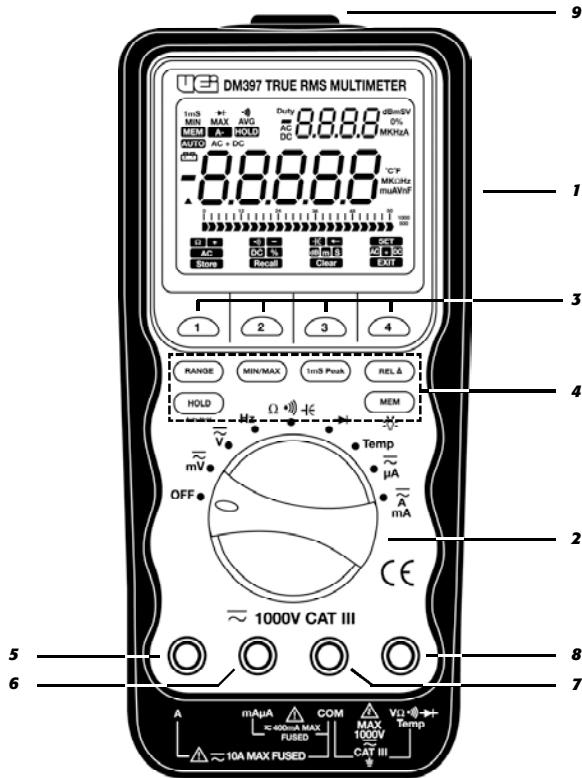
Electromagnetic Compatibility

The meter meets EN61326 : 1997 A1 : 1998.

International Symbols

| | |
|--|---|
|  Dangerous Voltage |  Ground |
|  AC Alternating Current |  Warning or Caution |
|  DC Direct Current |  Double Insulation (Protection Class II) |
|  Either AC or DC |  Fuse |
|  Not Applicable to Identified Model |  Battery |

Controls and Indicators



1. **Digital Display:** Readings are displayed on a 4-4/5 digit, 50,000 count (primary display) and 5,000 count (secondary display).
2. **Rotary Switch:** Used to turn the power on or off and to select a function.
3. **On Screen Menu Selection Push-buttons:** Used to select functions from the on screen menus.
4. **Special Function Push-buttons:** Used to select special functions and features.
5. **Input Terminal 10A:** (20A for 30 sec.) current measurement function.
6. **Input Terminal for Milliamp:** (mA) and micro amp (μA) current measurement function.
7. **Common Input Terminal:** (Ground reference) for all measurement functions.
8. **Input Terminal for Multiple Functions:** Input jack for all measurements except current (A, mA, μA) measurement functions.
9. **RS-232 Optical Interface:** Allows connection to a computer.

Rotary Switch

To turn the meter on, turn the rotary switch from the OFF position to any switch setting.

If you want to view the full display (all segments illuminated), press and hold the "HOLD" push-button while turning the meter on. Release the button to return to normal viewing.

Turn the meter on by selecting any measurement function. The meter presents a standard display for that function (range, measurement units, on screen menu, etc.). The display may also show other information based on the choices made through the on-screen menu selection.

Use the on screen menu selection or the other push-buttons to select any rotary switch alternative function.

When you turn the rotary switch from one function to another, a display for the new function appears. Button choices made in one function do not carry over into another function.

OFF: Turns the meter off. Setup parameters and stored measurements are saved.

mV: Select either Millivolt AC RMS or DC Voltage measurements. Compatible with various adapters.

V: Volts AC RMS, Volts DC, Volts AC+DC total RMS, Volts AC/DC dual display, dBm and dB.

Hz: Frequency measurement. Duty cycle and pulse width are also displayed if they are selected with the on-screen menu.

Ω \rightarrow \leftarrow : Access to resistance measurement, continuity test and capacitance measurement. Conductance ($1/\Omega$) is also displayed in the secondary display when measuring resistance.

\rightarrow : Diode measurement (Forward bias voltage drop).

Temp: Temperature measurement in degrees Fahrenheit or Centigrade.

μA : Select from Microamp AC RMS, Microamp DC, Microamp AC+DC total RMS, and Microamp AC/DC dual display.

A: Select from Amperes AC RMS, Amperes DC, Amperes AC+DC total RMS, and Amperes AC/DC dual display.

mA: Select from Milliamps AC RMS, Milliamps DC, Milliamps AC+DC total RMS, and Milliamps AC/DC dual display.

User-Friendly Rotary Switch Selections

| Position | Rotary Switch Function | Primary Display | Secondary Display | On Screen Menu Selection | When menu key is pressed | |
|--------------|---|-----------------|-------------------|--|--------------------------|-------------------|
| | | | | | Primary Display | Secondary Display |
| mV | True RMS AC and DC millivolt measurement from 0 mV to 500.00 mV and adapters applications | DC | - | 1 AC | AC | Hz |
| | | AC | Hz | 2 DC | DC | - |
| V | True RMS AC volts measurement (default) from 0 V to 1000.0 V | AC | Hz | 2 DC | DC | - |
| | | | | 3 dBm | AC | dBm |
| | | | | 1 AC+DC or AC/DC dual display (press to toggle) | AC+DC total RMS volts | Hz |
| | | | | | AC | DC |
| | DC volts measurements from 0 V to 1000.0 V | DC | - | 1 AC | AC | Hz |
| | | | | 4 AC+DC or AC/DC dual display (press to toggle) | AC+DC total RMS volts | Hz |
| | | | | | AC | DC |
| | AC volts and dBm or dB measurement | AC | dBm | 1 AC | AC | Hz |
| 2 DC | | | | DC | - | |
| 3 dB | | | | AC | dB | |
| 4 SET | | | | 600Ω | rEF | |
| Hz | Hz measurement (default) from 0.5 Hz to 5.0000 MHz | Hz | Pulse Width (ms) | 2 % (duty cycle) | Hz | % |
| | | | | 3 ms (pulse with) | Hz | ms |
| | Duty Cycle (%) measurement from 0.1% to 99.8% (pulse width > 3μ sec) | Hz | % | 4 SET | Hz | -EDGE |

| Position | Rotary Switch Function | Primary Display | Secondary Display | On Screen Menu Selection | Primary Display | Secondary Display |
|---------------------|--|-----------------|-------------------|--|-----------------------|-------------------|
| Ω •)) -(- | Resistance measurement from 0Ω to 50MΩ | Ω | S=1/Ω | 2 •)) | Ω | - |
| | | | | 3 -(- | Capacitance | - |
| → | Diode test | V | - | - | V | - |
| Temp | Temperature measurement | °C | - | 4 SET | °F | - |
| μA | DC current measurements (default) from 0 μA to 5000.0 μA | DC | - | 1 AC | AC | Hz |
| | | | | 4 AC+DC or AC/DC dual display (press to toggle) | AC+DC total RMS volts | Hz |
| | | | | | AC | DC |
| A mA | DC current measurements (default) from 0 mA to 10.000 A | DC | - | 1 AC | AC | Hz |
| | | | | 4 AC+DC or AC/DC dual display (press to toggle) | AC+DC total RMS volts | |
| | | | | | AC | dB |
| | True RMS AC current measurements from 0 mA to 10.000 A | AC | Hz | 2 DC | DC | - |

$$*V_{RMS} = \sqrt{V_{AC}^2 + V_{DC}^2} \quad (\text{AC+DC total RMS volts})$$

$$I_{RMS} = \sqrt{I_{AC}^2 + I_{DC}^2} \quad (\text{AC+DC total RMS amps})$$

$$*dBm \text{ readout} = 10 \times \log (\text{primary display readout} / R), \text{ where } R = 600\Omega \text{ (default)}$$

$$*dB \text{ readout} = 20 \times \log (\text{primary display readout} / \text{ref}), \text{ where ref} = 1V \text{ (default)}$$

Push-Buttons

RANGE: Use the "RANGE" push-button to manually select a range. Press and hold the "RANGE" push-button for two seconds to return the meter to auto range mode.

The meter is in auto range mode when the "AUTO" indicator is on.

The range and units are displayed on the LCD.

MIN/MAX: Press this button to scroll through the minimum, maximum and average values. The minimum (MIN) reading is displayed first and this mode calculates an average (AVG) of all readings taken since the mode was activated. The meter beeps when a new maximum or minimum reading is updated.

In the MIN/MAX mode, the primary display continues to show the present measurement value.

Auto Power Off feature will be disabled automatically in this mode.

1mS Peak: Press this button momentarily to activate the 1mS peak hold mode to capture transient voltage or current signal events as short as 1mS with its display resolution of 5,000 counts. The LCD displays the "1mS" and "MAX" indicators at the upper left corner and - and "EXIT" indicators in the on screen menu selection. In this mode the meter will display the captured maximum value. Press the - menu key and the LCD will now display "1mS" and "MIN" indicators and "+" and "EXIT" indicators on screen. In this mode the meter will display the minimum captured value. Press the "+" menu key to capture a maximum value again if desired. The meter will beep when a new maximum or minimum reading is updated. Press either the "1mS PEAK" push-button or the "EXIT" menu key to exit the 1mS peak hold mode. Auto Power Off feature is disabled in this mode.

REL Δ: Use this push-button to set the meter to relative (RELΔ) mode and make relative measurements. The reference value for the RELΔ measurement can be a measured, or a programmed value. The reference value appears in the secondary display and the difference value appears in the primary display.

<RELΔ to a Measured Value> - When you take the measurement and the meter settles on the value, press this button. Subsequent readouts will then be a difference from this reference value to the new reading. This is useful for very low resistance values to eliminate test lead resistance, or when observing a change from a stable reading.

<RELΔ to a Programmed Value> - Set the meter to the measurement function and range you want and then press the "RELΔ" push-button. While the meter is in RELΔ mode, press the "MIN/MAX" push-button then the setup menu appears. Use the on screen menu selection buttons to edit the desired reference value and then press the menu button "4" for "EXIT".

For subsequent readouts the programmed reference value is subtracted from the actual measurement. The programmed reference value is lost when the meter is turned off.

To exit RELΔ mode, press the "RELΔ" push-button.

HOLD: Press this button to turn the "HOLD" mode on or off. When the hold mode is activated, the meter beeps, freezes the display and displays the "HOLD" indicator on the LCD. Hold mode freezes the display for later view.

Auto Hold - To activate "AUTO HOLD" mode, press the "HOLD" push-button two times until "A" and "HOLD" indicators appear on the LCD.

NOTE: This mode is not available for capacitance measurements.

In this mode, the display automatically freezes and the meter beeps when the measurement reading is stabilized. The display value will be updated when a new measurement value is stabilized.

This mode is very useful when it is impossible for you to press the "HOLD" push-button or see the meter display while probing and taking measurements.

MEM: Use the memory mode to store and recall measurement values.

Press the "MEM" button momentarily in order to activate the memory mode. The display shows four menu selections: store, recall, clear and exit.

STORE: Select "STORE" to store the held value in the next available memory location. The memory location number momentarily shows on the secondary display. If no memory locations are available, FULL shows on the secondary display for two seconds and nothing is stored. You must clear the memory locations using the "CLEAR" key in order to store the held value.

RECALL: Select "RECALL" to review the stored value using the menu key. The secondary display shows the value stored in that location. Whenever you press "+" or "-" menu key, the next or previous stored value will be shown in the primary display and the secondary display momentarily shows the corresponding memory location.

CLEAR: Select "CLEAR" to clear all the stored values. When you press the "CLEAR" key, the meter will ask you with the display of "You Sure" along with the on screen menu selections of "AC" (stands for All Clear), "CLEAR" and "EXIT". When you press the "CLEAR" key, the displayed value in the primary display is erased. When you press the "AC" key, all the stored values are erased and the word "Done" shows on the display. Press "EXIT" to exit the memory mode without erasing the stored values.

EXIT: Select "EXIT" to exit memory mode. You can also exit memory mode by pressing "MEM" push-button or turning the rotary dial position.

 **(Backlight):** Press the "MEM" () push-button until the backlight is turned on or off.

On Screen Menu Selection Keys

Each setting of the rotary switch to a measurement function position may activate one or more menu selection key settings on the LCD. If there is more than one measurement for a rotary switch setting, a menu appears on the display. Press the corresponding menu selection key to select the desired measurement.

Setup Mode

The setup mode allows you to customize default settings. To activate the Setup Mode, press the menu Key "4" while the display shows all segments on at power on reset.

You can customize the following default settings in sequence during the setup cycle. The newly customized default values in any setup can be saved only when the entire setup cycle is completed. The meter displays "SAVE" at the end of the entire setup cycle. The setup values are stored so they will become the new defaults and are not reset after power off.

- **Enable or Disable The Auto Power Off Mode**

The meter displays "AtP" in the secondary display, "EnbL" or "DiSA" in the primary display and "+", "-", and "EXIT" in the on screen menu selection. You can toggle "EnbL/DiSA" by pressing the "+" or "-" menu keys. Press the "EXIT" menu key to get into the next setup screen

- **Auto Power Off Time (in minutes)**

If the auto power off is set to "EnbL" in the first step, the display will now allow you to choose the time until the meter automatically powers off. The display will show "MIN" in the upper left corner and "AtP" in the secondary display, and a two-digit number in the primary display. Adjust the time until auto power off using the "+", "-", and "<" menu selection keys to a number between 1 and 60. Press the "EXIT" menu key for the next setup selection

- **Backlight Auto-Off Time (in seconds)**

The meter will display "LitE" in the secondary display, a two-digit number in the primary display and "+", "-", "<" and "EXIT" in the on screen menu selection. You can setup a new backlight auto-off time (in seconds) by using the menu keys to select a number between 1 and 60. Press the "EXIT" menu key for the next setup selection

- **Enable or Disable The Power Saving Mode Beep Alert**

The meter displays "PALt" in the secondary display, "OFF" or "ON" in the primary display and "+", "-", and "EXIT" in the on screen menu selection. You can toggle "OFF/ON" by pressing the "+" or "-" menu keys. Press the "EXIT" menu key for the next setup selection

- **Enable or Disable Backlight When Meter Is Powered On**

The meter displays "InIL" in the secondary display, "OFF" or "ON" in the primary display and "+", "-", and "EXIT" in the on screen menu selection. You can toggle "OFF/ON" by pressing the "+" or "-" menu keys. Press the "EXIT" menu key for the next setup selection

- **Enable or Disable The Beep Alert Warning For Over Range**
The meter displays tone in the secondary display, "OFF" or "ON" in the primary display and "+", "-", and "EXIT" in the on screen menu selection. You can toggle "OFF/ON" by pressing the "+" or "-" menu keys. Press the "EXIT" menu key for the next setup selection
- **Enable or Disable The Beep Alert Warning For Incorrectly Connected Test Leads**
The meter displays "LALt" in the secondary display, "OFF" or "ON" in the primary display, a and "+", "-", and "EXIT" in the on screen menu selection. You can toggle "OFF/ON" by pressing the "+" or "-" menu keys. Press the "EXIT" menu key in order to save the customized default values entered during the setup cycle. The meter will return to normal operation after the message "SAVE" is displayed in the primary screen.

Use the menu selection keys in order to edit setup values as shown below.

| Key | 1 + | 2 - | 3 | 4 EXIT |
|----------|---------------------------------|---------------------------------|--|--|
| Function | Press to increase setting value | Press to decrease setting value | Press to step to next digit in setting value | Press to move to next setup. Press to save all setting and exit setup mode when setting is ended |

RS-232C PC to Meter Communications

The meter is equipped with an optically isolated interface port at the top for data communication. The RS70 optical adapter cable and the WS70 software disc are required to connect the meter to the PC. The meter includes these standard accessories. Refer to the **READ ME** file in the WS70 for further details.

Operating Instructions

Making Measurements

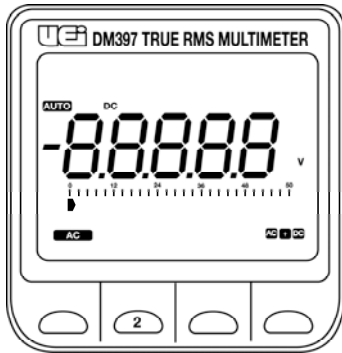
All measurements are made by first setting the function knob to a specific setting (the meter will select the default function for that position) and then select a measurement using the menu keys. Note that not all function knob settings have a corresponding menu selection option.

For example, the steps below show how to take a DC voltage measurement.

1. Set the measurement knob to \overline{V} for a voltage measurement.

NOTE: The default for this range is AC voltage.

2. Select the menu key 2 change to DC voltage (Fig 1).
3. Connect the test leads to the correct input jacks (COM, V Ω , \bullet), \rightarrow , TEMP).



(Fig 1)

Voltage (mV, V) Measurements

Ranges available in volts functions are:

- mV
50.000mV, 500.00mV DC and 500.00mV AC

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|-------------------------|----------------|---------------|-----------------|-------------------|
| DC millivolts (default) | (no selection) | | DC | - |
| AC | AC | | AC | Hz |

- V
5.0000V, 50.000V, 500.00V, 1000.0V

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|-------------------------------|-----------------------------|---------------|-----------------|-------------------|
| True RMS AC Voltage (default) | (no selection) | | AC | Hz |
| DC Voltage | DC | | DC | - |
| dBm | | | AC | dBm |
| dB | dBm or dB (press to toggle) | | DC | dB |
| AC+DC total RMS | AC+Dc or | | AC+DC | Hz |
| AC+DC dual display | AC+DC (press to toggle) | | AC | DC |

*dBm readout = $10 \times \log(\text{primary display readout} / R)$, where $R = 600\Omega$ (default)
 db readout = $20 \times \log(\text{primary display readout} / \text{ref})$, where $\text{ref} = 1V$ (default)

This meter has high impedance circuitry (10M Ω) for measuring voltage.

AC Voltage Measurement

All push-button features are available in this function. The on screen menu selection accesses decibel (dBm or dB) measurements.

dB (dBm or dB V) measurements in AC volts function.

The AC volts function allows you to display readings as deviations in dB (decibels) above or below an established reference level.

Set up dB measurements by using the on screen menu selection buttons when measuring AC volts. The dBm (or dB V) value appears in the secondary display and the AC reading appears in the primary display.

Normally dB is measured as dBm, which is a measure of decibels relative to 1 milliwatt. The meter assumes a resistance of 600 Ω in making this calculation. This resistance can be set for any value from 1 Ω to 1,999 Ω by using the setup menu selection buttons. When measuring dB V, the reference voltage can be set for any value from 0.1000V to 5.0000V by using the setup menu.

$$dB = 20 \times \log(Vx / Vr)$$

- For dBm, Vr is the voltage across the reference resistance at 1 milliwatt. For example, Vr would be 0.7746 V with a 600 reference resistance.
- For dB V, the reference voltage is 1 V.

DC Voltage Measurement

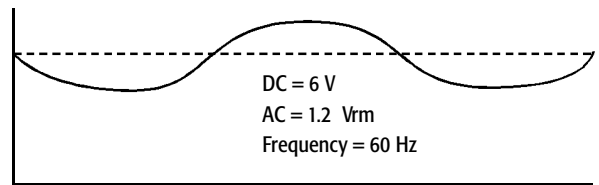
All push-button features are available for a standard DC voltage reading.

Both AC and DC voltage measurements.

When a DC volts function is selected, the meter can display the combined AC+DC (RMS) value or AC and DC components of a signal separately by using the on screen menu selections.

When the meter shows AC over DC (AC voltage in the primary and DC in the secondary display), the other push-button functions except "RANGE" are not available.

Applications: Using AC+DC in AC/DC volts mode



To take the combined AC+DC total RMS volts measurement, press menu key 4. In the above example the total RMS value of 6.118 V shows on the primary display and the frequency of 60.00 Hz shows on the secondary display. When calculating the power dissipated in a circuit component, it is critical that the DC value is factored into the equation $V_{rms} \times I_{rms}$ where V_{rms} is AC+DC total RMS.

Another useful feature of this meter is AC/DC dual display mode. AC voltages riding on power supplies can cause problems with electronic circuits. If the meter is set to DC volts mode, the display shows the DC component of 6.0000V. However, the AC component may be missed. It is recommended that you set the meter to AC/DC dual display mode by pressing menu key 4 twice. The primary display shows the 1.2000 V AC and the secondary display shows the 6.000 V DC. This is a method to take both the AC and DC readings on a source without changing the meter settings.

Frequency (Hz) Measurements

The meter auto-ranges to one of six frequency ranges:

NOTE: The 1mS Peak push-button cannot be used in the frequency mode. The meter will beep to indicate this when the 1mS Peak push-button is pressed.

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|--|----------------|---------------|-----------------|-------------------|
| Frequency | (no selection) | | Hz | -EdGE |
| Frequency and duty cycle dual display | | | Hz | Duty Cycle (%) |
| Frequency and pulse width dual display | | | Hz | Pulse Width (ms) |

- The meter defaults at negative edge triggering in the frequency measurement mode - You can select positive edge by pressing menu key 4. The secondary display will indicate either "EdGE" for positive or "-EdGE" for negative

Duty Cycle Measurement

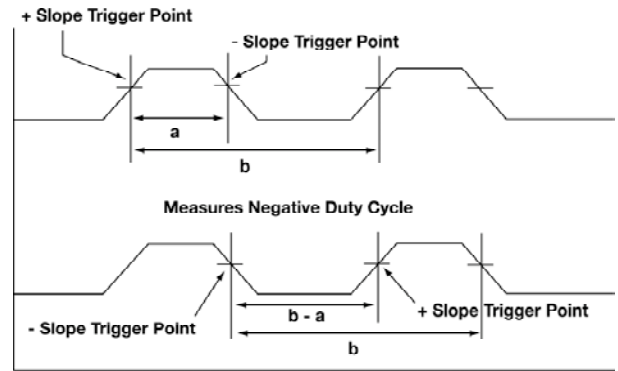
Duty cycle (or duty factor) is the percentage of time signal is above or below a trigger level during one cycle.

The duty cycle mode is optimized for measuring the ON and OFF time of logic and switching signals. Systems such as electronic fuel injection and switching power supplies are controlled by varying pulse-widths which can be checked by measuring the duty cycle.

Positive and Negative Duty Cycle

To measure duty cycle, set duty cycle to either positive or negative by using menu key 4. When you measure negative duty cycle a "-" symbol shows in the secondary display.

Measure Positive Duty Cycle



Positive duty cycle: % duty = $\frac{a}{b} \times 100$ (above trigger point)

Negative duty cycle: % duty = $(1 - \frac{a}{b}) \times 100$ (below trigger point)

Pulse Width Measurement

The pulse width measurement function allows you to measure the amount of time a signal is high or low within a given period. The measured waveform must be periodic.

Resistance (Ω , \cdot), \rightarrow (\leftarrow) Measurement (Ohms, Continuity and Capacitance)



CAUTION!

To avoid damaging the meter or the equipment under test, remove all power from the circuit and discharge all high-voltage capacitors before measuring resistance.

The available resistance ranges are 50.000 Ω , 500.00 Ω , 5.000k Ω , 50.00k Ω , 500.00k Ω , 5.000M Ω and 50.000M Ω .

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|----------------------|----------------|---------------|-----------------|--------------------------------|
| Resistance (default) | (no selection) | | Ω | S (conductance) |
| Continuity | | | Ω | OPEN or Short (beeps on short) |
| Capacitance | | | Ω | - |

Tips for measuring resistance:

- Because the meter's test current flows through all possible paths between the test probe tips, the measured value of a resistor in a circuit is often different from the resistor's rated value
- The test leads can add 0.1 Ω to 0.2 Ω of error to resistance measurements - To measure the resistance of the leads, touch the probe tips together and read the resistance - If necessary, you can press the "RELA" push-button to automatically subtract this value
- The resistance function can produce enough voltage to forward-bias silicon diodes or transistor junctions causing them to conduct to avoid this, and possibly damaging circuit components - Do not use the 50 M Ω range for measuring in-circuit resistance

Continuity Test

The continuity function detects intermittent opens and shorts lasting as little as 1 millisecond. These brief contacts cause the meter to emit a short beep. This function is convenient for checking wiring connections and operations of switches. A continuous tone indicates a complete wire or connection.



Using resistance and continuity function in a live circuit will produce false results and may damage the instrument. In many cases the suspicious components must be disconnected from the circuit under test to obtain accurate results.

The **1mS Peak**, **MIN/MAX** and **RELA** functions are not available when continuity is selected

Conductance for High Resistance Tests

Conductance is the reverse of resistance, and is the ability of a circuit to pass current. High values of conductance correspond to low values or resistance. The unit of conductance is the Siemens (S).

Capacitance Measurement



To avoid damaging the meter or the equipment under test, remove all power from the circuit and discharge all high-voltage capacitors before measuring capacitance. Large value capacitors should be discharged through an appropriate resistance load. Use the DC voltage function to confirm that the capacitor is discharged.

The available capacitance ranges are 5nF, 50nF, 500nF, 5µF, 50µF, 500µF, and 5mF (5000 microfarads).

Tips for measuring capacitance:

- To speed up measurements of similar values, press "**RANGE**" push-button to manually select the proper range
- To measure small values of capacitance accurately, press "**RELA**" push-button with the test leads open to subtract the residual capacitance of the meter and test leads

Diode (→) Test



Discharge all high-voltage capacitors before testing diodes. Large value capacitors should be discharged through an appropriate resistance load.

Use the diode test to check diodes, transistors, silicon controlled rectifiers (SCRs), and other semiconductor devices. The test sends a current through a semiconductor junction, and then measures the junction's voltage drop.

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|-------------|----------------|---------------|-----------------|-------------------|
| Diode | (no selection) | | V | - |

Forward Biased Reading: Normal forward voltage drop (forwarding biased) for a good silicon diode is between 0.4V and 0.9V. A reading higher than that indicates a leaky (defective) diode. A zero reading indicates a shorted (defective) diode. A reading of "**oFL**" indicates an open diode (defective).

Reverse Biased Reading: Reverse the test leads across the diode. The display should show "**oFL**" if it is good. Any other readings indicate the diode is shorted or resistive (defective).

Temperature (Temp) Measurements



Do not apply thermocouple to circuits exceeding 30V RMS 42.4V peak or 60V DC.

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|-------------------------|----------------|---------------|-----------------|-------------------|
| Celsius Temp. (default) | (no selection) | | C | - |
| Fahrenheit Temp. | 4 SET | | F | - |

*Use the ATT70, Temperature probe adapter with standard K-type thermocouples. Observe proper polarity.

Current (⎓, ⎓⎓) Measurements



Never attempt an in-circuit current measurement where the open-circuit potential to earth is greater than 1000V. You may damage the meter or be injured if the fuse blows during such a measurement.



Check the meter fuses before measuring current. Use the proper terminals, function, and range for current measurements. Never place the probes in parallel with any circuit or component when the test leads are plugged into the current terminals.

The available current ranges are 500.00µA, 5000.0µA, 50.000mA, 500.00mA, 5.0000A and 10.000A.

| Measurement | Menu key | Connect Leads | Primary Display | Secondary Display |
|----------------------------|---|---------------|-----------------|-------------------|
| True RMS AC Amps (default) | (no selection) | | AC | Hz |
| DC Amps | 2 DC | | DC | - |
| AC+DC Total RMS | 4 AC+DC or AC/DC (press to toggle) | | AC+DC | Hz |
| AC/DC Dual Display | | | AC | DC |

$$*I_{RMS} = \sqrt{I_{AC}^2 + I_{DC}^2} \text{ (AC+DC total RMS amps)}$$

To Measure AC or DC Current

1. Turn off power to the circuit and discharge all high-voltage capacitors.
2. Insert the black lead into the “COM” terminal and the red lead into an input terminal appropriate for the measurement range.

| Rotary Switch | Input | Ranges |
|---------------|-------|--------------------|
| | mAµA | 500.00µA, 5000.0µA |
| | mAµA | 50.000mA, 500.00mA |
| | A | 5.0000A, 10.000A |

NOTE: To avoid blowing the meter’s 440mA fuse, use the mAµA terminal only if you are sure that the current is less than 400mA. It is best to start in the higher range when unsure to take the initial measurement. 400mA is displayed as 0.4000A in the 5.000A range.

3. Open the circuit path to be tested.
4. Touch the red lead to the more positive side of the break and the black lead to the more negative side. (Reverse connections will only display a negative reading for DC current, but will not damage the meter).
5. Turn on the power to the circuit and read the display.
6. After measuring the current, turn off power to the circuit and discharge all high-voltage capacitors.
7. Disconnect the meter and restore the circuit to normal operation.

Wrong Input Warning Feature

If the display shows “LEAD” or “FUSE”, be sure the meter is set up correctly and test the meter’s fuses as described under **Auto Fuse Detection**. If the rotary switch is not correctly set to one of the current measuring positions, the beeper warns you by making a chirping sound. This warning is intended to stop you from attempting a measurement other than current when the test leads are plugged into a current terminal.

Placing the probes in parallel with a powered circuit when the leads are plugged into a current terminal can damage the circuit you are testing and blow the meter’s fuses. This is due to the fact that in the current range the resistance through the amps terminals is low, and the meter acts like a short to your circuit.

Auto/Manual Range Operation

Press the “RANGE” push-button momentarily to select manual and the meter will stay in the range it is in when the LCD icon “AUTO” turns off. Press the button momentarily again to step through the ranges. Press and hold the “RANGE” push-button for two seconds or more to resumes auto ranging.

Auto Power Off

The auto power off feature has two steps. The first step has the meter automatically go to the power saving mode to extend the battery life after approximately 15 minutes with no activity. When the meter enters this mode, the meter beeps warning tones every minute. To turn on the meter, press any button or move the rotary switch to any position. The second step is to automatically turn the meter completely off. This occurs approximately 15 minutes after the meter entered the power saving mode. To turn the meter back on after a complete power off you must rotate the selector to **OFF**, and then to the required range.

You can disable auto power off by using the setup menu. Both the auto off time and the power saving mode beep alert time can be adjusted from the setup menu.

Maintenance

Periodic Service



WARNING!

Repair and service of this instrument is to be performed by qualified personnel only. Improper repair or service could result in physical degradation of the meter. This could alter the protection from electrical shock and personal injury this meter provides to the operator. Perform only those maintenance tasks that you are qualified to do.

These guidelines will help you attain long and reliable service from your meter:

- Calibrate your meter annually to ensure it meets original performance specifications
- Keep your meter dry. If it gets wet, wipe dry immediately. Liquids can degrade electronic circuits
- Whenever practical, keep the meter away from dust and dirt that can cause premature wear
- Although your meter is built to withstand the rigors of daily use, it can be damaged by severe impacts. Use reasonable caution when using and storing the meter

Cleaning

Periodically clean your meter’s case using a damp cloth. **DO NOT** use abrasive, flammable liquids, cleaning solvents, or strong detergents as they may damage the finish, impair safety, or affect the reliability of the structural components.

Clean the input terminals as follows:

1. Turn the meter off and remove all test leads.
2. Shake out any dirt that may be in the terminals.
3. Soak a new swab with alcohol and work the swab around in each terminal.

Battery and Fuse Replacement

Always use a fresh replacement battery of the specified size and type. Immediately remove the old or weak battery from the meter and dispose of it in accordance with your local disposal regulations. Batteries can leak chemicals that corrode electronic circuits. If your meter is not going to be used for a month or more, remove and store the battery in a place that will not allow leakage to damage other materials.

Auto/Manual Range Operation

Press the **"RANGE"** push-button momentarily to select manual and the meter will stay in the range it is in when the LCD icon **"AUTO"** turns off. Press the button momentarily again to step through the ranges. Press and hold the **"RANGE"** push-button for two seconds or more to resumes auto ranging.



WARNING!

Disconnect the test leads from the circuit under test and from the meter prior to removing or installing batteries.

Auto Fuse Detection

The meter automatically verifies the integrity of the fuses when you set the rotary function knob to the amps or milliamps range and plug a test lead into either the **"A"** or the **"mA μ A"** terminal. In either case, if an open fuse is detected, the word **"FUSE"** shows on the primary display.

To install a new battery or fuse, follow these procedures:

1. Turn the rotary switch to OFF and remove the test leads from the input terminals.
2. Remove the screw and press above where indicated on back of meter to remove the cover.
3. Remove old battery or fuse and replace with specified new ones.
4. Reinstall battery cover and screw.



WARNING!

Under no circumstances should you expose batteries to extreme heat or fire as they may explode and cause injury.

Troubleshooting

Always check the battery and fuses when you encounter trouble. Also inspect the test leads for breaks or damage and replace if damage is visible.

If the meter's V/ Ω input terminal has been subjected to high voltage transients (caused by lightning or switching surge to the system under test) by accident or abnormal operating conditions a series fusible resistor may be blown. These are circuit components that are designed to open in the event of transients to protect the user and the meter. Most measuring functions through the terminal will then be open and not functional.

If this occurs, the series fusible resistor and spark gaps should be replaced by qualified personnel. Refer to the limited warranty section for obtaining warranty or repair service.

Specifications

Safety and Compliance

| | |
|---|---|
| Maximum voltage between any terminal and earth ground | 1000V AC/DC |
| Compliance | Complies with CSA C22.2 No 1010.1-92, ASNI/ISA-S82, 01-94 to 1000V over voltage CAT III |
| Certifications | UL & cUL standard UL 3111-1 listed CE-marking certified |
| Surge protection | 8kV peak per IEC 1010.1-92 |
| Fuse protection fro mA or μ A inputs | 1000V / 440 mA IR 10 kA fast fuse |
| Fuse protection for A input | 1000V / 11 A UR 10 kA fast fuse |

Physical Specifications

| | |
|----------------------------------|--|
| Display (LCD) | 50,000 count digital primary 5,000 count secondary Updates 4/sec. nominal Analog - 25 segments, updates 40/sec. |
| Operating temperature | 32° to 122°F (0° to 50°C) |
| Storage temperature | -4° to 140°F (-20° to 60°C) |
| Temperature coefficient | Nominal 0.15 x (specified accuracy)/°C @ (0° to 18°C or 28° to 50°C) Otherwise as specified |
| Relative Humidity | 0% to 80% @ 32° to 95°F 0% to 70% @ 96° to 122°F |
| Altitude | Operating - up to 6,500 feet (2,000 m) Storage - up to 32,000 feet (10,000 m) |
| Battery type | Single 9V battery - NEDA 1604, JIS 006P or IEC 6F 22 |
| Battery life | 150 hrs. typical (with backlight off) |
| Shock vibration | Per MIL-T-PRF 28800 for Class II instruments |
| Pollution degree | 2 |
| Electromagnetic capability (EMC) | Susceptibility - commercial limits for EN 50082-1 Emissions - commercial limits for EN 50081-1 |
| Size (H x W x D) | 8.2" x 4.1" x 2.1" (208 x 103 x 54 mm) |
| Weight | Approximately 1.44 lb (655 g) |
| Warranty | 5 years |
| Calibration interval | 1 year |

Feature Summary

| | |
|-----------------------------------|--|
| Backlight | For clear readings in poorly lighted areas |
| Fast auto ranging | Meter automatically selects the best range quickly |
| AC+DC total RMS (@40Hz to 10 kHz) | Choices for AC only, AC+DC readings or AC and DC Dual display |
| DBm, dBV | User selectable impedance references for dBm User selectable voltage references for dBV |
| Auto HOLD | Holds readings on display |
| Continuity/Open test | Beeper sounds |
| Fast analog bar graph | 25 segments for view of fast events and trends |
| Memory locations | 20 |
| Duty cycle/pulse width | Measures the time that the signal is ON or OFF in % or milliseconds |
| MIN/MAX mode | Record maximum, minimum and average values |
| 1mS PEAK mode | Captures peaks of 1 millisecond |
| Close-case calibration | No internal adjustment necessary |
| Batter/fuse access door | Battery or fuse replaceable without voiding calibration |
| High-impact over molded case | Protective feature for the meter and user |

DC Voltage

| Range | Resolution | Accuracy |
|--------|-------------|------------|
| 50 mV | 1 μ V | 0.05% + 10 |
| 500 mV | 10 μ V | 0.05% + 2 |
| 5 V | 100 μ V | |
| 50 V | 1 mV | |
| 500 V | 10 mV | |
| 1000 V | 100 mV | 0.1% + 2 |

NMRR : >60dB @ 50/60 Hz

CMRR : >120dB @ DC, 50/60 Hz, $R_s = 1k$

Input impedance : 10M Ω , 30 pF nominal
(50M Ω , 100 pF nominal for 50m V
& 500mV ranges)

AC Voltage

| Range | Resolution | Accuracy | | | |
|--------|-------------|-------------|-------------|-------------|---------------|
| | | 40Hz - 1kHz | 4kHz - 5kHz | 5kHz - 20z | 20kHz - 50kHz |
| 500 mV | 10 μ V | 0.3%+10 | 1.0%+10 | 2.0%+20 | Unspecified |
| 5 V | 100 μ V | 0.3%+10 | 0.5%+10 | 0.5%+10 | 0.8%+20 |
| 50 V | 1 mV | | | | |
| 500 V | 10 mV | | | | |
| 1000 V | 100 mV | 0.4%+10 | 0.5%+20 | Unspecified | Unspecified |

CMRR : >60dB @ DC to 60 Hz, $R_s = 1k\Omega$

Input impedance : 10M Ω , 30 pF nominal
(50M Ω , 100 pF nominal for 500m V range)

DC Current

| Range | Resolution | Accuracy |
|-------------|-------------|-----------|
| 500 μ A | 10 nA | 0.1% + 5 |
| 5 mA | 100 nA | |
| 50 mA | 1 μ A | |
| 500 mA | 10 μ A | 0.3% + 10 |
| 5 A | 100 μ A | |
| 10 A | 1 mA | |

AC Current

| Range | Resolution | Accuracy | |
|-------------|-------------|-------------|--------------|
| | | 40Hz - 1kHz | 1kHz - 10kHz |
| 500 μ A | 10 nA | 0.3% + 5 | 0.8% + 10 |
| 5 mA | 100 nA | | |
| 50 mA | 1 μ A | | |
| 500 mA | 10 μ A | | |
| 5 A | 100 μ A | 0.4% + 10 | Unspecified |
| 10 A | 1 mA | 0.4% + 20 | |

(AC+DC) Voltages and (AC+DC) Current

| Function | Range | Resolution | Accuracy | |
|------------|-------------|-------------|-------------|--------------|
| | | | 40Hz - 1kHz | 1kHz - 10kHz |
| DC mV | 500 mV | 100 μ V | 0.5% + 5 | 0.8% + 5 |
| DC V | 5 V | 1 mV | 0.5% + 3 | 0.8% + 3 |
| | 50 V | 10 mV | | |
| | 500 V | 100 mV | 0.8% + 5 | 0.8% + 5 |
| | 1000 V | 1 V | | |
| DC μ A | 500 μ A | 100 nA | 0.5% + 3 | 1.0% + 5 |
| | 5 mA | 1 μ A | | |
| DC mA | 50 mA | 10 μ A | 0.8% + 10 | Unspecified |
| | 500 mA | 100 μ A | | |
| DC A | 5 A | 1 mA | 0.8% + 10 | Unspecified |
| | 10 A | 10 mA | | |

Resistance

| Range | Resolution | Accuracy |
|----------------|----------------|--------------|
| 50 Ω | 0.001 Ω | 0.5% + 20 *1 |
| 500 Ω | 0.01 Ω | 0.1% + 5 *1 |
| 5 k Ω | 0.1 Ω | 0.1% + 2 |
| 50 k Ω | 1 Ω | |
| 500 k Ω | 10 Ω | 0.3% + 5 |
| 5 M Ω | 100 Ω | 0.5% + 20 |

Open Circuit Voltage: <1.3 V DC

*1: Using relative (REL Δ) mode

Conductance (5,000 counts only)

| Range | Resolution | Accuracy |
|-------|------------|-----------|
| 50 nS | 0.01 nS | 0.1% + 10 |

Continuity

| |
|---|
| Audible threshold: The beeper sounds if the measured resistance is lower than 10 Ω , and turns off when greater than about 70 Ω . |
| Response time: < 1 m sec. |

Diode Test

| Range | Accuracy | Test Current (typical) | Open Circuit Voltage |
|-------|----------|------------------------|----------------------|
| 4 V | 2% + 1 | 1 mA | <3.0 V DC |

Capacitance (5,000 counts only)

| Range | Resolution | Accuracy *1 |
|--------------|------------|-------------|
| 5 nF | 1 pF | 1.0% + 5 *2 |
| 50 nF | 10 pF | 1.0% + 3 *2 |
| 500 nF | 100 pF | |
| 5 μ F | 1 nF | 2.0% + 3 |
| 50 μ F | 10 nF | 3.0% + 3 |
| 500 μ F | 100 nF | |
| 5000 μ F | 1 μ F | 3.5% + 5 |

*1. Accuracy with film capacitor or better

*2. Using Relative (REL Δ) mode

Frequency, Duty Cycle, Pulse Width and Temperature

| Function | Range | Resolution | Accuracy |
|---|--------------------------------------|------------------|---|
| Frequency [Minimum Frequency: 0.5 Hz sensitivity 250 mV] | 50 Hz | 0.001 Hz | 0.002% + 3 |
| | 500 Hz | 0.01 Hz | |
| | 5 kHz | 0.1 Hz | |
| | 50 kHz | 1 Hz | |
| | 500 kHz | 10 Hz | |
| | 5 MHz | 100 Hz | |
| Duty Cycle | 0.1% to 99.9% | 0.1% | 0.5 Hz to 300 kHz (pulse width > 3 μ sec.) (0.1% + 0.05% per kHz + 1 count) for 5 V input (Logic signals only) |
| Pulse Width | Input Frequency 0.5 Hz to 300 kHz | | Pulse width > 3 μ s |
| Temperature | -58° to 2.372°F (-50° to 1.300°C) | 0.1°F (0.1°C) | with k-type thermocouple $\pm 5.4^\circ\text{F}$ ($\pm 3^\circ\text{C}$) typical |

dBm and 1mS PEAK Hold (5,000 counts only)

| Function | Characteristics | Accuracy |
|-----------|---|--|
| dBm | Selectable reference impedance of 1 to 1,999 At 600 : -11.76 dBm to 54.25 dBm Input impedance: 10M, 30 pF nominal | ± 0.25 dB + 2 digits (@ 40 Hz to 20kHz) |
| 1 mS PEAK | Specified voltage or current measurement accuracy ± 30 counts of the peak value of a single 1 mS pulse. | |

Burden Voltage (A, mA, μ A)

| Function | Range | Burden Voltage (typical) |
|--------------|--------------|--------------------------|
| mA / μ A | 500 μ A | 150 μ V / μ A |
| | 5000 μ A | 150 μ V / μ A |
| | 50 mA | 3.3 mV / mA |
| | 500 mA | 3.3 mV / mA |
| A | 5 A | 0.03 V / A |
| | 10 A | 0.03 V / A |

Glossary of Terms

Average sensing RMS calibrated: RMS (Root-Mean-Square) is the term used to describe the effective or equivalent DC value of an AC signal. Most digital multimeters use average sensing RMS calibrated technique to measure RMS values of AC signals. This technique is to obtain the average value by rectifying and filtering the AC signal. The average value is then scaled upward (that is, calibrated) to read the RMS value of a sine wave. In measuring pure sinusoidal waveforms this technique is fast, accurate and cost effective. However, in measuring non-sinusoidal waveforms significant errors can be introduced because of the different scaling factors involved with changing average to RMS values.

True RMS: True RMS is a term which identifies a DMM that accurately responds to the effective RMS value regardless of the waveform shapes such as square, saw tooth, triangle, pulse trains, spikes and transient glitches as well as distorted waveforms with the presence of harmonics.

Non-sinusoidal waveforms may cause:

- Overheating transformers, generators and motors to burn out faster than normal
- Circuit breakers to trip prematurely
- Fuses to blow
- Neutrals to be overheated due to the triplen harmonics present on the neutral
- Bus bars and electrical panels to vibrate

Crest Factor: Crest Factor is the ratio of the Crest (instantaneous peak) value to the True RMS value, which is commonly used to define the dynamic range of a True RMS DMM. A pure sinusoidal waveform has a crest factor of 1.414. A badly distorted sinusoidal waveform normally has a much higher Crest Factor.

NMRR (Normal Mode Rejection Ratio): NMRR is the DMM's ability to reject unwanted AC noise effect, which can cause inaccurate DC measurements. NMRR is typically specified in terms of dB (decibel). This meter has a NMRR specification of >60 dB at 50Hz / 60Hz, which provides the ability to reject the effect of AC noise in DC measurements.

CMRR (Common Mode Rejection Ratio): Common mode voltage is voltage existing on both the COM and Voltage input terminals of a DMM with respect to ground. CMRR is a DMM's ability to reject common mode voltage effect, which can cause digit rattle or offset in voltage measurements. This meter has a CMRR specification of >60 dB at DC to 60 Hz in AC volts measurement function and >120 dB at DC, 50Hz and 60Hz in DC volts measurement function.

Burden Voltage: Burden voltage is a voltage drop across the input terminals of a current measuring device, caused by internal shunt resistance. Burden voltage contributes to the measurement error, and should be as low as practical.

Temperature Coefficient: Temperature Coefficient is a factor used to calculate the change in indication or output of an instrument with changes in temperature. Un-compensated changes in temperature contribute uncertainty by an amount determined by the temperature coefficient of the instrument.

Analog Bar Graph: The analog bar graph provides a visual indication of measurements similar to a traditional analog meter's needle. It is excellent in detecting faulty contacts, identifying potentiometer's clicks and indicating signal spikes during adjustments.



True RMS Digital Multimeter

Limited Warranty

The DM397 is warranted to be free from defects in materials and workmanship for a period of five years from the date of purchase. If within the warranty period your instrument should become inoperative from such defects, the unit will be repaired or replaced at UEi's option. This warranty covers normal use and does not cover damage which occurs in shipment or failure which results from alteration, tampering, accident, misuse, abuse, neglect or improper maintenance. Batteries and consequential damage resulting from failed batteries are not covered by warranty.

Any implied warranties, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the express warranty. UEi shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim or claims for such damage, expenses or economic loss. A purchase receipt or other proof of original purchase date will be required before warranty repairs will be rendered. Instruments out of warranty will be repaired (when repairable) for a service charge. Return the unit postage paid and insured to:

1-800-547-5740 • FAX: (503) 643-6322
www.ueitest.com • Email: info@ueitest.com

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

