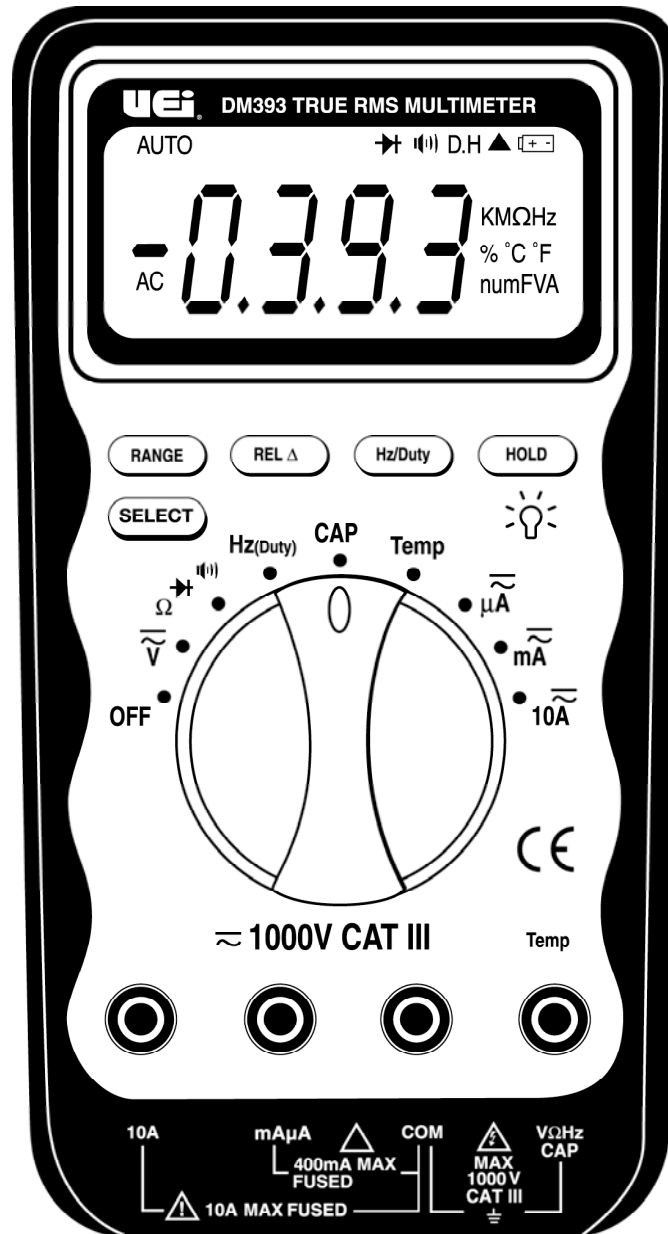




INSTRUCTION MANUAL

DM391/393



Digital Multimeter/True RMS Digital Multimeter

Introduction

The DM391/393 are some of our safest industrial duty meters ever made. All inputs, ranges and functions protected to 1000 Volts CAT III. Perfect for HVAC and electrical technicians whose applications require higher accuracy measurements and True RMS precision. Built in temperature means one less instrument to bring to the job. The DM393 has convenient access to battery and fuses without breaking calibration seals.

Features include

- All inputs, ranges and functions protected to 1000 V CAT III
- True RMS AC Volts and Amps
- Access to battery and fuses without breaking calibration
- Capacitance measurement from 40.00 nF to 100.0 µF
- 0.5% basic DC accuracy
- Frequency measurement to 10 MHz
- 4,000 count backlit display
- Autoranging
- Temperature from -40° to 2372°F
- 4,000 count backlit display

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.

- 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!

Using 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

International Symbols

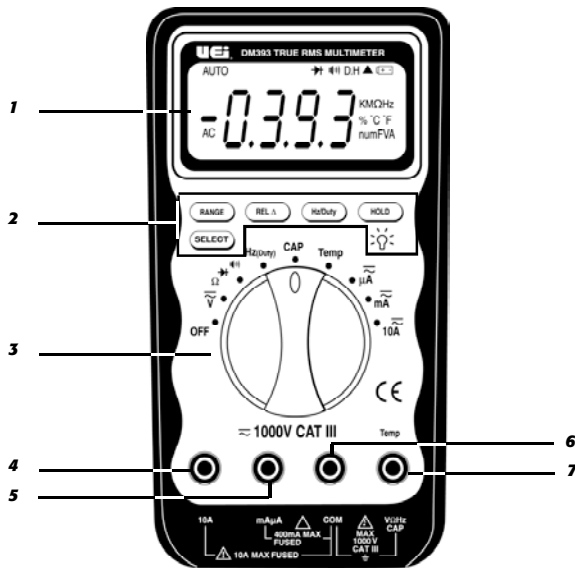
	Dangerous Voltage		Ground
	AC Alternating Current		Warning or Caution
	DC Direct Current		Double Insulation (Protection Class II)
	Either AC or DC		Fuse
	Not Applicable to Identified Model		Battery

Controls and Indicators

NOTE: Although this manual describes the operation of the DM391 and DM393, all illustrations and examples assume use of the DM393.

1. **Digital Display:** Readings are displayed on a digital, 4000 count display.
2. **Push-button:** Used for special functions and features.
3. **Rotary Switch:** Allows you to switch between any of the functions or values indicated by the numbers, icons, and group outlines printed around the rotating dial.
4. **Input Terminal For 10A:** (20A for 30 seconds) current measurement function.
5. **Input Terminal For Milli-amp and Micro Amps:** Current measurement function.

6. **Common Input Terminal** (ground reference): All measurement functions.
7. **Input Terminal for All Functions:** Except current (A, mA, μ A).



Rotary Switch and Push-button Overview

Turning the Meter On

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

Rotary Switch

Turn the meter on by selecting any measurement function. The meter presents a standard display for that function (range, measurement units, etc.). Use the **"SELECT"** push-button to select any rotary switch alternate 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.

Indicators

- OFF:** Turns the meter off
- V:** (DM393) AC volts RMS and DC volts. Press **"SELECT"** push-button to choose AC or DC voltage
- V:** (DM391) AC volts
- V:** (DM391) DC volts
- $\Omega \rightarrow \rightarrow$:** Access to resistance measurement, continuity test and diode test
- Hz (Duty):** Frequency measurement. Duty cycle is also displayed if it is toggled by the **"Hz/Duty"** push-button
- CAP:** Capacitance measurement
- Temp:** (DM393) Temperature measurement in degrees Centigrade or Fahrenheit. Changing the reading mode is preset at the factory

- μ A:** Micro-amps AC rms and micro-amps DC measurements (DM393)
Micro-amps AC and milli-amps DC measurements (DM391)
- mA:** Milli-amps AC rms and milli-amps DC measurements (DM393)
Milli-amps AC and milli-amps DC measurements (DM391)
- A:** Amperes AC rms and amperes DC measurements (DM393)
Amperes AC and amperes DC measurements (DM391)

Push-Buttons

The buttons activate features that augment the function selected with the rotary switch.

Range

Use the **"RANGE"** push-button to manually select a range. Press and hold **"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"** selection function is not available in **"Hz"** (Duty), **"CAP"**, and **"Temp"** modes.

The range and units are displayed on the LCD.

RELΔ

Use this button to set the meter to relative (Δ) mode and make relative measurements. Relative zero allows the user to offset the meter consecutive measurements with the displaying reading as the reference value. Practically all displaying readings can be set as relative reference value. Press the **"RELΔ"** push-button momentarily to activate and to exit relative zero mode.

Hz/Duty

Press this button to toggle between the **"Hz"** measurement mode and the **"Duty"** measurement mode when the selector switch is set at **"Hz"** (Duty), **V**, **μ A**, **mA**, and **10A**.

Hold

Press this button to turn **"HOLD"** mode ON and OFF. When the **"HOLD"** mode is activated, the meter beeps, freezes the display and displays the **"D.H."** indicator on the LCD. Hold mode freezes the display for later view.

Backlight

Press the **"HOLD"** ($\rightarrow \rightarrow$) push-button for two seconds to turn the backlight ON or OFF, when the **"HOLD"** function is simultaneously activated with the **"D.H."** symbol on the display. Press the **"HOLD"** push-button momentarily again to activate the backlight function only.

Select

Press this button to toggle between the DC measurement mode and the AC measurement mode when the rotary selector switch is set to V (DM393 only), μ A, mA, and 10A. Press the **"SELECT"** push-button to cycle through Ω , $\rightarrow \rightarrow$ or $\rightarrow \rightarrow$ measurement modes when the rotary selector switch is set to Ω , $\rightarrow \rightarrow$, $\rightarrow \rightarrow$.

Operating Instructions

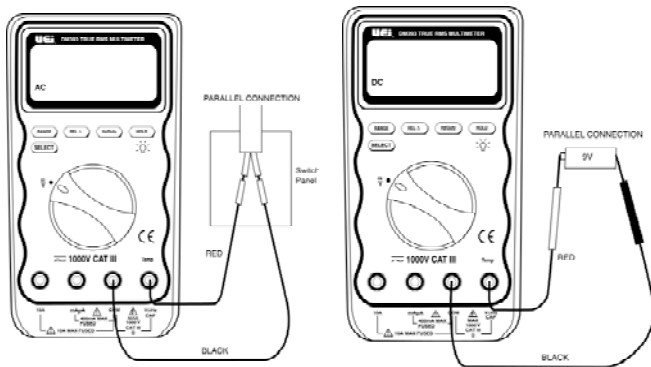
Voltage (V or V, V) Measurements

Voltage is the difference in electrical potential between two points. The polarity of AC (alternating current) voltage varies over time, while the polarity of DC (direct current) voltage is constant over time. V function defaults at DC. Press the **"SELECT"** push-button momentarily to select AC.

Range available in volts function are:

400mV, 4V, 40V, 400V, and 1000V

When measuring voltage, the meter acts like a 10M Ω ($10 \times 10^6 \Omega$) impedance in parallel with the circuit. This loading effect can cause measurement errors in high impedance circuits. In most cases, the error is negligible (0.1% or less) if the circuit impedance is 10k Ω or less.



Tips for Measuring Voltage

- In 400mV range, displayed value may fluctuate while disconnecting input terminals - This is normal
- AC voltage measuring circuit in DM393 is of root-mean-square (True RMS) value systems so the meter can accurately measure AC voltage of non-sinusoidal waveforms including harmonics caused by various non-linear loads
- To improve the accuracy of DC voltage measurement taken in the presence of AC voltages (such as, measuring the DC voltage of an amplifier in the presence of an AC signal), measure the AC voltage first. Note the just measured AC voltage range and select a DC voltage range that is the same or higher than the AC voltage range - This method improves the DC voltage accuracy by preventing the input protection circuits from being activated.



WARNING!

To avoid the risk of electrical shock and instrument damage, input voltages must not exceed 1000 V DC or AC (RMS). Do not attempt to take any unknown voltage measurement that may be in excess of 1000 V DC or AC (RMS).

Resistance (Ω , \rightarrow , \bullet)) Measurement (Ohms, Diode, and Continuity)



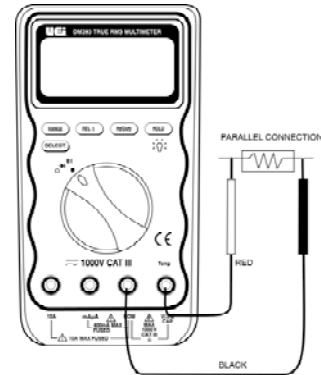
WARNING!

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.

Resistance is an opposition to current flow. The unit of resistance is the ohm (Ω). The meter measures resistance by sending a small current through the circuit.

Ranges available in resistance functions are:

4000.0 Ω , 4.000 k Ω , 40.00 k Ω , 400.0 k Ω , 4 M Ω , and 40 M Ω



Tips for Measuring Resistance

- Because the meters 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 diode or transistor junctions, causing them to conduct - Do not use the 40 M Ω range for measuring the in-circuit resistance to avoid this
- When measuring large resistance, reading may be unstable due to environmentally induced electrical noise - In this case, directly connect the resistor to input terminals of the meter or shield the resistor at potential of the **"COM"** input terminal to obtain stable reading
- For resistance above 1 M Ω , the display may take a few seconds to stabilize - This is normal for high resistance readings
- The meter has a circuit to protect the resistance range from over-voltage - However, to prevent accidentally exceeding the protection circuit's rating and to ensure a correct measurement, **NEVER CONNECT THE LEADS TO A SOURCE OF VOLTAGE** when the rotary switch is set to Ω , \rightarrow , or \bullet)) functions

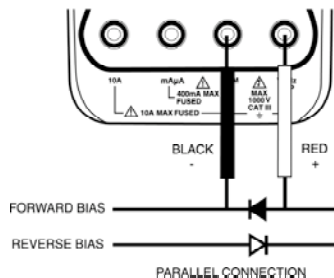
Diode (→) Test



CAUTION!

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, then measures the junction's voltage drop.



Normal forward voltage drop (forward biased) for a good silicon diode is between 0.4V to 0.9V. A reading higher than that indicates a leaky (defective) diode. A zero reading indicates a shorted (defective) diode. An "OL" indicates an open (defective).

Reverse the test leads connections (reverse biased) across the diode. The display shows "OL" if the diode is good. Any other readings indicate the diode is shorted or resistive.

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 operation of switches. A continuous beep tone indicates a complete wire.



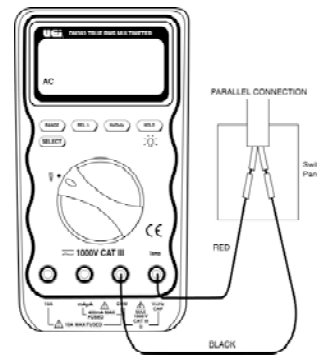
CAUTION!

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.

Frequency (Hz) Measurement

Frequency is the number of cycles a signal completes each second. The meter measures the frequency of a voltage or current signal by counting the number of times the signal crosses a threshold level each second. To measure the frequency of a voltage or current signal, press the "Hz/Duty" push-button momentarily while measuring volts or currents.

The available frequency ranges are: 5Hz, 50Hz, 500Hz, 5kHz, 50kHz, 500kHz, 5MHz, and 10MHz.



Tips for Measuring Frequency

- In frequency, the meter is always autoranging
- When disconnecting the input terminals, the overload sign may be displayed or the display may unsteadily fluctuate - This is typical

Duty Cycle Measurement

DutyCycle (or Duty Factor) is the percentage of time a signal is above or below a trigger level during one cycle. The duty cycle mode is optimized for measuring the ON or OFF time of logic and switching signals. Systems such as electronic fuel injection systems and switching power supplies are controlled by pulses of varying width, which can be checked by measuring dutycycle.

Press the "Hz/Duty" push-button to toggle between the Hz mode and the DutyCycle mode when the rotary selector knob is set to "Hz" (Duty), \overline{V} , $\overline{\mu A}$, \overline{mA} , and $\overline{10A}$.

Capacitance Measurement



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 capacitance. Large value capacitors should be discharged through an appropriate resistance load. Use the DC voltage function to confirm that the capacitor is discharged.

Capacitance is the ability of a component to store an electrical charge. The unity of capacitance is the farad (F). Most capacitors are in the nanofarad (nF) to microfarad (μF) range.

The available capacitance ranges are 40nF, 400nF, 4 μF , 40 μF , and 100 μF .

Tips for Measuring Capacitance

- In capacitance, the meter is always autoranging
- In 40nF range, the readings are probably unstable due to environmentally induced electrical noise and floating capacity of the test leads. Therefore, directly connect the object to be measured to the input terminals. Use **"RELA"** in this range for accurate measurement - The meter will display 0.33 nF with no connectors



Temperature (Temp) Measurements (DM393 only)

- The meter comes with temperature reading in either Centigrade or Fahrenheit preset at the factory - The reading mode can be changed at the factory only
- *The **"SELECT"** function is not available in temperature mode.



WARNING!

DO NOT apply thermocouple to circuits exceeding 30V rms, 42.4V peak or 60V DC.

- Be sure to insert the banana plug K-type temperature bead probe with correct + - polarities - You can also use a thermocouple probe adapter (optional purchase) to adapt other standard K-type thermocouple probes



Current (μ A, mA, 10A) Measurement



WARNING!

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.



CAUTION!

Check the meter fuses before measuring current. Use the proper terminals, functions, 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 terminal.

Current is the flow of electrons through a conductor. To measure current you must open the circuit under test, then place the meter in series with the circuit.

Ranges available in current functions are:

400.0 μ A, 4000 μ A, 40.00mA, 400.0mA, 4.000A, 10.00A
The meter defaults at DC. Press **"SELECT"** push-button momentarily to select **"AC"**.

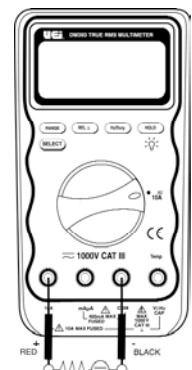
Measuring AC or DC Current

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 as the following table.

Range	Input	Ranges
	mAμA	400.0 μA, 4000 μA
	mAμA	400.0 μA, 4000 μA
	10A	4.000 A, 10.00 A

*To avoid blowing the meter's 440 mA fuse, use the mA μ A terminal only if you are sure the current is less than 400 mA.

3. Open the current path to be tested. Touch the red probe to the more positive side of the break and touch the black probe to the more negative side of the break. (Reversing the leads will produce a negative reading, but will not damage the meter).
4. Turn on power to the circuit and read the display.
5. After measuring current, turn off power to the circuit and discharge at high-voltage capacitors. Disconnect the meter and restore the circuit to normal operation.



Tips for Measuring Current

- When measuring a 3-phase system, special attention should be taken to the phase to phase voltage which is significantly higher than the phase to earth voltage. To avoid exceeding the voltage rating of the protection fuse(s) accidentally, always consider the phase to phase voltage as the working voltage for the protection fuse(s).
- When measuring current, the meter's internal shunt resistors develop a voltage across the meter's terminals called "burden voltage". This voltage drop may affect precision circuit or measurements.

Auto/Manual Range Operation

Press the "**RANGE**" push-button momentarily to select manual-ranging in volts, ohms, and current measurement functions, and the meter will remain in the range it was in, when the LCD annunciator "**AUTO**" turns off.

Press the button momentarily again to step through the ranges.

Press and hold the "**RANGE**" push-button for 2 seconds to resume auto-ranging.

Note: Manual-ranging feature is not available in Hz (Duty), CAP, TEMP, → and •)) functions.

Auto Power-Off

The Auto-Power-Off feature automatically turns the meter off to extend battery life after approximately 30 minutes of no activities. To turn on the meter after Auto-Power-Off, turn the rotary switch from OFF to any function (ON).

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.

Battery, Fuse and Test Load 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. This meter uses a single standard 9V battery (NEDA 1604, JIS006P, IEC 6F 22), a 1000V/440 mA IR 10 kA fast acting F fuse for mA μ A current input, and a 1000V/11A IR 10 Ka fast acting F fuse for A current input



WARNING!

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

To install a new battery, follow these procedures:

1. Turn off the meter.
2. Remove the rubber boot from the meter, starting at the top.
3. Place meter face down on a clean cloth.
4. Remove the screws from the rear case. Two machined screws fasten the bottom and two self-tapping screws fasten the top.
5. Separate the two halves to expose the battery.
6. Remove and discard the old battery. Always dispose of old batteries promptly in a manner with local disposal regulations.



WARNING!

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

7. Place a fresh 9V battery in the battery clip.
8. Reassemble the meter.

Troubleshooting

If the meter fails to operate even with the battery or fuse replacements, check twice according to operating procedures as described in this manual.

If the meter's V/ input terminal was subjected to high voltage transient (caused by lightning or switching surge to the system) by accident or abnormal operating conditions, the series fusible resistors will be blown in order to protect the user and the meter. Most measuring functions through this terminal will then be open circuit.

In this case, the series fusible resistors and the spark gaps should be replaced by qualified personnel. Refer to the **LIMITED WARRANTY & LIMITATIONS OF LIABILITY** section for obtaining warranty or repairing service.

Specifications

Safety and Compliance

Maximum voltage between any terminal and the ground	1000 V AC/DC
Compliances	Complies with CSA C22.2 No 1010.1-92, NASI/ISA-S82, 01-94 to 1000 V overvoltage category III
Certifications	UL & cUL standard UL 3111-1 listed CE-marking certified
Surge protection	8kV peak per IEC 1010.0-92
Fuse protection for mA or μ A inputs	1000 V/440mA IR 10kA FAST fuse
Fuse protection for A input	1000 V/11A IR 10kA FAST fuse

Physical Specifications

Display	Digital -4000 counts display; updates 5 times/sec.
Operating temperature	32° to 104°F (-0° to 40°C)
Storage temperature	-4° to 140°F (-20° to 60°C)
Temperature coefficient	Nominal 0.15 x (specified accuracy)/°C @ (0° to 8°C or 28° to 40°C), or otherwise specified
Relative humidity	0% to 80% @ (32° to 95°F) 0% to 70% @ (95° to 104°F)
Altitude	Operating - up to 6,500 feet Storage - 32,000 feet

Specifications

Battery type	Single 9V battery - NEDA 1604, JIS 006P or IEC 6F 22
Battery life	250 hrs. typical (w/backlight off) DM393 250 hrs. typical (w/backlight off) DM391
Shock degree	Per MIL-T-PRE 28800 for Class II instruments
Pollution degree	2
Electromagnetic compatibility (EMC)	Susceptibility - commercial limits for EN 50082-1 Emissions - commercial limits for EN 50081-1
Size	1.6 x 3.6 x 6.8 inches
Weight	13.6 oz.
Warranty	Five (5) year limited warranty
Calibration interval	One (1) year recommended

Feature Summary

Backlight	For clear readings in poorly lit areas
Fast autoranging	Meter automatically selects the best range momentarily
HOLD	Holds readings on display
Continuity/open test	Beeper sounds
Battery/fuse access door	Battery or fuse replaceable without voiding calibration
High-impact over-molded case	Protective holster features

Electrical Specifications

Accuracy is given as \pm ([% of reading] + [number of digits]) at 64° to 82°F with relative humidity up to 80%, for period of one year after calibration. True RMS responding accuracies are specified from 5% to 100% of range or otherwise specified; Crest Factor < 3:1 at full scale and < 6:1 at half scale.

Range	Resolution	Accuracy	
		DM391	DM393
400mV	100 μ V	0.5% + 2	0.5% + 2
4V	1mV		
40V	10mV		
400V	100mV		
1000V	1V	0.75% + 3	0.75% + 3

NMRR >60db @ 50/60 Hz

CMRR >120db @ DC, 50/60 Hz, $R_s = 1k\Omega$
(Common Mode Rejection Ratio)

Input Impedance 10 M Ω , 30 pF nominal
(50 M Ω , 100 pF nominal for 400 mV range)

AC Voltage

Range	Resolution	Accuracy			
		40 Hz - 400 Hz		400 Hz - 1 kHz	1 kHz - 20 kHz
		DM391	DM393	DM393	
400mV	100 μ V	0.75% + 3	0.75% + 3	2.0% + 10	
4V	1mV			2.0% + 3	
40V	10mV				
400V	100mV				
1000V	1V	1.0% + 5	1.0% + 5	2.0% + 5*	-

CMRR >60db @ DC Hz, $R_s = 1k\Omega$
(Common Mode Rejection Ratio)

Input Impedance 10 M Ω , 30 pF nominal
(50 M Ω , 100 pF nominal for 400 mV range)

*Accuracy for 400 Hz to 1 kHz

DC Current

Range	Resolution	Accuracy	
		DM391	DM393
400μA	0.1μA	1.0% + 2	1.0% + 2
4000μA	1μA		
40mA	10μA		
400mA	100μA		
4A	1mA		
10A	10mA	1.5% + 5	1.5% + 5

AC Current

Range	Resolution	Accuracy		
		40 Hz - 400 Hz		400 Hz - 10 kHz
		DM391	DM393	DM393
400μA	0.1μA	1.0% + 5	1.0% + 5	1.5% + 5
4000μA	1μA			
40mA	10μA			
400mA	100μA			
4A	1mA			
10A	10mA	1.5% + 10	1.5% + 10	2.0% + 10

Resistance

Range	Resolution	Accuracy	
		DM391	DM393
400Ω	0.1Ω	1.0% + 5	1.0% + 5
4000Ω	1Ω		
40kΩ	10Ω		
400kΩ	100Ω	0.5% + 3	0.5% + 3
4MΩ	1kΩ	1.0% + 5	1.0% + 5
10MΩ	10kΩ	1.5% + 10	1.5% + 10

Open circuit voltage: <1.3 V DC

Continuity

Audible threshold	: the beeper sounds if the measured resistance is lower than 10Ω, and turns off when greater than about 60Ω
Response time	: <1 msec.

Diode Test

Range	Resolution	Test Current (Typical)	Open Circuit Voltage
4V	2%	0.25mA	<1.5V DC

Capacitance

Range	Resolution	Accuracy	
		DM391	DM393
40nF	10pF	2.5% + 10	2.5% + 10
400nF	100pF		
4μF	1nF		
40μF	10nF		
100μF	100nF		

Frequency and Duty Cycle

Range	Resolution	Accuracy		Remark
		DM391	DM393	
5Hz	0.001Hz	0.05% + 3	0.05% + 3	Minimum frequency: 0.5Hz Sensitivity 5Hz - 1MHz, > 250mV 1MHz - 10MHz, > 350mV
50Hz	0.01Hz			
500Hz	0.1Hz			
5kHz	1Hz			
50kHz	10Hz			
500kHz	100Hz			
5MHz	1kHz			
10MHz	10kHz			
0.1% to 99.9%	0.1%	0.5Hz to 500kHz (pulse width > 2μ sec.) (0.1% + 0.05% per khz + 1 count) for 5 V input (Logic signals only)		

Temperature (DM393)

Range	Resolution	Accuracy
-40° to 14°F	1°F	3% ± 5°F
(-40° to -10°C)	1°C	(3% ± 5°C)
14° to 752°F	1°F	1% ± 3°F
(-10° to -400°C)	1°C	(1% ± 3°C)
752° to 2372°F	1°F	3% of reading
(400° to 1300°C)	1°C	(3% of reading)

Frequency Counter Sensitivity

Range	Minimum Sensitivity (RMS Sine Wave)	
	40Hz to 10kHz	10Hz to 20kHz
V (4V tp 1000V)	500mV	500mV
μA (400μA to 400mA)	> 15% F.S. of AC range	Not Specified
mA (40mA to 400mA)	> 15% F.S. of AC range	Not Specified
A (4.0A to 10A)	> 15% F.S. of AC range	Not Specified

Burden Voltage (A, mA, μA)

Function	Range	Burden Voltage (typical)
mA/μA	400μA	150μV/μA
	4000μA	150μV/μA
	40mA	3.3mV/mA
	400mA	3.3mV/mA
10A	4A	0.03V/A
	10A	0.03V/A

Electromagnetic Compatibility (EMC)

The meters meet EN 61326: 1997 A1: 1998.

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 waveform. This technique is fast, accurate, and cost effective. However, in measuring non-sinusoidal waveforms, significant errors can be introduced because of different scaling factors relating 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, sawtooth, triangle, pulse trains, spikes, and transient glitches as well as distorted waveforms with the presence of harmonics.

Non-sinusoidal waveforms may cause:

- Overheated transformers, generator 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: 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 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) 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). The meter has a NMRR specification of > 60db at 50Hz/60Hz, which means a good 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. The meter has a CMRR specification of > 60db at DC to 60Hz in AC volts measurement function and > 120db 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 measurement error, and should be as low as practical.

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

DM391/393

Digital Multimeter

Limited Warranty

The DM391/393 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.

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

