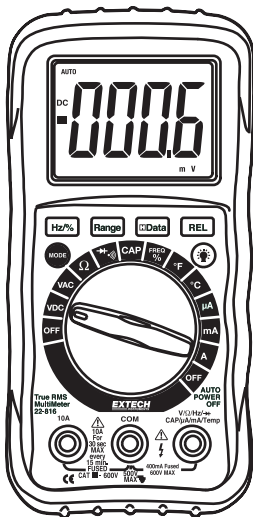


User's Guide

**EXTECH**  
INSTRUMENTS

# True RMS Digital Multimeter

Model 22-816



## ***Introduction***

---

Congratulations on your purchase of Extech's 22-816 true rms Digital Multimeter. This autoranging meter measures AC/DC Voltage, AC/DC Current, Resistance, Capacitance, Frequency, Duty Cycle, Temperature, Diode Test and Continuity. Proper use and care of this meter will provide many years of reliable service.

## ***Safety***

---

### **International Safety Symbols**



This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.



This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present



Double insulation

### **Overvoltage Category III**

This meter meets the IEC 610-1-95 standard for OVERVOLTAGE CATEGORY III. Cat III meters are protected against overvoltage transients in fixed installation at the distribution level. Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

## Safety Precautions

1. Improper use of this meter can cause damage, shock, injury or death. Read and understand this user manual before operating the meter.
2. Make sure any covers or battery doors are properly closed and secured.
3. Always remove the test leads before replacing the battery or fuses.
4. Inspect the condition of the test leads and the meter itself for any damage before operating the meter. Repair any damage before use.
5. Do not exceed the maximum rated input limits.
6. Use great care when making measurements if the voltages are greater than 25VAC rms or 35VDC. These voltages are considered a shock hazard.
7. Always discharge capacitors and remove power from the device under test before performing Capacitance, Diode, Resistance or Continuity tests.
8. Remove the battery from the meter if the meter is to be stored for long periods.
9. To avoid electric shock, do not measure AC current on any circuit whose voltage exceeds 250V AC.
10. Voltage checks on electrical outlets can be difficult and misleading because of the uncertainty of connection to the electrical contacts. Other means should be used to ensure that the terminals are not "live".

Input Limits	
Function	Maximum Input
V DC, VAC	1000V DC/ 600V AC
Ohms, Capacitance, Diode, Frequency, Continuity	250V DC/AC
mA DC/AC	400mA DC/AC
10A DC/AC	10A DC/AC (30seconds max every 15 minutes)

## Specifications

Function	Range	Resolution	Accuracy
DC Voltage	400mV	0.1mV	$\pm(0.5\% \text{ reading} + 2 \text{ digits})$
	4V	0.001V	$\pm(1.0\% \text{ reading} + 2 \text{ digits})$
	40V	0.01V	
	400V	0.1V	
	600V	1V	$\pm(1.5\% \text{ reading} + 2 \text{ digits})$
AC Voltage 50/60Hz	400mV	0.1mV	$\pm(1.0\% \text{ reading} + 70 \text{ digits})$
	4V	0.001V	$\pm(1.0\% \text{ reading} + 3 \text{ digits})$
	40V	0.01V	$\pm(1.2\% \text{ reading} + 3 \text{ digits})$
	400V	0.1V	
	600V	1V	$\pm(2.0\% \text{ reading} + 4 \text{ digits})$
DC Current	400 $\mu$ A	0.1 $\mu$ A	$\pm(1.5\% \text{ reading} + 3 \text{ digits})$
	4000 $\mu$ A	1 $\mu$ A	
	40mA	0.01mA	
	400mA	0.1mA	
	10A	0.01A	$\pm(2.5\% \text{ reading} + 5 \text{ digits})$
AC Current 50/60Hz	400 $\mu$ A	0.1 $\mu$ A	$\pm(1.8\% \text{ reading} + 5 \text{ digits})$
	4000 $\mu$ A	1 $\mu$ A	
	40mA	0.01mA	
	400mA	0.1mA	
	10A	0.01A	$\pm(3.0\% \text{ reading} + 7 \text{ digits})$
Resistance	400 $\Omega$	0.1 $\Omega$	$\pm(1.0\% \text{ reading} + 4 \text{ digits})$
	4k $\Omega$	0.001k $\Omega$	$\pm(1.0\% \text{ reading} + 2 \text{ digits})$
	40k $\Omega$	0.01k $\Omega$	$\pm(1.2\% \text{ reading} + 2 \text{ digits})$
	400k $\Omega$	0.1k $\Omega$	
	4M $\Omega$	0.001M $\Omega$	$\pm(2.0\% \text{ reading} + 5 \text{ digits})$
	40M $\Omega$	0.01M $\Omega$	

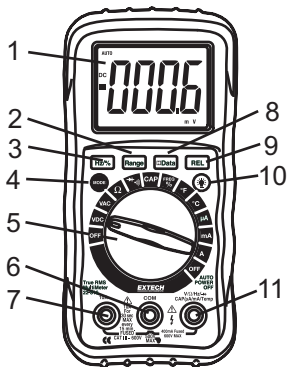
Capacitance	4nF	0.001nF	±(5.0% reading + 10digits)
	40nF	0.01nF	±(5.0% reading + 7 digits)
	400nF	0.1nF	±(3.0% reading + 5 digits)
	4μF	0.001μF	±(3.5% reading + 5 digits)
	40μF	0.01μF	
	200μF	0.1μF	±(5.0% reading + 5 digits)
Frequency	9.999Hz	0.001Hz	±(1.5% reading + 5 digits)
	99.99Hz	0.01Hz	
	999.9Hz	0.1Hz	
	9.999kHz	0.001kHz	±(1.2% reading + 2 digits)
	99.99kHz	0.01kHz	
	999.9kHz	0.1kHz	
	9.999MHz	0.001MHz	±(1.5% reading + 4 digits)
	Sensitivity: 0.8V rms min. @ 20% to 80% duty cycle and <100kHz; 5Vrms min @ 20% to 80% duty cycle and > 100kHz.		
Function	Range	Resolution	Accuracy
Duty Cycle	0.1 to 99.9%	0.1%	±(1.2% reading + 2 digits) Pulse width: 100μs - 100ms Frequency: 5Hz to 150kHz
Temp °F	-4 to 1400°F	1°F	±(3.0% reading + 3 digits) (meter only, probe accuracy not included)
Temp °C	-20 to 760°C	1°C	

**NOTE:** Accuracy is stated at 65°F to 83°F (18°C to 28°C) and less than 70% RH.

<b>Diode Test</b>	Test current of 0.3mA maximum, open circuit voltage 1.5V DC typical
<b>Continuity Check</b>	Audible signal will sound if the resistance is less than approximately 30Ω, test current <0.7mA
<b>Temperature sensor</b>	Requires type K thermocouple
<b>Input Impedance</b>	7.5MΩ (VDC and VAC)
<b>AC Bandwidth</b>	40 to 400Hz
<b>Display</b>	4000 count backlit Liquid Crystal
<b>Overrange indication</b>	“OL” is displayed
<b>Polarity</b>	Automatic (no indication for positive polarity); Minus (-) sign for negative polarity.
<b>Measurement Rate</b>	2 times per second, nominal
<b>Auto Power Off</b>	Meter automatically shuts down after 15 minutes of inactivity
<b>Low Battery Indication</b>	“ <b>BAT</b> ” is displayed if battery voltage drops below operating voltage
<b>Battery</b>	One 9V battery; NEDA 1604, IEC 6F22
<b>Fuses</b>	mA, μA and Temperature ranges; 0.5A/250V fast blow 10A range, 10A/250V fast blow
<b>Operating Temperature</b>	32°F to 122°F (0°C to 50°C)
<b>Storage Temperature</b>	-4°F to 140°F (-20°C to 60°C)
<b>Relative Humidity</b>	<70% operating, <80% storage
<b>Operating Altitude</b>	7000ft (2000 meters) maximum.
<b>Weight</b>	7 oz. (200g).
<b>Size</b>	6" x 3" x 1.75" (15.25x 7.6x 4.45cm)
<b>Safety</b>	For indoor use and in accordance with the requirements for double insulation to IEC1010-1 (1995); EN61010-1 (1995) Overvoltage Category III.

## Meter Description

1. Liquid Crystal Display
2. Range button
3. Hz/Duty Cycle button
4. Mode button
5. Rotary Function switch
6. COM jack
7. 10A Current jack
8. Hold button
9. Relative button
10. Backlite button
11. Positive input jack



**Note:** Tilt stand, fuse and battery compartment are on rear of unit.

### Symbols

AC	Alternating current or voltage
DC	Direct current or voltage
•)))	Continuity
▶	Diode test
mV, V	millivolt, volt (voltage)
$\Omega$ , K $\Omega$ , M $\Omega$	ohm, kilohm, megohm (resistance)
$\mu$ A, mA, A	microamp, milliamp, Amp (current)
nF, $\mu$ F	nanofarad, microfarad (capacitance)
Hz, kHz	hertz, kilohertz (frequency)
%	% duty cycle
$^{\circ}$ F, $^{\circ}$ C	Degrees Fahrenheit, Centigrade (temperature)
AUTO	Autorange
BAT	Low battery
HOLD	Display hold
REL	Relative

## Operating Instructions

---

### AC or DC Voltage Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
2. Turn the rotary switch to the **VAC** or **VDC** position.
3. Touch the test probes to the circuit under test and read the voltage on the display.

Note: Pressing the **H<sub>z</sub>/%** button while in the voltaget function will switch the display to frequency or duty cycle



### AC or DC Current Measurements

**CAUTION:** Do not make current measurements on the 10A scale for longer than 30 seconds every 15 minutes. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the;
  - a. Positive **uA/mA** jack for currents to 400mA
  - b. Positive **10A** jack for currents to 10A
2. Turn the rotary switch to the uA, mA or A position.
3. Press the **MODE** button to select AC or DC current
4. Touch the test probes in series with the circuit under test and read the current on the display.

Note: Pressing the **H<sub>z</sub>/%** button while in the current function will switch the display to frequency or duty cycle



## Resistance Measurements

**WARNING:** To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements.

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive  $\Omega$  jack.
2. Turn the rotary switch to the  $\Omega$  position.
3. Touch the test probes to the circuit or device under test and read the resistance on the display.



## Capacitance Measurements

**WARNING:** To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements.

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **CAP** jack.
2. Turn the rotary switch to the **CAP** position.
3. Touch the test probes to the circuit or device under test and read the capacitance on the display.




## Frequency or Duty Cycle Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **HZ** jack.
2. Turn the rotary switch to the **FREQ %** position.
3. Press the **Hz/%** button to select “**Hz**” or “%”.
4. Touch the test probes to the circuit or under test and read the frequency or duty cycle on the display.



## Continuity Measurements

1. Insert the black test lead banana plug into the negative COM jack and the red test lead banana plug into the positive  $\Omega$  jack.
2. Turn the rotary switch to the  position.
3. Press the MODE button until “•)”)” appears in the display.
4. Touch the test probes to the circuit or device under test. If the resistance is less than approximately  $30\Omega$  the buzzer will sound and the resistance appears on the display.



Note: The meter automatically holds the  $400\Omega$  range when continuity is selected

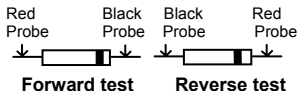
## Temperature Measurements

1. Insert the type K thermocouple probe black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **Temp** jack..
2. Turn the rotary switch to the  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$  position.
3. Read the temperature on the display.



## Diode Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive diode jack.
2. Turn the rotary switch to the  position.
3. Press the **MODE** button until "" appears in the display.
4. Touch the test probes to the diode under test. Forward voltage will indicate 0.4V to 0.7V. Reverse voltage will indicate "**OL**". Shorted devices will indicate near 0mV and an open device will indicate "**OL**" in both polarities.



## Manual Ranging

The meter turns on in the autoranging mode. Press the **Range** button to go to manual ranging. Each press of the range button will step to the next range as indicated by the units and decimal point location. Press and hold the **Range** button for two seconds to return to autoranging. Manual ranging does not function in the Capacitance, Frequency and Temperature functions

## Data Hold


Press the **Data Hold** button to freeze the reading in the display. "**HOLD**" will appear in the LCD. Press the button again to release the display.

## Relative Measurements

The relative measurement feature allows you to make measurements relative to a stored reference value. A reference voltage, current, etc. can be stored and measurements made in comparison to that value. The displayed value is the difference between the reference value and the measured value.

1. Perform any measurement as described in the operating instructions.
2. Press the **Relative** button to store the reading in the display and the "REL" indicator will appear on the display.
3. The display will now indicate the difference between the stored value and the measured value.
4. Press the **Relative** button to return to normal operation.

## Backlight

The backlight function illuminates the display and is used when the ambient light is too low to permit viewing of the displayed readings. Press the  button for one second to turn the backlight on and press the button a second time to turn the backlight off.

## Auto Off

The auto off feature will turn the meter off after 15 minutes of inactivity (Range switch or a button has not been turned or pressed). A beep will warn the user shortly before the auto off feature activates. Turn the Function switch to the OFF position and then to a function to resume operation.

## True RMS

The term stands for "Root-Mean-Square," which represents the method of calculation of the voltage or current value. Average responding multimeters are calibrated to read correctly only on sine waves and they will read inaccurately on non-sine wave or distorted signals. True rms meters read accurately on either type of signal.

## Maintenance

**WARNING:** To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery/fuse cover.

**WARNING:** To avoid electric shock, do not operate your meter until the battery/fuse cover is in place and fastened securely.

This Multimeter is designed to provide years of dependable service, if the following care instructions are performed.

1. Keep the meter dry.
2. Use and store the meter in mild ambient conditions. Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.
3. Handle the meter gently. Dropping it can damage the electronic parts or the case.
4. Keep the meter clean. Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents or detergents.
5. Use only a fresh battery of the recommended size and type. Remove the old or weak battery so it does not leak and damage the unit.
6. If the meter is to be stored for a long period of time, the battery should be removed to prevent damage to the unit.

### Battery Replacement

1. Disconnect the test leads from the meter.
2. Remove the rubber holster/boot (if in place).
3. Open the battery door by removing the screws using a Phillips head screwdriver.
4. Insert the new battery into the battery holder, observing the correct polarity.
5. Replace the battery door and secure with the screws.



## Fuse Replacement

**WARNING:** To avoid electric shock, disconnect the test leads from any source of voltage before removing battery/fuse cover.

1. Disconnect the test leads from any circuit being measured.
2. Remove the rubber holster (if in place).
3. Open the battery/fuse cover by removing the screws on the rear using a Phillips screwdriver.
4. Remove the battery cover.
5. Remove the old fuse by gently pulling up on it.
6. Install the new fuse by gently pushing it into the holder.
7. Always use a fuse of the proper size and value (0.5A/250V fast blow or 10A/250V fast blow).
8. Replace the cover and secure with the screws.

A UL mark does not indicate that this product has been evaluated for the accuracy of its readings.

## **Warranty**

---

EXTECH INSTRUMENTS CORPORATION warrants this instrument to be free of defects in parts and workmanship for one year from date of shipment (a six month limited warranty applies on sensors and cables). If it should become necessary to return the instrument for service during or beyond the warranty period, contact the Customer Service Department at (781) 890-7440 ext. 210 for authorization or visit our website at [www.extech.com](http://www.extech.com) (click on 'Contact Extech' and go to 'Service Department' to request an RA number). A Return Authorization (RA) number must be issued before any product is returned to Extech. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. Extech specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. Extech's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

### **Calibration and Repair Services**

Extech offers complete repair and calibration services for all of the products we sell. For periodic calibration, NIST certification or repair of any Extech product, call customer service for details on services available. Extech recommends that calibration be performed on an annual basis to ensure calibration integrity.



#### **Support Hotline (781) 890-7440**

Tech support: Ext. 200; Email: [support@extech.com](mailto:support@extech.com)

Repair>Returns: Ext. 210; Email: [repair@extech.com](mailto:repair@extech.com)

Website: [www.extech.com](http://www.extech.com)

**Copyright © 2002 Extech Instruments Corporation.  
All rights reserved including the right of reproduction  
in whole or in part in any form.**