

User Manual



MM870

Industrial TRMS Digital Multimeter





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1-Introduction

Professional True RMS Industrial Digital Multimeter with Bluetooth and 6000/60000 count LCD display. This meter measures AC/DC Voltage, AC/DC Current, Resistance, Capacitance, Frequency(electrical & electronic), Duty Cycle, Diode Test, and Continuity plus Thermocouple Temperature. It features a waterproof, rugged design for heavy duty use. Proper use and care of this meter will provide many years of reliable service.

2-Safety



This symbol adjacent to another symbol, terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid personal injury or damage to the meter.



This **WARNING** symbol indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.



This **CAUTION** symbol indicates a potentially hazardous situation, which if not avoided, may result damage to the product.



This symbol advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage with respect to earth ground exceeds(in this case)1000 VAC or VDC.



This symbol adjacent to one or more terminals identifies them as being associated with ranges that may, in normal use, be subjected to particularly hazardous voltages. For maximum safety, the meter and its test leads should not be handled when these terminals are energized.



This symbol indicates that a device is protected throughout by double insulation or reinforced insulation.

PER IEC1010 OVERVOLTAGE INSTALLATION CATEGORY

OVERVOLTAGE CATEGORY I

Equipment of **OVERVOLTAGE CATEGORY I** is equipment for connection to circuits in which measures are taken to limit the transient overvoltages to an appropriate low level.

Note-Examples include protected electronic circuits.

OVERVOLTAGE CATEGORY II

Equipment of **OVERVOLTAGE CATEGORY II** is energy-consuming equipment to be supplied from the fixed installation.

Note-Examples include household, office, and laboratory appliances.

OVERVOLTAGE CATEGORY III

Equipment of **OVERVOLTAGE CATEGORY III** is equipment in fixed installations.

Note-Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY IV

Equipment of **OVERVOLTAGE CATEGORY IV** is for use at the origin of the installation.

Note-Examples include electricity meters and primary over-current protection equipment

3-Safety Instructions

This meter has been designed for safe use, but must be operated with caution. The rules listed below must be carefully followed for safe operation.

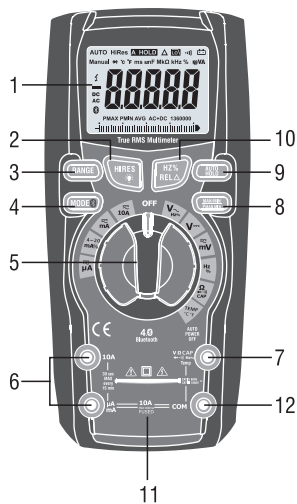
1-**NEVER** apply voltage or current to the meter that exceeds the specified maximum:

Input Protection Limits	
Function	Maximum Input
V DC or V AC	1000V DC/AC rms
mA AC/DC	800mA 1000V fast acting fuse
A AC/DC	10A 1000V fast acting fuse(20A for 30 seconds max every 15 minutes)
Frequency, Resistance, Capacitance, Duty Cycle, Diode Test, Continuity Temperature	600V DC/AC rms
Surge Protection: 8kV peak per IEC 61010	

- 2-**USE EXTREME CAUTION** when working with high voltages.
- 3-**DO NOT** measure voltage if the voltage on the "COM" input jack exceeds 1000V above earth ground.
- 4-**NEVER** connect the meter leads across a voltage source while the function switch is in the current, resistance, or diode mode. Doing so can damage the meter.
- 5-**ALWAYS** discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.
- 6-**ALWAYS** turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.
- 7-**NEVER** operate the meter unless the back cover and the battery and fuse covers are in place and fastened securely.
- 8-If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

4-Meter Description

- 1-LCD display
- 2-Backlight and HIRES button
- 3-Rang button
- 4-MDOE and Bluetooth button
- 5-Rotary Function Switch
- 6- μ A/mA and 10A input jack
- 7-V/ Ω /Hz%/CAP/DIODE/TEMP input jack
- 8-MAX/MIN and PMAX/PMIN Button
- 9-HOLD and AUTO HOLD button
- 10-Hz% and Rel button
- 11-BATTERY cover
- 12-COM input jack



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

5-Symbols and Annunciators

·)	Continuity
▶	Diode test
⊞	Battery status
n	nano(10^{-9}) (capacitance)
μ	micro(10^{-6}) (amps, cap)
m	milli(10^{-3}) (volts, amps)
A	Amps
k	kilo(10^3) (ohms)
F	Farads (capacitance)
M	mega(10^6) (ohms)
Ω	Ohms
PEAK	Peak Hold
Hz	Hertz(frequency)
V	Volts
%	Percent(duty ratio)
REL	Relative
AC	Alternating current
AUTO	Autoranging
DC	Direct current
HOLD	Display hold
°F	Degrees Fahrenheit
°C	Degrees Centigrade
MAX	Maximum
MIN	Minimum
4.0	Bluetooth 4.0



6-Operating Instructions

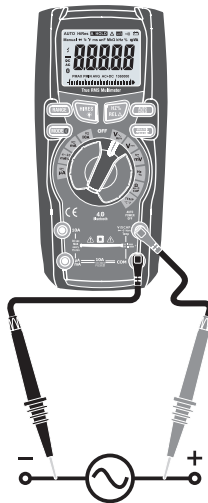
WARNING: Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

- ALWAYS turn the function switch to the **OFF** position when the meter is not in use.
- If “OL” appears in the display during a measurement, the value exceeds the range you have selected. Change to a higher range.

6-1.DC Voltage Measurements

CAUTION: Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the **VDC** position.
- Insert the black test lead banana plug into the negative **COM** jack.
Insert the red test lead banana plug into the positive **V** jack.
- Touch the black test probe tip to the negative side of the circuit.
Touch the red test probe tip to the positive side of the circuit.
- Read the voltage in the display.

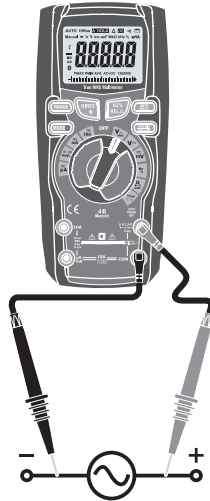


6-2.AC Voltage(Frequency, Duty Cycle)Measurements

WARNING: Risk of Electrocution. The probe tips may not be long enough to contact the live parts inside some 240V outlets for appliances because the contacts are recessed deep in the outlets. As a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are touching the metal contacts inside the outlet before assuming that no voltage is present.

CAUTION: Do not measure AC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

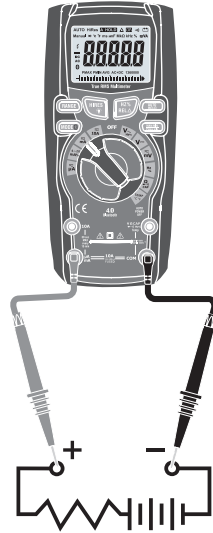
- Set the function switch to the **VAC/Hz/%** position.
- Insert the black test lead banana plug into the negative **COM** jack.
Insert red test lead banana plug into the positive **V** jack.
- Touch the black test probe tip to the neutral side of the circuit.
Touch the red test probe tip to the “hot” side of the circuit.
- Read the voltage in the display.
- Press the **Hz %** button to indicate “Hz”.
- Read the frequency in the display.
- Press the **Hz %** button again to indicate “%”.
- Read the % of duty cycle in the display.
- Press the **MODE** button again to indicate low pass “**LO**”.
- Read the low pass voltage in the display



6-3.DC Current Measurements

CAUTION: Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

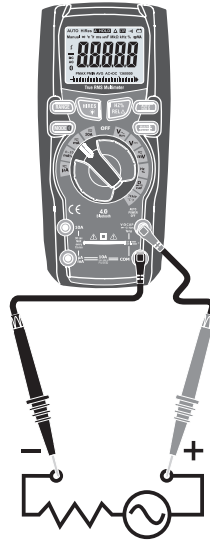
- Insert the black test lead banana plug into the negative **COM** jack.
- For current measurements up to 6000 μ A DC, set the function switch to the **μ A** position and insert the red test lead banana plug into the **μ A/mA** jack.
- For current measurements up to 600mA DC, set the function switch to the **mA** position and insert the red test lead banana plug into the **μ A/mA** jack.
- For current measurements up to 10A DC, set the function switch to the **10A** position and insert the red test lead banana plug into the **10A** jack.
- Press the **MODE** button to indicate “**DC**” on the display.
- Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
- Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
- Apply power to the circuit.
- Read the current in the display.



6-4.AC Current(Frequency, Duty Cycle)Measurements

CAUTION: Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

- Insert the black test lead banana plug into the negative **COM** jack.
- For current measurements up to 6000 μ A AC, set the function switch to the yellow **μ A** position and insert the red test lead banana plug into the **μ A/mA** jack.
- For current measurements up to 600mA AC, set the function switch to the yellow **mA** position and insert the red test lead banana plug into the **μ A/mA** jack.
- For current measurements up to 10A AC, set the function switch to the yellow 10A position and insert the red test lead banana plug into the 10A jack.
- Press the **MODE** button to indicate “AC” on the display.
- Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
- Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the “hot” side of the circuit.
- Apply power to the circuit.
- Read the current in the display.
- Press the **Hz %** button to indicate “Hz”.
- Read the frequency in the display.
- Press the **Hz %** button again to indicate “%”.
- Read the % duty cycle in the display.
- Press and hold the **MODE** button to return to current measurement.



6-5. Resistance Measurements

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

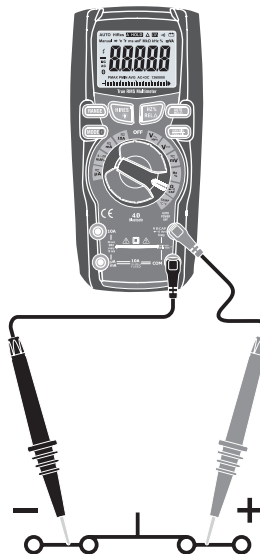
- Set the function switch to the Ω CAP \rightarrow (•)) Position.
- Insert the black test lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive Ω Jack.
- Press the **MODE** button to indicate “ Ω ” on the display.
- Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
- Read the resistance in the display.



6-6. Continuity Check

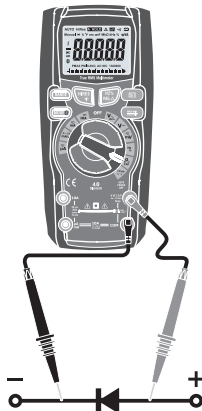
WARNING: To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

- Set the function switch to the Ω CAP \rightarrow \rightarrow \rightarrow position.
- Insert the black lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive Ω jack.
- Press the MODE button to indicate “ \rightarrow ” and “ Ω ” on the display
- Touch the test probe tips to the circuit or wire you wish to check.
- If the resistance is less than approximately 30Ω , the audible signal will sound. If the circuit is open, the display will indicate “OL”.



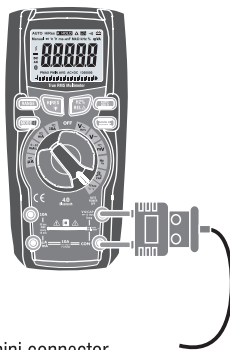
6-7. Diode Test

- Set the function switch to the Ω CAP \rightarrow \rightarrow) position.
- Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
- Press the **MODE** button to indicate “ \rightarrow ” and “**V**” on the display.
- Touch the test probes to the diode under test. Forward voltage will typically indicate 0.400 to 0.700V. Reverse voltage will indicate “OL”. Shorted devices will indicate near 0V and an open device will indicate “OL” in both polarities.



6-8. Temperature Measurements

- Set the function switch to the **Temp** position.
- Insert the Temperature Probe into the input jacks, making sure to observe the correct polarity.
- Press the **MODE** button to indicate “°F” or “°C”.
- Touch the Temperature Probe head to the part whose temperature you wish to measure. Keep the probe touching the part under test until the reading stabilizes (about 30 seconds).
- Read the temperature in the display.



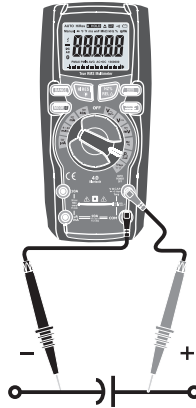
Note: The temperature probe is fitted with a type K mini connector.

A mini connector to banana connector adaptor is supplied for connection to the input banana jacks.

6-9. Capacitance Measurements

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

- Set the rotary function switch to the Ω CAP position.
 → \bullet) position.
- Insert the black test lead banana plug into the negative COM jack.
 Insert the red test lead banana plug into the positive V jack.
- Press the MODE button to indicate “F”
- Touch the test leads to the capacitor to be tested.
- Read the capacitance value in the display



6-10. Frequency(Duty Cycle)Measurements (Electronic)

- Set the rotary function switch to the Hz/% position.
- Insert the black lead banana plug into the negative COM jack and the red test lead banana plug into the positive Hz jack.
- Touch the test probe tips to the circuit under test.
- Read the frequency on the display.
- Press the Hz % button to indicate “%”.
- Read the % duty cycle in the display.



- **%4-20mA Measurements**

1-Set up and connect as described for DC mA measurements.

2-Set the rotary function switch to the **4-20mA%** position.

3-The meter will display loop current as a % with 0mA=-25%, 4mA=0%, 20mA=100%, and 24mA=125%.

- **MODE/Bluetooth**

Press MODE/Bluetooth button to select AC or Low Pass filter ,AC mV or DC mV, Resistance, Continuity, Diode Test, Temp °C and °F.

Press and hold the Mode/Bluetooth until the “**Ⓜ**” symbol appears on the LCD display. Bluetooth should be disable when not connected to a mobile device in order to conserve battery power. To turn off Bluetooth, press and hold the MODE/Bluetooth button until the “**Ⓜ**” symbol no longer appears on the display.

- **Autoranging/Manual Range Selection**

When the meter is first turned on, it automatically goes into Auto Ranging. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For measurement situations requiring that a range be manually selected, perform the following:

1-Press the **RANGE** key. The “**AUTO**” display indicator will turn off.

2-Press the **RANGE** key to step through the available ranges until you select the range you want.

3-To exit the Manual Ranging mode and return to Autoranging, press and hold the **RANGE** key for 2 seconds.

Note: Manual ranging does not apply for the Temperature functions.

- **MAX/MIN**

1-Press the **MAX/MIN** key to activate the **MAX/MIN** recording mode. The display icon “**MAX**” will appear. The meter will display and hold the maximum reading and will update only when a new “**MAX**” occurs.

2-Press the **MAX/MIN** key again and the display icon “**MIN**” will appear. The meter will display and hold the minimum reading and will update only when a new “**MIN**” occurs.

3-Press the **MAX/MIN** key again and the display icon “**AVG**” will appear. The meter will display the average reading.

4-To exit **MAX/MIN** mode press and hold the **MAX/MIN** key for 2 seconds.

- **RELATIVE Mode**

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.

Note: Relative mode does not operate in the 4-20mA function.



1-Perform the measurement as described in the operating instructions.

2-press and hold the **REL** key for 2 seconds 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 and hold the **REL** key for 2 seconds to exit the relative mode.

- **Display Backlight**

Press the  key to turn the backlight off. Again Press the  key to turn the backlight on. Change function switch will turn the backlight on.

- **HIRES**

Pressing HIRES for 2 second causes the Meter to enter the high-resolution(HiRes), 4-1/2 digit mode. Readings are displayed at 10 times the normal resolution with a maximum display of 59,999 counts. The HiRes mode works in all modes except capacitance, frequency counter functions, temperature, and the(peak)MIN/MAX modes.

To return to the 3-1/2 digit mode, press H again for 2 second.

- **Bar Graph**

The analog bar graph functions like the needle on an analog meter, but without the overshoot. The graph is not shown for capacitance, frequency counter functions, temperature, or peak min max, or REL functions.range 6000.

- **HOLD**

The hold function freezes the reading in the display. Press the HOLD key momentarily to activate or to exit the HOLD function.

- **AUTOHOLD**

The Auto HOLD mode captures the present reading on the display. When a new, stable reading is detected, the Meter beeps and displays the new reading. pressing **AHOLD** for 2 second To enter or exit Auto HOLD mode.

- **PEAK HOLD**

The Peak Hold function captures the peak AC voltage or current. The meter can capture negative or positive peaks as fast as 1 millisecond in duration. Momentarily press the **PEAK** button, “**PEAK**” and “**MAX**” will display. The meter will update the display each time a higher positive peak occurs. Press the **PEAK** button again, “**MIN**” will display. The meter will update the display each time a lower negative peak occurs. Press and hold the **PEAK** button for more than 1 second to exit PEAK Hold mode. Auto Power Off feature will be disabled automatically in this mode.

- **LOW Battery Indication**

With a fresh battery installed, the battery icon  with four lines above it will be displayed in the lower right corner of the LCD. The lines will disappear as the battery is used. When the  icon appears alone in the display, the battery should be replaced.

- **AUTO Power OFF**

The auto off feature will turn the meter off after 15 minutes. To disable the auto power off feature, hold down the **MODE** button and turn the meter on. “**10FF**” will appear in the display. Turn the meter off and then on again to re-enable the auto power off feature.

7-Replacing the Batteries

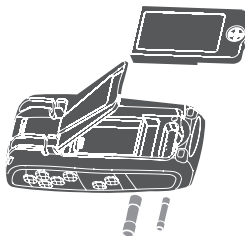
Refer to Figure and replace the batteries as follows:

- Turn the Meter off and remove the test leads from the terminals.
- Remove the battery door assembly by using a standard blade screwdriver to turn the battery door screw one-half turn counterclockwise.
- Replace the batteries with 4*1.5V “AAA”
- Reinstall the battery door assembly and secure it by turning the screw one-half turn clockwise.

8-Replacing the Fuses

Referring to Figure, examine or replace the Meter's fuses as follows:

- Turn the Meter off and remove the test leads from the terminals.
- Remove the battery door assembly by using a standard blade screwdriver to turn the battery door screw one-half turn counterclockwise.
- Remove the fuse by gently prying one end loose, then sliding the fuse out of its bracket.
- Install only specified replacement fuses.
- Reinstall the battery door assembly and secure it by turning the screw one-half turn clockwise.



9-Specifications

6000counts:

Accuracy calculated as[%reading + (num. digits*resolution)] at 18°C+28°C < 75%HR

60000counts:

Accuracy calculated as[%reading + (10*num. digits*resolution)] at 18°C+28°C < 75%HR


Function	Range	Resolution	Accuracy	
DC Voltage	600mV	0.1mV	± (0.1% reading + 2 digits)	
	6V	0.001V	± (0.05% reading + 2 digits)	
	60V	0.01V		
	600V	0.1V		
	1000V	1V		
AC Voltage			50 to 1000Hz	1K-5KHz
	600mV	0.1mV	± (1.0% reading + 4 digits)	± (2.0% reading + 5 digits)
	6V	0.001V		
	60V	0.01V		
	600V	0.1V		
	1000V	1V		Unspecified
	All AC voltage ranges are specified from 5% of range to 100% of range Low pass filter: Rang 1000V(50-60Hz), +(1.0+20); >3kHz(-3 dB)			
DC Current	600μA	0.1μA	± (0.2% reading + 5 digits)	
	6000μA	1μA	± (0.2% reading + 3 digits)	
	60mA	0.01mA	± (0.2% reading + 5 digits)	
	600mA	0.1mA	± (0.2% reading + 3 digits)	
	10A	0.01A	(10A: 30 sec max with reduced accuracy)	
AC Current			50 to 1000Hz	1K to 5KHz
	600μA	0.1μA	± (1.0% reading + 3 digits)	± (3.0% reading + 5 digits)
	6000μA	1μA		
	60mA	0.01mA		
	600mA	0.1mA		
	10A	0.01A		Unspecified
	(10A: 30 sec max with reduced accuracy)			
All AC current ranges are specified from 5% of range to 100% of range				

NOTE: Accuracy is stated at 18°C to 28°C (65°F to 83°F) and less than 75% RH.

Function	Range	Resolution	Accuracy
Resistance	600Ω	0.1Ω	±(0.2% reading + 5 digits)
	6kΩ	0.001kΩ	±(0.2% reading + 3 digits)
	60kΩ	0.01kΩ	
	600kΩ	0.1kΩ	
	6MΩ	0.01MΩ	±(1.0% reading + 8 digits)
	60MΩ	0.01MΩ	±(2.0% reading + 8 digits)
Capacitance	60nF	0.01nF	±(3.5% reading + 10digits)
	600nF	0.1nF	±(2.5% reading + 10digits)
	6μF	0.001μF	
	60μF	0.01μF	
	600μF	0.1μF	±(3.5% reading + 10digits)
	6000μF	1μF	
Frequency (electronic)	60Hz	0.001Hz	±(0.5% reading + 2digits)
	600Hz	0.01Hz	
	6kHz	0.0001kHz	
	60kHz	0.001kHz	
	600kHz	0.01kHz	
	6MHz	0.0001MHz	
	10MHz	0.001MHz	
	Sensitivity: 0.8V rms min. @ 20% to 80% duty cycle and <100kHz; 5Vrms min @ 20% to 80% duty cycle and >100kHz.		
Frequency (electrical)	40.00-10kHz	0.01Hz	±(0.5% reading)
	Sensitivity: 15Vrms		
Duty Cycle	0.1 to 99.90%	0.1%	±(1.2% reading + 2digits)
	Pulse width: 100μs-100ms, Frequency: 5Hz to 100kHz		
Temp (type-K)	-58 to 1832 °F	0.1°F	±(1.2% reading + 5 °F)
	-50 to 1000°C	0.1°C	±(1.2% reading + 3°C) (probe accuracy not included)
4-20mA%	-25 to 125%	0.1%	±20 digits
	0mA=-25%, 4mA=0%, 20mA=100%, 24mA=125%		

Note: Accuracy specifications consist of two elements:

- (% reading)-This is the accuracy of the measurement circuit.
- (+ digits)-This is the accuracy of the analog to digital converter.

Enclosure	Double molded, waterproof
Shock (Drop Test)	6.5 feet(2 meters)
Diode Test	Test current of 1.5 mA maximum, open circuit voltage 3.0 V DC typical
Continuity Check	Audible signal will sound if the resistance is less than 35Ω(approx.), test current <0.35mA
PEAK	Captures peaks >1ms
Temperature Sensor	Requires type K thermocouple
Input Impedance	>10MΩ VDC
AC Response	True rms
AC 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.
ACV Bandwidth	50Hz to 5000Hz
Display	6000/60,000 count backlit liquid crystal with bargraph
Overrange indication	"OL" is displayed
Auto Power Off	15 minutes(approximately)with disable feature
Polarity	Automatic(no indication for positive); Minus(-)sign for negative
Measurement Rate	3 times per second, nominal
Low Battery Indication	"  " is displayed if battery voltage drops below operating voltage
Battery	4*1.5 volt(NEDA 1604)battery

Fuses	mA, μ A ranges; 0.8A/1000V ceramic fast blow A range; 10A/1000V ceramic fast blow
Operating Temperature	5°C to 40°C(41°F to 104°F)
Storage Temperature	-20°C to 60°C(-4°F to 140°F)
Operating Humidity	Max 80% up to 87°F(31°C)decreasing linearly to
Storage Humidity	50% at 40°C(104°F)
Operating Altitude	<80% 7000ft. (2000meters)maximum.
Safety	Complies with EN61010-1:2010 , EN61010-031:2015 and EN61010-2-033:2012 for measurement Category IV 600V and Category III 1000V , Pollution Degree 2

Warranty

Triplett / Jewell Instruments extends the following warranty to the original purchaser of these goods for use. Triplett warrants to the original purchaser for use that the products sold by it will be free from defects in workmanship and material for a period of (2) two years from the date of purchase. This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons in any way or purchased from unauthorized distributors so as, in our sole judgment, to injure their stability or reliability, or which have been subject to misuse, abuse, misapplication, negligence, accident or which have had the serial numbers altered, defaced, or removed. Accessories, including batteries are not covered by this warranty.

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